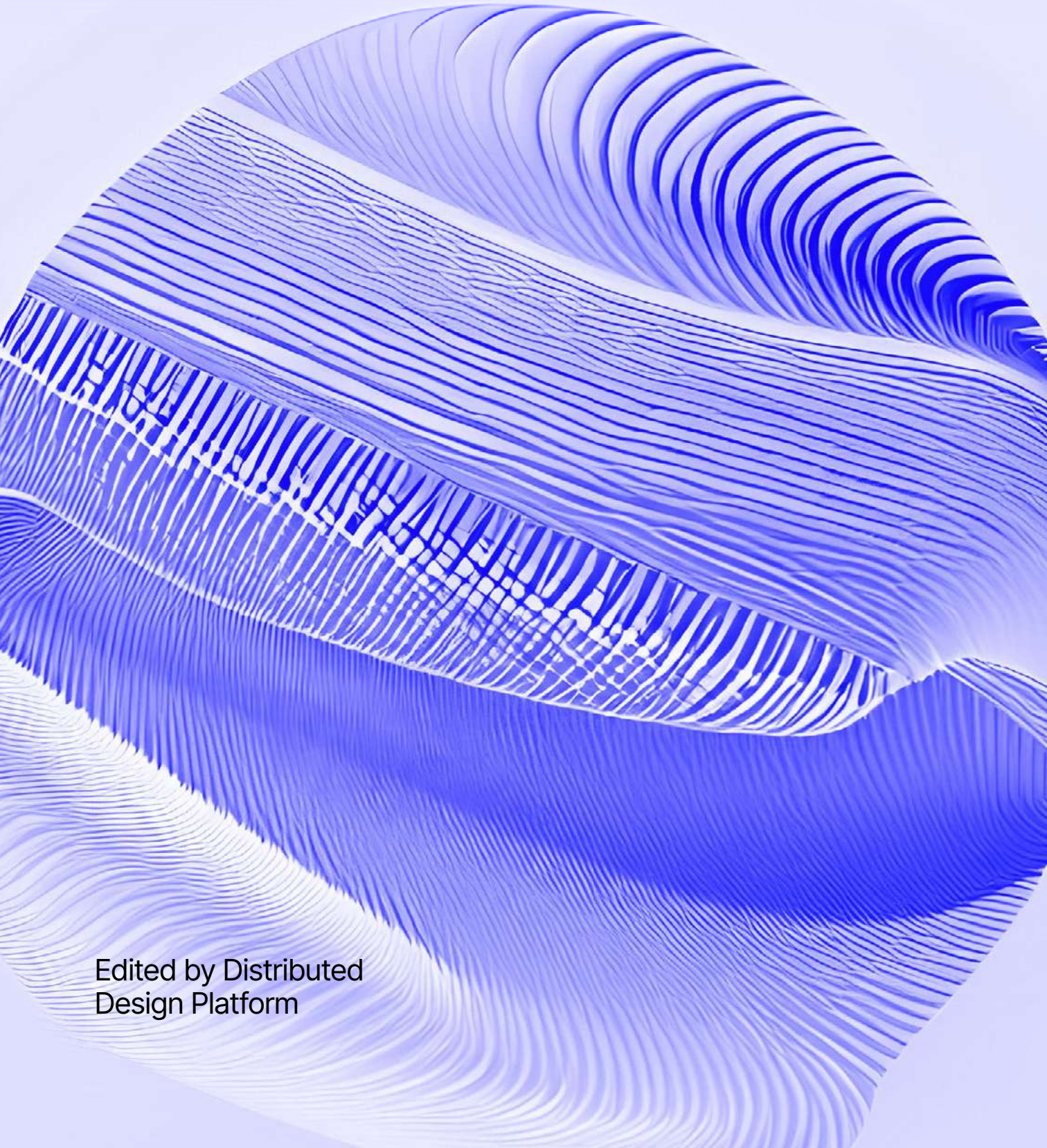
Driving Design

Collective approaches enriching design principles



Edited by Distributed Design Platform

The cover of the 2023 edition of Driving Design, was generated in collaboration with AI (Dreamlike.art) the prompt used is "Melted risograph, gradient waves, geometrical logic, simple pattern, printed grain, high quality detail, 3d plastic render, oscillate, mapping illustration" and the seed is 37756092

Introduction

Jessica Guy, Distributed Design Platform lead at Fab Lab Barcelona | IAAC

Driving Design is the fifth of seven publications from the Distributed Design Platform. Established in 2017 and co-funded by the European Union, the Distributed Design Platform brings together Fab Labs, Makerspaces, cultural organizations, universities, and design centers from around the globe. The community is growing in members, local and global collaborating organizations, and Creative Talents in Europe and beyond. Over the past four years, the platform designed and supported the development of local and global programming, strengthened a network of creatives and fostered opportunities to learn and exchange.

Each publication is an opportunity to explore the advances and challenges in the field of Distributed Design while also reflecting on the values of collaborative, openness, regenerative, and ecosystemic practices and how these contribute to the exchange of knowledge, skills, value, and power. In the last book, This is Distributed Design, we consolidated best practices and state of the art interventions in the emerging field of Distributed Design. In this year's edition, we highlight the motivations, opportunities, and challenges that drive the practitioners and the field of Distributed Design.

In increasingly challenging times - the climate emergency, divisive political situations, escalating conflicts, and systemic inequality - it is even more important to question why and how we intervene as creative practitioners. How can Distributed Design create more equitable presents and futures? What are the gaps and challenges to overcome? How can we foster reciprocal relationships between diverse communities and the environment? What new worlds are we going to explore when we investigate designing with extended and other intelligences? And with that, we ask who and what are the drivers of Distributed Design in 2023?

An open call was launched to explore possible answers. Designers, makers, craftspeople, and scholars have answered our call and shared their approaches and areas of exploration in a selection of emerging themes. Each of the five chapters build upon the other. First, we connect to the last article in the This is Distributed Design book from 2021 - The Bauhaus Society - to explore new areas of intervention for Distributed Design. Then we dive deeper into how we learn and unlearn the design practice in the first place. We highlight the importance of reconnecting to ancestral wisdom and the potential to share knowledge, skills, and power by connecting it with emerging technologies. Then we explore how we can create and reclaim agency through design practices. Finally, we reflect upon the evolution of the commons in the age of technology and how we can use collective responsibility to manage it.

Enjoy a glimpse into the field of the ever-evolving field of Distributed Design.

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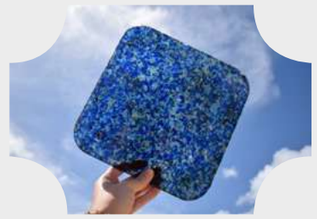

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Value driven - Systemic approaches to design

We begin Driving Design with a tribute to the last chapter of the 2022 edition, which delved into the values of the New European Bauhaus and Distributed Design. What does it mean to design for a beautiful, sustainable society and environment together? How can Fab Labs and makerspaces help us design based on values? This chapter continues to explore and reimagine what it means to be a distributed designer and where we'd like to continue to go towards: a present that is open, collaborative, ecosystemic and regenerative. These are our first (nonexhaustive) examples that are driving design.

Chapter 01

Systemic Objects

How the materiality of Distributed Design Can Enhance Systemic Design

By Nat Hunter, Gareth Owen Lloyd from Other Today,
& James Tooze from University of Brighton

Introduction

The UK Design Council's publication of the Systemic Design Framework (Design Council, 2021) has brought Systemic Design to the attention of the wider design industry. The publication builds on a growing awareness of and implementation of systemic design methods in industry. The approach combines design and systems thinking to empower designers to tackle complex problems at a planetary scale, which often cannot be solved using traditional human-centred design methods. Systemic Design equips designers with the necessary tools to zoom out and identify leverage points, allowing them to address the root causes of issues rather than simply treating symptoms. This way of thinking is critical to designing responsibly and avoiding unintended side effects, both at the environmental and societal levels.

While Systemic Design is valuable in planning policy and addressing complex challenges and excellent at communicating itself through graphics, symbols, and words it often neglects the actual physical objects and products that contribute to environmental issues like climate change. By viewing products as abstract concepts rather than addressing their materiality and movement around the world, the discipline overlooks a crucial component of sustainability.

This review proposes that Distributed Design can enhance Systemic Design by providing a more comprehensive approach that recognises the physicality of materials and the impact of objects on the environment. It will argue that Distributed Design is a necessary component of a broader Systemic Design framework, which accounts for the physicality of products and their relationship to the wider system. While systems are intangible, products are their tangible manifestations, even high-design furniture emerges from hidden environmental complexities like snowflakes forming under the right temperature around a speck of dust. (Acaroglu, 2017).

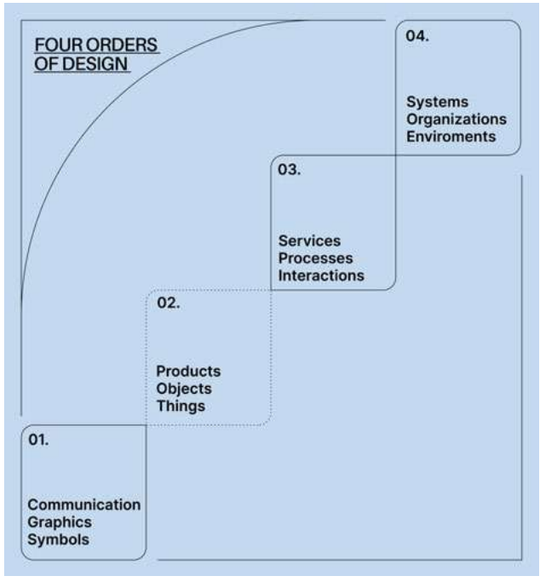


IMAGE 1. Four Orders of Design Buchanan 2001 adapted and redrawn by authors

In his 2001 essay "Design Research and the New Learning," Richard Buchanan proposed a four-part spectrum of design that ranges from the visual to the abstract. Systemic Design, which combines the methods of the third and fourth orders, is a powerful problem-solving approach that communicates with the first level but arguably overlooks the materiality of the second level. However, rather than seeing the four orders as a hierarchy or ladder, with graphic design at the bottom and industrial design at the top, Buchanan suggests that we view them as an interconnected web. He encourages us to "consciously consider the possibility that our communications and constructions are, in some sense, forms of action," and to recognize products as systemic objects that interact with the environment in complex ways. From this perspective, even the most humble of objects, such as a pencil, can have profound impacts on forests, fields, and cities. As such, a systemic approach to design that accounts for the consequential nature of designed things and their impact on natural systems is essential.

Systemic Objects

The table is a ubiquitous product that we often take for granted in our daily lives. However, when we examine its creation process and logistical flows, we start to uncover its hidden complexities. James Tooze's 'A New Perspective' table was designed to bring these complexities to light, featuring outlines of the internal structure on its surface to reveal the various materials, design choices, and construction methods involved.

IMAGE 2. A New Perspective by James Tooze 2009

Yet, this is just one layer of complexity to consider. Beyond its physical attributes, a table's use has significant ergonomic impacts on posture and work habits, and culturally, it conveys status and community. Economically, tracing the table's materials and production process reveals the intricate web of transportation, distribution, and sales involved.

The table's life cycle is further intertwined with cultural meaning, social norms, and environmental impact. What happens to a table at the end of its life? Does it enter a waste system or undergo repair and resale? These questions demonstrate that products are not just outputs of a linear design process but rather nodes in a complex system of interconnections.

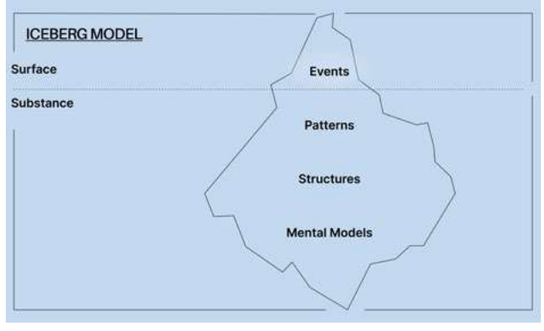


IMAGE 3. Iceberg model adapted from Goodman M. 1997 redrawn by author from unschool.co

Metaphors Matter

The Iceberg Model in systems thinking illustrates the relationship between the observable and hidden aspects of a system. In the context of product design, observable outcomes and objects can be symbolised by the tip of the iceberg. In Distributed Design these include digital fabrication tools and shareable designs.

The hidden elements beneath the waterline encompass the underlying structures such as Fab Labs, maker spaces and networks, patterns of behaviour, and mental models (such as open source sharing and distributive value) that sustain the system.

From this perspective, Distributed Designs are far from being merely expressions of form and function but the visible tip of distributive cultures.

“discard the engineer’s hard hat and spanner, and pick up some gardening gloves and secateurs instead.” - Kate Raworth 2017

It is tempting when trying to gain perspective on the complexity behind objects to use mechanical metaphors, we draw supply chains as linear conveyor belts and in Distributed Design we design with manufacturing and distribution in mind yet system thinkers argue that we should ditch mechanical metaphors and instead see our roles as gardeners of organic complexity.

Leyla Acaroglu adapts the Iceberg Model by using the example of the mushroom’s mycelium system in nature. Rather than products being represented by the tip of the iceberg they can be seen as the emergent cap of a field mushroom - the visible outcome of a complex hidden system of mycelium that runs underground, connecting trees, plants and sharing resources.

Mycelium forms an “internet for trees” and is responsible for supporting the decay of organic material, creating new life and enabling the cycle of decay and growth to continue. The power of using this mushroom and mycelium metaphor is the underlying reminder of the interconnectedness of all natural systems, and that Distributed Designs are the tangible artefacts of hidden complexities.

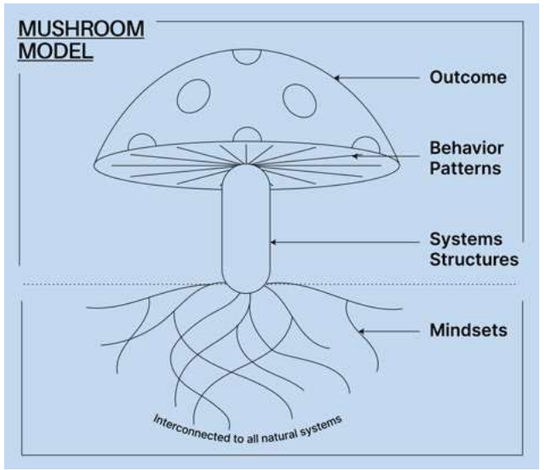


IMAGE 4. Mushroom Model by Leyla Acaroglu redrawn by authors from unschool.co

Instead of seeing objects as the second step on a ladder of ever-increasing complexity we can instead see them as the emergent outcomes of systems.

In her 2017 book Donut Economics, Kate Raworth introduces the concept of “Distributive by Design” as a framework that prioritises the creation of distributive systems, rather than extractive ones (Raworth, 2017). This approach to design aims to distribute resources, power, and opportunities fairly to all members of society, rather than extracting wealth from some to benefit others.

Leyla Acaroglu’s Mushroom Model can be seen as a fitting metaphor for the complexity of Distributed Design. Just like a mushroom cap emerges from a complex system of mycelium underground, the tangible outcomes of Distributed Design are the visible result of a complex web of structures and systems, including digital fabrication tools, shared designs, maker spaces, and networks.

By combining Raworth’s Distributive by Design concept with Acaroglu’s Mushroom Model, we can map the underlying structures and patterns of Distributed Design.

‘Systemic Design combines design and systems thinking to address complex planetary problems, but it often overlooks the physicality of products and their impact on the environment.’

Outcomes: Making
The emergent crown of our mushroom represents the form and function of digital manufacturing; which on the surface, like a cap, share common aesthetics from 3D printed parts to cnc cut plywood. But these aesthetics are surface level, digital designs open up opportunities for distribution that sits at the heart of circular economy enabling designers to rethink the sources of materials and the end of life for objects.

Behaviour patterns: Knowledge
The distribution of knowledge is like the release of reproductive fragments from beneath the crown of a mushroom. These less noticeable patterns aid in replicating designs through open-sourcing, workshops, and creative commons licensing. Platforms such as Wikifactory, Gitbook, and Github help spread ideas, projects, and knowledge. The growing maker movement and rise of makerspaces and Fab Labs foster mass collaboration through the sharing of knowledge and practices.

System structures: Value
The distribution of value is symbolised by the stem of a mushroom. This stem represents the underlying structures that support the distribution of value. A decentralised approach to design considers both financial and non-financial impacts, promoting fair distribution of profits throughout the supply chain. The maker mentality of creating rather than consuming fosters job creation and a more sustainable and equitable economy.

Mindsets: Power
Deep at the base of the mushroom model of Distributed Design lies the crucial factor of power distribution, represented by the far-reaching mycelium network of a mushroom. This intricate system serves as a symbol for the interconnecting mental models or attitudes that shape the underlying power structures of design. In contrast to traditional top-down design processes, a decentralised approach to design prioritises multiple mindsets, including those of communities, nature, organisations, and all living beings.

Distributed design enables people to design according to their needs and fosters the plurality of cultures by promoting diversity, decentralisation, and collaboration in the design process. In the mycelium metaphor, solutions are not viewed as one-size-fits-all, but rather as pluriversal and context-specific. By tailoring designs to specific local needs, resources, and conditions, distributed design supports the development of more context-specific and sustainable solutions that better suit the unique conditions and requirements of different communities. (Escobar, 2018)

Distributed Design as part of Systemic Design

This article has explored the value of Systemic Design in tackling complex issues at a global level, while acknowledging its limitations in overlooking the physical aspects of products and their environmental impact. In response, this essay has proposed Distributed Design as a complementary approach that embraces the materiality of products and their place in the wider system.

By drawing on metaphors from systems thinking and design thinking, and emphasising the interconnectedness of Distributed Design through Leyla Acaroglu’s mushroom model, this essay has argued that Distributed Design is an essential component of a broader Systemic Design framework.

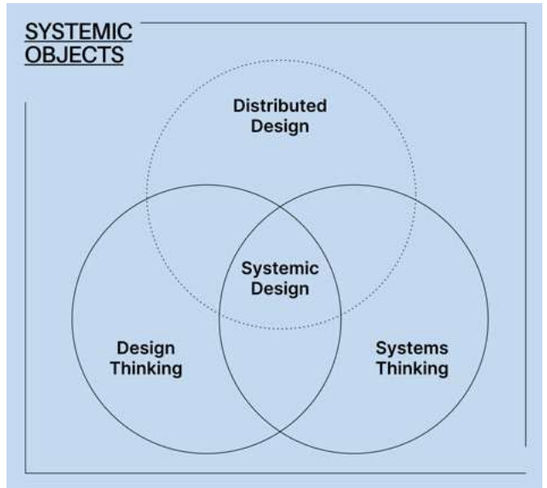


IMAGE 5. Distributed Design links to Systemic Design, diagram by authors

Just as systems thinking and design thinking merge to form a powerful problem-solving approach, the inclusion of Distributed Design completes the picture by accounting for the physicality of products and their relationship to the wider system. Distributed Design should be seen as an integral part of Systemic Design, forming the third wheel of the Venn diagram and providing a holistic approach to complex problem-solving.

How distributed design might drive the circular transition

Eight potentials for how distributed design can contribute to the transition to a circular society

By Therese Balslev from Danish Design Center

Distributed design shows significant promise in driving the transition to a circular society. Firstly, a distributed approach to design can help free designers from centralised manufacturing and globalised (non-resilient) supply chains by working in shorter ones. Secondly, distributed design can aid in extending the longevity of products and materials, e.g., by applying digital manufacturing techniques to produce new spare parts for products. Finally, distributed design allows makers and designers to open up processes, enabling other makers and designers or even manufacturers to produce locally, thereby minimising transportation.

"Fab labs can potentially be places that encourage sustainable design, where people can produce products locally and think about the various implications on the environment and society of their design"
-(Fleischmann et al. 2016)

Distributed design can help democratise design and manufacturing, which significantly contributes to the circular agenda. Circularity is about circulating and extending the lifetime of the resources we already possess by decoupling value creation from resource consumption.

DDC - Danish Design Center - has investigated the cross-section of Distributed Design and Circular Economy - identifying and gaining an overview of the overall barriers and potentials by diving into previously conducted research. The findings make it possible to gain an overview of the barriers and potentials related to how distributed design can contribute to the circular transition. It enables you to pick out one or more potentials to have as a focus area for change. The results are also accessible as a resource at the Distributed Design Platform website.

Obstacles for makerspaces to contribute to the circular transition

We know that more needs to be done to harness the potential of fab labs and makerspaces toward sustainability and circularity (Fleischmann et al. 2016). But some of our core findings show the following obstacles:

1) Lack of communication

- Sustainable and circular developments in makerspaces and fab labs are rarely promoted in their own right (Kohtala, 2017)
- Fab labs are recognized as centres/ meeting places for distributed production and design but are not necessary spaces for promoting environmental sustainability as a core principle or value (Kohtala, 2016)

2) Lack of focus/priority

- There seems to be a gap between the claimed transformative possibilities of fab labs and the realities we see on the ground (Fleischmann et al. 2016)
- The fab labs tend to be directed towards other ideological concerns than the ones concerning circularity and sustainability
- The labs usually take care of day-to-day work in their spaces (Prendeville et al. 2017). They, therefore, risk reproducing unsustainable practices unless tangible strategies for sustainability and circularity come into place (Smith & Light, 2017).

3) Lack of knowledge

- Maker communities tend to be divided in their sustainability capacity and knowledge (Kohtala, 2017)
- Makers lack information on products and raw materials. This knowledge is crucial to know how circular or green the product or material is - especially if they are to communicate it to potential future customers (Unterfrauner et al. 2019).

"[...] without devaluing the building of conceptual skills, is key to facilitating activities within Fab labs that are reflective towards sustainability issues and co-creational processes." - (Fleischmann et al. 2016)

Eight potential areas for increased circularity in fab labs and makerspaces

At DDC, we have identified eight potentials for how distributed design can contribute to increased circularity in society. Each should be regarded as a subject on its own. Yet they intertwine with the others, acknowledging the level of complexity each subject contains.

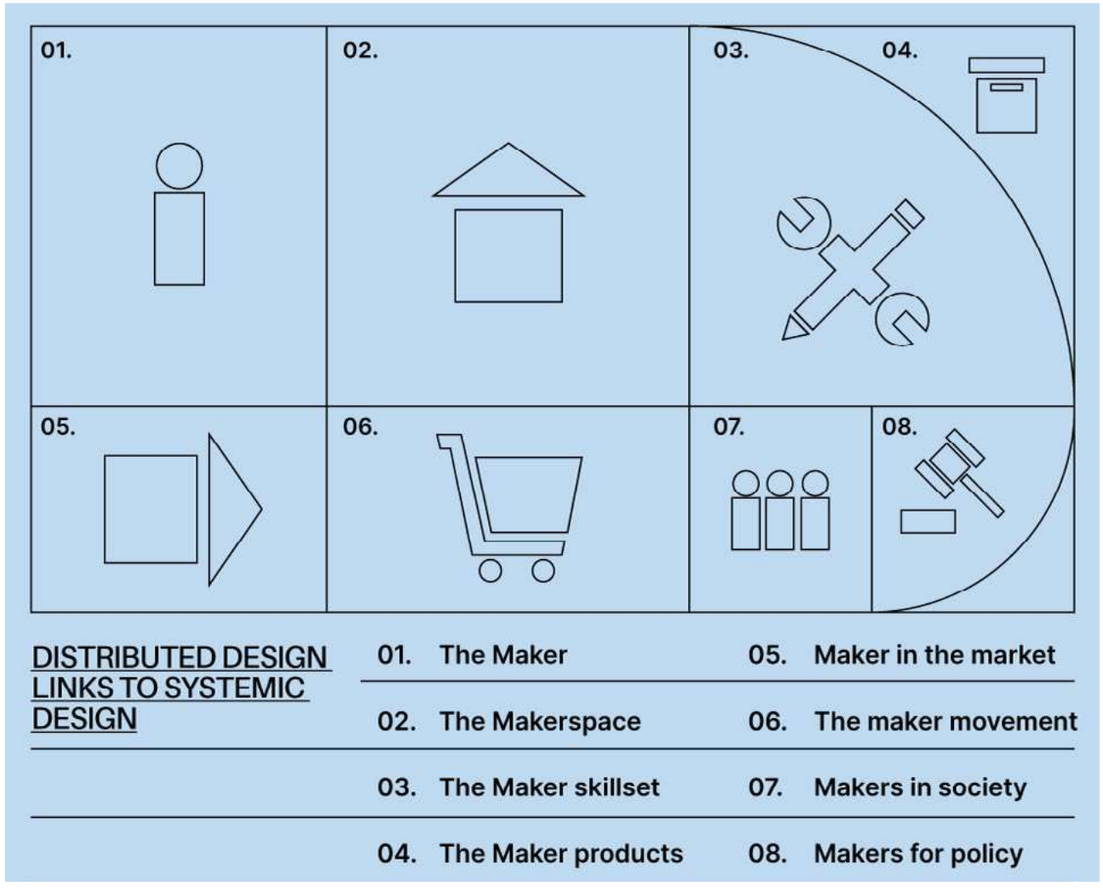


IMAGE 1. 'Graphic Illustration of the 8 potentials' drawn by author

Potential #1 · The maker

How might we actively work on shifting the makers' mindset in makerspaces to be prompted by sustainability and circularity?
Working with sustainability and circularity certainly requires the individual maker to be confident to challenge current design practices and norms (Prendeville et al. 2017).
Ultimately, makers should find their own personal way to be motivated around sustainability and circularity - this tends to help if it is fun, exciting, and fulfilling. For this to happen, the relevant tools, resources, and activities should be accessible to the makers and designers using the spaces (Smith & Light, 2017).
Designers have a key role to play as they can help facilitate the necessary transformation in human interactions, mindsets, and relationships (Fleischmann, 2020). One can ask how much of the undirected creativity in the makerspaces is currently being managed.

Potential #2 · The makerspace

There is no such thing as a dominant design of makerspaces and fab labs that has emerged just yet (Rayna & Striukova, 2020). This makes it possible, to a certain extent, to influence and direct the design in a more circular direction - if decided.
Managers of makerspaces can drive the approaches to sustainability and circularity from within (Fleischmann et al. 2016). What the fab labs consciously promote usually pays off - e.g., offering workshops, hosting entrepreneurship events, etc. (Rayna & Striukova, 2020).

"If it is desired that environmental issues are closer to the core, they need to be moved further up the agenda via strategies for visibility aand conscious practice."
- (Kohtala 2016, 9)

Fab labs and makerspaces can help foster highly demanded skills of the 21st century (Rayna & Striukova, 2020) - one of them indeed being sustainable and circular thinking and implementation. Though, it requires that the management team in the spaces is determined to actively work on this agenda.

Potential #3 · The maker skillset

How might makerspaces, fab labs and all their users, have access to the right training and knowledge on circularity? The spaces need to consciously work with a product's full lifecycle and circular business models. This will create a bigger positive impact on the environment.

Fab labs and makerspaces are key interfaces through which designers can come to understand their future profession (Kohtala, 2016). Different activities and training sessions can be beneficial for working with increased sustainability and circularity implementation and awareness in the spaces - like masterclasses on circular economy, mapping of local maker ecosystems, and sharing of legislation experiences (Bakırlıoğlu et al. 2021, 12).

"[...] without devaluing the building of conceptual skills, is key to facilitating activities within Fab labs that are reflective towards sustainability issues and co-creational processes."
- (Fleischmann et al. 2016)

Makerspaces have the potential to play a role in a future circular economy. They can do that by functioning as educational spaces for developing creative solutions. And they can take it even further by also educating young people to a high level at an early stage in circular design into the mainstream for prototyping and, even possibly, as places for manufacturing.

Potential #4 · The Maker Products

How might we scale the production and know-how of maker products?

We have seen how makers attach great value to their creations. This is a crucial driver for caring, maintaining, and repairing their creations to extend the lifespan of the products (Kohtala, 2017). The open-source approach applied to a certain number of maker products creates better opportunities and incentives for end users to repair and maintain the product on an ongoing basis.

Fab labs and Makerspaces can also use activities like product tear-downs to explore how things get made as well as their social and environmental implications (Smith & Light, 2017).

IMAGE 2. 'Yellow Green Eyes' India, Azmaan Baluch, via Unsplash

"It requires the development of dynamic and flexible products, which implies designing for variability, product attachment, and preparing the product for future repair and upgrading."
- (Fleischmann, 2020)

We need to gather any general learnings about how makers produce their products and see whether this provides insights for product design in a more scalable fashion - for makers but also on a more general basis.

Potential #5 · Makers in the market

How might makerspaces be an opportunity to introduce local and small batch production on a larger scale having a closer connection to mass production? Thinking of, e.g., a production pipeline from a prototype, to a small batch, to larger orders, to mass production. And how can this be carried out more sustainably and circularly than is currently the case?

With the aid of Distributed Design approaches, we see how production can be drawn back into the cities closer to the consumer. The maker movement, fab labs, and makerspaces can help strengthen local production, decrease mass production, and focus more on customisation and on-demand production (Unterfrauner et al. 2019). Furthermore, fab labs offer a relatively risk-free platform for exploring open and distributed design, which benefits sustainability and circularity (Kohtala, 2016).

If the supply chains and production systems are to be more resilient, they should be reshaped towards more effectively integrated production by smaller entities. The focus should move toward more individualised solutions for society and moving away from mass production (Unterfrauner et al. 2019).

Potential #6 · The Maker Movement

How might the bottom-up, democratic, and collaborative processes and approaches of the maker movement hold the potential to address making and manufacturing in new ways that open up a socially inclusive innovation space, which is necessary for a transition to a circular economy?

The maker movement encourages so-called 'master makers' to transfer their knowledge of production techniques to makers who are less experienced. The knowledge and apprenticeship created in makerspaces is shared among the network both physically and through digital platforms to people of different backgrounds that allow for comments and improvement suggestions that will enrich the value of the projects (Maravilhas & Martins, 2019).

"Making can prompt reflections about our material culture and can remind us of the diversity of motivations, conditions, and moments of activation under which radical creativity and collaboration emerges."

- (BayBrooke & Smith, 2018)

The maker movement has an active position when it comes to producing tangible artefacts whilst at the same time using and experimenting with new processes, materials, and technologies - therefore, both social and environmental sustainability aspects are likely to count as some of the most important concerns to them (Kohtala, 2016).

IMAGE 3. 'Green grass field under blue sky during daytime' Andreas Dress, via Unsplash

Potential #7 · Makers in society

How might we deploy the activism approaches and social values in the makerspaces to increase sustainability?

Institutions committed to social development could potentially do more to recognise and support the democratising capacity of makerspaces. This involves the culture of activism in makerspaces which can aid pushing for these crucial transformations.

It is vital to continually acknowledge and appreciate the social value produced by the activist communities (Smith, 2017).

There's a potential for the spaces to increase sustainability and circularity through collaboration with stakeholders outside the spaces. The partnerships could work more with, e.g., citizens' engagement, practice-based science, inclusion, and democratic cooperation.

Potential #8 · Makers for policy

How might incentivizing policies help support the collaborations that could contribute to solving some of these policy-related issues? And how might closer cooperation among makerspaces and policy actors actively support the bottom-up movement and the scalability of learnings, effects, and processes from makerspaces and fab labs?

Since the Maker Movement emerged not long ago, policies related to maker practices tend to either lack or block the way to circularity.

Suppose a system of policy measures were to be established to incentivise, e.g., the repairing of household objects. In that case, this could be an essential driver for a circular economy. Another ample opportunity is to enhance collaborations between makers and industries, aiming to extend the lifespan of products (Unterfrauner et al. 2019).

"There are still formidable policy and economic obstacles blocking the path of this radical transition to a circular way of doing business. Designers and citizen designers as change agents can help remove those obstacles and accelerate the transition to a Circular Economy."

- (Fleischmann, 2020)

Large businesses tend to be concerned with, e.g., invalidation of warranties and safety issues when letting citizens perform repairing activities themselves (Unterfrauner et al. 2019).

Let the changes begin!

Fab labs and makerspaces seem to be divided in their sustainability focus, capacity, and knowledge. They need the correct information, tools, and methods to positively impact the environment and increase the circularity of the spaces. Policy and economic obstacles contribute to the blocking of the transition to circular procedures. However, we have also seen how these spaces can be good places for exploring and inspiring systemic changes for a more circular and sustainable society.

There is a need to change, shift and influence people's mindsets. The makers need to re-think the tendency towards undirected creativity in the makerspaces so they can increase their awareness of their potential impact on the environment with their creations.

Hopefully, this article provided you with new insights, an overview of aspects to improve, and the great potential of fab labs and makerspaces. These places no doubt represent one of our times' promising approaches to democratising design and innovation and increasing the transition towards a circular economy.

Working actively on circularity can seem like an everlasting and complex task; admittedly, it most often is. The transition to a circular economy - on both a societal, organisational - even an individual level - often feels like eating an elephant. But there's only one way to do it. Take one bite at a time.

If you wish to gain more insight into different circular strategies and how to concretely work with circularity, you can have a look at DDC's open-source toolkit 'Designing Your Circular Transition' at their website, ddc.dk. The first tool in the toolkit, 'Circular Strategies Wheel' gives you a comprehensive overview of the different strategies and will start reflections upon how you might apply these in your own context.

IMAGE 4. 'Green Grasses' Masha Kotliarenko, via Unsplash

Innovation processes in distributed textile labs across Europe:

An exploratory case study of labs from the shemakes.eu project

By Adriana Cabrera, Elena Knispel, Hala Aissaoui & Niels Lichtenthäler from matrix Gruppe

Labs are the primary environment where all physical, virtual and hybrid interactions take place. The lab provides synergies inside and outside the space. In a time of uncertainty, Fab Labs and textile labs are playing an essential role in distributed design and production, as they connect different entities while taking ecological, economic and participatory sustainability into account and supporting the development of small-scale ideas and prototypes towards big efforts to change society. Labs confront a new culture of entrepreneurship and show how these spaces can be a catalyst where innovation becomes a reality. Nevertheless, beyond the labs, there is not a single formula for achieving innovation and, consequently, the methodologies to form an innovation ecosystem can vary.

This article is situated in the spirit of the New European Bauhaus as a creative and transdisciplinary movement in the making. It will introduce a vision from the lenses of the project shemakes.eu, sharing the values and the collaborative call for action of 18 distributed labs across Europe. In the following chapters, the authors will introduce an innovative analysis of the different textile labs and Fab Labs, which has been carried out with the participation of Gurus and women leaders belonging to the shemakes ecosystem.

Introduction

Within the scope of the project, an action research approach was adopted by studying the ecosystems of opportunities for women innovators through the experience of the project participants and case studies of textile labs. The research objectives of the project were to assess how a network of women innovators from textile labs can support other individual women by creating new career development opportunities, as well as to examine the innovation processes of women entrepreneurs.

IMAGE 1. Rethinking Wool, Greenfabric Lab.

For the purpose of this article, the authors dive into the use and application of agile methods of innovation and compare how shemakes labs develop their own processes when developing a product or prototype. This analysis was motivated by the women innovators' experience of diverging knowledge about agile innovation processes and best practices from other textile labs. This demonstrates a need for an exchange of techniques in this respect. It also emerges from this article that the maker culture in the textile and sustainable fashion industry, connecting practices from conceptualisation to design and prototyping, tends to be carried out in a rather individual manner. This process raises some insights into scenarios where women innovators use the lab as a space where they can complement their main work out of their personal motivation. Here, the innovation methods do not necessarily stem from scientific research. Still, there is an opportunity to apply them from the beginning and create new structures and guidelines for the next generations.

This analysis contributes to understanding what innovation methods and tools are used during project development in European labs. With this insight into each of the labs, the authors want to understand 1) what are the agile innovation methods used and 2) what are the barriers and needs that these emerging spaces in distributed production develop in their labs. Finally, this paper presents 3) an overview of methodologies that can be implemented and enriched from the open-access community for further development.

Maker culture innovation in European creative labs

Fab Labs, textile labs and Makerspaces across Europe can be considered the physical representations of the maker movement. These unique spaces seek to provide communities, businesses and entrepreneurs with the necessary infrastructures and manufacturing equipment to turn their ideas and concepts into reality (Friel and Borrione, 2022). Since the maker movement is grounded in an ideology promoting cooperation and sharing, makers are inspiring each other to create smart solutions for all types of individual needs and to address social and environmental challenges at the same time (Unterfrauner et al. 2017). In these collaborative workspaces, they share ideas and solutions with an emphasis on the principle of circularity by using repair and recycling. (Herrero-Luna, Ferrer-Serrano, and Latorre, 2021). The applications and the specialisations of European makers can vary from textiles to ceramics and bio prints (McNeilly, Popova, and Freire de Oliveira, 2018).

IMAGE 2. "Biomaterials Design with rotating stations", by Fab Lab Barcelona.

processes through tangible manifestations of production and prototyping, in particular, focused on sustainable and social innovation.(Sedini et al. 2021). This is connected to the fact that in the European fashion and textile (T&C) sector, innovation is increasingly generated not only by the places of traditional training and production but also by multiple and different structures that can support transformation in the sector through the promotion of new entrepreneurial actors and production modes. This is happening at a local level and within the vision of social and technological change (Friel and Borrione, 2022).

The relationship between fashion and technology has become stronger and stronger in recent years. This has happened thanks to the efforts of numerous independent local centres, such as textile labs, which helped transform many fashion goods into technological products (McNeilly, Popova, and Freire de Oliveira, 2018) and simultaneously brought a new mindset towards value-driven innovation to the T&C sector.

Shemakes.eu as a case study

Shemakes was a two-year European project responding to the Horizon 2020 Call “Innovators of the Future: Bridging the Gender Gap”, with the objective of empowering future female innovators in the sustainable fashion industry through inspiration, skills and networks. It started with the premise of building an opportunity ecosystem for women by offering a space of action. This space has grown from two leading innovation ecosystems – Fabricademy and TCBL - within the textiles and clothing sector and acts to promote, highlight and celebrate the leading role of women in innovation, with the goal of permanently reshaping the opportunity structures of at least 16 European Member States and Associated Countries.

'Shemakes.eu operates on multiple intersecting planes that could be conceptualised as a circular system'

- **Fabricademy** (‘Fabricademy’ 2023) is a transdisciplinary course that focuses on the development of new technologies and approaches in the textile industry.
- **TCBL** (Textile Clothing and Business Labs)(‘TCBL’ 2022) is an EU-project and now an association that focuses on co-developing testbeds for cutting-edge innovation in the sustainable and circular fashion industry.

Shemakes.eu operates on multiple intersecting planes that could be conceptualised as a circular system. Since there is no simple magic formula that can generate the significant mindset shift needed to change the prospects of women in the industry, shemakes.eu actions are meant to enable access to skills in technology, innovation learnings, and business and community engagement. Thus, the foundation of the shemakes ecosystem lies in a collaborative community of role models and improves the perceived value of these skills. This, as a result, should lead to greater gender and socio-economic diversity, as well as increased equity for women in the field.

At its core, shemakes is based on its designated Theory of Change and uses a large-scale change strategy (across labs, countries and generations) to address some of the individual, interactional and organisational factors that contribute to the gender gap. Moreover, the change system creates a broader resonance in other fields, bringing this learning into the lab context while distributing and acting in the local and global environment. It strives for the ultimate goal of enabling women to move into role models and creating an opportunity ecosystem for innovation, encompassing the values of empowerment, equality, collaboration, welcoming differences, and promoting circular, sustainable and near-shored structures.

IMAGE 3. shemakes.eu network.

The New European Bauhaus opened a space in which shemakes contributes and aligns with its concept based on the important work of women and men united by distributed work in the labs. They share experiences between art, culture, and technology in an environment of co-creation and co-implementation. This approach reflects a social and design culture change that goes beyond functionality and relates to the transformation of the green and digital challenges. Shemakes mainly relates to the practices of a sustainable mindset, in line with the environment, circularity and care for our planet. Diversity is embedded in its modus operandi as shemakes labs consider an inclusive approach, encouraging dialogue between cultures, disciplines, genders and ages by welcoming differences and acting locally while connecting globally.

A framework for an innovation analysis

The analysis of innovation processes in this article refers to the processes by which the participating Gurus and lab leaders acted as managers and main engines in the textile and Fab Labs belonging to the shemakes.eu project. The research was motivated by the experience of female innovators in emerging scenarios, such as creative labs that tend to lack knowledge about agile innovation processes. Here, the processes are more value-driven and often inspired by best practices from other textile labs. These synergies, centred on the interaction between technology, knowledge and human talent, are manifested in a spiralling manner. It is, therefore, difficult to understand whether there is a common methodological approach and what pathways the labs adopt for innovation. In order to give scope to the nature of developing projects/ prototypes and products, the innovation analysis was intended as a useful tool to understand which innovation methods are applied to labs that can potentially contribute in a distributed form.

The workshop format enabled knowledge-sharing among the leaders of all labs and identified knowledge gaps in innovation methods by presenting the following framework:

- The principles that each leader within the lab brings to the ecosystem.
- The methods, in particular, used in developing a project.
- The techniques and tools often used in the co-creation process/ the activities or in technologically-oriented processes.

We introduced the concept of agility as a fundamental component in innovation processes. It was highlighted and discussed how this concept is applied in the process of conception to prototyping and production inside the labs. Cultural agility can be described as the mindset for working agile and is embedded in a team. A representation of the approach is shown in figure 1, in which this workshop explores the last two stages of the method, techniques and tools.

There were a series of research questions planned for the workshops and aims that were set out to guide the analysis framework:
Meaning of Innovation: What do you mean by innovation?
Application of methods: Do you apply any innovation methods in your developments? In which phase do you use which method/tool?
Supported sources or self-developed tools: Do you have any guidelines or digital tools that support your process? Which sources are relevant in your process?
Identification of lack of knowledge in the innovation process

A total of 18 labs, including Partner and Transfer Labs of the shemakes network, were invited to participate in the workshop. During this workshop, different lab leaders shared their practices and knowledge by using and recognizing agile innovation methods in the lab context. The results could generate new reflections for all labs and encourage the application of agile innovation tools to improve the workflows in the community.

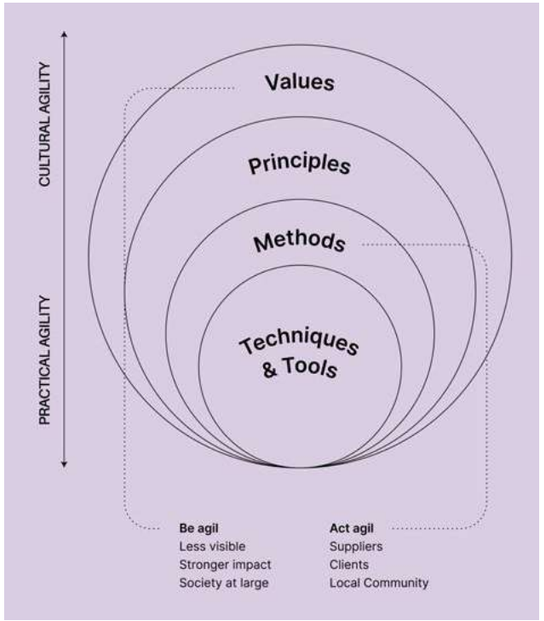


FIGURE 1. The levels of agility (Agilität erleben, 2019).

Participating Labs:
Centre for Circular Design (London, UK), Fab Lab León (León, Spain), FarmLab.at (Kapfenstein, Austria), Green Fabric (Brussels, Belgium), IAAC | Fab Lab Barcelona (Barcelona, Spain), Le Textile Lab (Lyon, France), Makesense (Paris, France), Onl'Fait (Genève, Switzerland), REDU (Laşi, Roumanie), Textile Lab Amsterdam Waag (Amsterdam, the Netherlands), The Icelandic Textile Center (Blönduós, Iceland), VIVISTOP (Užupis, Lithuania), ZIPHOUSE Fashion Innovation Hub (Chișinău, Moldova) Center Rog Creative Hub (Ljubljana, Slovenia), Lottozero Laboratories (Prato, Italy).

The meaning of Innovation

The motivation for asking a question about the meaning of innovation was to compare the different understandings of innovation among the Gurus and Transfer Lab leaders. The findings show a common understanding of innovation based on multiple frequently used terms (fig 2).

Distributed design in the intersection between creativity and innovation:
The creative hubs, the labs, have the mission to bring innovation in the intersection with their local ecosystem, e.g. urban factories, rural farmers, etc., and to transfer knowledge in a responsible and sustainable vision. This constant exchange creates added value to short supply chains connected in a massive industry, which is, in this case, the textile and clothing (T&C) industry. Innovation is more a process of bringing together knowledge about existing practices and interactions in the industry between design, creativity, investment and manufacturing. Because a new generation of designers and brands of creatives needs to be made aware of what already exists, it is an opportunity to expand the existing industry in which they do not invest as heavily in design. Bringing these two actors of the textile

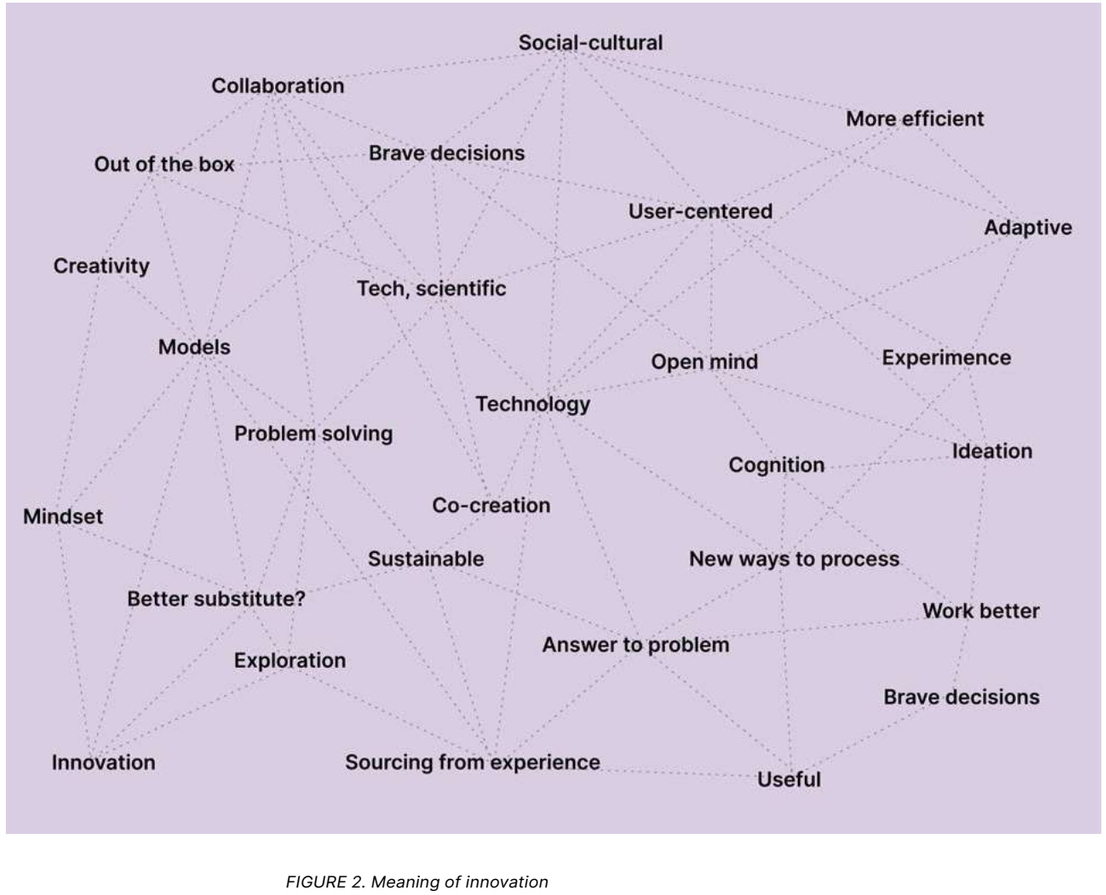


FIGURE 2. Meaning of innovation

and fashion field together creates production and design, a reciprocal benefit showing the opportunities demonstrating a double expansion of creativity and innovation. On one side, the brand expands its portfolio, and on the other side, the designers can fully envision and recreate an idea into a product. Once they see what can be produced, it changes their mindset entirely. "Once the designers see their opportunities within the industry, their creativity explodes" (Lottozero Labs). In that case, the lab is the bridge between the two actors. It creates an enabling environment to establish the conditions and translate the same language where all possibilities can grow.

Sustainability
The Gurus and lab leaders expressed through the word 'innovation' the correspondence to alternatives to solve sustainability problems in the lab practices as well as the correlation to the impact that can be generated socially and ecologically in the T&C industry. This change requires the responsibility not only for production but also for sustainable consumption and the understanding that collaboration plays a vital role in shaping a sustainable culture.

Value-driven
As a key to innovation. It means all phases must respond to the values and be aligned throughout the process. Partnerships must identify

with the values of the lab; for example, it has to be sustainable. It has to be accessible to socially excluded people and must enrich the values as a driving force of innovation in the project context. We appropriated the shemakes values as processes and the rise of a collective social innovation impact.

Out of the box
Refers to taking a different mindset in which technology, materials and the environment are considered. This outlook from different angles must also consider an affordable, viable and applicable solution.

Curiosity, courage and decision-making
A personal attitude to innovate requires curiosity for a unique approach, an open mind to welcome new fields and the courage to make decisions.

Collaboration and co-creation
Are common concepts in most labs, thus identifying open innovation and constant cross-collaboration between different actors (e.g. research, academia and industry) on the design and implementation of technologies for good.

Phases and methods

For this research question, we considered three variables: the process, the duration and phases. The description of the phases follows the methods the labs described during the innovation analysis.

The processes
The labs developed different processes that can vary depending on whether the outcome is the development of a commercial product, prototype, or educational programme. The authors identify mainly three scenarios:

1. Product or service development, e.g. educational programmes and consultancy.
2. Co-creation of products and services in a public environment, e.g. partnerships with the municipality.
3. Project research or specific cases of innovation within the shemakes project, e.g. involving innovators in producing sustainable embroidery.

The duration
The processes can vary from a short duration of three months up to one year. This is related to the creation of the service but also to whether the process can be the solution or if the process is co-created, either within a funded programme or developed by objectives upon which the timeline can be extended with the generation of different outcomes.

The phases
While it was recognised that the approaches could be very different in each strategy, most of them showed some constants. Eight phases were identified, which are common among the labs. However, many labs expressed that there is no linear innovation process and that their organicity enriches the processes. It is key to adapting each process to the user's needs. The following figure shows an overview of the processes, which will be described in detail below.

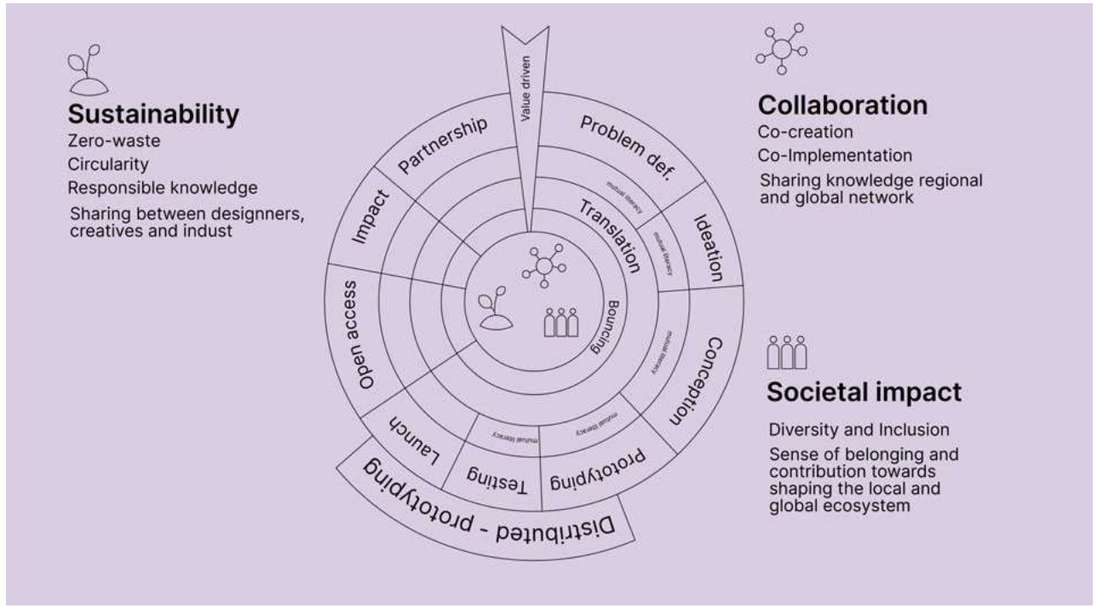


FIGURE 3. Methods

Phase 0/ 8 - Partnership:
Creative labs are collaborative, and many start their projects through public-funded programmes or calls. This collaboration has different starting points and levels, from finding partners to working with partners to collaborate. In the case that labs offer programmes through calls for partnership in the form of residencies, research or training, this partnership allows the exchange of knowledge and involves looking for organisations that already have the knowledge to bring these practices to a local context and make them accessible to anyone who wants to learn and undertake a new topic.
Partnerships can be a result of the innovation processes that connect to the following process. Thus, partnerships can produce different levels and strong relationships of collaborative transformation. Therefore, this phase can be the beginning or the end of a project (0 or 8).

Phase 1 - Identifying the problem:
Includes formulating the research questions and problem staging. Surveys and monitoring were mentioned as tools to support and inform this process. The objective of the first phase is to understand the needs and the observed problems. Data collection, personal maps or "Five Ws" are used by the Gurus and Transfer Labs throughout this process. The initial phase is similar to the first step in the design thinking process.

Phase 1.1 - Translation
Applies to the lab that acts as an advisor during a mentored partnership. The translation involves an understanding of ambitions, since the producers and the factory often need to appreciate what can be done through design and designers. Meanwhile, designers need to learn how to present their projects so that the industry interprets ways to make the final product feasible and exciting for the producer. On many occasions, ideas in design are very experimental, and there needs to be a strong economic push behind them. In this case, a producer must invest heavily in research and development to bring them to a point where they can be launched on the market. In this scenario, the labs can be an enabling environment to support the translation process to a feasible process.

Phase 2 - Ideation
The second phase is not as much about understanding the problem in detail as it is about analysing the context. Data collection tools such as surveys, interviews and mapping exercises are frequently used. This phase often includes a comprehensive analysis such as a market study, Life Cycle Assessments, literature reviews or field research. At the same time, it should also encompass curiosity and empathy for the client. After the context is clear, creating a vision follows, and subsequently, idea generation begins.

Methods used for idea generation are (team) brainstorming, Design Driven Material Innovation (DDMI) or the Six Thinking Hats method. Many labs highlight the importance of a co-creation approach while focusing on creating value. The orientation towards defined goals and the vision guides the second phase of the innovation process.

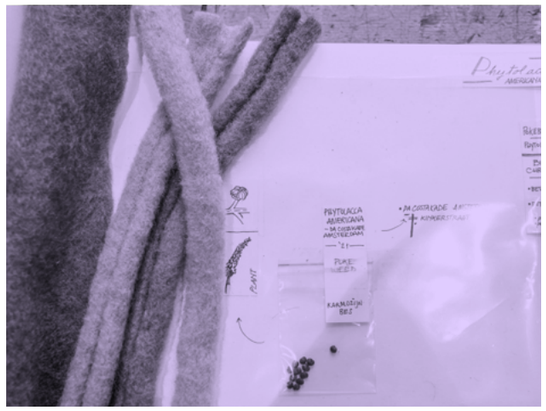


IMAGE 4. Waag's Wool Monday workshop.

Phase 3 - Conception:
Next, phase 3 describes how to develop a workflow and how to define the collaboration. The ideas are co-developed, and many participants connect with different intersectional fields throughout this phase, establishing a common ground of interaction in a setup and systematic guidance in which both sides contribute and exchange in the process.

The tools to facilitate co-creation support the transition from design frameworks to the final output. Thus, the use of open-source networks and participatory design methods, and existing methods such as design sprints and repeated trial-and-error attempts, are critical activities. The use of personas and the Gemba walk method support user-centred design. Conducting workshops is an integral part of this phase. In workshop design, open discussions with customers can occur, and participants can be interviewed after the workshop to define a working plan. Physical meetings, coffees, and an open atmosphere are essential for the creation of a solid base, but the use of digital work environments increased and switched routines after the pandemic. Some tools, such as team canvas, Burndown charts and project diagnosis are often used to follow the collaborative status.

Phase 3.1 - Mutual Literacy
Is more than a phase; it is a recurrent process. Mutual literacy describes the spaces where each discipline and actor (designers, biologists, engineers) has its own space, as they are unknown fields. Each discipline sets tasks to inform and contribute to the primary process in this step.

Phase 3.2 - Bouncing
Represents the intermediation after translation and starting the prototyping phase. Bouncing is a fundamental part of decision-making and an iterative process to close a loop by finishing a stage of development of the prototype or process. The act of bounce also enables one to come back and forth to the ideas with the certainty of a common result together with all actors involved. Thus, the lab, as a mediator of the process and closing the loops, supports the ultimate goal of guiding the result in the ecosystem.

Phase 4 - Prototyping
Many labs support this process in different loops to refine the prototype by using digital fabrication. Rapid prototyping is used to develop the first tangible representation. Furthermore, from this process, the need to look for further possibilities in the local and global community serves as an output of the process - a checklist of what could possibly be outsourced or found in a distributed network, the further development of the prototype in the manufacturing method, or transfer of knowledge of a network.
All labs of the shemakes network put particular emphasis on developing a sustainable solution. Although, usually, an outcome of this phase can

IMAGE 5. Lottozero's "SHEMAKES - Female Entrepreneur Mixer" event.

be a Minimum Viable Product (MVP)('Minimum Viable Product (MVP)' 2023), which is a prototype or demonstrator that can be modified and reproduced further in the industry. The advantage of having the lab is the quick interaction with the intersectional fields, which can speed up the development of the prototype and the sourcing for further resources in the distributed network. Furthermore, prototyping always has to reflect the original design's comeback to the purpose and its values, e.g. through sustainable production, zero waste, traditional reinterpretation, etc. In a sense, digital and traditional manufacturing play a vital role in finding the right path. Some labs review and refer to the Fabricademy as a reference when looking into techniques and technologies applied at this stage of the innovation process.

Phase 4.1 - Distributed Prototyping:
The following phase can be observed when the lab supports its connection with local industry or other partners as an extension of the lab's prototyping possibilities. As an active driver in the region, the lab supports knowledge transfer, bringing this experience to the user to produce and drive the development of prototypes into a product. For example, Lottozero, located in Prato, works in a textile district with over 5,000 companies operating in fashion and textiles and all the annexed machinery, making it a diffused lab. It also means supporting interaction locally, engaging people in the local ecosystem around the lab and helping them to produce locally by demonstrating the capabilities of the region while connecting globally and sharing the results.

Phase 5 - Testing and evaluation
Many labs carry out activities to adapt the prototype: observation, redesign, and constant user feedback are part of the evaluation process. In addition, parameterisation is relevant to apply the process in different scenarios and demonstrate replicability.
Prototype testing and data collection are supplemented by different loops of feedback and interaction with users. Finally, validation is a path to prepare the prototype for market launch. However, only some labs participate in this stage of the process, as many labs strongly focus on prototyping or supporting the first stage. A minority integrates the production methods, prices and cost evaluation.

Phase 6 - Launch
When the process evaluation ends, labs active in this stage recommend working on and finalising the business plan using the Business Model Canvas. Price and market strategy are defined not only based on research but also in a participatory process. Here, the values and principles should align with the strategy, such as open business, circular and inclusive. Marketing campaigns and presentation material are produced, ranging from social media posts, photographs of the products to exhibitions, and media to share and disseminate the practices, the process, and showing the room for interest—this defines a detailed branding strategy.

Phase 7 - Open access
To fully document all relevant information is one of the guiding principles among the labs. Open-source archives, repositories or dissemination in events such as the TCBL, FabConference ('FABx Event' 2023) or other related fairs are places where information is documented and disseminated to sustain and extend the legacy of the initiatives in the global ecosystem. The shemakes project offers a Toolkit ('Shemakes Open Toolkit' 2023) to enable further implementation of the activities with the interaction of new users. The documentation includes tools and materials needed for prototyping to be replicable and further developed to share with the community. The production of a manifesto or white paper, e.g. the Gender Equality and Diversity Plan, supports a common understanding of governance and supports social innovation towards a positive impact in the community.

IMAGE 6. TCBL's "Welcoming Differences" Conference.

Phase 7.1 - Dissemination and impact
Labs involved in academia or consultancy publish in a journal and gather information about the development process in a final report. Usually, open science follows the FAIR principles (Findable, Accessible, Interoperable and Reusable) to share data and make it available to other researchers while protecting intellectual property in a shared base. The use of licences in documentation such as the project publication is under the Creative Commons ('Creative Commons' 2023) and other licenses, often used by open source hardware Apache ('Apache' 2023), and the MIT licence ('The MIT License' 2006).

Other strategies that labs use to support the development of projects and thus, leverage them to a new status to achieve sustainability outcomes are:

Regional and global networking: which refers to the possibility of connecting the outcomes between the labs working in similar procedures and having the information at the disposal of other brands and labs to use and connect with each other. Networking supports the idea of globally sharing information and expertise with other labs as well as stakeholders outside of the region/ country while contributing to opening opportunities for investments in the local region.

Societal impact: This approach is taken up by the project by understanding the trends and effects of societal impacts and contributing to the local or global ecosystem. This strategy is guided from the beginning of the project and is connected at various points throughout the process, especially in the project evaluation.

Advocacy and participatory governance: This step refers primarily to labs that are part of public institutions or associated with public funding. In this scenario, the outcome of an innovation process is destined for citizens' action. It means a part of funding and process can be used only by users and citizens who are outside of the organisation, but as citizens, they can decide how to use these resources. In this case, a democratic selection by voting is made in order to decide how to invest the funds. By doing that, a new loop and process of making is developed.

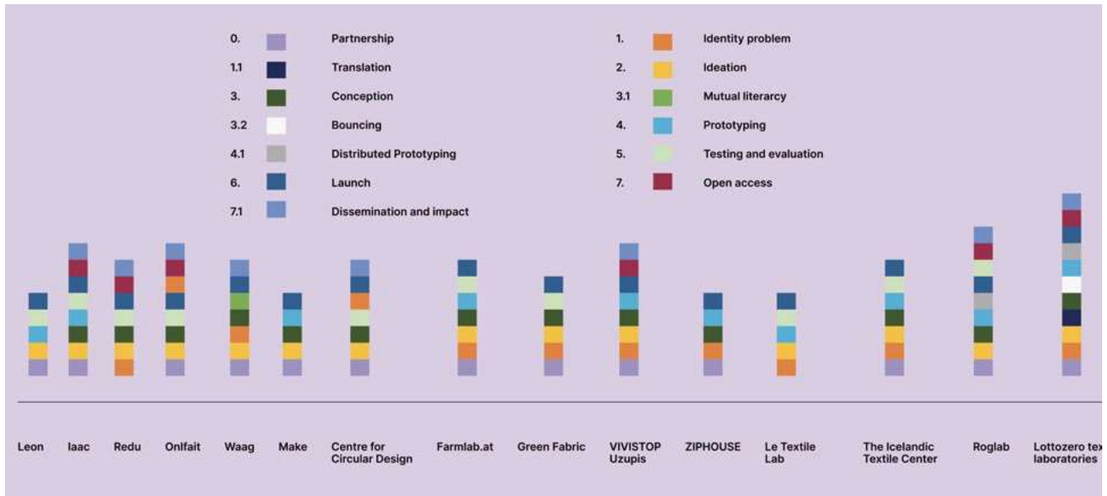


FIGURE 3. Shows whether each lab mentioned the phases of the standard process.

Resources

The third part of the innovation analysis with the shemakes labs was about the guidelines and tools used to support the process. One of the essential aspects of sharing practices and resources is that labs add guidelines, websites, toolkits, and other resources used during the innovation processes. The following table presents an overview.

Websites	**Books**	**Toolkits**	**Others**
-The Golden Circle *(Sinek 2011)* -Atlas of the Future *('Atlas of the Future' 2021)* -Transition Design Framework *('Transition Design Seminar CMU' 2023)* -The TEN *('The TEN - Circular Design' 2023)* -The Academia *('Academia.Edu' 2023)*	-The Lean Farm *(Hartman 2015)* -Learning to scale *(Medina and Charles-Lavauzelle 2020)* -9 lies about work *(Buckingham and Goodall 2019)* -Getting Everything You Can Out of All You've Got: 21 Ways *(Abraham 2001)* -E-Myth *(Gerber 2004)* -Reinventing organisation *(Laloux 2015)* -Tribes *(Godin 2008)*	-Citizen awareness Toolkit *('Toolkit – Making Sense' 2023)* -Fab Academy framework *('The Fab Foundation' 2023)* -Reflow governance toolkit *('REFLOW – Collaborative Governance Toolkit' 2023)*	-SISCODE co-creation journey *('SISCODE – Let's Talk about Our Co-Creation Journey' 2023)* - Active learning pedagogy -CENTRINNO methodology *(process by missions x KPIs)* - Shared governance bioshades model Textile lab research methodology *(TCBL days)* -Collaborative models like sociocracy\ *('Sociocracy Archives - Sociocracy For All' 2023)* - Hands-on learning

TABLE 1.Resources for the guidelines and tools used by the labs during their innovation process.

Lack of knowledge

Finally, the innovation analysis focuses on identifying knowledge gaps in the innovation process and increasing knowledge transfer between the participating labs. Often mentioned is the lack of exchange of business advice and best practice examples from other Fab Labs. Although the exchange of project ideas and implementation is already taking place, there is a need for exchange strategies that support project management, time management and, in particular, the labs' visions of sustainability and successful practice across the labs. Table 2 summarises the answers related to this last question on knowledge gaps.

People, best practice, success stories	**Community and shared information**	**Business advice**
-Examples of projects realised by the Fab Labs -Case studies of successful innovation implementation from -Fab Labs -How to motivate people to engage -Anticipate people turn-overs or team/ individual development	-Knowledge and experience sharing between labs (dos and don'ts) -Open-source material innovation databases -Circularity practices -Shared platform for collaboration -Network for co-creation across disciplines and across countries -Tools for co-creation	-Business trainings -Business model generation and design + sustainable business models (for -Fab Labs in particular) -Funding, allocation of budget in Fab Labs (staff, machines and others) -How to make the innovation process efficient -Governance, power distribution, openness in debates, transparency -Sustainability

Table 2. Identified gaps in knowledge in innovation processes.

Conclusions

The workshop discussed in this paper aimed to provide a shared vision of innovation and innovation capabilities as well as to identify capability gaps related to individuals and labs. It was noted that each process is not linear but rather value-based, networked, distributed, open, accessible, and layered. In most labs, there is no exact procedure, not because there is no model but because the organisational aspect of the model can change depending on the situation. After consideration of the emergent factors and a common consensus on how to proceed, labs decide collaboratively to adapt the model. Consequently, the result of a collaborative process can be sustainable in various ways, even though the adaptation of the methodologies may be unique. The process itself is thus the solution. It is like a hybrid approach in which the starting point is based on multiple insights drawn from previous experience, and in conjunction with these inputs, a methodology is established. The lab then implements, adapts, and finalises the project with extensive documentation. This dissemination strategy often consumes more time than the project itself, but enables others to further develop the results.

The innovation process can vary significantly from lab to lab. However, it demonstrates the great opportunities for exchange. It creates a particular space where most workshop participants work in a Fab Lab environment and do not aim to produce commercial products but focus rather on rapid prototyping activities.

The application of methodologies to foster innovation needs to be improved, to bring greater agility to the process. Further exchange between lab leaders and their teams as well as the collaborative use of the above-mentioned tools is suggested as a first action. The results of this innovation analysis can broaden the level of collaboration for the benefit of open innovation. Lab managers can apply and integrate the standard innovation process to enable greater collaboration in the quadruple helix environment and, ultimately, bring more sustainability to the innovation ecosystem.

Application of distributed design and circular economy principles to the event industry

By Soumaya Nader from Fab City Store, Ars Longa

Since 2018, the Fab City Store, which brings together several players in the manufacturing ecosystem in eastern Paris (Fab City Grand Paris, Ars Longa, Volumes, Woma), has been organising mentoring events and exchange sessions for young designers. The Fab City Store is not a store. It is a project that aims to support designers at the beginning of their activity in their reflection on the economic and societal issues they have to face, and in their efforts to develop their work and make a living out of it. The objective of the Fab City Store is to involve the designer in a virtuous circle between production, consumption and distribution through hyper-local production, the use of responsible materials, by developing distributed projects and processes.

During its last bootcamp, the Fab City Store focused for the second time on reuse, in partnership with the Maison & Objets fair. The January 2023 edition of the event addressed a specific topic: Take Care. This was an occasion for us to deepen our collaboration with Maison&Objet, developed since 2021 within the framework of the Reflow EU project, and now experimented through the prism of distributed design. It is also an opportunity to confront young talents and designers to new logistic challenges, to a tangible context, and to an audience specialised in design.

Challenges for designers - from waste to projects

Since June 2022, we have been working with the fair's logistics team to define the most appropriate type of event to set up for the January 2022 edition. The idea was to be able to foresee what kind of reused materials collected from the previous edition of the fair would be available for this project. The question of storage space was a major issue: the network of urban workshops that we are (Woma, VolumesLab, Ars Longa) has only limited storage space and it was necessary to collect the wood and transport it to our workshops so that it would be accessible for the bootcamp. Based on two main criteria, the largest storage space available and the presence of a CNC machine, we decided to hold the bootcamp at Ars Longa's workshop in Bagnolet. After the September edition of the fair, we were able to recover several hundred kilos of wooden plates to be reused for the January 2023 edition. This was a way of bringing together the Fab City Store team, along with new talents discovered or those already present in our network, to imagine a collective exhibition around the reuse of wood and the circular economy called: " Caution, fair scraps ". After having collected several dozen 15 cm thick sheets of poplar plywood, we launched a call for projects for designers to rethink one of their projects with the constraints of this particular material. The challenge was to think of a design that would take into account the visible and assumed marks of the previous life of the wooden plates, with the aim that these objects would become a manifesto and would raise awareness of the thousands of kilos of waste generated during the fairs.

IMAGE 1. Projects in progress during the Fab City Store bootcamp

IMAGE 2. Projects in progress during the Fab City Store bootcamp

During the bootcamp, about ten projects were developed, challenging the way designers are facing more complex systems today than those of their usual practice. In a context of major shifts concerning local manufacturing, circular economy, industrialisation and craftsmanship, designers must now integrate networks with a variety of competences and open the field of their skills to other disciplines. With the support of the Fab City Store, Yoann Bordes-Pagès, Damien Coquet, Cécile Michel, Dalcio Martinho, Thomas Naville, Tarik Belkhir, Léo Sprimont, Jean-François Bernateau and Mileno Guillorel-Obregon have been able to develop adaptable projects, some already existing and redesigned to fit the dimensions of recycled materials. Each project has been certified Re-label (www.re-label.eu), a label which was developed as part of the Reflow EU project and was created through the observation and feedback of the Fab City Store community between 2019 and 2021. The goal of the label is to question a project during the creative process, to contribute to a new way of producing and consuming, and to integrate a network of actors and partners in a collaborative approach.

A privileged context to experiment these new challenges

For 25 years, Maison&Objet has been the international showcase for design and interior architecture. Each year, during 2 different editions, the show brings together more than 5000 exhibitors and 250,000 visitors. Like all such events, the fair uses many materials, mainly wood and carpet. The event industry is aware of these issues and is seeking more and more to implement solutions that address the challenges of sobriety, reuse and circular economy.

Maison&Objet seemed to be an interesting place to challenge these new issues: logistics of setting up and dismantling, questioning the materials used, to be reused, recycled or trashed... How can the designer apply his creative skills to go beyond the object and the furniture in order to raise awareness, to create a new way of thinking about projects and to build a coalition of stakeholders in the event industry, in logistics and in waste? What new patterns are emerging, between these issues and these actors, to explore the solutions around circular economy? But in a major event like this one, how can we compete with industrialisation or the know-how of craftsmen with years of training, when our designers have learned by themselves and through digital tools? What is the place for reuse and digital fabrication? What is the audience's tolerance for reused materials? What are the limits of accepting the imperfections of materials in order to be part of a responsible approach and a sustainable design?

For Maison&Objet, the challenge was to make this partnership part of its CSR strategy, but also to offer visitors an example of alternative design and to promote materials that are often invisible at fairs.

For designers, the issue of reuse and this specific situation linked to the event industry is also a way of showing their work and defending what this new generation of creators wants to promote: local production, which takes place in specific contexts with available materials and tools. The context of the event becomes an opportunity to further theorise their ideal of a more responsible economy and production while responding to the issues related to the development of their activity: to show themselves, to value their work, to practise their skills and to be part of a global project led with other designers.

For us, the important aspect was to give young designers the opportunity to show their work and their ideas at such a prestigious exhibition, while at the same time keeping in line with the questions raised by the H2020 Reflow programme on which we worked for three years between 2019 and 2022. We wanted to help the visitors understand what is behind the scenes of a fair, to visualise the possibilities of the waste generated, but also to question the materiality of the projects presented: use of the CNC machine, reused wood, etc. Our objective was to confirm the place of this sustainable design in a place where the habit is to have a perfect, aseptic design, by integrating young designers or makers.

'this new generation of creators wants to promote: local production, which takes place in specific contexts with available materials and tools.'

Feedback and opportunities

During the show, the designs presented raised a lot of enthusiasm from furniture publishers, prescribers, architects, etc. For some, it was a question of integrating an ecological dimension into their activity, with a more marketing-oriented approach, while others were interested in the distinctive shapes of the digital manufacturing processes. Other visitors were simply surprised by the products, which they found interesting but could not ignore the stigma of the materials' previous lives.

But for us, the most important challenge was the variety of stakeholders with whom we were in contact, from the early stages of the project to its setting up and dismantling after the fair: technical partners, workshops, digital fabrication workshop managers, transporters, the fair's technical director, organisers, designers, manufacturers, etc. The frequency of such

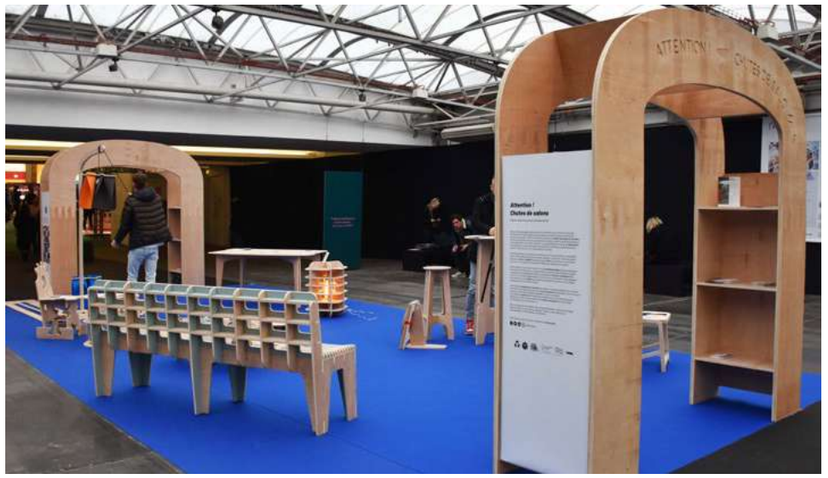


IMAGE 3. The bootcamp projects showcased during the exhibition "Caution, fair scraps" at Maison&Objet

IMAGE 4. The bootcamp projects showcased during the exhibition " Caution, fair scraps" at Maison&Objet

projects would allow clear and simple processes to be put in place for the initiators like us, who are not often familiar with the logistical issues, to simplify and repeat the experiences. Several event organisers across Europe and in France have been seduced by the ideas presented and have asked us to reproduce the experience in similar events to raise awareness of these issues through local manufacturing. And why not offer trade show organisers and exhibitors a catalogue of reused furniture and devices as a solution to ephemeral fittings, and to rethink the aesthetics of fairs to prevent all this waste from being created?

Design beyond the decline

The programme in which design talents talked about their regenerative and distributed work

By Sara de Boer & Faezeh Mohammadi from Pakhuis de Zwijger

IMAGE 1: Biomaterials from excess seaweed, shell waste, and seagrass

'Regenerative design principles include circularity, repairing, resilience, and social well-being'

Introduction

Our society has inherited and mainly uses linear, degenerative industrial systems. We take raw materials from the earth, make products, use them for a while and then discard them, losing the earth's resources as waste. During these processes wealth and opportunity are driven into the hands of a few, resulting in bigger wealth inequality.

To turn this around, we need an economy that is regenerative and distributive by design, as renegade economist and spiritual mother of doughnut economics Kate Raworth has explained. Designers can play a crucial role in reaching such a new economy. As part of the European Distributed Design Platform programme, one of the founding members, Pakhuis de Zwijger, has launched an open call in September 2022 for those who take up Kate Raworth's challenge and put distributed and regenerative design into action. In short, distributed design principles stand for open source, transparency, adaptation, and/or customisation. Additionally, regenerative design principles include circularity, repairing, resilience, and social well-being. We asked the applicants to come up with design projects that take these principles into account. We were looking for anybody, from designers to artists, researchers, architects, engineers, (tech)startups, students, makers, and others in the mutual quest towards a regenerative future. We received plenty of applications with brilliant and innovative ideas. However, based on regenerative and distributed design principles, we selected eight pioneers. The chosen talents had the chance to showcase their designs on the Pakhuis de Zwijger stage and our website and join us for network and workshop meetings.

To create a space for the designers to present their ideas we arranged an evening at Pakhuis de Zwijger on November 4th, 2022 with the designers, experts in the field, previous years' talents, and of course an interested audience who registered and confirmed their presence beforehand. This evening consisted of two main parts: presentations given by the designers where they showcased their work and an open conversation in which we explored their inspiration, work process, and the hurdles they may have faced. We talked about how we can popularise distributed and regenerative design through legislation, imagination, and making it simple and inclusive.

Design talents & Initiatives

Eight designers have been selected to showcase their projects on the stage of Pakhuis de Zwijger. Their work varied from conceptual proposals to a designed final product. The only pre-required values for the proposals to be considered were to include regenerative and distributed principles. In the following paragraphs, we will elaborate more on each of the selected projects and the designers of those to know more about their desires and driving forces.

[Seaweed] Farm to Table by Kathryn Larsen

Excess seaweed, shell waste, and seagrass are all parts of a normal marine farming ecosystem. [Seaweed] Farm to Table creates an open-source material archive for biomaterials from these marine materials and proposes how to use them in architecture.

These materials vary from shell waste from farming to algae. The driving force behind this project started from studying the entire ecosystem of local species. Overextracting the resources to use them as the first material did not seem to be regenerative to Kathryn. She believes [Seaweed] Farm to Table is distributed because it can easily be adapted according to the available materials in different areas. However, each case and design may need specific consideration. In addition, the design process is open source and accessible via her website to give free access to everyone. She tries to encourage people to adjust the designs according to their local regions.

Lucrative Dumpster Dives (LDD) by Angelina Kumar

LDD is a foundation and an open-source platform that helps to transform the art and cultural sectors into circular and sustainable ones. The platform offers free material and educational support to a wide range of young artists, designers, and makers, helping to revise, boost and turn creative practices into thoughtful, social, and circular flows. LDD started in 2017 from a personal passion. Angelina wanted to do something about sustainability and to be greener with an impact on local society. “I was a fine art student and amazed how a large amount of material is wasted and thrown in the bin,” says Angelina. At the time, students had a small budget for the needed art materials and that was the moment for her to start to collect the material that could be re-used later and started her studio with the idea of circularity in mind. The concept started to grow and led to various projects and education programmes.

IMAGE 2: Art Swap Shop at Lucrative Dumpster Dives

Rain(a)Way by Fien Dekker

Rain(a)Way is a design studio that has launched a new climate-adaptive paving tile called Park Positive. It is a building block with the paving including the foundation, that has water storage available for green and restores the soil fertility. This will change the way how we design our paved cities. The foundation construction has three layers:

(1) The surface, which contains grass, and the unique Rain(a)Way tiles.
(2) The middle layer contains all the nutrients and space for the grass to grow. The grass species they use, make a lot of roots that can grow 60cm deep.
(3) The underlayer is the water storage, this layer can absorb rain fast. Fien says that they see Park Positive as more than a product; it is a movement. Their mission is to make green parking and paving the new standard!

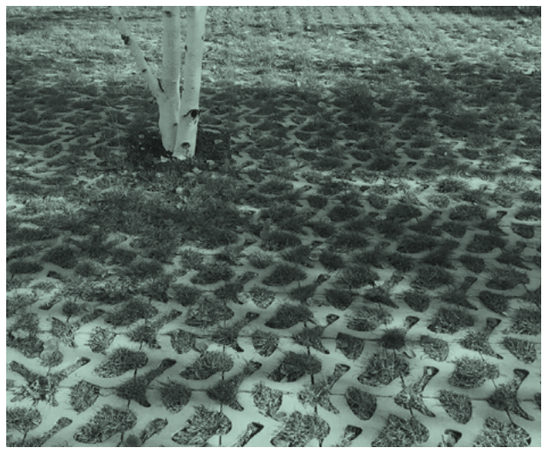


IMAGE 3: Dodola is an installation of intricately shaped filtration modules which purifies water of contaminants

‘At the time, students had a small budget for the needed art materials and that was the moment for her to start to collect the material that could be re-used later and started her studio with the idea of circularity in mind.’

IMAGE 4: This soup is made of vegetable stock and contains dry-frozen vegetables. The soup is rinsed and boiled in water; the stock melts, and the vegetables return to their juicy, flavorful state.

NakedPak by Naama Nicotra

NakedPak series is a line of zero-waste, edible meals, wrapped in soluble bio-plastic made of agar produced from algae. The series includes vegetable soup, spaghetti with tomato sauce, rice with green Thai curry, lasagna, and ice cream. All you have to do is rinse and cook your meal. The meals are not only vegan and zero-waste but the portion size is also taken into account. The project offers a new point of view on food packaging. NakedPak is not inventing a new method, it is asking us to take a look at our habits, and the way we act with natural packaging. We don’t mind when an apple, bread, or pastry is unwrapped, we simply trust packaging that is made by nature. So why do we stop there? Why don’t we eat an unwrapped meal?

‘All materials used are natural and can be locally found.’

IMAGE 5: Climate-adaptive Rain(a)Way tile offers a solution against flooding, heat stress and the growing grey concrete craving in the city

Dodola by Pjorkkala

Dodola’s a ceramic water filter for places where the public water supply isn’t adequate or available. The 3D clay printing technology doesn’t create any material waste during production. All materials used are natural and can be locally found. The final product needs very little maintenance and no additional parts. Furthermore, it is autonomous and doesn’t need electricity to function. Dodola was designed by a team of talented students from Ljubljana, Slovenia. Slovenia is a small country with a lot of natural resources including water. The water filter can be used by people in different areas, mainly in parts where water is polluted with the E.coli bacteria.

Blade Made by Jos de Krieger

Blade Made reuses decommissioned wind turbine blades to make urban furniture, playgrounds, sound barriers and more. Glassfibre-reinforced plastics are hard to recycle and very durable, making them a perfect fit for beautiful outdoor installations. The fact that we replace virgin materials with an existing waste flow reduces carbon emissions by roughly 90% compared to conventional products. Besides that Blade Made tries to include environmental enhancers to increase biodiversity, store water or grow plants. The project is still discovering some of the possibilities as it switches between manufacturers, policymakers, and energy companies. Jos believes that they are offering a solution that is applicable worldwide due to the similarities in windmills.

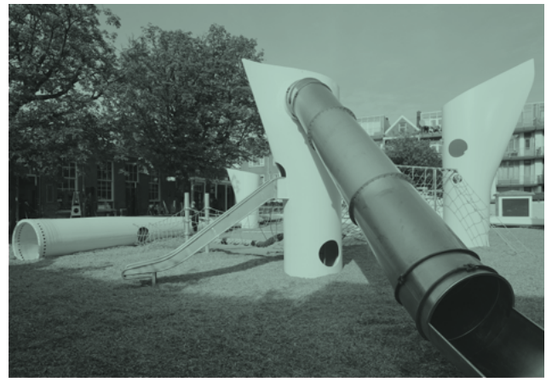


IMAGE 6: Turbine blade has been transformed into a playground object and the Blades are being saved from downcycling (shredding, incineration)

Community Biodigester by Maartje Bos from Green Hub

The Green Hub in Amsterdam hosts the first mini biodigester in the urban living environment in the Netherlands. It runs on locally collected food waste (swill) and produces methane and liquid compost. The green gas is distributed amongst everyone delivering the swill (a school, restaurants, community centre and the Green Hub). The liquid compost (when sanitized) feeds horticulture and aquaponics. It serves as a showcase of how a community can produce its energy with swill. The involvement of the school and its students is essential in this cooperation which will include educational programmes. The local government, businesses, organizations, and citizens can cooperate in this biodigester project, combining social and sustainable issues. This is what the Green Hub calls a Donut Deal.

IMAGE 7: The first mini biodigester in the urban living environment in the Netherlands

Towards Nature Permaculture by Nuri Tayfun Yalcin

Towards Nature Permaculture is a design, consultancy, and landscaping company, based on the Permaculture concept. In this project, Nuri Tayfun Yalcin developed a design for a ring of “volkstuinen” (allotments) around Amsterdam, including food forests, growing beds, and community-managed areas with flowers, herbs, berries, and perennial and edible flowers. The design is based on expanding productivity, community building, education, childcare, diversity, and edible landscaping. In other words, he aims to create spaces that combine community building, edible and regenerative landscaping, education, food production, and living. This project aims to meet the needs of affordable housing, environmental balance and resilience, social connection and community building, regenerative landscaping, and reducing nitrogen emissions. regenerative and distributed design.

Grounding production design in space and activity

A framework for responsible product design practice under the New European Bauhaus

By Max Kersten Boll & Kay Marten Boll, Muthesius University of Fine Arts and Design - Sustainability Design Lab

Respecting and appreciating the social role of the production process leads to the design of valuable activities and products, a modest and therefore democratic objective. STREEV is an ongoing project introducing a methodology that enables us to reflect and correct the production process. Its main 'design feature' is the synchronicity of sustainable socio-ecological and long-term technical development while focusing on social-ecological goals and respecting the role of labor and production (see NEB, European Commission, 2021) within a given and for the future elaborated space.

'We need to design production methods that make the process comprehensible to all involved people.'

A production method dictates the context of the product. Our environment is shaped by available semi-finished and finished products mostly delivered by a divisive industry (i.e. particleboards, concrete stones, furniture, metal-profiles, injection molded objects etc.). To design the context of products in a less complex way, we need to design production methods that make the process comprehensible to all involved people—through contact with other involved people and through observation of its impact on space, production and product. The definition of the context of objects in this paper derives from all the relationships, impacts and interactions that an object has or potentially will have with people.

The concept of space is complex and encompasses various scientific fields, including geography and anthropogeography, which primarily focus on cultural and economic spaces(Guenzel, 2010). While discussing spatial relations in terms of regions, cities or nations is tempting, it's important to recognize the multidimensional complexity of social relations (Jesop, Brenner, Jones, 2008) as an important part of the spatial context of objects and people.

How can we support design approaches with goal-oriented theories and models used within a methodology? To define and work on a common good, it seems vital to validate and reflect practical output within research but also with respect to institutionalized design. This allows us to better understand design, its role in society and also how to overcome its current limits by accepting the need of cooperation and interdisciplinary work (Bassi, 2021).
In the first part of this paper, I will discuss how referencing an appropriate space for action can help in designing activities that contribute to social and cultural diversity. How can this reference space be extended from urban to structurally weak spaces? What is an abstract definition of the underlying design process?[1]

The second part aligns the model outlined in the first part with STREEV, a project crucial for developing the theoretical model approach. In addition to the practical exploration of essential model parameters, the project provides important pointers for goal setting, reflection, and reorientation. The concrete everyday objects resulting from the STREEV project can help communicate the scope of the space- and activity-contextualized model better.

Methods, models and theories

Responsibility and ability to change
A brief consideration of the ethics of responsibility, rootedness, and human action allows us to delimit better the diffuse and elusive interactions within complex production and interaction systems. Philosopher Hans Jonas (Jonas, 2012) argues that humankind has a responsibility to act in ways that preserve the planet for future generations. Further, philosopher Simone Weil (Weil, 2011) suggests that responsibility is a human need that involves taking ownership of one's role in the community and working towards shared goals. Together, these ethical considerations emphasize the importance of considering long-term forecasts in decision-making and aligning actions with the goal of preserving human life on earth. A responsible design process for production systems should be orientated towards this ethical standard and therefore select those transformative ideas and theories that support this goal for testing in an elaborate learning process.

Model of Change

Need for transformation
As put forward by the New European Bauhaus initiative, change is needed for a green transition and to address challenges like climate change (NEB, Commission, 2021). According to Kristof, this systemic change is already happening in part and has to be directed in a goal-oriented way through understandably "designed change processes".(p.12-14, Kristof, 2020) The selection of possible contexts and concepts for an activity- and space-contextualized design process proposed in this paper is based on the demand for a societal transformation and builds on the recommendations found in Kora Kristof's Model of Change (Kristof, 2020).

Following the definition of responsibility, four aspects of the Model of Change appear suitable for the purpose of a activity- and space-contextualized design process:

- **Name resistances**

Find and point out structures of resistance. Acknowledge and reflect on their arguments to find new, different solutions (e.g. conventional economic practice).

- **Find narratives**

Find a narrative that is oriented towards common needs and problems; such a narrative is a motivating story of a positive future and can be found in the field of transdisciplinary research (eg. positive scenarios for future).

- **Small flexible frameworks**

Find a framework to address problems central to the transformation; such frameworks need great flexibility to allow for a trial-and-error process and need to be small enough to engage diverse interests and actors. Different places come with many different solutions (e.g. open initiatives with little investments required).

- **Correction options**

Find solutions for new upcoming problems early enough to avoid path dependencies to occur. Organizational path dependencies as an example limit possible options by repeating and reproducing the same procedure (p.691, Sydow, Schreyogg, Koch, 2009). For instance, the car as the primary mobility concept for rural areas led to the construction of roads and occupations shifting to more distant locations that could only be reached by car. A distanced view can help to find other design solutions such as bringing work closer to people instead of people to work. Growing solutions lead to more complex contexts that are difficult to

1 The model presented here was developed as part of my bachelor thesis (Boll, Max Kersten, Space-contextualised design, Muthesius University of fine Arts and Design, 2022).

oversee; iterations with regular evaluations and change of perspective between the whole and the concrete are mandatory.

Selection of transformative contexts
The model of change seeks concepts that promote responsibility in small, flexible frameworks, both in concrete communities and in abstract, reflective global contexts. To effectively drive change, concepts must be defined in a broad and adaptable way that can be applied by diverse actors and in various contexts.

The pressure to prioritse economic growth (Balamir, 2021) often leads practical or commercial design to present "things that are not new at all as the latest novelty" (p. 37, Friedrich, 2008). Despite efforts to promote sustainability within design, these efforts are often still focusing on growth rather than clear solutions for global problems (Hickel, Kallies, 2019) and thereby constitute resistance against change.

Kristof's model suggests that small, spatially limited partial solutions, ideas, and prototypes should be developed, tested, and refined for transition processes. One aspect, which was also considered in the development of the STREEV project, is the appropriate handling of geographic scale. Various programs promote similar approaches, with differences in wording and geographic scale (dimension, distance, size) and territories (human-made borders) (e.g., cities, regions, villages, local, global, and national; (NEB Commission, 2021; Tsuda, 2021) For a specific model, it is important to define a goal that addresses appropriate space.

The narrative of post-growth geographies
The examination of the use of available land, habitats and resources is a fundamental part of spatial science. In the spatial sciences, discussing the meaning of economic growth in the context of resource consumption has led to the concept of "post-growth geographies". This concept brings together theoretical and practical approaches to enable a "temporally and spatially just, sustainable and humane life" (p.62 Schmid, 2020). The "post-growth" movement questions the "growth imperative" and strives for positive change beyond technology-fixated approaches (Lange, 2020). Its objective is not to go back to previous times or to reduce population and economic performance. Instead, it seeks to enable economic growth, especially in poor regions, to achieve an adequate standard of living (p.18, Schulz et al., 2020). The effects of spatial transformations can be differentiated by various spatial concepts, which will be briefly introduced in the model (p. 66-71, Schmid, 2020).

'The "post-growth" movement questions the "growth imperative" and strives for positive change beyond technology-fixated approaches.'

In the context of the space- and activity-contextualized design process, the post-growth theories introduced by Lange serve as an appropriate narrative. The spatial transformation concepts of Schmid were used as concrete strategies (Schulz, Lange, Hülz, Schmid, 2020). Here, I will focus on two space concepts, with the purpose of designing tangible objects: place and network. Activity manifestations (Bürkner, Lange, 2020) are defined by their economic and social spatial reference, which can be chosen according to the situation. It is necessary to establish new and flexible solutions at the network level and work out concrete solutions in heterogeneous groups through symbiotic strategies. This can be achieved by discovering and creating meaningful, shared practices in places and networks, resulting in tangible and intangible artifacts that provide a concrete reference to a common activity and its orientation. Socially innovative activities can also be key to creating these references.

Understanding through contextualization

Why methods?
According to Zerweck, the concept of methods is controversially discussed in the design practice. The heated method discussions in the 70s still have an impact on debates about design methods today, which are notoriously charged with emotion. As for communicating complex design artifacts, models and methods are needed to assess the exchange, further develop and validate the created artifact. For a design understanding outside of self-sufficient author design, methods serve as "model-like" abstracted communication tools. A method is an opportunity to find common goals and reflect the design output within these goals avoiding discussing only subjective perspectives on complex topics (p. 93-94, Zerweck, 2008).
The following model intends to create methodical and reflected conditions for concrete design. In its incompleteness, it is subject to continuous change and modification by practical experience.

What can we learn from school?
A pragmatic approach to comprehension in primary school is the method of contextualisation. This method will be introduced and then merged into our model of design processes.

For the hypothetical model of the space- and activity-related design process, contextualisation serves as the foundation of the methodological process. Contextualised learning means enriching and elaborating a specific area with knowledge in a situated way, i.e. in relation to everyday life. According to Lohrmann, the aim of the method is to deal with concrete initial situations and their contexts in order to make knowledge applicable and transferable to other cases. The concrete (or "context": everyday situation, environment) is abstracted by reducing it to its foundational ("conceptual") elements. In this way, it can then be transferred back into the concrete as the "new". The process consists of a constant alternation between concretising and abstracting and is intended to promote vertical and horizontal networking as well as flexibilizing the structure of knowledge. The following steps explain the main steps of the method (p. 415-416, Lohrmann, 2014):

- **Contextualisation (Con)**
Contextualisation refers to a concrete initial situation with everyday relevance, which is relevant and appropriately complex for learners and contains central abstract structural features (e.g., a tomato). The learner intensively engages with the topic by establishing a personal reference and accessing existing knowledge (e.g., the tomato is red, edible, comes from the supermarket and can be found in many dishes).

- **De-contextualisation (De-Con)**
In de-contextualisation, concrete everyday references are broken down into their details such as "structural knowledge" and "higher-level concepts". Thus, abstracted knowledge components of the concrete are related to previous knowledge (e.g., the tomato is the fruit of a plant, just as the apple is the fruit of an apple tree). The reduction of information enables long-term and efficient memorisation as well as deep understanding of new knowledge structures (e.g., fruits contain seeds, plants grow from seeds).

- **Re-contextualisation (Re-Con)**
  Re-contextualisation represents the application of newly acquired knowledge and allows for referencing back from the abstract to the concrete (e.g., the seeds in the fruit are planted, growth of the plant can be observed over a long period of time). Re-contextualisation is a particularly important component of knowledge networking in that the new knowledge structure can be enriched (by references to the existing one), expanded and supplemented by personal references for the learner (e.g., the fruits of the tomato planted by oneself can be eaten after the observed growth). The process alternates between concrete and abstract knowledge (e.g., tomatoes need time and care, it takes a long time and a lot of work until they can be sold or eaten). The goal is the transfer to other references to consolidate and apply the knowledge (e.g., other plants, other organisms).

According to Lohrmann, de-contextualisation needs moderation to prevent learners from focusing on details and recognising abstract parts. Tools for this process can be models and visuals that facilitate orientation and understanding. Another tool is the comparison of well-chosen concretisations to work out the differences on the abstract level, as well as impulses and focussing aids to stimulate the process (p. 417, Lohrmann, 2014). This moderation is one of the activities to be designed.

Results

Model of a space- and activity-contextualized design process
The activity- and space-related design model is intended to change or develop subsystems participatively in an ongoing, reflective and corrective process. In this process, the spatial and activity reference is a means to forming transdisciplinary hypotheses (p.33-34, Meier, 2001), which reduce and structurally organise information.

Role of (design) actors in the process
For the use of a didactic method in design practice, the roles of actors have to be redefined. The orientation towards post-growth geographies necessitates that the role of consumers and producers[1] has to be replaced by learners in order to build up and deepen an understanding of processes. This also involves the designers, who initially take on an additional moderating role.[2]

Space- and activity-contextualized design model
The process is the activity, or more precisely, the activity emerges from the process. In discovering and creating meaningful practices, places and networks define the social space. According to Brükner and Lange, communal “discovering and practising” is meaningful in the action. The reason for this is the creation of artifacts and the social symbolic reward (p.41, Brückner, Lange, 2020), which can already be part of social innovation by itself. A continuous trial-and-error process takes place, which is a constructive and culture-friendly alternation between small and large levels (p. 89-91, Kristof, 2020).

1 Inclusion and proximity of the roles to each other is important for the adaptation of conditions and a changed understanding of values(p. 127, Tschumi, Winiger, Wirth, Mayer, Seidl, 2020

2 Concrete technical implementation through the strong involvement of the designers in the production process (p. 26, Loebach, 2001).

The shared social space of the actors defines the framework of the process and provides an everyday reference for contextualisation. The process is necessarily collaborative. In the process, the socio-spatial contexts of everyday reference promote understanding of the actors (Lange, 2020) and the continuous development opens up new contexts. The goal of the process is concrete material and immaterial artifacts (common work), which are produced by sub-processes (concrete design by moderated actors). The processes and sub-processes should be evaluated as social innovation because of their relevance for the actors (Brückner, Lange, 2020). The process cycle, shown in figure: 2 (process model), is not linear throughout, but should be described as follows:

1. Concrete space as an everyday reference (Con)
The common social space of the actors forms the initial situation (concretion) for a sub-process and includes location-bound materials, practices and artifacts (i.e., things, personal- and traditional relations, traditions, raw materials, procedures, forms of production) as well as social structures at the level of place and networks (i.e., interaction of individuals and organisations, institutions, fair trade, values, knowledge exchange; Schmid, 2020).

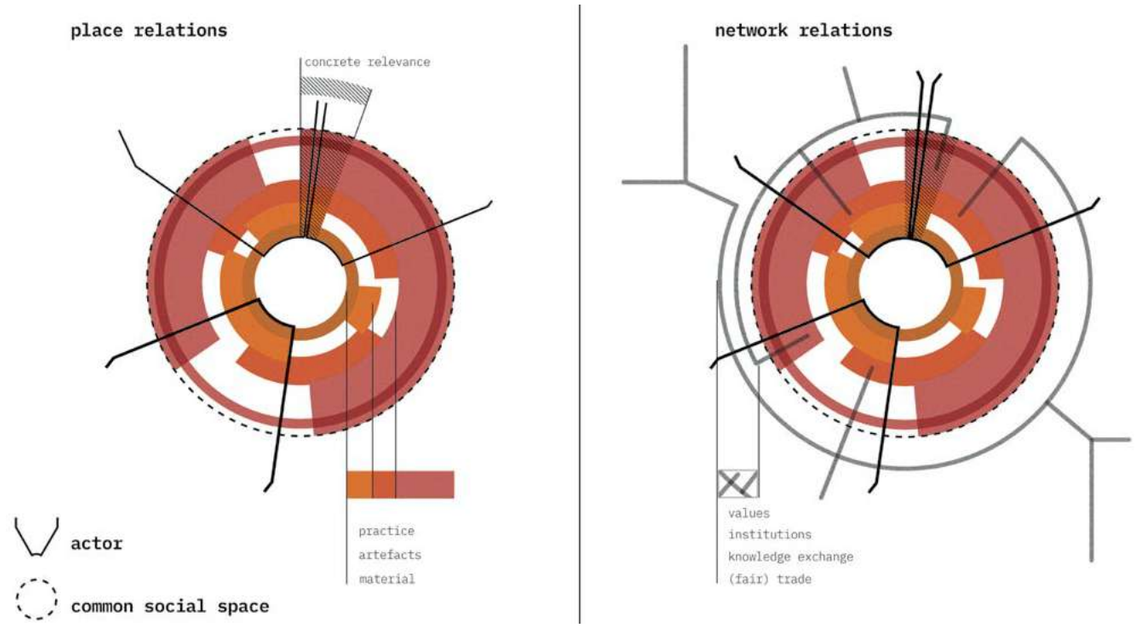


IMAGE 1. Places and networks

2. Relevance by actors (Con)
The selection of the concretion is determined by the actors through relevance and is based on interest, need or socio-ecological problems (Lange et al. 2020). In this way, a topic (concretion) is determined and its meaning and references are explored. Path dependencies can serve as a reflection concept when obligatory correlations (i.e. argumentations of best practice compare with approaches that have failed in the past) appear and changing them seems impossible.

3. Moderate abstraction (De-Con)
The concretion is broken down into its knowledge components (structure) and analysed to classify its knowledge components. In case of problems, the analysis of path dependencies can help jointly identify the structures constituting the problem.
Knowledge components of the concretion can be related to knowledge that is available in the common social space or in new network-like connections (p.64-65, Schmid, 2020). The type and structure of knowledge (e.g. production processes, practices) is leading to a concrete goal (e.g., a product or a service) in our case to common „work".

4. Concrete, enriched practices (Re-Con)
The development of concrete processes and activities is informed by knowledge that considers spatial conditions, and involves trial and error to identify new potentials in the existing space. This process leads to the creation of new connections and personal relationships among the actors involved. Challenges can be addressed by involving new actors and working collaboratively to find solutions.(p. 90-91, Kristof, 2020)
The process involves alternating between concrete and abstract content to identify references that are relevant to the space, tradition, values, and process, and defining an aesthetic and contextual framework(p. 98-101, Stalder, 2016). Actors should be cautious about romantic and ideological perspectives (p. 203-218, Krueger, Pfeiffer, 2019) in their analysis of reference, so that spatial reference and therefore strong connection to the actors' values are strengthened.

5. Evaluation
Looking at the process at the macro level is equally important for reflecting and adapting the goals and concepts as well as identifying new problems and needs. In doing so, the entire process is considered, corrected and discussed with respect to path dependencies and references. This is the most important step for further development.

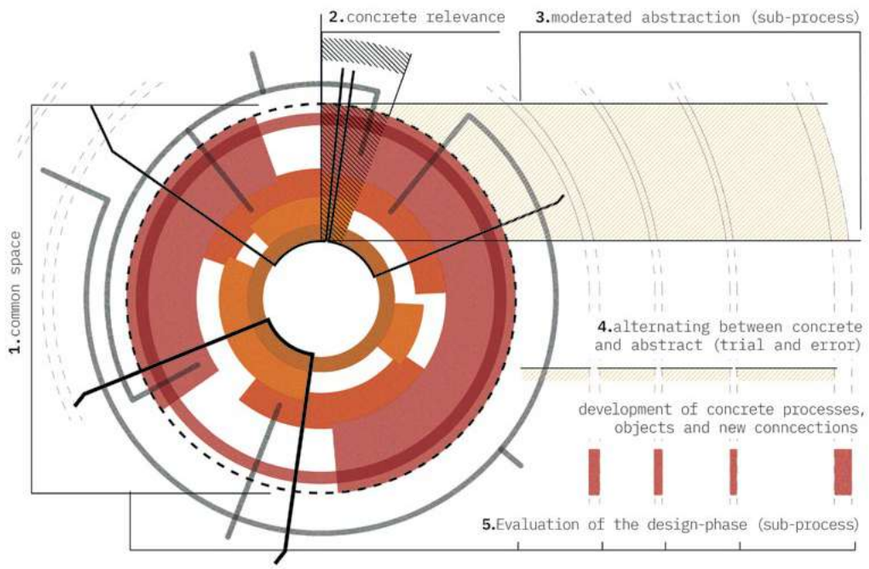


IMAGE 2. Process model: space- and activity-contextualized design process

The everyday relevance of the actors expands to concretisation in the common social space. New abstractions can emerge from this and iterative improvements can be promoted by evaluating the results and goals. The sub-processes represent multi-layered activities that are constantly improved through their repetition. Ideally, the newly acquired knowledge is integrated into the process and made available in the different spaces (places, networks) of the actors. In the communication of networks and new actors, the knowledge background, advantages and limits can be well mediated by practices and actors due to their strong involvement.

The model forms a hypothesis for a socio-ecological design process in a production context. It is unspecific in its representation with regard to detailed processes and proposals for action and requires further specification based on case studies. A process with sub-processes intended to generate new insights through contextualisation is presented in the discussion part of this paper. The enrichment and improvement of the model can also be seen as an ongoing process still in its beginnings.

Discussion

The introduced model categorizes and analyses the STREEV project, which began as the KFVR project in October 2019 during my third semester of industrial design at the Muthesius University of Fine Arts and Design in Kiel, Germany. The project had several goals, including a paradigm shift in the industry through design, developing a functioning prototype, using accessible and local materials, delivering to an existing market, and achieving new aesthetics.

The framework allowed for a comprehensive evaluation of the project goals, also in relation to general questions within the field of industrial design. The project sought to create and interact with objects, focusing on socio-ecological responsibility, production, and craft, with the use of local materials and aesthetics as an important consideration. The analyses of the project focused on the spatial categories of place and network, as they relate strongly to objects and the context of things. In contrast, I deemed other spatial categories, such as territory and scale, less relevant for iterative inclusive transformation.

Concept phase (09.2019 - 04.2020)

1. Locating the concretion within and actor-related space and 2. Finding relevance (con)

Actors: At the project's start, two actors were involved. Due to our family and friendly relationship, my brother Kay and I have multiple spatial intersections. A relevant concrete reference within our interest is our background knowledge and interest in technical fields and solutions with different specifications. Other involved actors can be found in our daily places and networks (e.g., workmates, friends, tutors, and neighbours).

Traditions: Having been raised on a farm, we are a relatively self-reliant in trying to make needed objects on our own. This involves certain architectural traditions in our environment, like framed buildings made out of wood

IMAGE 3. Wood joints

through located crafts. There is a willingness of us to understand, reproduce and change practices learned for different demands.

Practices and knowledge: As being trained in our professions, e.g., mechanical and electronic production and engineering, we know about methods and processes within the fields.

Interest:
I experienced work within wood-related jobs as an assembler and can also use workshops in different places. Modern approaches to woodwork awaken my interest in traditional woodwork, especially its technical logic. Also, our shared interest in making things, interaction with concrete objects, and results in finding solutions for tangible objects is an essential part of the project.

Materials: Wood, because of the fascination that a minimally processed material is quite understandable, looking at the trees in the rural area of Schleswig-Holstein (Northern Germany).

Values: The enjoyment of cooperation, shared understanding of our results and agreeing on a common goal. Also, sovereignty should be mentioned as an activity-related value to discuss and decide what is needed and which way to approach the need. We like to act as a part of a group engaging others within rural areas to find new concepts of living and mobility besides moving away for better work conditions. Relevance for change: An unsatisfying result of our experience the economic logic is that business models only look at the added value (profit) of our work rather than taking other values like engagement, cooperation, or added knowledge into account. This kind of work also leads to hierarchies within work conditions to unilateral tasks within a process.

3. Moderate abstraction (De-Con)

Knowledge of the common social space (both network and place-like):

Wood: Wood is a surprisingly simple material when it comes to understanding its origin in appliance of a tree. Though Wood is a highly complex term, thinking of all meanings, importance and relations behind the abstract word (Moe, 2019). Wood also has a rich production tradition, so the empirical "data "on the long-term impact of traditional production is much easier to follow by each actor in our environment through observation (Zwerger, 2019). Changes and challenges within the craft-work and wood industry: Time efficiency became crucial for selling normalized industrial products. Craftspeople work shifts adding value during production to assembling pre-manufactured products (Graubner, 2000).

Wood joinery: The globally distributed tradition and knowledge of wood joinery experienced a downturn since industrialization. The heterogeneous properties of wood make up a significant resistance, which requires experience to read the wood and use it in an appropriate context within joined structures (p. 58-59, Hudert, Pfeiffer, 2019).

Wood in an industrial context: Wood composite products suit automation and normalized production methods (e.g., wood is homogenized and reassembled with glue to produce chipboards; Hughes, 2019) These materials build paths for design and production, leading towards sheet-based prefabricated construction (figure 4). The value chain of prefabricated products is less accessible due to high investments which are necessary to enter the market. Solutions for working in rural-structural-week areas depend on approaches on different paths.

Wood structures: Trees grow in complex 3D structures, which need surprisingly little material to resist forces like wind. Akin to these natural principles, more traditional structural building techniques connect single beams and slats using wood joints. Complex and irregular structures made of small wood slats open the possibility of advanced aesthetics, structural performance, and material-saving design. Contemporary architecture and design research are pushing forward within the field (Eversmann, 2019). As seen in historical structural buildings, struts can be reused over multiple life cycles of objects by just adding new joints. Highly individualized design processes allow for different shapes and sizes, which are not available on the regular market (Self, 2019).

Findings and knowledge within the place-network relations:
The "New Design Manifesto" of the Institute of Design Research Vienna gave theoretical design insights to tangible, valuable work and production in an accessible way. A global network of Fab Labs and craftspeople enables self-production of needed objects for the common good with the help of robots (Bergmann, Thun-Hohenstein, 2018). This sub-process can be seen as preparation for the moderation role at the concept phase. Finding design features and concepts to communicate and enrich together.

4. Concrete, enriched practises (Re-Con)

Combining findings of the research with available spatial methods:
We build jigs (designed within the framework of a given space: University workshops) to manually produce irregular and truly three-dimensional wood structures connected by simple joints (Figure: first structural prototypes).

The results laid the foundation for digitally producing more complex joints on a machine system. Also, the geometry of the joints was improved and tested again. It is used not only for rounded strut profiles but for less intensive prefabrication, which standard wood workshops can handle with the help of table saws and planers.

Tool design concept:
The trial-and-error process showed that a manual or semi-automated tool is unsuitable. We conceptualized a compact, lightweight, and highly specialized machine, which can create joints on slats in any position. A fully automated system promises a more inclusive and valuable production-process, according to demand and transformative potential. Introducing the ideas to actors within place networks to refine and concretize our solutions led to a machine applicable for a broad range of use cases such as small workshops, maker spaces, and on-site production. New, and importantly improved, structural and aesthetic properties demand the truly five-axis build. Self-production keeps the costs low.

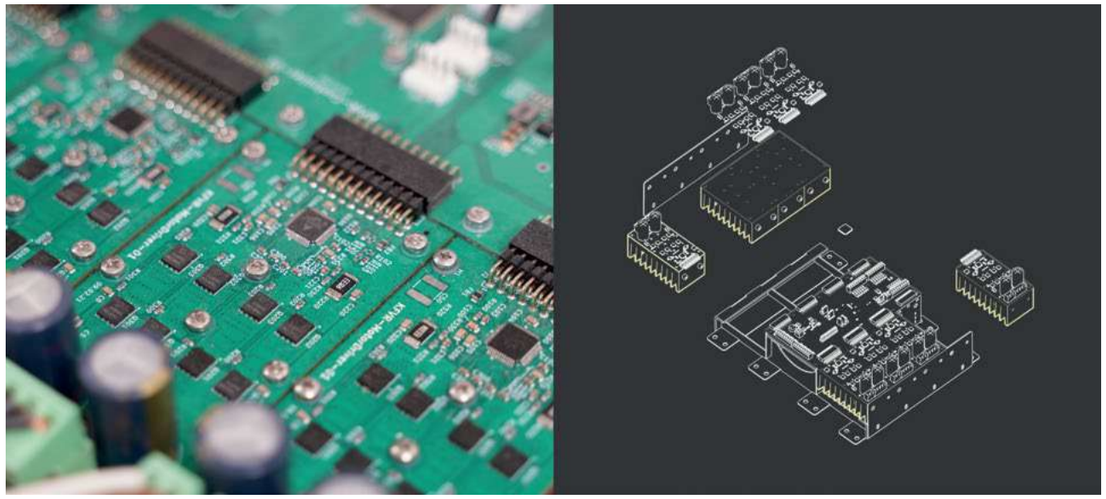


IMAGE 4. Modular controller closeup and design

5. Evaluation

Findings:
The performance and application of strut-based three-dimensional spatial wood structures is material-saving and different from standard industrial solutions in their aesthetics. The technical design, with its goal of small-scale, mostly local production must be verified before tackling other aspects of the hypothesis. Material simplicity, complexity in geometries, and joinery restrictions offer aesthetical potential, but also foster a deep understanding of the selected wood with respect to its type, origin, growth, and usage.

Creating and designing structures with conventional CAD (computer-aided design) tools takes time and is quite abstract in its visual representation. Now, the product design process is not accessible without three-dimensional CAD tools due to the digital fabrication process. According to the goal of ecological, economic, and social transformation through participation and understandable processes, this led to the results that the participatory attempt isn't accomplished nor proven.

References:
The decision to develop an automated tool plays with references rooted and widely used in the growth-oriented industry, such as "industry 4.0" on-demand production or efficiency for higher production volumes. The challenge is to design an attractive and functional system without being adopted by the growth-oriented industry. Solutions are needed to design a non-regular-business—oriented adaption for the production process, which is valuable.

Upcoming dependencies:
Some production technologies with a similar approach to accessibility, such as 3D printers, lead to a certain number of poorly designed products (the result of the process) in terms of quality and use cases. Although plastic is recyclable in the proper context, wood needs to be used in a system where the design is tested for technical, aesthetic and emotional quality. Solid wood should be kept in an overarching recycling cascade (Hughes, 2019).

better repair and upgrading through iterative development. Also, relatively simple and compact heat management for controls was achieved.

Findings and knowledge within the place-network relations:
One major key to small scale inventions are technological solutions distributed across networks (e.g., open-source software for the controller, named gbrlHal, allows 6-axis use and a microcontroller with enough computing power for adding functions; K.Boll 2021). Finding inspiration, similarity, and details to build upon in the same field of production processes(e.g., Joyn Machine of studio Milz; Deeg, Picker, 2019).

Prototyping phase (04.2021 - 08.2021)

1. / 2.
Common interests as well as concrete goals and work in the space of the actors were enriched by the results of the concept phase. The concept phase is a foundation to build and reflect on in the prototyping phase, which in turn aims to advance the production system through design, development, and building it.

Material:
The complexity of used materials increases (for developing a machine) compared to the production system output (wood). The quantity on this level should be the smallest possible quantity needed for insurable use.

3.
This phase differs from the previous one as it is not mostly about collecting and organizing the knowledge and ideas of other disciplines. Instead, the role of design and moderation now addresses other fields depending on complex contexts of technical development (i.e. decisions on components, functions, milestones, value-chains and product complexity). Keeping an eye on the concept and communicating it in different ways, especially to new actors but also within the transdisciplinary team, is still important. Due to their complexity, insights into technical developments are only briefly described.

Knowledge of the common social space:
The system's key features are named by balanced mass for low energy needs, modularity of the controller, and the mechanical parts for

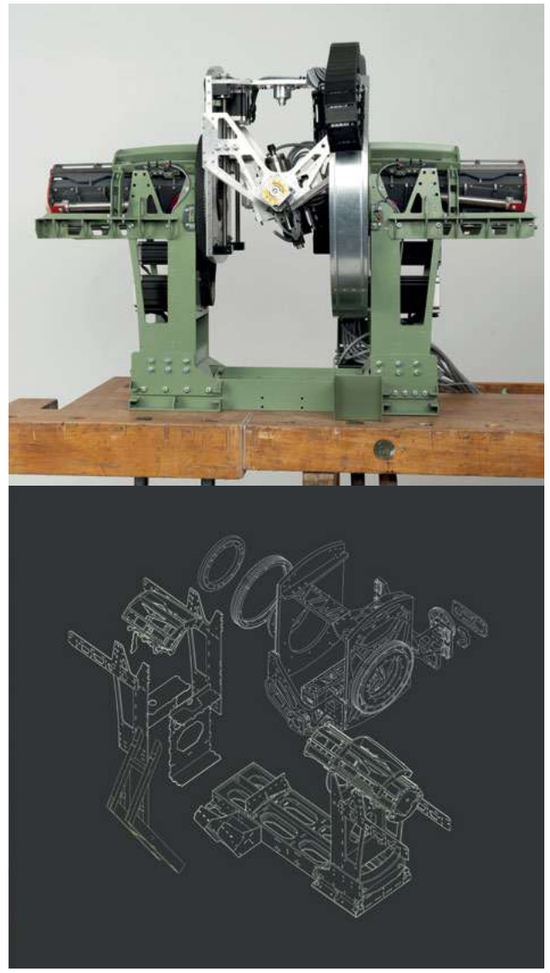


IMAGE 5. Machine

4.
Formulate accessible and distributed production design for all components, which were mainly designed and built by the actors to ensure that the context of decisions can be communicated in the future.

5. Findings:
The construction of the machine offers the opportunity to demonstrate the manageable complexity of the production. Also, directly testing the system's production, assembly, and use of wooden structures is possible now. In addition, testing some functions shows that the concept for the machine is target-oriented. References: Visible and physical interfaces such as screws or plug connections actors potentially interacting with during expansion or repair. Upcoming dependencies: Adhering to shortest distribution at the material level. Due to limited equity, compromises are made with respect to electronic and mechanical components. In some cases, there was no way to keep procurement traceable.

IMAGE 6 . Interaction with the kit, process

Abstraction phase (09.2021 - 03.2022)

1. / 2.
To evaluate and target socio-ecological impact more effectively, the design framework needed further exploration. One goal, jet unattempted, is to enable actors to engage, reflect and change their own design during sub-processes as iteration phases (i.e. design wood structures). Simultaneously, the practical project part aims to answer questions of accessibility and participation. The difficulties we experienced working only with software interfaces while creating physical structures were prioritized for solving within this phase. This led to the concrete goal of developing a design kit to help as a tool in a comprehensive sub-process for designing wood structures.

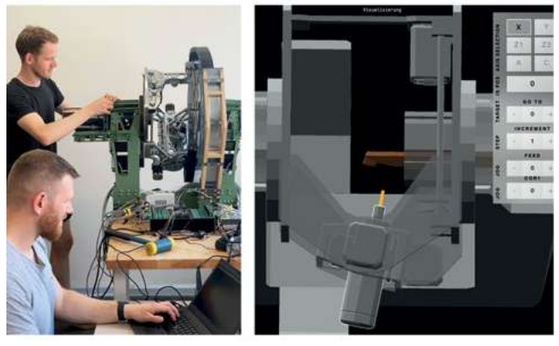


IMAGE 7. Web interace collision test

3.
To find abstract geometric conditions of wood structures and joints. Paying attention to the value of making something together and engaging multiple senses. Haptic understatement and learning critical features of making.

4.
The project expands to include a participatory and analogue design process. Prototyping allows for quality testing of the design concept and physical parts. A software prototype planned to bridge the gap between the analogue and digital worlds for easy digitalization is built.

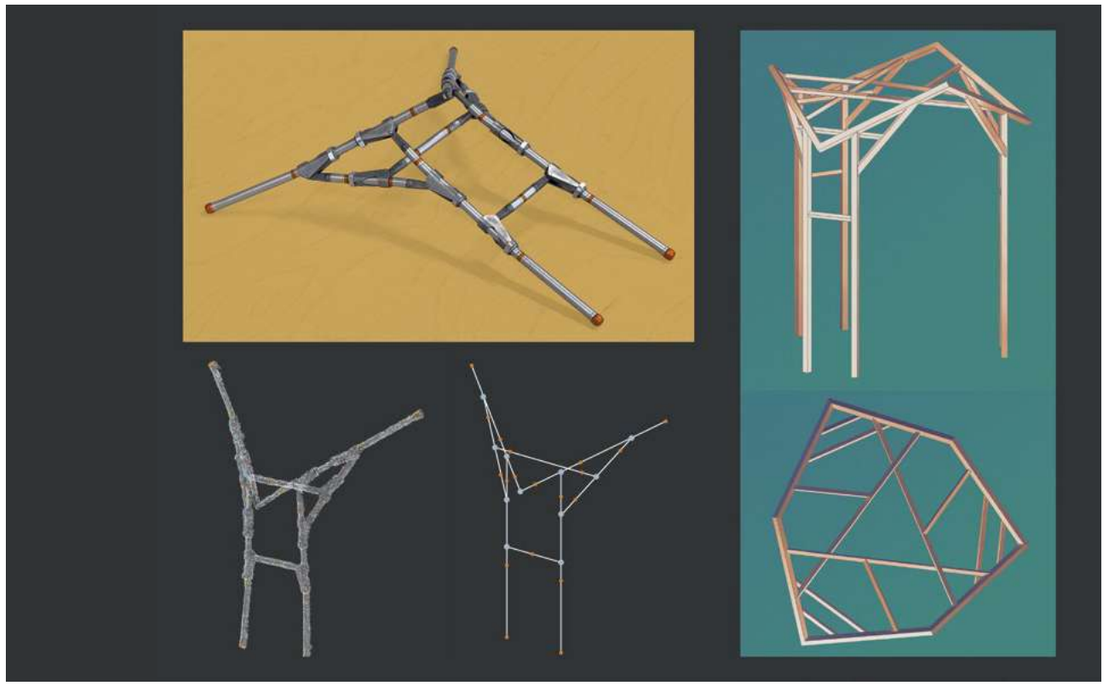


IMAGE 8 . First produced structural truss

5. Findings:
Actors get to know the features while experimenting with the design kit including haptic feedback for better understanding. The approach is limited to smaller parts or structural components. The Kit might be useful for testing single concepts or details within a more complex structure. It needs advanced software for elaborate use. The potential of the Kit unfolds in the context of the whole STREEV system.
Digital post-processing of the analogue input needs to be accessible. A participatory environment is a place of help and inspiration for a better understanding of the abstract rules for structures and the use of wood.

References:
Only aluminium and rubber were used to test the material transformation conceptually for better abstraction.

Upcoming dependencies:
Usage within the STREEV system could be too limited compared to the time efficiency of digital tools. The Kit needs to be tested and further developed in the production process to evaluate results.

Concretising phase (Sustainability Design Lab) 04.2022 - 02.2023

1. / 2.
Joining the newly founded Sustainability Design Lab at the Muthesius University of Kiel (SDL) broadens the space spanned by place and network. As an employed research assistant, I have access to the infrastructure and network of the institution. The spatial dimensions of territory and scale (e.g., acting within human-made boundaries) gains relevance. The team must organize joint teamwork in the SDL cooperatively. The process of new professional constellations puts to test both the transdisciplinary work of mainly Muthesius-trained designers and non-institutionally integrated team members. We collaboratively carry out projects and create a supportive structure. The support from the European React fund covers the designers costs of living temporarily , thereby freeing up time and resources.

3.
Defining major workflows in the STREEV system: material preparation, object design, production

planning, and actual production processing to precisely address the needs of each phase. We are also isolating the key aspects of the project. The STREV system equips the actor with a precise understanding of the product(-ion) context and produces customized, complex wood structures. On the level of cooperative work between design and other professional fields, a strategy for cooperation is vital for a community-oriented practice. Our single disciplines need to broaden their view and reflect results respecting each disciplines point of view equally (Mayer, Slezak, 2023).

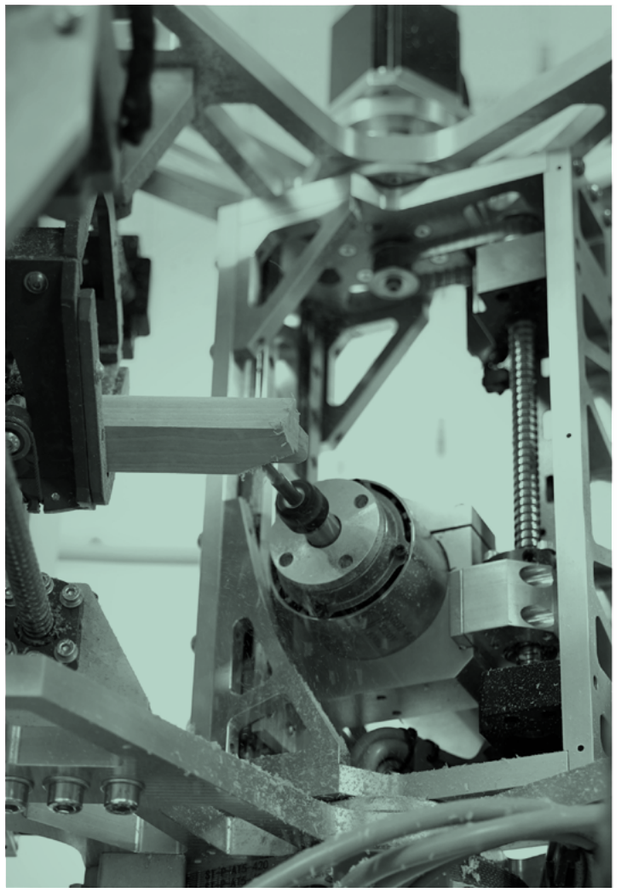
4.
The concrete and relevant output of the system are the actual objects. This output relies on machine functions and development. Refining and testing the controller and electronic components. Documentation, refinement and testing of results. Testing open-source solutions for simulation, interaction, processing, and design components. Defining selections for the workflow. Translating joinery, structure design knowledge and experience to the system.

5. Findings:
Communicating and opening the concept up to more actors through networks, for example, presentations and exhibitions is challenging, and shows that prioritizing the project's scope is crucial at the current project state. Finding the most viable approach while working on several project areas requires intensive exchange about the objectives.

Workflow analyses show that our comparably limited needs for visual software can be met by a more specific approach than using FreeCAD (FreeCAD 2023). The programming language Python (Python 2023), the javaScript library three.js for WebGl rendering (three.js 2023) and other open-source projects are used now. Also, the first joint with two rotations was tested and used in an example structural truss (Fig. Truss). Feedback from our network shows that concrete results of the process output need to be validated and reflected more broadly. In addition to the existing model for space and activity, contextualized design territory and scale must be included to better reflect given boundaries.

IMAGE 8. Wood joints prototypes

References:
At the moment, the institutional structure of the project shapes other people's perception of the project as a "test" or "experiment," not a potential business model, which would be mandatory for developing processes like a start-up. Therefore, it might be useful to give the project a different framework, which also serves as a more precise reference.



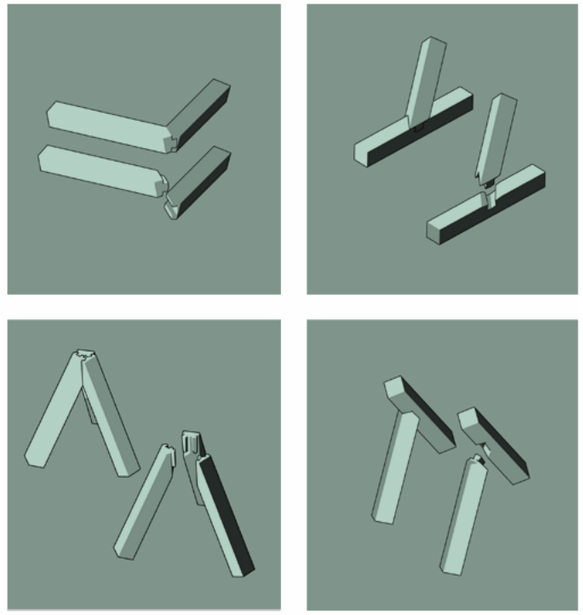


IMAGE 9. Modular wooden joints.

Upcoming dependencies:
As for the project's future, we need to find goals suitable for the situation of all actors. The question of work models influences considerations of open-source publishing, including open hardware. Also, the topic of fair and balanced workload needs to be further developed for distributed, democratic activity models with the potential to change responsibly.

Discussion

The abstract definition of the approach presented here can be applied to different contexts, which makes it a valuable framework for thinking about responsible design. It allows for both moderation and freedom in design and can be adapted to suit various social spaces. A more abstract approach to design accelerates change within social or cultural narratives, where rigid or specific solutions may not be appropriate or effective.

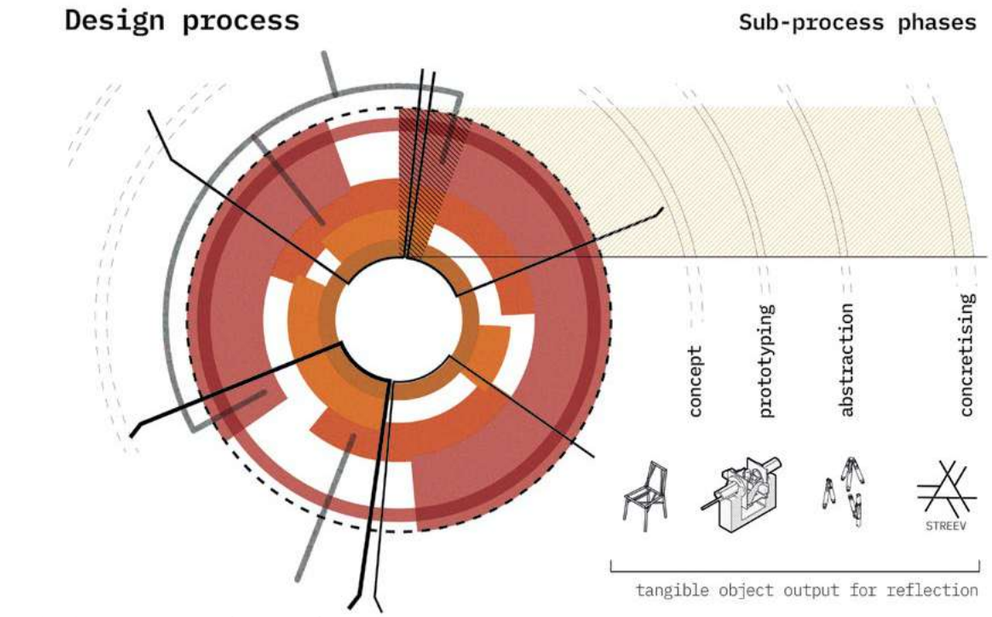


IMAGE 10. Design process, sub-process phases

The model is a theory that needs to be tested and proven. It should be instrumental in finding benchmarks that represent the complex world and our interactions with it by combining more diverse fields of knowledge and experience.

The model defines a specific project phase, which is the framework to work within at the moment, and reflect on for further usage. All actors are involved, so this can't be a masterplan for socio-ecological responsible design, which needs to be executed because every actor in the considered space defines and changes the framework according to the common needs and relevances within the space.

The cooperation of the actors in diverse spatial situations enhances meaningful activities. Feedback within a professional context was necessary for every phase at our universities. Working towards a common goal within a group of people enriches perspectives.

The theories of post-growth geographies offer approaches for social innovations, expressed concretely in objects or immaterial artifacts. In this way, it is a work-like activity design that uses positive diversity and seeks to counteract the overburdening one-sidedness. The spaces as a framework are pragmatic and recognize the limitations of human beings in their social and physical environment.

New work models in rural spaces like the region Holsteinische Schweiz seem possible within the STREEV system, pushing towards common goals like "place-based approaches and small-scale initiatives" (NEB, European Commission 2021). Primarily for thermal use, processing wood is a common practice in this space. The system would capitalise on the possibility of adding value to the raw material (Tsuda, 2021).

To further validate the system in the STREEV project, it is essential to involve new actors. New spatial relations could be established by organizing a test or workshop format with Fab Labs, maker spaces and small companies or by creating more immediate learning contexts in the form of transdisciplinary cooperations between people in vocational training and universities.

‘Complex and irregular structures made of small wood slats open the possibility of advanced aesthetics, structural performance and material-saving design’

Authors
Maria Levitskaya
& Daniil Chechin

Where
Prostor. Studio
Vienna, Austria

Project type
Furniture,
Topic research

Feel Refill

Design shaped by responsible consumption lifestyle

Project description

Feel Refill is a sustainable furniture project that aims to make the process of garbage sorting more appealing. It was designed as a stool with a bottle storage function under the sitting surface. Eight bottles of any regular size fit between the openings created by the wave-shaped elements. It serves as a reminder to bring deposit or recycled goods to the collection point. The stool is compact and can be used as a sitting place anywhere in the apartment.

IMAGE 1. Feel Refill Stool, Close-up

Context and history

The rapid tempo of the population increase combined with excessive consumption is a part of the complex climate change problem. To address this, the European Union has set up an economic transformation goal from linear to circular, where resources and materials are recycled instead of wasted. It is planned to increase municipal waste's reusing and recycling rate from 48% to 65% by 2035 (Statista, 2022). To achieve it, industries and individuals must properly dispose of their trash. This brings us to the question, which factors stop people from taking action?

At the same time, with population growth, urban areas become more crowded. The population of European cities rose from 69% in 1990 to 75% in 2020, projected to reach 83% by 2050 (Data Worldbank 2022). These factors result in a lack of accessible housing - a significant concern in dense European urban areas. People choose smaller apartments in a specific location, such as a city centre, where larger dwellings may be less available or more expensive. Kitchens in such homes have enough capacity for food and crockery, while the garbage section takes up a tiny bit of space. Therefore garbage collection could be a struggle. This is often seen in living spaces, where bags for bottles or cartons are stored in places not intended for them.

What is the need it tackles?

New home furniture solutions are a challenge for designers guided by the New European Bauhaus (NEB) principles. Despite materials sustainability being a key factor for quality design nowadays, we still need to rethink our household items. Beautiful and functional design can motivate people to become more involved in environmental protection and encourage them to act in everyday life.

What is the global-local relationship of the project?

The current project focuses on waste produced from liquid foods and beverages. Despite differences in garbage recycling systems in European countries, empty bottles must always be brought to a specific container or returned to the shop. The second process has the name Deposit Refund System (DRS). The customers pay a small fee for PET, aluminium cans, or glass bottles and receive a refund when they give back the product to the shop. The current system already works in some European lands or will be introduced soon. Statistically, countries with DRS in place have higher PET Bottles collection rates, from 65% to 95%, in comparison to countries without DRS ranging from 22% to 73% (Unesda, 2022).

Recent start-ups are already trying to improve the existing system in countries with DRS. For instance, the Canit app in Finland provides its users with a time-saving solution. The bottles are picked up from your doorstep, and you share part of the deposit as a service fee.

Small-scale initiatives change a mindset and brighten up light on global problems. Feel Refill and projects shaped by responsible consumption lifestyle can impact the overall bottle collection rates and make the DRS system more efficient.

IMAGE 2: Assembeling of version one

How was the development process of the project?

Material research

The material should be simple to process using digital fabrication or hand and power tools. MDF (Medium-density fibreboard) or its denser variation HDF (high-density fibreboard) is a versatile material that can be easily machined and has a homogeneous structure. However, it keeps most of the wood-based material properties due to the wood fibres used in its production. MDF allows a wide range of finishing techniques and has a visually appealing look. Currently, there are many MDF-like products on the European market. MDF, found in local hardware stores, is usually the most affordable one. Its low price comes with a significant disadvantage- it might be unsustainable and even dangerous for health. Certifications and EU regulations can help us find a material that fits modern standards.

The FSC® (Forest Stewardship Council) and PEFC™ (Programme for the Endorsement of Forest Certification) are two of the most widely recognised forest certification systems in the world. They aim to promote responsible forest management practices and ensure the sustainable use of forest resources. One can find the certification in the description of the material on the webpage or by asking your local distributor. Certificated source of the material also minimises the risks of unfair labour practices.

Another critical question is if the material contains any harmful chemicals. Today all of the regular MDF products contain Formaldehyde in the resin that connects wood fibres. It is a volatile organic compound (VOC) that can contribute to the formation of ground-level ozone and smog, harming human health and the environment. European regulation EN 13986:2004+A1:2015 has limits and a rating system for formaldehyde emissions. In the current classification, the lower the number, the lower the emission is. For instance, regular Valchromat (coloured moisture-resistant fiberboard) have a Formaldehyde Class E1, where formaldehyde emissions are limited to 8 mg/100g (EN 120). Class E0, as well as label NAF, stays for no added Formaldehyde.

Prototypes, progress with new versions

We successfully produced two prototypes improving each variation in terms of the efficiency of material use, minimising finishing labour and improving the design quality. We constructed our first prototype using six MDF sheets with circular openings connected with a threaded metal rod.

Nuts for the rods were pressed into the material from one side of each sheet. The top had milled slots and was eventually glued together with the vertical elements.

The design seemed simple, yet it had a few crucial disadvantages. The lack of structural stability and the difficulty of assembling were the most obvious things we could think of. But as we analysed the concept further, we thought about leftover materials. Nine circular openings sum up to 46% of the whole vertical element. We decided to make drink coasters out of cut-out circles, but it was only a temporary solution.

IMAGE 3. Feel Refill version one

IMAGE 4. Drink coasters with a laser-engraved custom design

For the second version, we rolled back to focus on the design adaptation. Considering the circular openings in Version One as waste, we used 26% less material for Version Two. The wavy elements are vertically and horizontally symmetrical.

Thus it is possible to arrange one element by another on the layout for digital fabrication machines. 24 waves connect the top and bottom MDF sheets creating a structurally stable form. However, no additional steel connection elements were used. From strict and geometric, the shape of the stool became wavy and fluid yet utilitarian. Bottles appear to float in between the wavy supporting elements. The new version has a colourful, vivid look. We experimented with different stains to create various colour palettes for the finished product.

IMAGE 5. Water-based stains applied on MDF

	Version one	Version two	Version three
Material	MDF Moisture-resistant V313	MDF raw NAF (No added formaldehyde)	Valchromat E05
Production Tools	CNC mill, table milling machine, Orbital Sander		
Colouring	Comes in slightly green colour	Water based Stain	Comes in various Colours
Finishing	Organic wood Oil	Organic wood Oil	Natural wood Wax

What results did your project accomplish?

After going deeper into material analysis and prototyping, we finalised all the thoughts and concerns and came up with the final vision of the project. We see Version Three as ready-to-assemble and, consequently, more compact for transport and storage. The design and the overall look will be similar to Version Two. Using parametric modelling tools, we plan to customise the stool length converting it into a bench for those needing more storage space. The material of choice will be Valchromat, produced in different colours. A coloured-through structure has a significant advantage. With time, any furniture piece might lose its colour, get damaged, scratched or dirty. Valchromat deals extensively with restoring its first look. To do so, one has to sand the surface and reapply the protective coat.

Why is Feel Refill distributed design?

Feel Refill was developed as a part of a Distributed Design Residency Program in Happylab, one of the fab labs in Vienna. The design can be adapted in size and made with different tools and other locally available materials. Being part of a maker space community, we stand for an open exchange of ideas and experiences. Those who wish to recreate the project could gain access to the files using open-source tools.

IMAGE 6. Feel Refill Version two

Authors

Léo Sprimont &
Arthur Grethen

Where

Valenciennes,
France

Project type

Product

VAU.R308

Fabrication of a recycled plastic sailing boat that questions the quantity of waste in and on the shores of waterways

Project description

«It is from a study of a small sailing boat: the Vaurien, designed by Jean-Jacques Herbulot in 1951, originally conceived to make sailing accessible to the working class and built with the remains of post-war plywood, that Arthur Grethen and Léo Sprimont devoted their second cycle to a common reflection: that of a new sailing dinghy. They crossed their views and concerns about the life cycle, reuse, and recycling in design, with that of the position of ESAD Valenciennes, anchored on the banks of the Scheldt river. The significant presence of plastic waste, in the waters, and on the shores, led these two designers to question the collection and reuse of this waste to confront our place in the cycle of materials and our capacity to act as consumers and users» Elizabeth Hale.

IMAGE 1. VAU.R308 close up, Valenciennes.

Context and history

VAU.R308 consists of making visible that which is invisible of the Scheldt. The Scheldt is a European waterway that is threatened by the industrial zones that run alongside it. The significant presence of plastic waste in and on the shores has led us to question the extraction and reuse of this waste to confront our place in the cycle of materials and our ability to act as consumers / users by creating a recycled plastic sailboat inspired by the “Vaurien” that was designed by Herbulot in 1951.

The original Vaurien was designed to make sailing accessible to the working class and was built using post-war plywood. Asked by the French Sailing Schools Committee introductory sailing courses and learning class, it was a robust, light, and inexpensive boat.

What is the need it tackles?

After reporting all the plastic waste near the Scheldt, we decided to give a direction to the project that talks about this subject. So we thought of using recycled plastic as a functional object that uses plastic for its quality and also materialises its quantity. Here came the idea of the boat inspired by the story of “Le Vaurien”.

What is the global-local relationship of the project?

We decided to create a small sailing boat that could both easily trace the route of the collected materials and at the same be manifest. The aim of this sailing dinghy is to raise awareness of the amount of waste thrown into waterways, but also to demonstrate that it can be put back into another life cycle. Not only as a new raw material: but as a material that can be used for the creation of objects with complex specifications.

This project aims to criticise the creation and use of plastic by highlighting the difficulties and opacity of its recycling cycle and questioning our mode of global consumption on a local scale.

How was the development process of the project?

All along the project we collected materials along the Scheldt and started to transform plastic on our own to carry out materiality tests and ways to construct with it: we finally found a way to weld to assemble.

We crossed all the knowledge we got and searched to design our boat inspired by the Vaurien. Our process was also a multiplication of drawing, maquette, 3D modelization and 3D printing that we tested in real conditions. We chose to make this sailing dinghy from a single family of plastic (HDPE) to avoid the use of other products for its construction, unlike other traditional boats. This aims to facilitate its recycling. It also led us to see that it is impossible to recycle some types of plastic.

After designing and assessing the feasibility of the Vau.R308, we started a collaboration with several professionals in a radius of less than 100km to build the Vau.R308.

Firstly Bel Albatros, a plastic recycling company based in Brussels. Their members, Guilain Sévrière and Grégoire Hupin have placed their trust in us and have based our project on the amicable contract of a virtuous exchange. Using the company’s production methods, we were able to develop all of the different plate sizes and thicknesses used for the creation of our boat as well as the milling work to be able to cut the parts of our assembly.

From the beginning, we also had the support of the Cercle de Voile. Through the exchange that was created with the actors of the sailing association, we were able to test the boat’s sealing and buoyancy while privileged access to the advice and experiences of each one. At the same time, we were able to extend our collaboration by tackling the issues of re-use, which are not very present in the nautical sector. We designed the VAU.R308 to readapt the mast and sail from a Laser model: a common four-metre plastic monohull dinghy.

What results did your project accomplish?

VAU.R308 is a prototype which is perfectly functional, but we want to make another lighter

and better version. This boat can be a good sailor, we want to improve it and also make it accessible for sailing lessons.

Following this project, we associate ourselves to collaborate under the VAU.R name and with our partners to develop design projects in different fields.

Why is VAU.R308 distributed design?

The purpose of our design was to invest in several aspects :

- Raising awareness during waste collection, transformation, and waterway cleaning.
- Transformation and revalorisation of the plastic material which is too often considered limited, weak, and worthless.
- Questions about shipbuilding and difficulties that sailing clubs encounter regarding the recycling of their old boats. The same method that allows us to assemble the boat can also repair boats, prolonging their use and life instead of wasting them.

Our project was not designed to be distributed in open-source yet because it's a prototype and we want to raise awareness through it. But we are thinking about a new version and new way to construct it to make it more accessible and also open to anyone to build it.

We also want to communicate with sailing schools to create a cycle to repair or recycle their broken boats. We are also interested in educational projects in the field of recycling and waste disposal and transformation. The collective is open to any collaboration in order to push further our ideas of making in the way of education, recycling and reuse.

IMAGE 2. VAU.R308 logo engraved on the boat

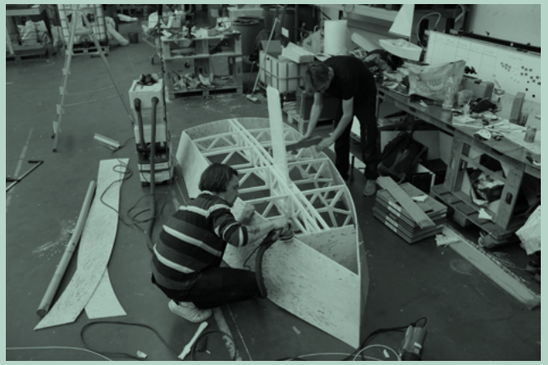


IMAGE 3. VAU.R308 construction at bel albatros workshop, Brussels

IMAGE 4. VAU.R308 construction at bel albatros workshop, Brussels

IMAGE 5. VAU.R308 navigating on Vignoble lake

IMAGE 6. VAU.R308 structure

How the future. New forms of learning and unlearning

The Bauhaus taught us to reflect on the design process and we can continue to push the boundaries as we unlearn, relearn and reimagine how we practise design. Learning by doing, designing with others, curiosity, project-based solutions in local contexts and life-centred approaches are helping us understand how to move beyond our current design paradigm and create inclusive, regenerative and meaningful interventions. This section questions and proposes new approaches to: how and what we learn; who learns and who we learn from; and why we learn what we do.

Chapter 02

Developing maker-centred learning programs to promote critical thinking about technology and design for emergent futures

By Dafni Gerodimou, Eduardo Chamorro & Santiago Fuentemilla from Fab Lab Barcelona at IAAC

Introduction

The MDEF master's program is a complex learning environment integrating, in its educational curriculum, different concepts and topics relating to emergent technologies. Topics from synthetic biology, digital fabrication, machine learning and design theory are all incorporated into one coherent course. This master aims to provide the strategic vision and tools for designers, sociologists, economists and computer scientists to become agents of change in multiple professional environments. The program focuses on the design of interventions in the form of products, platforms and deployments that aim to produce new emergent futures through analyzing the current challenges in society and industry. (MDEF 2019-2020 – EMERGENT FUTURES, n.d.) During the course, the students are encouraged to create a network of projects that exceed the boundaries of the academic space and engage communities and organizations addressing societal problems in the form of design interventions. Projects are not limited to the development of artifacts and prototypes that represent single solutions, but incorporate a combination of methodologies, interventions and designed objects under an umbrella of strategic, future thinking and design activism.

‘Strategic vision and tools for designers, sociologists, economists and computer scientists to become agents of change in multiple professional environments’

Students arrive at the program with different cultural and professional backgrounds, that instate the diverse areas of investigation in which they will initially focus their research. A core aim is to empower students with hands-on prototyping in the Fab Lab environment, unlocking technological ‘black boxes’ to create a deeper understanding of technology in designing for emergent futures. In that regard, technology does not represent the solution, but rather a powerful tool to enhance the process of creating change (Soomro, 2021). The challenge methodology framework consists of two fundamental curriculum paths: individual reflection tasks for each weekly topic and an intensive monthly maker-sprint week referred to as a challenge. Students work in small groups to develop week-long projects applying accumulated knowledge and skills from the previous Fab Academy weekly topics with concepts related to MDEF and their research projects, aiming to bridge the gap between the two courses.
In this paper, we will analyze the implementation of the challenge methodology and argue that design and digital fabrication courses can equally benefit from one another to foster a deeper understanding of technology and more critical and meaningful use of its tools and practices. This model differs from Stanford’s design thinking model that relates to a well-established conceptual framework in which the development of a solution leads to a concrete product (Tschimmel,2012) and broadens the scope of direct technological education frameworks merged with non-pre-established design agendas. This hypothesis will be focused on the academic year 2020-2021 through a range of probe-based projects developed during the four micro-challenges.

Research Scope

Prior to the definition of the paper’s scope, the following subchapter presents a guide to the educational models that this research combines. This is necessary in order to understand the foundational framework of the Micro-challenge methodology. The Fab Academy program has provided an educational guidance track framework for the digital fabrication course of MDEF that is deployed over the second and third terms. The adapted course is designed to assist students in dealing with the demands of rapid prototyping and design.

Fab Academy Curriculum

Fab Academy program is a distributed course taught by the Fab Foundation, inspired by the “How to make almost anything” course of the Massachusetts Institute of Technology (MIT). It presents a unique educational model. Instead of being centralized with students attending one campus, or decentralized, with students attending an online class remotely, Fab Academy is based on a networked model. Each student attends a physical lab, referred to as a node, where he has peers, mentors, and access to machines. All these nodes are connected to one global network: this is what we call Distributed Education. As part of distributed learning, faculty and students can engage in more interaction, and collaborate on learning. (Oblinger, et al.,2001) Students get to interact with their local peers, but also with a vast global community of students and tutors from every corner of the network.

Fab Academy is a six-month crash course in rapid prototyping. Nineteen transversal topics are addressed, at a weekly pace, summing up into a final project at the end of the course, combining a wide variety of topics covered during the semester. It is not a project-based course, but rather a combination of technical skills expressed in one final project. This advanced digital fabrication instruction is provided through a unique, hands-on curriculum and where students get access to technological tools and rapid prototyping resources as a fast lane exposure to the latest praxis and state-of-the-art techniques related to digital fabrication. The distributed educational model of the course allows for the development of a set of soft skills relating to spiral project prototyping, including creativity, collaborative work and problem-solving (Alimisis,2013) as it offers a peer-to-peer review and project mentoring by other instructors and students worldwide.

Design Interventions

During the MDEF master's program, students are expected to propose small-scale design interventions as part of their thesis development. The focus of the interventions is to approach large-scale societal problems that cannot be solved with single moon-shot solutions. Hence, the student's projects consist of a network of design actions, artifacts, platforms and prototypes that aim to address complex issues from a multifaceted perspective.

A variety of instructional methodologies are used throughout the design studios to help students reflect on their purpose as designers and establish their research paths. The multidisciplinary nature of the students as well as the structure of the first term is very influential in terms of cultivating various areas of interest. During the first term, the students are exposed to various thematic with topics ranging from biology and agriculture to machine learning and physical computing electronics to not only broaden their scope beyond their pre-established interests but exceed their preconceived notions and discover new research possibilities. "As a tangible artifact, not an abstract description that requires interpretation" (Beaudouin-Lafon, 2002)

The role of the design studio, which runs in parallel to the different weekly courses, is to aid students to filter all this new information and provide them with the tools to build their own design identity. Through a series of activities and reflection exercises, they are encouraged to focus on an area that they are most passionate about creating change.

As soon as the students have identified their areas of interest, they must start working on creating interventions, either individually or in collaboration with other classmates. An "intervention" in MDEF, as defined by the studio's lead professor Oscar Tomico (ELISAVA, School of Design of Barcelona), is a design action situated in context that involves the community object of study. Hence, situating the projects in real life context and collaborating with communities that relate to the research areas are the key assessment criteria for the design studio. Therefore, throughout the year, students are expected to design and develop tools in forms of platforms, workshops, communicative or educational artifacts and prototypes that support or even inspire these interventions.

Micro-Challenge model

During the first two academic years of the MDEF Master's program (2018-2019 and 2019-2020), an adapted version of the Fab Academy course was transversely integrated into it, following the weekly cycle of the original Fab Academy course as well as the content of the assignments but reduced in its scope. The course structure and concepts, as well as assessment criteria, were closer to the Fab Academy educational goals and principles, focusing more on the learning-by-doing approach rather than on the conceptual outputs of the assignments as per other courses along the MDEF program.

As a result, the MDEF design studio and the Fab-Academy adapted version course felt alienated from one another, as per multiple students' feedback at the end of the program. Even though the content was interesting and

'The focus of the interventions is to approach large-scale societal problems that cannot be solved with single moon-shot solutions'

potentially useful, the typology of pre-defined exercises presented to them, made the students feel they were lacking the time or opportunity to apply it to their current thesis-project in order to evolve their prototypes according to the knowledge gained and diminishing the capabilities that the range of technologies provided them (Blikstein, 2013).

Therefore, the challenge methodology was primarily conceived as an answer to this problem in an effort to bridge the gap between the two courses and create an integrated and meaningful learning experience for the students. An initial assumption in this context is the need to integrate digital fabrication technologies and rapid prototyping workflows in the master's curriculum. This is considered a crucial part for the students, in order to gain a better understanding of the intrinsic complexities that new technologies might impose on our current realities and the ways in which these realities can influence the future. In return, the master's critical perspective on technology would enrich the "learn by doing" methodology and provide insight into rethinking maker-centered learning experiences in a way that digital fabrication becomes a vehicle and resource for addressing personal or complex societal issues. (Smith, Iversen & Hjorth, 2022)

The main intention of the challenge is to amplify the impact of the design interventions by empowering the students with the knowledge and technical skills to create artifacts that help them investigate and communicate their ideas to their community of practice. In this context, rapid prototyping frameworks provide a means for making design ideas tangible. The projects developed during the challenge are not expected to present singular solutions, but to be part of a wider network of actions and interventions that aim to address the wicked societal problems that the students have been investigating through their design projects. This use of digital prototyping processes fosters development of competencies across a variety of fields such as science, technology, engineering and mathematics commonly stated as STEM competences. Providing an understanding of these digital technologies, supports their ability to interact with their current digital world, giving the opportunity to create their own understanding of it as participatory citizens. (see Schelhowe, 2012 as cited by Smith et al.2015)

The challenge is a project development tool as much as a learning methodology, based on the hypothesis that the process of learning by creating something that the students are passionate about increases the level of engagement and enhances their cognitive abilities. Although the challenge methodology has been implemented in the last two consecutive academic years of the MDEF program, we decided to focus on the first one as we have had more time to analyze the projects and reflect on the application of the challenge methodology. Furthermore, the MDEF course evolves and changes slightly every year, and therefore we would have to treat each year as a separate case study in its totality.

Methodology

Following the Fab Academy global schedule, the challenges combine four weekly cycles into one intense project-based fabrication sprint. Therefore, the objective is to combine the skills and knowledge acquired throughout the weeks prior to the challenge in order to ideate a small project that is connected to their personal interests and individual or

collective interventions. The students have to use the technology and equipment available and focus on the specific skills they have already acquired during the past weeks. This is set as a primary goal to foster the students' capacity to design and conceptualize their projects with the tools and skills they might have available, without limiting the possibilities of what they could achieve. In addition, the challenges align with the MDEF design studio in an effort to connect each challenge topic to the current status of the design interventions of the students. As mentioned before, the intention is to weave the two courses together in order to enhance both for the benefit of the students' projects. The design studio provides a critical context in relation to the technologies developed during Fab Academy, and in return the Fab Academy course yields the skills and knowledge to help physicalize these concepts.

Challenge Instructional Design (Tools and Platforms)

Each challenge is initiated with an ideation and brainstorming session, where the students are asked to form small groups of either two or three according to their personal interests. For the ideation process, the instructors have prepared a collaborative Miro board with brainstorming templates for each group. The first template is designed to facilitate students to find intersections between their personal areas of interests and their individual projects. Then they proceed to the project ideation or first project iteration template where they can include references, sketches and start prototyping ideas in a digital fashion.

The use of Miro has multiple advantages for both students and instructors. Since the past two years, most of the educational programs have shifted to online or hybrid models, collaborative platforms like Miro provide the opportunity for students to work remotely in groups or in a hybrid format, but also to gather their ideas simultaneously in a communal digital space and therefore get inspired from each other's work. (Gerodimou et al., n.d.) The instructors are equally benefited as they can easily access and monitor the progress of the projects and use the boards that feature all the student's work and ideas as a documentation tool for further educational research.

Challenge Agenda

On the first day, the students are introduced to the challenge brief and are given time to brainstorm on the projects. In the middle of the session, they are asked to present their initial ideas mostly focusing on explaining the common grounds that they detected through the intersection of their personal interests and share some first ideas on how they could approach the project, knowing beforehand the tools and skills they have developed throughout the previous weeks.

This part is important and therefore significantly emphasized in this methodology. The intention of the challenge is to approach digital fabrication and technology in a way that is meaningful and critical for the learner. The technological tools are not the goal, but rather the means for creating integrated projects through the challenge. Hence, time and consideration must be dedicated to the ideation process, for the groups to reflect on meaningful connections that benefit and motivate all team members. After the ideation session is concluded, the students continue to work on the projects while the instructors are available for feedback. In this early stage, the assistance is mostly focused on project planning and conceptualization. Since the time is limited, proper organization and early prototyping is key for the successful development of the challenge.

On the second day students are requested to expose their intentions and project management plan to the rest of the class. This is enforced so that the students gain insights from each other and faculty on whether their initial project statement is in line with the challenge criteria. A second control session is conducted by the faculty at midday to assess any prototyping flaws.

The third day is mostly focused on production, having only one evaluation session, mostly focused on debugging or revising deviations from the initial idea due to problems encountered or time constraints.

The fourth day is mostly spent with one-on-one tutoring in order to finalize the prototypes and assess the presentation's key points. During the week, students are provided with constant fabrication support from the lab experts on machine usage as a guided instruction rather than a fabrication on demand facility. The intention is for the students to familiarize themselves with the fabrication processes in view of eventually becoming autonomous with the tools and machines.

On the last day, the challenge results in a joint presentation from all the groups. It is not necessary for students to present their finalized prototypes, but instead they should explain their design process, concept in relation to their research and reflect on their key learnings and problems encountered. In addition to receiving daily feedback throughout the week, during the final presentation, students can receive comments from a panel of invited faculty related to their subjects.

Assessment criteria and Deliverables

The assessment criteria of the challenge are defined in alignment with those of the design studio in order to establish a meaningful reciprocal relationship between the two. The challenge briefs, as aforementioned, also correspond to the current status of the design studio and consequently some of the assessment criteria change as the course progresses.

The key points of the assessment, as presented to the students, are the correlation between the challenge project and their individual investigations as well as the possibility of the prototypes to inspire or facilitate design interventions.

Additionally, the assessment criteria correspond with those of the Fab Academy course in terms of the documentation and replicability principles. For each challenge, the groups are asked to create a GitHub repository where they collaboratively document the whole process and development of the project. A detailed evaluation spreadsheet (Figure-3.3.1) of the assessment criteria is shared with the students in advance, which is accessible throughout the year. This way the students can track their progress, understand the strong and weak points of their documentation and proactively ask questions regarding the evaluation criteria.

The overall deliverables of each challenge include a completed repository that covers all the points expressed in the spreadsheet, as well as an individual post on each student's personal website reflecting on key learnings and personal contribution to the challenge. On the final day, the students are asked to present through the repository rather than create a separate presentation. The evaluation detailed criteria are demonstrated below, as presented in the spreadsheet that is shared with the students.

25%	**INDIVIDUAL POST**
o	Write a post out of personal experiences
o	Explain your contribution to the project
o	Reflect about learning outcomes
o	Add link to the challenge section and repo
30%	**ACADEMIC LEVEL** ***Level of the project (quality and complexity of the designed prototype/code/artifacts)***
o	Linked to your individual pages
	Initial idea / Concept of the Project (aligned to research areas)
o	Propose (What is supposed to do or not to do)
o	Shown how your team planned and executed the project
o	System diagram (illustration explaining function, parts, and relations)
o	Integrated Design (How you designed it - relation between elements)
	Honest Design (use of technology in a meaningful way) Relation to the topics
	Be creative (find solutions with materials and technology you have)
	Explore design boundaries (based on your expertise)
o	Listed future development opportunity for this project
30%	**REPLICABILITY** ***Level of clarity and detail of the documentation material (photos, video, text, etc)***
o	How did you fabricate it (fabrication processes and materials)
o	Design & Fabrication files (open source or open format)
o	BOM (Build of Materials)
	Iteration Process (spiral development)
o	Described problems and how the team solved them
o	Photographies of the end artifacts
10%	**ATTITUDE** ***Involvement, Motivation level, proactive behaviors***
o	Attendance to classes
	Proactive behaviors to find answers during the challenge
o	Help others student's projects
o	Participation in feedbacks sessions
	Dealing with uncertainty
	Don't be afraid to make mistakes (going out of your comfort zone)
5%	**EXPLOSION**
	Explode
	Green = 1
	Orange = 0.8
	Red = 0

IMAGE 1. Evaluation criteria spreadsheet

Each topic holds a percentage of the final grade, and each requirement is evaluated on a scale of 0 to 2: 0 (red) meaning that the student has not submitted, 2 (orange) that a certain part of the requested documentation is missing, and 1 (green) that the basic criteria are met. The green colour is not indicative of the quality of the documentation, but rather signifies that the task is completed. The grade is defined later amongst all the instructors and faculties, considering additional assessment criteria.

INDIVIDUAL POST									
Write a post out of personal questions	1	0	1	2	2	0	1	2	0
Explain your contribution to the project	0	0	2	0	0	0	0	0	0
Reflect your learning goals	2	2	2	2	2	0	2	2	0
Add link to the challenge section and repo	0	0	1	0	0	0	0	2	0
ACADEMIC LEVEL *Level of the project (quality and complexity of the designed prototype/code/artifacts)*									
Linked to your individual pages	1	0	1	0	0	1	0	1	0
Initial idea / Concept of the Project (aligned to research areas)	1	1	1	1	2	1	1	0	2
Propose (What is supposed to do or not to do)	1	1	1	1	1	1	1	1	0
Shown how your team planned and executed the project	0	2	2	2	2	0	1	0	2
System diagram (illustration explaining function, parts, and relations)	2	2	1	1	2	2	1	2	2
Integrated Design (How you designed it - relation between elements)	0	2	1	1	2	0	1	0	1
Honest Design (use of technology in a meaningful way) Relation to the topics	1	1	1	1	1	2	1	1	1
Be creative (find solutions with materials and technology you have)	1	1	1	1	1	2	1	1	2
Explore design boundaries (based on your expertise)	2	1	1	2	1	0	1	0	2
Listed future development opportunity for this project	1	0	1	1	0	0	1	0	0
REPLICABILITY *Level of clarity and detail of the documentation material (photos, video, text, etc)*									
How did you fabricate it (fabrication processes and materials)	1	2	1	2	2	2	2	0	0
Design & Fabrication files (open source or open format)	1	1	1	2	0	0	0	0	0
BOM (Build of Materials)	1	0	1	0	0	0	0	0	0
Iteration Process (spiral development)	1	2	1	1	1	0	2	0	0
Described problems and how the team solved them	1	0	1	1	2	0	0	0	0
Photographies of the end artifacts	1	2	1	1	1	1	1	2	2
ATTITUDE *Involvement, Motivation level, proactive behaviors*									
Attendance to classes	1	1	1	1	1	1	1	1	2
Proactive behaviours to find answers during the challenge	2	1	1	2	2	0	1	1	0
Help others student's projects	0								0
Participation in feedbacks sessions	1	1	1	1	1	1	1	1	0
Dealing with uncertainty	2	2	1	2	1	0	1	1	1
Don't be afraid to make mistakes (going out of your confort zone)	1	1	1	2	1	2	1	1	1
EXPLOTION									

IMAGE 02. Evaluation documentation spreadsheet

Case Studies (Student's projects examples)

We have selected four student projects for each of the four challenges conducted during the academic year of 2020-2021. Additionally, we have included a fifth project that has been deployed throughout all four challenges. Each project encapsulates the main objectives of each challenge's goals and methodology, which is enabling students to create meaningful projects in relation to the technological tools taught over the previous weeks and the capacity to combine them with their design interventions that are being developed concurrently in the design studio.

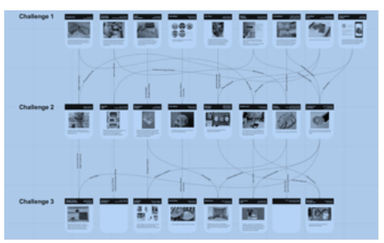


IMAGE 3. Challenges outputs interrelation

Case Study challenge 1: “The silent board Game” [1]

Topics	*Challenge brief*	*Students*
Principles and Practices, Computer aided Design and Computer Controlled Cutting.	“Design and make something that can help the process of designing/creating/ thinking/collaborating with others”.	Ines Burdiles & Morgane Shaban

The two students were working on individual design projects throughout the year, but due to the challenge, they found a common ground to explore both of their interests. Ines was focused on biomaterial exploration and the emotional impact of materials, and Morgane was interested in how children’s agency can be empowered through play. Therefore, they decided to develop a version of the silent board game1 “that would enable two people to play the game, developing a space of implicit communication through the silent alternative creation of patterns, sculptures or images” (Habraken & Gross, 1987).

IMAGE 4. The Silent Game

1“The Silent Game is about implicit understanding among design participants through making patterns and conjecturing patterns in making forms. The game involves two kinds of acts: inventing patterns and guessing patterns. The game needs at least two players. Players take turns inventing patterns for the other(s) to guess, and guessing the patterns made by other players. Patterns involve selections of pieces and spatial relations among the pieces and are expressed only by placing pieces in the site. A player is assumed to understand the patterns if s/he can make moves to continue the configuration without objections from the other player(s). Patterns remain implicit throughout the game, and no verbal or any other kind of explicit communication is allowed. Therefore, the game is silent. (Habraken & Gross, 1987)

The group designed and fabricated the game with plywood, fabric and acrylic using the laser cutting machine for different purposes. They created a press-fit box to contain the pieces from plywood, engraved the instructions of the game on canvas fabric that was integrated into the design of the box and used the acrylic to cut out the pieces of the game and its negative as a mould in order to create more pieces from biomaterials. Since both students were passionate about sustainability, an important part of the fabrication was to take advantage of the materials used to minimize waste during the fabrication process.

Their project was successful in terms of the objectives of the challenge, as they developed a prototype that was aligned with their research interests and additionally enabled them to collaborate with others and enrich their design interventions. The game was both a functioning prototype and a tool to communicate their projects to their communities-objects of study. In this case, the challenge worked as a project development tool for the students, as it allowed them to advance their individual research and inspired further interventions and collaborations with communities.

Case Study challenge 2: “Pascal, the Chameleon”

Topics	*Challenge brief*	*Students*
3D scanning and Printing, Electronics Design, Computer Controlled machining, Embedded programming (optional).	“Develop an artifact that allows you to explain your project to others” or interact with others so that they understand your research project.”	Rita Veronica Amparo Agreda de Pazo, Clément Luc Rames & José Francisco Flores Carreño

IMAGE 5. Pascal: colour indications according to air quality

Developed during the second challenge, the chameleon is an air quality sensor co-designed with and for kids. In this case the student’s interests were quite diverse, but all equally represented in the project. José and Clément were interested in spatial justice, co-design and participation methodologies for citizens engagement and Veronica was interested in education focused mostly on women and children.

In their project repository, the students describe the chameleon as a communication and educational artifact. Pascal changes colour as a function of the ambient air quality and is therefore able to demonstrate environmental data in a way that is more accessible to children. This way, complex topics like pollution in cities, public health, climate emergence as well as technological concepts (sensors, etc) can be introduced playfully. Additionally, the way the team designed the artifact involved co-creation methods with the community object of study. Veronica’s daughter crafted the chameleon’s shape out of playdough and then the team created the digital model by 3d scanning, taking advantage of the technologies included in the challenge. The base containing the electronics is fabricated with CNC and the electronics are visible from below for the kids to interact with the technology even at a subconscious level.

In this case, two of the students were more advanced in terms of technical skills, which allowed them to create a high-quality functioning prototype. However, this fact had little influence on the assessment criteria. What was more significant in this case was the participatory design approach, the successful alignment of their individual interests as well as the use of the prototype in real context, as they subsequently used the artifact in educational workshops with children.

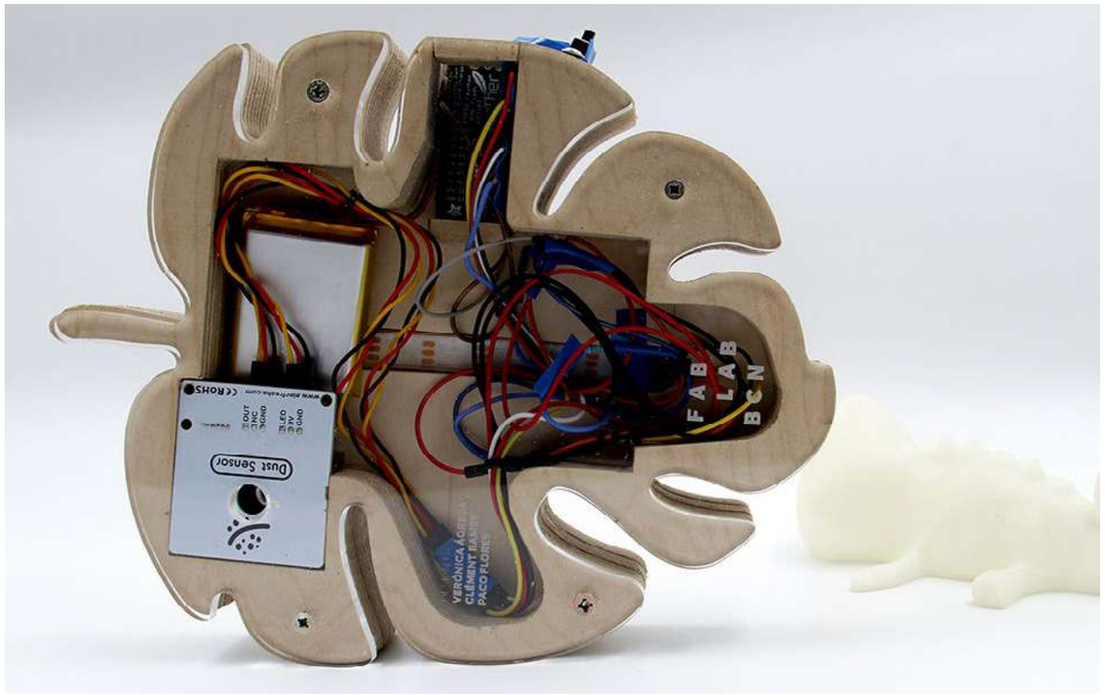


IMAGE 6. Pascal: hardware integration

Case Study challenge 3: “Design Practice Self - Assessment

Topics	*Challenge brief*	*Students*
Input devices, moulding and casting, output devices, networking and communications	“Design and make a tool or strategy that in combination with your artifacts help you measure the impact of your interventions”	Roger Guilemany, David Wyss & Krzysztof Wronski

The students’ research projects, in this case, had a more theoretical background aiming to critically examine and rethink the design practice under the prism of posthumanism and interspecies collaboration. Inspired by the challenge brief that was to design something that measures the impact of an intervention, the students decided to work on a self-assessment artifact that would provoke designers to critically reflect on their design practice and its impact. As described in the repository of

Image 07 - Design Practice Self-Assessment Final Prototype

the student’s documentation, the “Design Practice Self-Assessment” is a collaborative exploration of alternative metrics for measuring success and performance beyond today’s traditional ones. With the intention of transcending the limits of conventional formats, this project explores ways to encourage designers to think about posthumanism and its impact on industry, people, social systems and cultural values.

The device consists of five columns, each representing one assessment topic relating to posthumanist practices. Each topic-column is measured on a scale from 1-10 by pressing the button dedicated to each column. The front panel is designed to create openings for the buttons and light arrays to display the data.

The user can add multiple projects by pressing the new button and eventually see the average of all the projects measured by pressing the update button. As a result, the designer can gain an overview of their practice over time based on criteria defined in the beginning.
This project is an interesting example of physicalizing an abstract and theoretical concept through a device/ artifact, while at the same time connecting to both the individual projects and the challenge brief.

Another important aspect has to do with the fabrication processes chosen by the students in relation to the topic. The group decided to fabricate the panels with recycled plastic, as they considered that using virgin materials would contradict their critical reflections on equitable and sustainable design practices. In this case, digital fabrication becomes part of the narrative and an equally crucial part of the design process,rather than just a means to an end.

Case Study challenge 4: “Magic Twister”

Topics	*Challenge brief*	*Students*
Interface and application programming, wildcard week, applications and implications, invention / intellectual property and income.	“Integrated prototype that helps your MDE Fest’s intervention and combines the range of units covered”.	Alejandra Tothill Calvo, Roger Guilemany, Pietro Rustici & Clément Luc Rames.

The fourth and last challenge was the least demanding in terms of fabrication. As the students approached the end of the course the intention was to focus on their final thesis and interventions and therefore the challenge was designed to assist with that process without adding more tasks that might not be valuable for all student’s projects. Hence, they were encouraged to be more autonomous and to reflect on what technologies would be useful when developing their final prototypes instead of being restricted to using specific tools.

Consequently, the main brief provided to the students was to develop a prototype that would help with their final design interventions using any of the units covered throughout the year, while also developing a long-term dissemination strategy and a way of sharing/communicating their project in order to reach communities and increase impact.

The Magic Twister project is, therefore, an online exhibition through a website developed by the students, in view of sharing the resulting pieces and reflections gathered throughout their master research. Their idea was to create a virtual universe of 3d objects that would allow users to explore them and their related information in an interactive and engaging way. Two of the students in this group, who had been working together throughout the master’s program, had collaborated on the first challenge in which they created a box that was used to distribute and collect the objects (Fig: 3.4.7) to their community object of study, in this case local designers. It is, therefore, interesting to see how the challenges can both inspire interventions and as the course progresses support and help students communicate the results of these interventions to a wider audience.

IMAGE 8. Nomadic box online exhibition (website screenshot)

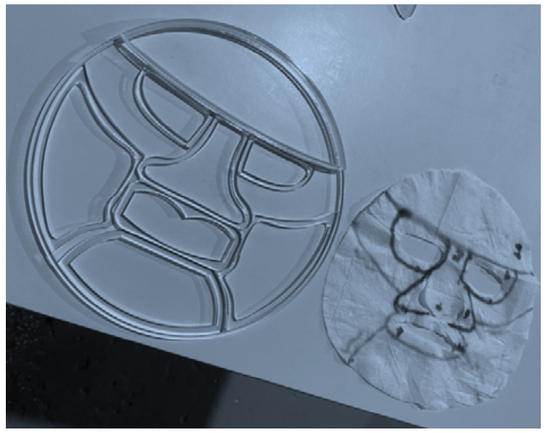


IMAGE 9. Face Mask Mould: 1st challenge prototype

IMAGE 10. Face Mask Mould: 2nd challenge prototype

Challenges 1,2,3,4: Face Masks

Topics	*Students*
(All the above-mentioned).	Anais Bouvet & Botaina Rafaa A Alamri.

In this case, the two students collaborated for all the challenges. Their areas of interest revolved around sustainability, the environmental impact of production waste and alternative materials. Focusing primarily on the cosmetic industry and the waste produced by one-use face masks, they decided to prototype a mould for creating do-it-yourself (DIY) customized face masks with natural ingredients.

This project is a great example of how the four challenges could work as a continuous exercise in order to evolve the same idea with different digital fabrication methods. Apart from using the technologies in correlation with their design projects, the group was able to get a deeper understanding of how each fabrication method could be beneficial for their purpose and the ways in which they could enrich their prototype with the use of different tools. It is important to mention that neither of the two students had extensive prior experience with digital fabrication.

For the first challenge the fabrication methods were limited to Principles and Practices, Computer aided Design and Computer Controlled Cutting. Therefore, the group created the first mold by laser cutting acrylic, as it had to be waterproof in order to be able to pour the bio-based recipes. The technology presented some limitations, as they could not create smoother edges that would help with demoulding the masks.

Therefore, during the second challenge that included CNC (numeric controlled cutting) they were able to optimize their design by making rounded edges. As the students mentioned in their presentations at the end of the second challenge, this was a valuable learning outcome as they were now able to understand the limitations and possibilities of the different manufacturing methods and could therefore be more proactive when designing or prototyping in the future. They also used 3d scanning to scan their classmate’s faces in order to investigate how they could personalize the size and shape of the moulds and printed one of the scanned models in order to test the size of the masks.

During the third challenge which included electronic hardware and coding, the team decided to create a sterilizer box for the silicon moulds of the face masks, taking as a reference the sterilization phone boxes that use UV light LEDs to kill bacteria on electronic devices. The design of the box required a UV LED, an Arduino board and an ESP32, and a relay. In this case,

the challenge worked as a learning opportunity. While the object itself wasn't essential to the project's development, it motivated the group to tackle complex topics they didn't have prior knowledge of.

For the fourth and last challenge, the main objective, as explained in the previous case study, was to reflect on a long-term dissemination plan and explain the strategy they would use to share their project with potential users. Therefore, the team decided to work on a website that would eventually function as a platform to share open-sourced recipes in view of creating a community around natural face masks and sustainable cosmetics.

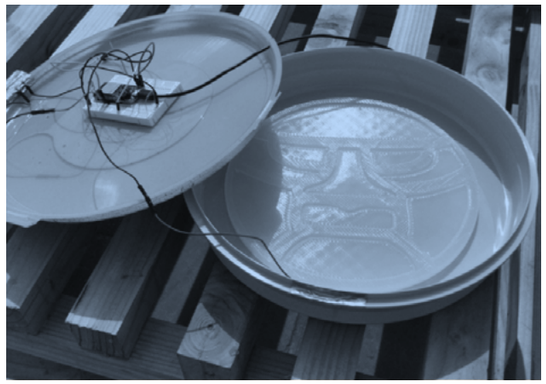


Image 11. Face Mask sterilization box: 3rd challenge prototype

Problems and Challenges

As aforementioned, MDEF master students come from different disciplines with a wide range of skills and expertise. Most of the students are not proficient in digital fabrication, and only a small portion has prior knowledge of more complex topics like electronics and coding. Thus, the instructional team must provide substantial technical support to ensure that the challenge is a fertile learning ground and not overwhelming and intimidating. Moreover, due to the short time frame of the challenge and the group work modality of the course, some students who were less experienced with the topics felt as though they didn't have enough time to become independent with the technologies, as they had to rely on their more experienced classmates in order to complete the project on time.

It was also clear as the course progressed that not all the challenges had the same importance or were equally beneficial to the students. Specifically, on the last challenge, students lacked engagement as they were more focused on finalizing their final studio deliverables. Additionally, as the end of the course approaches and the projects are mostly defined, it was evident that the challenge was more beneficial to certain types of projects that were more focused on technology or needed to fabricate artifacts for their final interventions.

Furthermore, the more complex the topics became regarding technological skills, the more difficult it was for the students to foresee prototyping issues and manage the workload. Particularly, students that lacked experience, for example with coding and electronics, were less proactive and struggled to ground their ideas in relation to what was possible in the short timeframe provided. Nonetheless, these students seem to gain valuable insights on project management and the importance of adapting fast according to one's capabilities and limitations.

Conclusions and Contributions

Several insights regarding rapid prototyping learning approaches have been derived from the research performed so far pertaining to the practice-based education design challenges model. Rapid prototyping on focused and restricted topics (enforcing the use of a specific set of digital prototyping tools) have pointed to an increase in creativity and the development of project management skills. Because MDEF students' projects might shift throughout the year and different collaborations might be formed, thechallenge could be just a brief expression of an interest that might be disconnected from the final project. In that case, the challenge works as an exploration tool where the students can engage with certain topics and ideas and filter what is or isn't important for their individual projects.

In every challenge, students were given constraints regarding the technologies and tools they should use, in order to not become overwhelmed by the lab's wide range of capabilities. This allowed them to focus more on the ideation process and in certain cases get inspired by one specific manufacturing process that they might not have engaged with otherwise. The short timeframe provided, forced students to concretize and therefore physicalize their abstract project ideas, as well as make quick design decisions and dive quickly into an iterative prototyping process. All of the above might have otherwise required more time or remained only in the ideation phase due to overlapping with the other courses' deliverables.

Furthermore, the research team has detected novel research paths in relation to the micro-challenge methodology that have to do with the interchange of knowledge, skills, and design sensibilities between the students, amongst all four challenges. The students had to work together in different groups and develop various projects based on the intersections of their diverse interests, backgrounds, and skills. As a result, each team member had a unique contribution in terms of mentality, knowledge, and capabilities.

Students were actively learning from each other and were inspired by their classmates' unique perspectives and distinct approaches to design and prototyping. Often, more technical profiles aimed to collaborate with classmates that were more creative or theoretical and vice versa. According to the students, this enabled them to develop stronger concepts and better prototypes. Additionally, the mandatory group-work format of the challenge methodology nourished collaborations that were maintained throughout the program. Through the ideation process, by focusing on detecting intersections between their areas of interest, some students discovered surprising commonalities that inspired them to collaborate on design interventions after the completion of the challenge. The research team aims to further explore this topic by mapping the student's trajectories, throughout the challenges, to assess how this transversal interaction influences their final projects and learning development.

It is important to note that the case studies discussed here only provide a small explanatory probe, similar to other outcomes of the courses. Due to the research methodology set out at the beginning of previous academic terms, insights have been gained from all the case studies and workshops that have taken place.

Acknowledgement

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Prototypes as learning tools for exploring biomaterials

Patrizia Bolzan and Carlo Emilio Standoli from Politecnico di Milano – Design Department

Prototyping as a design phase

Design as a discipline over time has increasingly drawn closer to other fields, fostering its contamination with other multidisciplinary and interdisciplinary knowledge and skills. This seeking of connections and contamination resulted in the construction of profiles such as designers skilled in conceptualizing, developing, and communicating responsive solutions to the principles of innovation, ethics, usability, etc. These skills are gained through experience and practice with multiple tools and techniques, among which the effectiveness of the creation of mock-ups and prototypes stands out.

The prototyping activity is an already recognized and well-established moment within the design process. No one can write without editing; in the same way, the design process stipulates that, after an initial phase of formal definition of the conceived concept, moments of verification are necessary. These verification moments can be effectively achieved through the creation of tangible artifacts, such as mock-ups and prototypes, terms often used interchangeably.

When we refer to a mock-up, we deal with an artifact made in the midst of the design phase, representing an active tool for verification and formal redefinition; what is relevant is not so much the aesthetic quality but the ability to be compliant and responsive to the design requirements (Polato, 1991). The prototype is an early or original form, a full-scale model of a structure or part of the equipment used in evaluating form, design, fit, and performance (Morris, 1992). We can assert that the term prototype could be considered ambiguous because it doesn't rely on how it is manifest; what defines a prototype is that it is used to explore or demonstrate some aspects of a future artifact (Coutts et al., 2019). To disambiguate any interpretations, we will refer to these as prototype artifacts (PrArts).

In the past, PrArts were made by hand from materials such as wood, clay, paper, and cardboard. Today they are increasingly produced through the use of digital fabrication machinery, such as CNC milling machines, laser cutting machines, and 3D printers. The places where it is possible to find an aggregation of all these easily accessible technologies and machinery are Fab Labs and makerspaces, within which PrArts are made in a remarkably fast and aesthetically pleasing manner. Places play an elective role in conducting this experimental and knowledge validation process, shared through innovative and integrated processes. However, this trend is causing a parallel phenomenon in which designers and makers lose sight of the intermediate steps that bring real value to the prototype phase, namely the moments of verification and understanding of shape, as well as the orderly creation of different functional alternatives to be tested and validated. Almost anything that is being formalized through 2D or 3D modeling software is readily producible and reproducible, so the wiping out of the time and effort of manual labor invested in the creation of the PrArt often makes it less meaningful.

In this way, the PrArt has been transformed into a prototype, regarded as an outcome instead of an element within a design process, due to the ease of producing a functional and usable product, with an aesthetic performance often no match for other industrial artifacts, made possible by digital fabrication technologies. From this comes the conclusion that increasingly the PrArt is being strongly influenced by the possibilities offered by the technologies available to the manufacturing space, as well as the designers' ability to know how to work with 3D modeling software and parametric and generative plug-ins. Actually, places - understood as containers of digital technologies - do not take on a particular value, which is instead attributable to the human capital and the communities and groups that populate them, whose know-how is transmitted and increased through mutual comparison, exchange, and collaboration.

During the creation of PrArts, it is appropriate for the designer to reorient his or her attention: to move away from the tendency to design for another technological intelligence - found in digital machinery - to reassume the cognitive act in which the available technologies and intelligence are considered as elements of a system of opportunities that enables the formalization of prototypes and products in line with the design stimuli and needs of users and communities. Therefore, the prototyping phase is a moment in the design process that requires an act of critical responsibility on the part of the designer.

Designers, historically, express an idea of the artifacts as prototypes (Giaccardi, 2019).
Building prototypes is essential in the development of virtually and manufactured products, for example, to foster testing and proving of ideas (Chua et al., 2010; Ulrich & Eppinger, 2011). A prototype could be a sketch, a mock-up, or polished material outcome confronting the world of ideas and skills of the designer with the world out there before a final artifact exists (Bucheneau & Fulton Suri, 2000). So, the prototype is an artifact for sure, but not necessarily a product, and each prototyping effort requires a specific strategy to resolve a design problem or opportunity (Camburn et al., 2017).
According to Giaccardi (2019), when talking about prototypes in the design field, the critical aspect concerns the purpose, and the possible scope could refer to one of the following categories:

1. prototypes for evaluating design outcomes
2. prototypes for empirically testing hypotheses
3. prototypes for supporting materials explorations
4. prototypes for exploring areas of concern
5. prototypes for provoking alternatives.

The first category refers to all those prototypical artifacts that arise and qualify as tools for reflecting (1) on the quality of the idea and the potential outcomes related to it. In this case, the evaluative capacity of a PrArt is what takes on value. In the second category, PrArts are intended to test hypotheses and ideas (2) in order to build a theory based on verified, tangible evidence. In this case, PrArts are nothing more than data collection tools during empirical evaluations of an experimental nature. When we talk about the third category, we refer to PrArts used as demonstrators of experimental research lines and directions (3). Here we frequently situate experiments on materials and strategies that can open the way to design directions not conceivable at first sight. Then there are PrArts in the fourth category, which are those tangible elements that can be used as something visible and bounded (4) without a purpose related to knowledge exploration or production. PrArts in this category can form a collection of artifacts that are relevant to both designers and users because they can immediately convey their main issues. Finally, there are PrArts that can be used as provocative tools and/or to stimulate alternative thinking outside a linear framework (5). The provocation generated can also take on the value of transgressing social and cultural norms to stimulate debate related to hypotheses for building an alternative future.

Alongside, after a consistent literature review, Camburn et al. (2017) identified a solid connection between the purpose, the reasons why a designer has to make a prototype, and the techniques that can be embraced to produce the final output. There can be two main strategies: iterative prototyping and parallel prototyping. Iterative prototyping works for sequential testing and related refinement of a PrArt, proving particularly useful when one must tackle results that are responsive to specific challenges (Moe et al., 2004). Conversely, parallel prototyping is a

helpful strategy for exploration activities where there may be alternatives to evaluate, thus helping to gather critical and informed feedback (Christie et al., 2012).

But how do these typological categorizations and strategies for making PrArts find their place within open and distributed digital fabrication spaces? Here we are going to give a critical reading of what we are currently witnessing, also bringing the example of the experimentation conducted at Polifactory (Fab Lab and makerspace of Politecnico di Milano) within De_Forma, a project that aims to investigate the relationship between biobased materials and spaces and tools for digital fabrication.

Opportunity and limitation: the dichotomy of digital fabrication technologies in the design act

Over the last decade, the Fab Lab model has spread widely, often in connection with or within universities, especially those related to design disciplines. This phenomenon is closely interconnected and interdependent with the accessibility (in terms of use, affordability, geography, etc.) of technologies and tools for digital fabrication. At the same time, when speaking of the relationship with the university and within design schools, the enabling possibilities offered by digital fabrication technologies often contribute to distorting the prototype phase as an active part of the design process.

Indeed, in the case of schools of design, this trend is a reflection of a growing habit that leads students to consider PrArt as a result in itself and not as a tool to support the ideational phase of the design process. The exploratory and communicative moment of ideas through sketches and immediate drawings on paper is replaced by the use of three-dimensional modeling software, which is increasingly widespread, intuitive, and accessible. Thus, when the three-dimensional file replaces the sketch, the mock-up also undergoes a transformation in sense and identity, becoming the product of a 3D printer, also increasingly widespread, intuitive, and accessible (Riascos et al., 2015). This trend, which is constantly growing and very difficult to dispute, presents several critical issues for the development of design skills and practice on the part of the student.

Unfortunately, when 3D-printed artifacts take the place of the mock-up in the design phase, there are mainly negative effects. For example, students often self-limit themselves in devising formal and functional solutions that are not primarily aimed at meeting previously defined design requirements.

Thus, at this specific point in time, the democratization of 3D printing technology (Von Hippel, 2006) means that the proposed design solutions clash with the level of knowledge acquired by students in the use of 3D modeling software. Particularly in the first few years of the Bachelor's degree course, knowledge of 3D modeling, through which files for 3D printing can be generated, is limited and restricts the design process. Moreover, when 3D printers are used to give shape to an idea, they are rarely considered by students and young designers as a production technology but rather as a tool for the direct and rapid materialization of their concept.

In doing so, there is a lack of reflection, understanding, and awareness that objects designed for another production chain (from polymeric materials to other types of material) are not necessarily correct if they are made or materialized with 3D printers or in general through Fused Filament Fabrication/Fused Deposition Modeling (FFF/FDM).

In the dialogue and overlap between the activities of design universities - in the teaching and research dimension - and Fab Labs, we can observe the emergence and radicalization of this trend, in which design reflection through PrArt is lacking in favor of PrArt per se.

In this regard, we can see that there are mainly three types of interpretations of PrArt taking place:

- PrArt as the result of a linear and structured process in which the materials and digital technologies available in fab labs and makerspaces are used to shape an object and initiate a reflection limited to the object itself;
- PrArt as the result of a linear but unstructured process in which reflection on materials and possible production alternatives occurs superficially at the end of the design and development process. This type of approach is typical of students in their training, who superficially select the materials to be applied to the developed product, selecting in an uncritical and decontextualized manner the technologies of the production tools, especially with regard to digital fabrication;
- Artifacts that are the result of an iterative process in which it is not only the outcome - documented and replicable - and thus the product that assumes value, but the process by which the output was arrived at, which led to the construction of knowledge - personal and widespread - awareness of the product, materials, and possible production alternatives technologies.

'Design and related exploration are necessary and fundamental in increasing and amplifying the role and value of Fab Labs and the situated knowledge that characterizes these spaces.'

This latter interpretation is the most significant with respect to the university mission and that of the Fab Labs. In fact, in their shared vision, the third interpretation turns out to be more interesting because it concerns both the project understood as a didactic result and as an artifact in itself and the project understood as an exploration - on the project and its geometric, formal, material, use, accessibility, producibility, etc. components. Design and related exploration are necessary and fundamental in increasing and amplifying the role and value of Fab Labs and the situated knowledge that characterizes these spaces.

In this experimental dimension, in recent years, we have witnessed a growing interest on the part of universities, Fab Labs, and companies in the biofabrication and growth of bio-based materials. Biofabrication refers to the process of growth and production of materials (Chambers & Karana, 2017) and the subsequent possibility of realizing complex artifacts. The De_FORMA project fits into this scenario.

De_FORMA: when prototyping meets the world of bio-materials

De_FORMA is a project born in late 2020 in Politecnico di Milano - Department of Design, as a collaboration between a group of researchers and Ph.D. students. The project aims to explore the possible collaboration and contamination between the bio-fabrication of sustainable growing materials and Digital Fabrication processes. This design activity constitutes that reflective practice that allows us to figure out the possible futures for Design research and practice.

In a broader, contemporary scenario, research is pushing toward the exploration of innovative strategies to overcome production linearity in favor of circular and holistic practices (Moreno et al., 2016). Designers, autonomously and independently, are on the lookout for new materials and material properties (McQuaid et al., 2019, p. 106). From this perspective, research in design and through design may offer an interesting opportunity for bridging the world of practical experiments with that of design research. This entanglement of research domains is possible due to the holistic nature of design and the capacity of designers to guide and face complex problems with a flexible attitude (Dorst, 2016; Dorst, 2019).

Enabling by design, this synergy between exploration and practical grounding of research results allows reaching consistent research results, which for their practical nature, can easily set the ground for multidisciplinary activities and hands-on practices, also in the dimension of teaching and learning. Specifically, experimentation linked to exploring and understanding raw bio-materials offers a nourishing base ground to produce new knowledge in different domains, both theoretical and practical, to be used for research and didactics aims.

In fact, contamination between design and biology through bio-fabrication techniques (Fritz et al., 1994) is a promising and interesting research field. Bio-fabrication techniques deploy hybridization between designing and natural processes until we understand how to co-design with living beings to realize biomaterials and growing materials (Camere & Karana, 2017; Myers, 2012), contributing into the creation of an emergent research area, already populated by numerous studies (Myers, 2012; Stephanopoulos, 2022). In particular, the growing materials (GMs) are realized from living organisms such as fungi (Karanaet al., 2018), algae (Wijffels et al., 2013), and bacteria (Lee, 2011). These materials are characterized by: their assembly precision at the nanometric scale, the possibility of being influenced by the growing environment to embed different properties in themselves [18], the auto-assembly capability both at macro and micro scale (through hierarchical structures) (Lehn, 2002; Whitesides & Grzybowski, 2002), and by the programmability of their growing in non-standardized shapes to realize materials in a zero-waste perspective.

All the cited characteristics show how the growing of materials instead of extracting them is a practice that could efficiently embrace production logic that is sustainable, circular, and low impact. Notably, Bacterial Cellulose (BC) can find wide application in artifacts design and production; BC can derive, among others, from the fermentation of Kombucha tea supplemented with Symbiotic Colony of Bacteria and Yeast (SCOBY), and, due to its growing behavior, seems a sustainable alternative to traditional materials production lines.

De_FORMA aims to develop multidisciplinary knowledge on the themes of growing materials and digital fabrication, identifying and verifying potential applications in sectors such as consumer electronics, lighting, healthcare, and fashion-tech.
In De_FORMA, digital fabrication represents an enabler for the construction of ecosystems to cultivate growing materials. The project explores the possibility of building an experimental and flexible production system that allows the integration of formal choices, surface treatments, aesthetics, and additional integration a priori, with a zero-waste logic toward environmental sustainability.

IMAGE 1. Some of the bacterial cellulose PrArt obtained over the duration of the De_FORMA trial

In De_FORMA, the main object of observation and study is a particular type of bacterial cellulose, a biological product derived from Kombucha fermented tea and commonly known as SCOBY. The innovative element of the project lies in the idea of being able to conceive, produce and develop new growth chambers for the SCOBY according to the specific scope of application and hybridizing it with other materials or technological elements. This change of approach has the advantage of realizing a bacterial skin with the preset shape, color, and thickness of the final semi-finished product, avoiding post-production processes. The first result is the construction of new scientific knowledge based on practical and replicable evidence. The empirical results could be scaled to improve the lifestyle of users, with particular attention to the construction of a sustainable supply chain, using design as a holistic discipline. To date, the project has achieved the ideal growth parameters of the SCOBY. The programming of the cultivation of growing materials into specific shapes and with textures aiming at the aesthetic characterization and the integration of sensors and actuators on its surface is still evolving.

According to Giaccardi (2019), our prototypes aim to explore the characteristics (e.g., physical, mechanical, aesthetical, etc.) of the material at different stages of its development and implementation. In addition, we use the material to gather insights to identify the proper process to better its cultivation (prototypes for empirically testing hypotheses) according to the future field of application and usage (prototypes for provoking alternatives).

Several BC cultures were initiated during the course of the project, with as many variations in growth mediums. The cellulose formed, which also varied greatly in consistency and aesthetic appearance, was dried in various ways, trying to give it shapes and to integrate other specific components or materials derived from processing waste into it. All this made it possible to collect an abacus of samples that well render the properties of the material and allow for an understanding of its limitations and potential when applied to design outputs.

Due to this type of approach that is strongly based on the expansion of knowledge through the creation of PrArts, De_FORMA's experiments have fostered the creation of products developed according to a conscious and informed approach of material use.

In particular, testing of possible applications led to the creation of two projects that are interesting to mention: a garment made completely in zero-waste logic, in which BC found expression both in parts of the garment and in some of its accessories and elements; and a series of collars, which explored the dimension of fashion tech with BC.

The garment made by Arianna Regaglia (Regaglia, 2022) is characterized by the application of Zero Waste logic at the level of construction and material reuse. The paper patterns are designed to eliminate or minimize the formation of waste from the single-material textile material: in fact, the textile waste generated (about 3% of the total amount of fabric used) was integrated into a BC pulp for the creation of details on the garment and other accessories.

Therefore, BC was used as an element to be integrated into the textile supply chain, becoming a means for the aesthetic-sensory characterization of textiles and expanding compositional and formal possibilities in the creation of zero-waste garments.

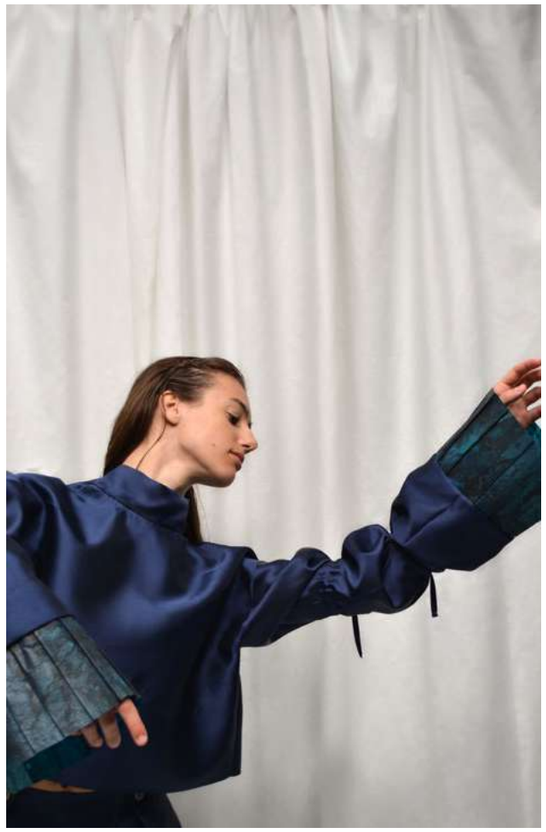

IMAGE 2, 3, 4. Shooting of Re-Growth project realised outfit courtesy of Arianna Regaglia

The result was an outfit composed of outerwear and pants with simple shapes and clean lines, yet presenting an aesthetic related to the nature and innovation inherent in the material.

Another design output that benefited from the experimental results on BC was the collection of three collars for the purpose of investigating the possible applications of this material in fashion tech output. In these collars, the combination of the same elements could result in aesthetically and compositionally different products. For the creation of the various versions of collars, a limited list of ingredients was chosen for consideration to explore how they could find different interpretations in possible shapes and assemblages. In terms of the DF technologies employed in these experiments, both for making the accessories and for giving rise to post-production finishing processes, there are essentially two leading technologies used: laser cutting and 3D printing (FDM).

The first application case involves the use of digital technology to shape material based on BC and textile scraps. Using 3D printing, a mold of variable thickness was produced having the shape of the pattern of a collar. Some finely shredded fabric scraps were combined and amalgamated with a tartare of BC. This material, obtained from scraps of further experimentation, was smeared on top of the 3D-printed geometry. Once dried, the collar was finished by laser cutting along the edges.

The second application proposes a collar with the integration of backled and BC parts in synergy with textile material. Using 3D printing, molds were created that could: shape the chopped bacterial cellulose, contain high thicknesses of material, and hold the pair of backled used in place.

The 3D-printed molds were filled with a compound formed from chopped BC and inert waste powders to provide more structure to the material. The parts were then assembled into the laser-cut textile component by following the shape of the pattern. Finally, electronic connections were created using copper tape, and the whole circuit was powered by a button battery placed in a battery holder printed with FDM 3D printing technology.

The latest proposal is that of a collar made from a layer of BC, with parts of BC tartare to hold 6 LEDs for decorative purposes. Through the use of 3D printing and a laser-cut PMMA base, triangular molds were created to shape bacterial cellulose. When completely dried, it was possible to obtain triangles with material texture having precise shapes.

The main body of the collar consists of a layer of BC, laser cut with the shape of the paper pattern of a collar. The electronic components were again connected through a copper tape and powered by a button battery placed in a special housing printed with FDM technology.

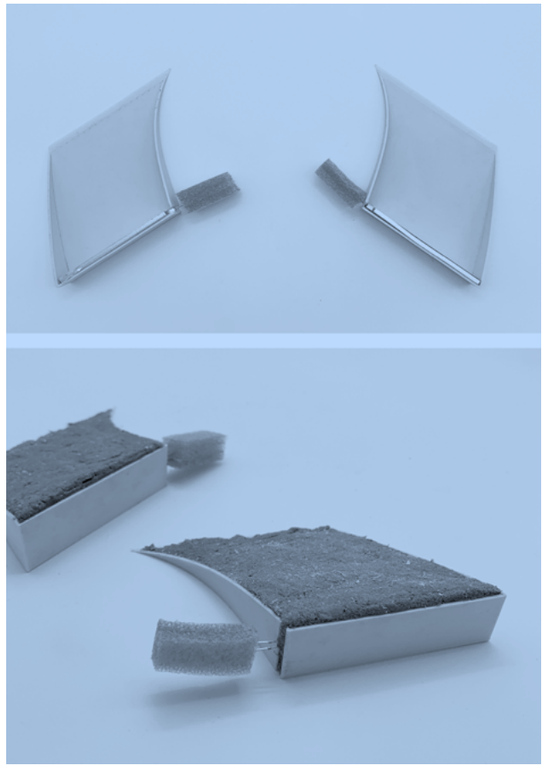

IMAGE 5 & 6. Images of collar components in development.

IMAGE 7. Overview of three collars integrating fashion tech and digital fabrication

Reflections and conclusions

The dialogic exchange between the world of design and that of applied sciences (Antonelli, 2012; Miodownik, 2007) led national and international research groups to envision a promising environment for growing materials instead of extracting them. While designers have always been involved in the material selection process (Ashby & Johnson, 2013), today, the focus is on creating experimental materials (Rognoli et al., 2015; Sakao & Brambila-Macias, 2018).

With this awareness, although GMs are inherently sustainable as they are renewable and biodegradable (Aquary et al., 2014; Camere & Karana, 2018), current experiments do not consider the production system in terms of circularity, integration and optimization with potential applications.

Through a design case study dealing with the use of biomaterials within the fashion tech research field, this paper aims to reflect on the role of PrArt as learning tools. The process of learning is related to both the school of design and Fab labs, considering them the proper places for developing a reflective practice that involves students as well as designers, makers, and other professional figures, each of them bringing their personal knowledge and expertise.

According to Giaccardi (2019), here we'd like to highlight the meaning that could arise if prototypes are intended as a reflection tool within the whole design process. Considering the design outcome of this project, PrArt creates knowledge, value, and meaning in the specific field of fashion-tech,

IMAGE 8. Material processes

introducing new materials, specific production processes, and the integration with other materials and sensors.

To this aim, we highlight the importance of the functioning prototype, consolidated, implemented and verified through iterative design loops. It is possible to envision the possible integration of circuits equipped with sensors and actuators into BC's already growing layers, overcoming the limitations and complexities given by the realization of connective traces sewn directly onto garments or accessories.

Considering the PrARt as a means for material exploitation, we can identify several trajectories for exploration and innovation to create knowledge and meaning arising from our case study. First of all, the use of the material itself and from the point of view of the production of artifacts and accessories that take advantage of the use of DF during the growing phase. Secondly, the opportunity to customize the material and the growing process according to the possible application, including the hybridization with other materials and sensors. This means a reduction of post-production activities as well as waste materials. We're dealing here with a case study exploration strictly connected to sustainability in each stage of the prototype development, from the production to the reduction of post-production, from the reuse of scraps and waste material to the final disassembly of all the components, such as sensors and electronics.

Considering the PrArt as a means to explore areas of concerns and for provoking alternatives, we can highlight some reflections related to the production process and to the knowledge gathered from the experience. A preliminary reflection may be related to the creation of specific processes, machines and tools to optimize the production of BC intended for fashion field application - or for other fields of application - capable of reducing the resources used for culture starting and avoiding the formation of surface defects in the growing material. In fact, DF makes it possible to materialize any production innovations in a direct manner, drastically reducing the time and resources used for the verification and validation phases of proposed solutions. In addition, another great advantage offered by the DF is its flexibility, which allows it to respond effectively to changes or updates to be applied to the final product or its production process. The use of DF, not only in the laboratory space but also in the production phase, makes it possible to drastically reduce the raw materials used and the consequent production of processing waste.

Finally, the use of BC in the fashion-tech field can be said to be very promising, and the authors plan to continue developing current research to understand the possibilities offered in this area, also checking the possible integration of other technological elements in accessories, and finished garments, as well as extending the fleet of digital machines used.

The activities, results and reflections here presented come from an experimental investigation conducted at Polifactory, dealing with growing, modifying and implementing the bio-material according to a specific field of application: the fashion tech domain. The resulting conclusions offer a critical reflection upon limitations and opportunities given by prototypes intended as research and learning tools within the domain of digital fabrication and bio-materials in product applications towards environmental, social, and cultural sustainability.

IMAGE 9. Collar components in development

Recentering design education

A decolonial approach to resist hegemonic design education in India locally

By Twisha Mehta, Independent Educator & Design Researcher

Since 2014, Prime Minister Narendra Modi's Hindu nationalist Bharatiya Janata Party (BJP) has maintained a hegemonic position in India. Education, as many other democratic institutions in the country like media and financial institutions have increasingly become a tool of domination for a right-wing government that fuels Hindu majoritarianism (Narayanan 2023, Jaffrelot and Jairam 2019, The Indian Express 2020).

Under Modi's India, educational institutions have become ground for Islamophobic, patriarchal, and casteist discrimination among other public spheres. The right-wing agenda thrives in spaces of higher education, both private and public, through their policies (or lack thereof), administration, faculty, pedagogy, and students. Instances of the Hindu supremacy taking over spaces of higher education are brought to light with the death of Dalit students like Darshan Solanki by suicide due to caste-based discrimination on a central government owned campus (Handa 2023), the hijab-row in Karnataka where muslim women wearing hijab are denied entry on college campus (Qureshi 2022), or the 'saffronisation' of textbooks to align with Hindutva ideologies (Suroor 2014).

As public intellectual G. M. Tamás writes, "Cutting the civic and human community in two: this is fascism." (Tamás 2000). By clamping down on critical thinking, collective inquiry and any forms of collective thought, action, or reflection, suppressing dissent and resistance becomes easy, making way for hegemonic narratives of Hindu, Brahminical supremacy to dominate discourses, while cleansing intellectual spaces of non-Hindu, non-oppressor caste communities (Paliwal 2023).

Design education in India follows "the notion of modernity coming from the Global North and West, and so-called 'Indian' tradition referring to norms established by Brahmanical hegemony", while it ignores its casteist roots (The Big Fat Bao 2023). This individual-centric, commercial, mono-disciplinary system furthers a universal and singular vision of design. This vision plays between aspiring to emulate either "superior" Western standards of design or seeking an "Indian authenticity" to art and design. The search for this "Indianness" in design, in the name of decolonisation, too plays out in the ignorant appropriation and fetishisation of arts and crafts of the country that were developed and nurtured by many marginalised castes and communities or by centering creative work produced by Hindu oppressor castes (The Big Fat Bao 2023).

As the Indian illustrator and researcher The Big Fat Bao writes in 'On Caste: The Roots of Discrimination in Indian Design', "Indian design student" is almost synonymous with upper class, elite, and urban—and from an oppressor caste family. Most Bahujans—who come from marginalised castes, religious minorities, and other underserved communities—don't feel at home in such educational spaces"(The Big Fat Bao 2023).

Within its pedagogy, design education's shallow focus on social awareness (Abdulla 2021) and its fabricated demeanour of neutrality, design's silence perpetuates hegemonic narratives behind a veil of indifference.

It is becoming increasingly urgent for Indian design education to reclaim the decolonial discourse from the jingoistic narratives of the country by identifying how colonial, casteist,

IMAGE 1. Classroom of second year undergraduate students of design collectively e-reading for a shared inquiry session. 21 April 2022. Pune, India. Twisha Mehta.

racist, sexist, capitalist narratives dominate design, and building a repository of pluriversal, subversive accounts of critical design pedagogy and praxis. At the same time, it is critical to address the question of how to engage designers and design educators in a co-learning and co-educating process that addresses this convoluted environment.

In this article, I propose an approach that (i) places marginalised perspectives and ontologies at the centre of design education and while exploring the idea that engaging the politics of the self, the classroom, and the "everyday" (Manzini 2019) in the classroom can empower design educators and learners. As a method to move towards a critical, collective, and self-reflexive design pedagogy, I present a decolonial, feminist, practice-based approach within design that relies upon learning by dialoguing (Freire 1970), and linking social movements with design's academic discourse.

Such an approach, I present, has the power to challenge hegemonic narratives, and prevent the appropriation of decolonial discourses by neo-fascist Indian agendas that design theory, education, and practice enables. The approach presented herein is not presented as a 'model' or a 'case study', but an exploration towards alternate action.

This article discusses a practical application of such an approach to design by the means of a workshop I piloted with a class of undergraduate design students at MIT Institute of Design, a private design school in India. The class participated in an engaged design pedagogy with the awareness and understanding that design is deeply political, and by practising it one either "serves or subverts the status quo" (Fry 2007).
Through the means of this article, I present a participatory process that argues against a "one solution fits all" formula of teaching, learning and practising design. Further, I share a critical, counter colonial approach that centres resistance, communal change, and peer- and self-reflection as spaces to learn from, while exploring its potential to challenge accepted hierarchies, binaries, and hegemonies through design.

Design Education in India

Design pedagogy reflects the ideologies, thoughts, and norms of modernity that preserve and strengthen structural inequalities (FHNW Academy of Art and Design 2020) such as casteism, racism, homo- and transphobia, ableism, capitalism, and patriarchy. There is no hiding the fact that design institutions in India sit comfortably upon these structures, even when these facts are far from being acknowledged by them.

Design pedagogy and praxis in India, notwithstanding the efforts of some exceptional educators, tends to underplay issues related to caste, race, and gender (Pandya, Kachru, and Beniwal 2018). Its largely Eurocentric and anthropocentric vision of the future of design education is dominated by models that foster and perpetuate the oppressive systems in design.

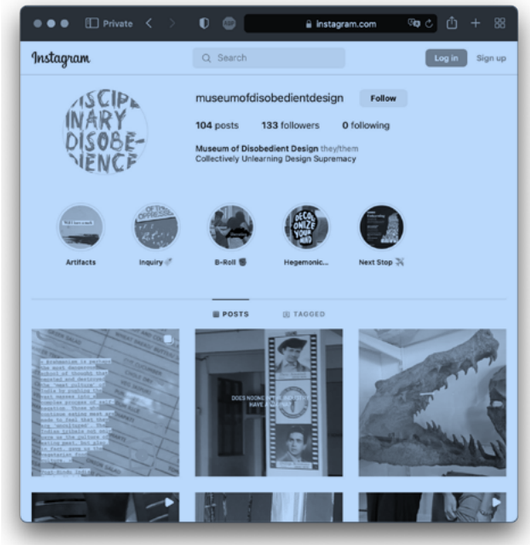

IMAGE 2. A screenshot of the Museum of Disobedient Design hosted on Instagram, co-owned, governed, and managed by students of the workshop. 2023. Online. @museumofdisobedientdesign

Design education in the country reinforces systemic oppression through their curriculum which is largely a facsimile of dated colonial, Anglo-European worldview on design and anthropology, or is a blatant indoctrination of the oppressive patriarchal, brahminical, vedic literature and arts as Indian design in the name of decolonial politics (The Big Fat Bao 2023).

Universities in India are slowly co-opting the discourse on decolonisation without critically engaging with its politics of religion, caste, gender, sexuality, or race. Under the pretence of countering Eurocentrism as a system of oppression behind the facade of decolonisation, these institutes are strengthening Brahmincal and Hindutva (Hindu supremacist) ideologies through their actions (Shalini Sharma 2019).

The bare existence of literature or reportage on critical, anti-caste design or on issues of diversity and representation of the marginalised communities in design faculty and students in India highlights the disinterest of design institutions in addressing the neo-colonial structures of design pedagogy.

The lack of affirmative action through quotas in private Indian universities for students from scheduled castes, scheduled tribes, and marginalised communities reflects the absence of design institutions' intention to transgress into a liberated egalitarian space (The Big Fat Bao 2023). It is apparent how these institutions with their admissions, administration, recruitment, and pedagogical processes structurally serve the oppressive status quo that govern the country's social, political, economic, and cultural landscape.

As a visual communication design graduate of a private design institute in India, I found my educational experience to be highly isolating, competitive, and centred around the commercialisation of the design practice. My design education as a student from the oppressor caste - like most of my peers in the classroom - was limited to the boundaries created by the echo-chambers of our class, caste, and religion. Our aesthetic and moral sensibilities of design evolved, bereft of any political or critical lens, on histories, practices and expressions of Western, specifically Swiss and American design.

Design in India is also hurriedly shifting towards "toolkit" led methodologies of learning and thinking, thanks to popular design corporations preaching ways to save the world "the easy way" (Seitz 2018), catalysing a design-saviour complex in the minds of those that can afford design education, which happen to be oppressor caste, upper class students. The inability of the design discipline to critically examine the politics of the industries that preach toolkits in, say, "design thinking" legitimises the role of design as the reproducer of social inequalities. This inability also structurally erases the presence of any counter-hegemonic narratives, thereby eliminating the chance of practising design "otherwise" (Abdulla 2017).

The link between the demand for manuals, toolkits, and formulae and the contemporary "solutionist paradigm" of design education is visible (Flesler, Neidhardt, and Ober 2021). The narrowness, simplicity, and superficial adoption of popular methods from various disciplines under an umbrella of, say, "design thinking" (Abdulla 2021) makes the integration of these methods within design's "banking system of education" absolutely effortless (Freire 1970).

This raises countless pressing issues and challenges for contemporary design education in India. There is a dire need, for example, to identify how heteronormative, colonial, casteist, racist, sexist, capitalist narratives dominate design project briefs. With dominant narratives of the socio-political, economic, religious, and cultural oppressions in the country seeping into design, it is critical to expose and challenge the skewed power dynamics in the design teaching and learning processes and to explore new ways of confronting structural inequities.

There is also urgent action required in resituating design education away from the "imposition and worldly enframing of design...as an assemblage of the modern" (Fry 2017) and toward a shared inquiry of contexts, lived experiences, and knowledge can encourage a more engaged design sensibility. A "relational approach" of designing – acknowledging and working with difference – can possibly subvert the complacent design education space in order to liberate the field from the ongoing project of the "epistemological colonisation" of the minds and everyday cultures (Ahmed 2021; Fry 2017).

Museum of Disobedient Design

To contest the design's disciplinary pedagogies dominated by hegemonies, hierarchies, and binaries would be to provide space for plural perspectives and interpretations of decoloniality that arise from various historical, social, cultural, communal contexts and experiences.

In his paper "Design's Missing Others and Their Incommensurate Worlds", Ahmed Ansari (2020) examines the possible interpretations decolonization could hold in today's Indian subcontinent. By asking, "what if other relations and oppositions matter more when we talk about coloniality and decolonisation, relations that cannot be couched in, or translated into, the language of coloniality\modernity and indigenous\settler?", he challenges the language of decolonization (Ansari 2020). Ansari leaves us with an important reminder when he concludes that decolonization cannot simply revolve

around delinking from Eurocentrism and that it must involve a delinking from "local elitism, local hegemony and their projects of epistemological colonisation" (Ansari 2020).

In April 2022, I piloted a two-day workshop with second-year undergraduate students which facilitated the co-creation of a knowledge commons called Museum of Disobedient Design. With around 30-40 students as a part of this class, the intention of the workshop was to identify and uncover patriarchal, colonial, hegemonic power systems present in a space of design learning. By challenging and critiquing the current status quo in mainstream contemporary design discourse, the goal was to visibilise nuances of systemic oppression perpetuated in design institutions. Collectively recognising that design is not an apolitical and ahistorical process was the narrative in which this class was fundamentally positioned.

The proceedings of this workshop borrowed its processes and methodologies from Critical Participatory Action Research (CPAR) (McTaggart, Nixon, and Kemmis 2016), while employing principles of commoning. Grounded in principles of democracy, social justice, and critical theories (feminist, critical caste, & queer), critical PAR engages through the lens of democratic participation (Torre et al. 2012). At the same time, using shared inquiry as a tool, our conversations on power, and positionalities, the personal and political knitted these processes together within our individual and collective contexts.

The workshop began with the acknowledgement that the university space is not neutral, and that the relationships that occur in the classroom are not equal or egalitarian, in that they are bound by various intersections of power.

In 'Choosing Margins as a Space for Radical Openness', feminist writer and activist bell hooks advocates for confronting the reality of choice and location to transgress and find the space where there is "unlimited access to the pleasure and power of knowing" (hooks 1989). Along her argumentation, by centering narratives that emerge from alternate and marginal discourses and by moving "out of one's place" that is defined by oppressive boundaries of race, gender, caste, or class (hooks 1989), we can avert design's past universalisms (Mareis and Paim 2021).

The first session of the workshop, "Community Building, Shared Inquiry and Exploration" focussed on acknowledging our identities, caste, religion, class and gendered locations while exploring the power structures that we learn and operate in. To step back from functioning within the notions of "design supremacy" that design education in India imparts upon designers (oppressor castes in most cases) to "save" society with their newly acquired design skills, the workshop focussed on unlearning by engaging with knowledge produced by, about and from the margins.

In order to rethink the design discipline, it is imperative to expand its definition by shifting its narratives towards recognizing and acknowledging the innovation and change-making that happens, for example, at the interface of resistance, by communities that design has consistently "othered". At the same time adopting an approach in design education that moves away from abstract, apolitical, ahistorical approaches, and towards cultivating a sensibility to learn from borderlands, margins, resistances without their appropriation, orients the learning experiences to historical and biographical differences, specificities, and positionalities. In an attempt to do this, amongst other material explored, a book that the class chose to collectively read was Kancha Ilaiah Shepherd's Post-Hindu India – an apt title, inline with the liberatory, decolonial agenda of the workshop in building alternate imaginations of design in India.

In Chandra Talpade Mohanty's formulation of decolonization, she writes that "diversity and difference are central values" and they must "be acknowledged and respected, not erased in the building of alliances" (Mohanty 2007). The class divided itself into groups that chose to explore different chapters of the text, first privately, then as a group and finally as a class. Coming to terms with one's own positionality, through a "self-reflexive collective practice" (Mohanty, 2003, p. 8) to challenge exclusion and discrimination can have the power to shift one's worldview. "Meat and Milk Economists", "Productive Soldiers", "Subaltern Feminists", were some of the chapters explored in depth in the session, with guiding questions that prompted the students to share which castes, communities, or ecosystems they read about, if they could identify "design" outside the academy within communities, and their locations with respect to what they had read as shared experiences, differences in their histories, or preconceived notions that were challenged.

For the second session of the workshop, "Autonomy, Ownership and Shared Creation," the class unanimously agreed upon an exercise amongst all the ones I had proposed, to use photography as tool to document and dismantle how the local design culture in the university space perpetuates systemic oppression while furthering the neo-fascist, Hindutva agenda of the state through symbols, objects, spaces, policies and people. Students explored the campus in groups to identify how colonial, casteist, racist, sexist, capitalist narratives dominate design and uploaded their photo anonymously on an Instagram page they co-owned and managed with captions as critique. As a digital commons, the Museum of Disobedient Design, grew quickly to become a space of resistance, while functioning as a collaborative design learning, practising tool of dialogue that created a shared space for alternative, counter hegemonic thought in the post-neoliberal learning environment. Museum of Disobedient Design also performed as an expository tool to make diagnoses and uncover pressing issues and situations within the university space.

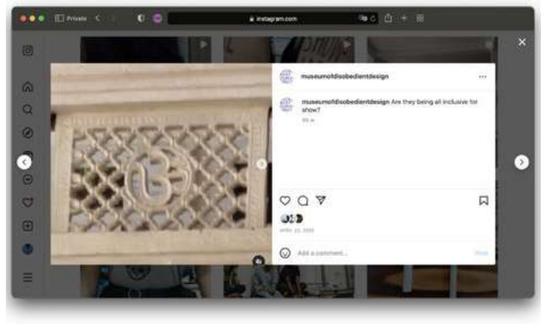

IMAGE 3. A photographic artefact anonymously documented and displayed on the Museum of Disobedient Design. The image shows the Hindu "om" symbol embedded in the architecture of the design building. The caption questions the institute's claim of being inclusive as it projects a Hindu identity in a learning space that is deemed to be secular. April 2022. Online. @museumofdisobedientdesign

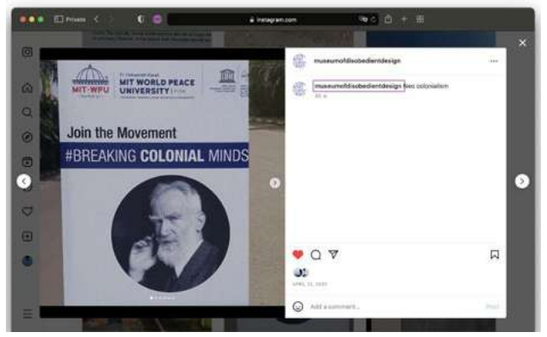

IMAGE 4. A photographic artefact anonymously documented and displayed on the Museum of Disobedient Design. The photograph captures a bizarre irony in a poster displayed by the university in the campus that reads "Breaking the Colonial Mindset" along with a black and white portrait of a celebrated white man beneath it. The caption on the artefact reads, "Neo-colonialism". April 2022. Online. @ museumofdisobedientdesign

The reliance of traditional Indian design education in India on conventional methods of teaching are often underpinned by oppressive currents that suppress dialogue – an act that requires critical thinking, and these methods lend themselves to suppressing communication that is necessary for education. However, as a part of this process of shared inquiry, documentation, and presentation, the students exercised their ability to fundamentally question their shared social, spatial and historical realities through collective reflection, and ideate on collective action towards this shared reality. This was an exercise in building a critical consciousness, or collective conscientização (Freire 1970) that led to the last session of the workshop.

In the final session, "Critical Reflections and Celebrations", we gathered to analyse the various processes we had engaged in and how they were different from how design is often taught, learnt and practised in university spaces. A lot of laughter, and love was shared in this session as the students engaged with and appreciated "artefacts" in the museum that were uploaded by their peers. Students critically analysed the symbols captured in these artefacts by dialoguing and creating shared knowledge against the dominant narratives that surround them.

The process of the entire workshop was collectively documented by the students and posted as a B-Roll on the Instagram page, as a form of appreciation for the process and the 'in-betweens', taking away power from constant designerly need to "produce a finished product" and giving power to collective engagement, participation, and action. By participating in the classroom that evolved into a public sphere, the students co-created communicative space and action—clarifying their concerns, informing changes in their practices, and creating power and solidarity.

By the ‘minor gesture’ (Abdulla and Oliveira 2023) of reclaiming design education through performative and hyper-visible acts like the curation of the satirical Museum of Disobedient Design, students’ employed commoning as a method to renegotiate the design education system and reclaim their agency over it as a resource from hegemonic, oppressive narratives. The Museum of Disobedient Design gained immediate reach amongst students of other disciplines, faculty and alumni of the design school with its participatory nature, culture of interdependence, self-governance structure. With such retrofitting of accessible digital infrastructures, design educators can facilitate commoning practices in classrooms of design learning. An exercise of this kind actively contributes to changing the way designers position themselves while supporting the emergence of new socialities and protocols for shared (un)learning.

The workshop unfolded to grow local, public knowledge within the classroom and university space to strengthen the design learners’ community, while honing skills design students need for effective citizenship, critical thinking, and working towards building counter-hegemonic design sensibilities.

Conclusion

Design cannot remain apolitical, especially in contexts of political crises unfurling in countries like India where religious extremism is paving way into fascist, authoritarianism. Decoloniality of design also cannot simply be theorised or practised without referring to the politics of everyday life. A critical, counter colonial learning approach that centres narratives of design from spaces of resistance has the potential to contest dominant ways of thinking and doing. Documenting and distributing plural, minor gestures that offer a direction in recognizing, repairing, and restoring oppressive pedagogies in design are crucial in decolonising design education.

A plural understanding of theories and practices of decolonising and debrahmanising the design classroom that are written from a diverse landscape of geographical and historical struggles, has the potential to encourage a nuanced, alternative design process in Indian design education. The aim is to enable design educators and students to understand that “all education is ideologically oriented”, and “all design is political, and equally important” (van Amstel et al., 2021, p. 179). This shared knowledge can potentially allow the liberation of design education from colonial, brahminical, oppressive structures by allowing social movements to reach design practice in order for design practice to reach social movements.

Design education can contribute to creating learning spaces to foster critical thinking, by creating a setting that facilitates discussion and supports the emergence of new socialities and protocols for sharing, and by providing the infrastructure for these commoning practices to take place. Seeing the classroom as a communal place enhances the likelihood of collective effort in creating and sustaining a critical learning community. Design can be a useful tool, an important medium of thought, but when it remains apolitical, it becomes yet another system that perpetuates oppression in our country.

Design educators, too, need to play an active role as facilitators to contribute to changing the way designers position themselves to support the emergence of new socialities and protocols for decolonising design. Critical design pedagogy then, also becomes a political, social and moral exercise in the battle to rekindle civic literacy, critical civic culture and in constructing engaged, collective citizenship.

‘The reliance of traditional Indian design education in India on conventional methods of teaching are often underpinned by oppressive currents that suppress dialogue – an act that requires critical thinking, and these methods lend themselves to suppressing communication that is necessary for education.’

Popping the designer's bubble

By Angel Yoon Kyung Cho, Didac Torrent Martinez & Vikrant Mishra

This article comprises a collection of discussions between Angel Cho and Vikrant Mishra on the subject of designing for curiosity. Rather than simply solving problems, these conversations emphasise the use of design and creative practices to ask meaningful questions. The dialogues are presented in a conversational style, with the intention of inspiring a broader discussion among readers. For the sake of brevity and readability, the conversations have been edited slightly.

Vikrant Good morning, thanks for joining me for coffee today.

Angel Yes, of course. I'm excited to have this conversation with my first cup of coffee. Shall we jump right in?

Vikrant Sure, let's do it.

Angel I think a good place to start is the performance we designed together last year (May 2022) for the Poblenou Open Day.

Vikrant Yes. Poblenou Open Day was a really good playground and space for both of us because we've had so many common interests, and it felt like a perfect space to come together and build something innovative both of us cared about. But even then, the project had a bit of a story, which starts with your interesting relationship with insects. Do you want to start from there?

Angel Sure. I'll start by introducing the performance itself then a bit about my personal drawing practice.

First, we had an amazing opportunity to be a part of the Poblenou Open Day (Windows Art Circuit 2022) event, which highlights emerging artists and brings cultural value to public spaces in the Poblenou neighbourhood of Barcelona, previously an industrial hub.

As you mentioned, we came together with our own individual projects; 'Syne' (Syne 2022) , a sensory wearable you created with Didac, and my practice in drawing insects, also with limited senses and tools. This was kind of a perfect excuse to combine these two projects along with some ideas we've been sharing.

Vikrant At first, we didn't know exactly what the topic of the performance would be, but we thought it was a great opportunity to open up both of our projects to the public. I think this is really important because as creatives, we tend to get lost in the cycle of endless creation with the question of 'what to create next?'. In this case, more than creating a pre-defined outcome, we wanted to focus on starting a conversation.

Angel Exactly. That's why we decided the format would be a performance rather than a conventional exhibition. We wanted to open up the conversation to the public with topics we've been reflecting on individually.

With the background of my drawing practice, which I'll get to later, we came up with the theme of endangered insects. We wanted to discuss ideas of extinction, the impacts of human intervention, and the reality that entire species will be wiped from our planet during our lifetimes.

From there, we organised a series of live drawings and sound performances based on this theme. During these performances, I created large-scale live drawings of endangered insects using unconventional tools while wearing Syne, which translated my act of drawing into sounds of the insects. The idea was to allow the audience to reflect on the image and sounds of the species that will no longer be present on the planet.

IMAGE 1: Syne 1

IMAGE 2: Syne 2

Vikrant I believe the goal was to create an experience for a certain group of people rather than just telling them how the situation is and what its impact. Actually, that was one of the initial reasons why we developed Syne.

Syne was developed to explore how the experience through a usual day would change if you heighten or delete one of our natural senses. One of the outcomes that resulted from this exploration was the wearable that you wore during the performance.

In simple words, it [Syne] is a tool that converts optical values to sound, and I think the idea of programming each insect sounds with the drawing performance was really interesting. The way it would generate unique soundscapes for every new drawing performance was a very reflective and immersive experience for whoever came to see it.

Angel Totally. We wanted to use our tools and practices to open up questions and collectively reflect in an unconventional and engaging way.

Vikrant Yeah, it's interesting how we worked with insects because when you think of sensing and designing, insects are not really the first thing that comes to mind. And even in our everyday lives, we don't really think about insects, even though they are such an important part of the ecosystem that we live in. When I reflect on this as a whole - I'm wondering as to why we do not involve such species or agents in our everyday lives and processes? Is it because we don't know much about them, or do we not have the understanding of how to incorporate them in our thinking models? What do you think?

Angel

It's an intriguing subject to think about. In my personal experience, growing up in big cities, insects were, just simply put, not supposed to be there. Living in cities taught me that most insects were repulsive, and we had to get rid of them immediately. So I grew up with really little understanding and positive interactions around insects.
But as I reflected on it, for us [humans] to have deemed certain species as "unnatural" within "our" environment is strange. Over the past decade, as I spent more time living outside of cities, I've reflected on my relationship with insects. I came to the realisation that they're a perfect representation of our delusions - both ubiquitous and unwanted, yet camouflaged in plain sight within the natural world. Through my Zen practice, I've learned that eliminating these delusions (or insects) is impossible and instead, I must learn to coexist with them. This realisation led me to start my drawing practice.

Each day, I used a found object and my non-dominant hand to draw an insect (#100daysoffacingmyenemy) . The intention of using my non-dominant hand helped me to focus on the act of observation and to move slowly, pay attention to the insect, and let go of the pursuit of perfection. The same approach applied to my use of various tools.

IMAGE 3: Drawings 1

IMAGE 4: Syne 3

Vikrant

Funny that we were talking about design and its ethics, to us now talking about fear and coexistence. When one thinks of fear, there are usually many negative connotations attached to the word. But do you think a simple definition of fear could also be something that you simply just don't understand yet?

Angel

Yes, absolutely. I think, as humans, we have a natural inclination to organise, categorise, and understand our environment. It provides us with a sense of control and safety.

But fear can be quite a valuable tool as well. Confronting our vulnerabilities can help us overcome our limitations and create something truly remarkable, resulting in a shift in faith or ideology.

Vikrant

Interesting that you say that because while I was thinking about it, I was pondering how humans in general, have always found comfort in knowing things, and when you know certain things, you want to act on that information. You want to build on it and the more you create, it provides us with security.

Let's zoom out and look at it this way. We can see that our civilization has been built on a progression from the individual self, to finding a partner, expanding to a few chosen individuals as family, then to forming a community or village, and eventually creating a city, a country, and beyond. These sequential steps represent the fundamental building blocks of our society and civilization. Familiarity and belonging have always brought us comfort. At this point in time, there is so much abundance of everything. At this point in time, everyone's struggling to find the balance between so many devices, solutions and data.

Many cultures in the global south and east talk about holistic living, which is really unique because it visualises life as an ecosystem of energies rather than something just human-centred. At the most fundamental level, matter is composed of particles that possess energy in various forms, whether kinetic, potential, or thermal. This energy is what gives matter and all of us shape and characteristics. So, when we break everything down to its most basic components, we can see that everything is just different forms of energy.

This ideology believes in a perspective that views life as a detached observer rather than placing oneself as the singular or central agent. To truly rethink our place in the world and our relationships with other beings, it is time to move away from the notion of Human centred design and towards Life-centred design. This would require a significant shift in our values, priorities, and mindset. It'd challenge us to involve compassion, empathy, and a deep sense of responsibility, recognizing that the choices we make today will have a profound impact on the world we leave behind for others.

Angel

Actually, many new schools of thought in the West, within science, medicine, and even design, are starting to point to more holistic and relational ideas that have been prevalent in traditional Eastern philosophies.

Vikrant

I'd like to mention this because my positionality might give more context to this subject. Many people may not be aware that the education system in India was modelled after the German schooling system with the aim of producing a workforce for industries. A lot of traditional and western academia - from schooling systems to research - focus similarly on an end-to-end, black and white, problem-solving sort of approach, which I have found to be non-holistic and problematic in the past few years. In any given system or situation, it might feel like common sense, but I think it's time to reflect and re-think these models of learning.

Angel

Absolutely. The problem-solving approach tends to focus on a single problem rather than considering the broader context, and oftentimes, once we think we have “solved” one problem, we will have created another. And the cycle begins.

Vikrant

When you start by labelling something as a “problem”, it can create an implicit expectation that there must be a solution, even if it is not well-defined. This can create a simplistic, black-and-white perspective in both systems and workspaces.

There exists a hierarchy in which designers or creative professionals hold a privileged position over the ones that aren’t. This can lead to a disconnect between the designers and the people who are affected by their designs. The focus tends to sway more towards what needs to be designed rather than why it is needed in the first place. I refer to this as a ‘designer’s bubble’.

Angel

True, because we have always focused on the solution, we fail to understand that human situations and problems are complex.

Vikrant

They involve multiple causes, and there are many. There are always multiple possible ways forward. It’s only recently that we have started questioning this linear way of thinking and have finally initiated conversations about how we could possibly move ahead.

Angel

So, what does Life-centred design mean to you?

Vikrant

Life-centred design means moving away from the traditional way of placing human lives as the centre of a design or its system. Humans have been self-centred for the longest time catering to our comfort and needs. We are only realising now what we do on this planet could have very serious implications, cut-to-now, we suddenly care about the bees.

Angel

Also for me, it’s a kind of understanding and acceptance that we [humans] are not in control. Even though we think we have the power to control our environments, there are so many other agents and environmental factors that control our terms of existence. Even inanimate human-made tools dictate the way we use them and ultimately transform human cultures. We’re equally as susceptible and vulnerable as any other species at this given moment.

There’s a quote that really put things into perspective for me by the biologist, E. O. Wilson, “If all mankind were to disappear, the world would regenerate back to the rich state of equilibrium that existed 10,000 years ago. If insects were to vanish, the environment would collapse into chaos”.

The fact that we’re sitting here trying to “fix” human-centred design, in a way, is yet another way for us to feel in control. I do think as designers, we have a responsibility to make better decisions and take action. But it’s not just our actions that need to change, rather also our inactions and our ability to accept our place in the larger ecosystem.

Vikrant

More than making right decisions I think it’s more important to be curious and ask important questions. Simply having that curiosity on an everyday basis has driven us to do some pretty amazing things.

It’s clear that humans have always been a curious bunch. We’re always wondering about the what-ifs and the maybes, and that curiosity has driven us to do some pretty wild things. Like, have you ever thought about the first person who decided to try using fire to cook? That was a pretty speculative move. And look where we are now - we’ve got fireplaces, stovetops, and even flamethrowers, although I don’t recommend using that for cooking. The intention was not to create fire but just to see what would happen.

Angel

Curiosity. That’s a great asset. Do you think this brings us full circle back to our performance?

Vikrant

For sure! I believe we utilised the experience of being deprived of an everyday privilege as a driving force, with the aim of making people understand what they don’t usually encounter on a daily basis. By highlighting what they might miss out on, it generates a sense of curiosity and urgency to the situation. Although it can be scary or even depressing at times, using fear can be a powerful tool in creating speculation and disruption.

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Angel

I like the idea of using fear as a design tool! Also curious about what we may “miss out on” when we’re only seeing things from a singular or mainstream perspective. Can you talk a bit more about that in the context of your wearable device, Syne?

Vikrant

It’s interesting that you use the word device, but I would rather use the word tool. When you look into the meaning of the word device, it is ‘a thing that is made or adapted for a particular purpose’. And like I said previously, there’s already an abundance of solutions and data, and we didn’t want to create another thing that harvests more data. Our main objective was to speculate and ask questions, and that’s what we did. It doesn’t solve the problem. Rather it provides a perspective of looking at things differently whether it’s hearing colours, code or numbers.

Angel

I’ve also been reflecting on the idea of “tools” for a while within my own practice. The root of the word tool in Korean, do-gu, originates from the words “way” or “path” combined with “tools” or “means”, pointing to a process more than an object. Which is such a nice way of recontextualizing the word “tool”. I think the design and creative practices can be great tools for generating curiosity and asking questions about things that are outside of our comfort zones.

Vikrant

I think the line between curiosity and fear is quite thin. In a very subconscious way, you also ended up using fear as a tool to learn how to simply accept what you don’t know and possibly have a different outlook. What you did with drawing insects for a hundred days, and how it changed your outlook on insects in general. Thoughts?

Angel

I will say I still feel a bit repulsed by insects. But the practice has changed the way I look at the situation in general. Perhaps it’s made me more curious rather than sceptical, and I think that’s a good start.

In a way, this conversation and article are also tools to ignite further discussions about how design and creative practices can push us beyond our self-made boundaries. So, here’s an open question for anyone interested in engaging with this topic. Let’s explore and discover new perspectives together.

Vikrant

I think the biggest magic simply lies in challenging perceptions and asking the right questions while staying curious. To be more humane, it is essential to be more human first.

Association of Women in Agriculture, Kenya

Resilient Recovery Program for vulnerable women

By Judy Matu, AWAK

Agriculture is an important engine of growth and poverty reduction. The focus on rural small-scale women farmers and vulnerable mothers living in urban informal settlements in Kenya resonates with the Zero hunger, gender equality and no poverty global goals. Women farmers make up 60% of the agricultural labor force in Kenya. Less than 15% of these farmers have full access to the returns from the farms, nor the decision-making authority over the land, the produce or the returns thereof (FAO report 2017). Women make essential contributions to agriculture, but there is also much diversity in their roles that undermines policy relevance and planning. Agriculture currently contributes 26% of Kenya's GDP and 27% through linkage to other sectors and employs more than 40% of the total population. The sector accounts for 65% of export earnings. It is therefore crucial to address the core of this fundamental pillar. Food security, climate Action and economic empowerment for this woman. The Covid 19 pandemic has decimated these efforts and more so in the informal settlements.

About AWAK

Association of Women in Agriculture Kenya (AWAK) is a Non-Profit women-led, women-focused organisation legally registered in Kenya under section 10 of the Societies Act.

Our target is to reach and impact at least 4,000,000 women in 10 years. Empowering a woman is empowering a society.

AWAK was conceived on the precept of scaling up agribusiness from conventional subsistence farming to advanced climate smart agriculture, urban food security, value addition and advocacy in the quest of achieving the Sustainable Development Goals (SDGs) both at household and national levels.

At AWAK, we are passionate about empowering women, youth and the vulnerable in Agri-sector; with skills to maximise productivity sustainably; for better production, better nutrition, better environment and better lives. We believe that this is a critical intervention area that will transform Kenyan communities and contribute towards Climate Action, Women's Economic Empowerment, and the Food Security Goal of the Kenya Big 4 Agenda.

To achieve the above, we focus on 4 key thematic areas, which are:

- Food Security.
- Women Economic Empowerment.
- Climate Justice and Climate Action.
- Advocacy, Policy and Partnership.

Our Vision:
To create a Nation where all women and their households are empowered, equal and equipped to reach their full potential.

Our Mission:
Our mission is to Transform, grow and Prosper small scale women in agriculture and vulnerable mothers in urban slums to become informed decision makers and key industry players.

To this end, AWAK designed and adopted a Resilient Recovery Program for vulnerable mothers living in informal settlement.

Poor urban households are facing the risk of severe food insecurity due to the volatile nature of their communities and exacerbated by the loss of livelihoods due to the Covid-19 pandemic. Innovative approaches to address this problem urgently were vital. We designed long-term interventions to boost the income and nutrition of the slum households while addressing climate change. This invention was initiated in April 2020. Phase 1 targeted 1500 vulnerable mothers within informal urban settlements. Phase 2, launched in November 2021, aims to target 4000 mothers in the Coast region and Nairobi. The program is ongoing, and with the availability of funds, we'll launch phase 3 in mid-2023.

IMAGE 1. Briquette making

Empowering households

When you empower a mother, the entire household and communities benefit. For example, Jane Muthoni, a beneficiary of the program in Nairobi, has been growing all manner of vegetables and tubers on the rooftop of her rented space in the Kawangware slums in Nairobi. She doesn't spend money on vegetables for her household. Instead, she channels that money into table banking, allowing her to save and borrow credit to expand and diversify her income options. She sells the extra harvest from her farming. Jane has trained more than 200 women with skills she acquired, i.e., urban farming, briquette making and baking. They have formed different table banking groups to grow their micro-enterprises.

Mariam Mohammed, a beneficiary in Mombasa, has perfected her briquette-making skills acquired from the phase 2 sessions. She trained 11 women within her community, and they made briquettes for sale. During the Business development training, mothers were trained on how to leverage online marketing through social media. After learning how social media works, Mariam opened a Facebook account for her briquettes business. Currently, the group has received orders from different counties, and they supply in bulk. The buyer pays for the courier services of the briquettes. Each woman in the group is making approximately USD 100.00 per week. These were women that hardly made USD 2.00 per day before attending our program. Once trained, the direct beneficiaries are mandated to train a minimum of 3 women per day. These are just two examples of the thousands of transformations happening as a result of our program design and intervention.

Training interventions

As illustrated, the interventions include adaptation to help the mothers cope, feed their families and adopt affordable and accessible, alternative clean energy; all the interventions are easy to learn and adopt, sustainable and affordable for the slums households. All mothers receive training on:

IMAGE 2. Baking class

- Urban farming for food security and nutrition and equipping them with startup kits - Slums are congested without any space for meaningful farming. The mothers lack the horizontal space to grow anything, thus, we train them to design vertical gardens for their backyards and verandas and on any available space to grow simple, indigenous and highly nutritious vegetables in vertical sacks and waste containers. This provides safe food for their households and even extra to sell to their neighbours.

- Briquette making as an affordable and accessible source of clean energy - We train them how to convert waste into smokeless briquettes. They use their hands to mix the waste and waste plastic pipes to mold the briquettes according to the preferable size and thickness. They allow the mold to dry in the sun, and voila! They have clean fuel for domestic use and extra to sell to their community. This has increased the adaptation of clean, smokeless fuel. Considering the population congestion in slums, the rate of pulmonary health complications at the household level is reducing significantly.

- Baking as a skill for domestic and sale - Training the women how to bake as a simple, easy-to-adopt skill was informed by their need to provide affordable breakfast and snacks for their children to carry to school. The majority cannot afford common bread. We train women to use locally available whole foods like cassava, sweet potatoes, and dried vegetables and convert them into flour to fortify the all-purpose flour for higher nutritional value. Using briquettes, they bake using a locally fabricated oven that we donate to them in groups. This subsidises their baking, and they can afford to sell their baked products at a much more affordable rate for the community while their children can also bring a bite to school. Most children eat one meal a day in the slums, but this intervention has made it possible for children to concentrate better, with a snack to eat during the break.

- Business development skills – Having developed the capacity of women to generate some income from the interventions, it is key to next equip them with financial and business management skills, though at a preliminary level for the start-up businesses. The business skills are aimed at opening their minds to basic business development skills. After a while, and depending on the uptake of their business acumen, we link the women to organisations that support entrepreneurship, incubation and mentorship as their core business so as to elevate the women to become better in their trade transactions and scale-up from micro-enterprises to small business enterprises.

IMAGE 3. Graduation ceremony

Mental health is also an emerging critical need for our beneficiaries. Our training program now includes a session to support mothers' mental well-being.

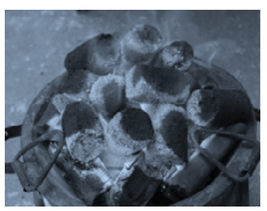
'Our recent Monitoring and Evaluation Exercise on the Resilient Recovery Program reported a 96.7% adoption success rate.'

In rural areas, AWAK also focuses on sustainable land use and climate action.

Training women in Agroforestry and donating tree seedlings that are economically, environmentally and socially beneficial to the women farmers. As a commitment to SDG 13 and 15 on climate Action and reversing land degradation in Kenya. We train farmers on climate-smart agriculture, soil health, reforestation, especially in ASAL regions, water harvesting and conservation and post-harvest management.

We are also big on advocacy, being the voice of the women we represent in decision-making arenas for policy, leadership and representation. Our community is highly patriarchal, and most policies favour men in decision-making, land use and ownership, and leadership and are blind to the effects of unpaid care to caregivers. We advocate for gender-responsive policies. We also address the impact of unpaid care on gender equality, climate action, food security and women's economic empowerment. Through our project 'We Care', the caregivers influenced their County Integrated Development Plans to adopt and make budgetary allocations for care infrastructure in Kitui County.



Breaking walls

Redistributing power in formal highschool learning

By Liting Liao

As a city designed and expected to create economic miracles, Shenzhen, a very young city with only 40 years of modern development, has always been eager to harvest talent in all aspects worldwide. Among the efforts to achieve that goal, Shenzhen International Foundation College (SIFC), founded by a team of professors from Shenzhen University, has been carrying on that mission since it was born in 2004.

IMAGE 1. SIFC Baoan campus. Photo from SIFC

SIFC's Shenzhen gene can be told through its motto, "融汇中西，坐言起行" which means "be a person who can integrate knowledge and values from both the east and the west, and after that, be practical and do one's job without hesitation." It insists on creating the most suitable environment for students to thrive in mental and physical development rather than having the most students accepted by the highest-ranked universities. To do that, SIFC offers diverse curricula, including American Advanced Placement examinations, British Advanced Level qualifications and four art and sports centers for devoted students.

While the transition from industry 3.0, which features automation, to industry 4.0, which features artificial intelligence, is sweeping the globe and generating a profound impact on our societies, education as a societal department responsible for future-oriented workforce cultivation is undertaking reform initiated by a framework called 21st-century skills published by Organization for Economic Cooperation and Development, OECD. Many fruitful and ambitious attempts are springing up, and one by one, countries with superpowers all digest the goal and internalise it into their local education systems.

To embrace this change, SIFC established a PBL Innovation Education Center in 2021, exploring ways to make the traditional teaching and learning system more sustainable and support students to succeed in their lives in this incredibly fast-changing world.

Design Challenge: education from PITO to DIDO

Unsurprisingly, the education system, similar to other societal departments, is running in a highly linear model in the context of globalisation. Taking Advanced Placement examinations as an example, College Board--the nonprofit organization that runs a membership association of over 6000 schools, colleges, and universities-- standardised AP exams by unit guides, AP classroom online resources, and mock exams. The global system runs in a hierarchical structure where schools apply and get accreditation to use standardised syllabi and resources. Students get scores through a global network of exam centers.

In most cases, the teaching and learning are running as a mechanically repetitive mass production line under the high pressure and fast pacing of the exams. As a result, students who get the highest scores during the exams are those who perfectly copy the American-centric mindset and toss that knowledge away after the exams. What about their local contexts and issues that need solving?

The design challenge here is breaking down walls between the centralised AP exam system and the local real-world context, as well as between theoretical and creative tools. Finally, all efforts serve an ultimate purpose: building a more meaningful learning experience for students so that they can witness and reflect critically on how knowledge is a tool that assists them in understanding or even changing the world. SIFC is asking for a redesign of the current system in which the real, local impact is prioritised, and AP standardised exams are no longer allocated in the center but as a supportive foundation to stimulate innovations in a distributed global network.

The transformation here can be concluded as a model from PITO (product in trash out) to DIDO (Data in Data out).

In the toolbox: TPACK

What tools in a designer toolbox are available to fulfill this transition? Here are some tools selected and listed following a Technological Pedagogical Content Knowledge (TPACK) framework, the structure of which can be found below.

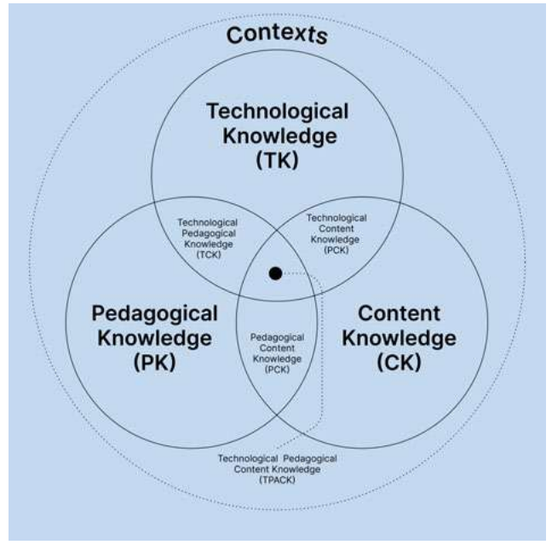


IMAGE 2. TPACK framework. Diagram from TPACK.org

TPACK identifies the nature of knowledge teachers require for technology integration in their teaching while addressing the complex, multifaceted and situated nature of teacher knowledge.

Tools fall into the PK pillar, including STEM and Project Based Learning. The idea of STEM as an interdisciplinary education design principle stems from the independent curriculum standards of science, technology, engineering, and mathematics, which emphasize the integration of knowledge and diverse angles to solve a real-world problem. "Project Based Learning (PBL) is a teaching method in which students learn by actively engaging in real-world and personally meaningful projects." according

to PBLworks. Unlike the teaching and learning mode emphasizing resource design, project-based learning is always a journey started by an ill-structured students-related real driving question. Students learn knowledge articulated in standards and iteratively produce a public product to address the question. There are no detailed step-by-step models for implementing project-based learning. Instead, PBLWorks proposes two gold standard PBL rings to portray what a high-quality PBL would look like.

In the CK pillar, tools appended are standards articulated in Common Core State Standards in Mathematics and English Language Arts, Next Generation Science Standards, and Advanced Placement Program.

Finally, in the TK pillar, many digital tools are selected, from online interactive textbooks, science experiment simulators, computer-aided design software, collective whiteboard applications, etc. It is highly featured that a multifunctional project management tool, Dingding, provides a seamless integration of all these digital tools.

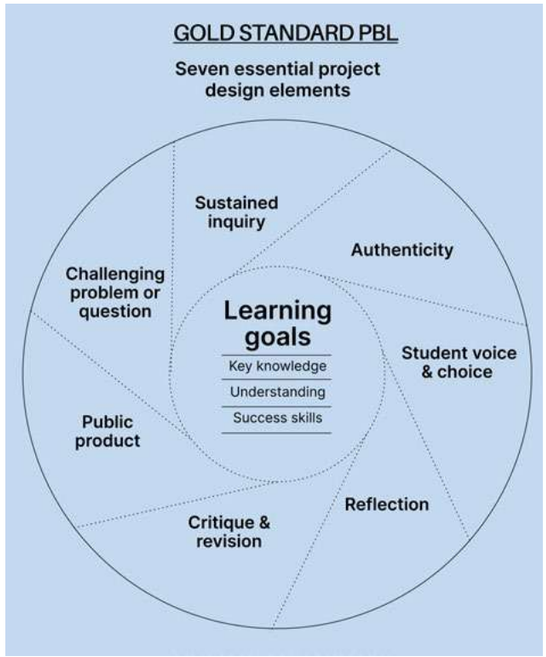


IMAGE 3. Gold Standard PBL. Photo from Buck Institute for Education

RISE model: redistribute power in formal high school learning

Weaving all components together, here comes the RISE model curriculum. RISE is a curriculum designed based on the American high school system, integrating science, social science, art & design, computer science, and English language art as a whole five categories of classes. The goal of RISE is for students to cultivate their abilities to develop a prototype from 0 to 1, identifying needs in their local communities and generating solutions within their capabilities. Promisingly, students can then locate their academic interests before applying to colleges and universities.

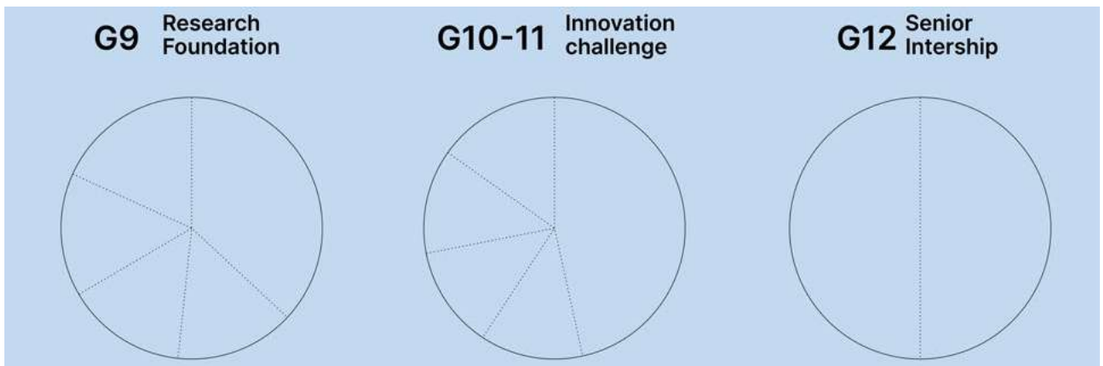


IMAGE 4. RISE model

RISE comprises four essential sectors. They are Research Foundation, Innovation Challenge, Senior Internship, and E-hub.

- **Research Foundation**

Research Foundation is a stage aimed at preparing students from three aspects: interdisciplinary vision, creative tools, and self-driven project management. The project scale in this stage is small, laying a foundation for the next exploration stage.

- **Innovation Challenge**

In the stage of the Innovation Challenge, design challenges from outside of the school community will be introduced to the classroom. They can be high school innovation contests, design requests from the school-parents community, etc. Students work as teams on more significant projects extending from two to four months. 21st-century soft skills, including collaboration, creativity, critical thinking, and communication, sit at the center. Students should be more confident and specific about their future academic pathways at the end of this stage.

- **Senior Internship**

Senior Internship is a stage built on the school-parent community. It offers practical internship opportunities to those students who have decided on future academic pathways. Students can work with professional teams immersively for three months to collect rich first-hand experience in their direction and adjust their expectations in their next stage of learning.

- **E-hub**

E-hub represents a digital portfolio generation platform that consists of cloud-based collaborative project management tools, regular exhibitions of learning, and the counselor team. By digitizing all formative learning evidence and regular reviews, E-hub provides visible channels for students to reflect on themselves, and gain new understanding.

The assessment system of RISE is an open one. Rather than centralizing all assessment power into the hands of teachers, RISE adopts a 3S holistic assessment system in which all stakeholders can influence the final results.

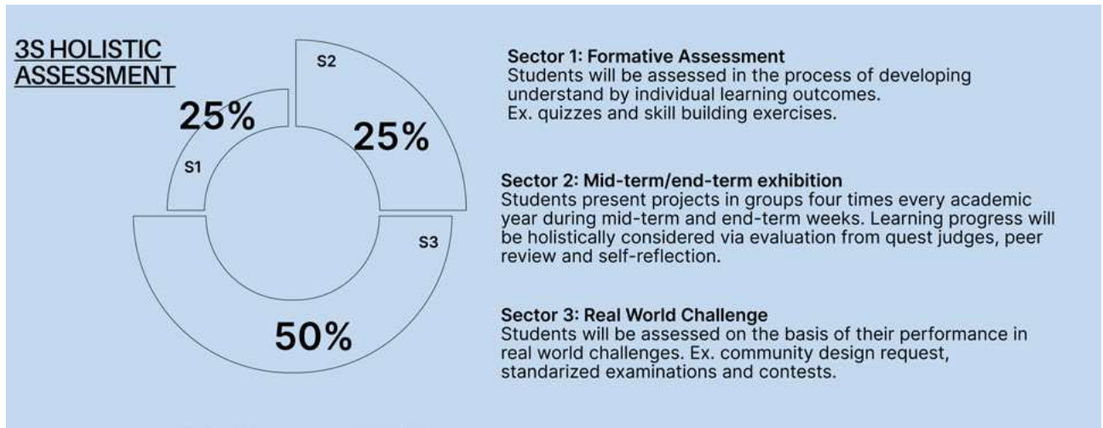


IMAGE 5. 3S assessment

Application of RISE in the classroom

Some examples are given below to explain further how the RISE model runs in the field.

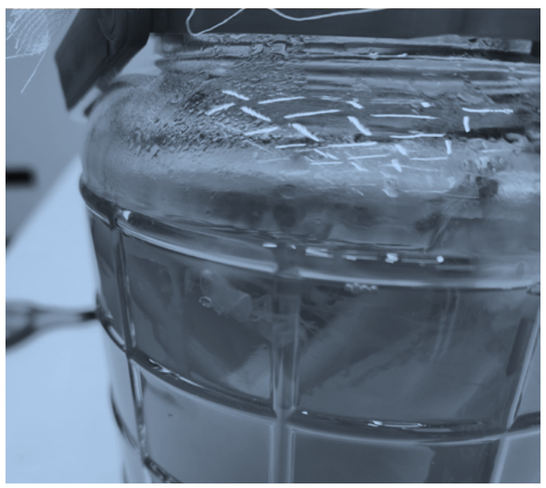
Project 1: Should we preserve Cantonese or not? Following the tremendous administrative stress of using Mandarin as the only institutional language in schools, there comes a time when fewer and fewer kids can speak their dialects. Nevertheless, how should we respond to that? Let it be or intervene positively? In this project, students design and execute survey research on public attitudes towards dialects after learning about the landscape of global language distribution and its diffusion process. And then, as a group, compose a script following a hero journey framework and produce a video to advocate for endangered languages.

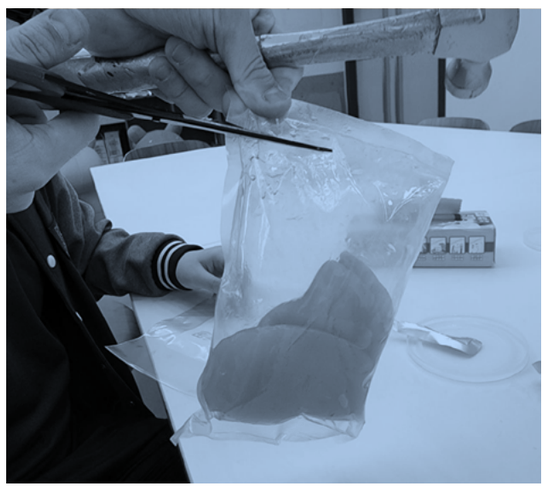
IMAGE 6. Advocation video. photo from CanTech

"The survey triggered a heated discussion among my colleagues. Many parents have not considered the life cycle of dialects and their responsibilities to inherit them. The survey made them start to think about it."

-(parent A)

Project 2: Grow your clothes with SCOBY!
SCOBY stands for symbiotic culture of bacteria & yeast. It can turn sweet tea into a fizzy beverage, kombucha, and yield a cellulose mat, regenerative material for clothes. In this project, students explore the procedures of designing fashion items with SCOBY and figure out the biochemical composition of kombucha and the process of cellular respiration within. The outcome of this project is a lab report which is turned into a high school innovation contest, China Thinks Big 22-23.





IMAGES 7, 8 & 9. Biofilm generated by SCOBY

In this project, standards from biology, art & design, and English language art are hit. Students are practicing academic writing skills upon the requirements of the innovation contest. Moreover, the contest, in return, serves partly as an assessment tool outside of the campus. When surveyed after the completion of the contest, students showed high confidence in themselves and reflected on collaboration between team members.

"I never imagined I could write such a long academic report. I feel that what is next is to improve the yield of biofilms as well as the procedures for drying biofilms. I am confident that I can draft a proposal." *-(student A)*

"I wanna remove student B from the team because he barely does things. However, I was not allowed to do that after registration. I will be more cautious about choosing team members next time." *-(student C)*

Education is never a realm that can be easily transformed due to its nature as a management tool of the elite. The redistribution of power in the strictly leveled academic society asks for a network of distributed innovations that inspire and support each other. There is still a long way to go.

Authors

Tomas Vivanco, Tomas Diez & Josefina Nano

Where

Globally

Project type

Learning program

Master's in Distributed Design and Innovation

New frontiers in distributed education

Project description

MDDI is a practical program based on emergent theoretical approaches founded on the experience of Fab Lab Barcelona, IAAC, the Global Fab Lab Network along with worldwide researchers and practitioners. It connects faculty and students from all over the world within a distributed infrastructure that includes communication and fabrication technologies; a 21st century distributed classroom that nurtures digital-physical relationships, diversity, globalisation and localisation.

IMAGE 1. Students explore microworlds as part of distributed learning programs

Context and history

The Fab City global initiative – conceived between Barcelona and Boston – proposes a shift in our production paradigm to one that refutes the need for complex global supply chains and instead focuses on circulating atoms locally enabled by the global travel of bits of information. It builds onto the digital revolution in telecommunications and computation, and emerging digital manufacturing technologies by harnessing the transformational potential of domestic-scale digital fabrication spaces like fab labs and makerspaces. The Fab City vision acknowledges that such digital fabrication spaces and skills are key to an urban model based on local production. Enhancing the resilience of citizens so that they may assess and produce for their own needs and the needs of their local communities and bioregions is the first step to shifting the paradigm towards a localised regenerative model. Domestic-scale digital fabrication laboratories provide communal spaces in which approaches to making, prototyping and eventually urbanisation can become restorative and regenerative by design. They provide a context to reconfigure relationships between spaces, species and cultures that contribute to localised experiences, ways of being and ways of doing. The Master in Design for Distributed Innovations (MDDI) is a learning program conceived at the intersection of design, technology, ecosystems and communities to respond to the potential bubbling in such spaces across the world.

What is the need it tackles?

Design education has traditionally been based on colonial foundations and globalised ideals of the past. To harness the potential of the Fab City vision, a shift is needed in how we learn to, from and with design by imagining new processes to reconfigure the relationship between human culture and natural ecosystems in a distributed manner. MDDI aims to rethink the cannonic methodologies that design education is accustomed to, by focusing beyond the classroom, towards embodied experience and community spaces; as well as the infinite everyday contexts in which design occurs when we consider design as a discipline that serves the planet as a whole.

IMAGE 2. Distributed learning programs

What is the global-local relationship of the project?

MDDI creates a global campus where nodes offer students access to fab lab facilities to prototype and bring ideas to life. Creating a 21st century digital education network of design, technology and bioregional principles the program blends the best of digital and physical learning environments. By offering an international accredited program, MDDI enables a global network to pursue the purpose of the Fab City global initiative to change the global production and design system through a professional formation. Students learn online in their local cities from faculty, researchers, practitioners and students from all over the world. At the same time, they assess, prototype and interrogate their own contexts, by developing and implementing technologies, design methodologies and implementation strategies where they work, live and play using the productive capacity of their local fab lab. Support and compliance is ensured by local instructors who provide practical and methodological support.

How was the development process of the project?

Using the success of the distributed learning program Fab Academy as a basis, the program was built to enable the Fab City vision. From a methodological perspective, it is designed to test and iterate the multiscale framework of the Fab City global initiative, the Fab City Full Stack. The program Co-Directors and faculty designed a learning methodology that is structured into three modules of one trimester each, plus a final project implementation. Each module focuses on different levels of the Full Stack, which are developed in three tracks: Ecosystems, Communities and Technology.

Module 1: Why design?
The foundational layer of understanding of the implications of design in its relationship with natural, technological and social ecosystems, by giving students methodological tools to design valuable and meaningful solutions.

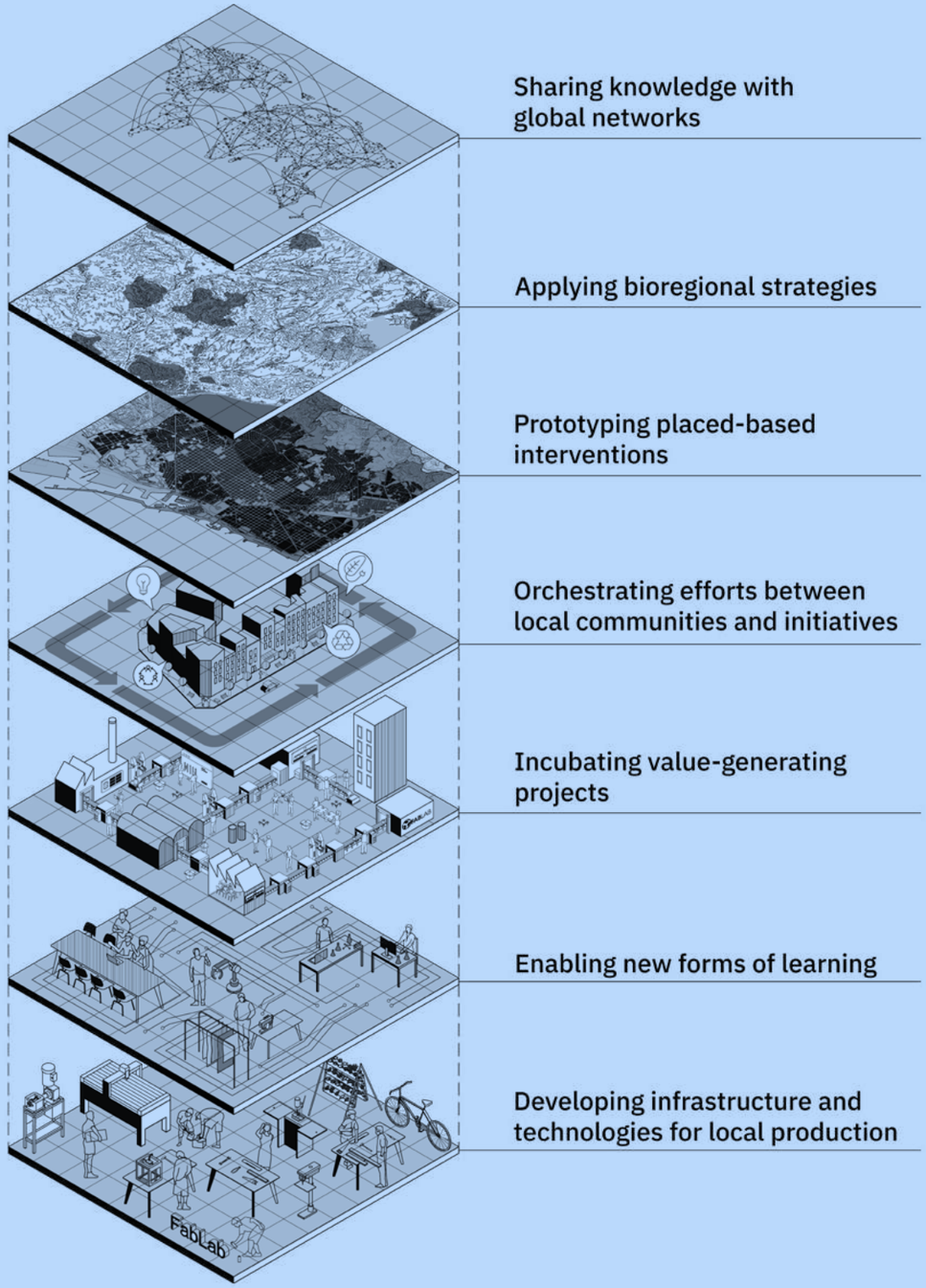
Module 2. How to design?
The technical skills to develop sustainable and innovative design-systems based on the reconfiguration of technology, social dynamics and resources.

Module 3. Where to design?
Integrated strategies of applying and developing innovative projects in an economic, social and environmental regenerative manner.
Final Project Students have to develop and implement a final project in collaboration with its node ecosystem. The projects should be a positive solution that integrates the local ecosystem and community through technology, service or model.

‘From a methodological perspective, it is designed to test and iterate the multiscale framework of the Fab City global initiative, the Fab City Full Stack.’

Fab City Full Stack

Fab City Full Stack is a framework that helps cities and regions to interpret the Fab City challenge and also a tool that guides them to implement it in a multiscalar and ecosystemic approach and define their own strategic action plan.



Uniting ancestral wisdom and contemporary knowledge

Key to unlearning extractivist practices is reconnecting with ancestral knowledge, the original circular approach. At times, the wisdom of cultural and ancestral practices seems nearly lost, pushed to the edge of extinction by systemic erasure combined with a reliance on tools and technology in a rapidly moving world.

However, a new generation of heritage practitioners and designers are demonstrating how contemporary tools can be leveraged to help us: restore our connection to- and learn from- ancestral knowledge; exchange skills with knowledge holders; and explore tools to innovate cultural crafts. Respect-based knowledge exchanges are even facilitating the distribution of cultural practices to new contexts. The practitioners, designers and researchers in this chapter are helping us reconnect to ancestral practices that focus on reciprocal and regenerative exchanges with communities, the planet and other life forms.

Chapter 03

Distributed design for plant-based food

Massimo Bianchini, Luca Grosso, Laura Cipriani, and Stefano Maffei;
Polifactory, Department of Design, Politecnico di Milano

In our contemporary society, we are witnessing a push towards increased consumption of plant-based foods. Underlying this drive is the desire to counter the environmental and social impact generated by modern food.

It is a systemic change that affects people's behaviour and lifestyles, stimulating the agri-food industry to create a new generation of plant-based products that can satisfactorily replace animal-based food such as meat, fish, eggs, milk, etc. The production of innovative plant-based aliments needs research that focuses on the different properties of plant ingredients and the innovation of the production processes required to convert them into food products or, alternatively, cultivate food products using proteins derived by vegetables. But, within this framework, there is also a space to (re)think solutions that help the production of plant-based foods starting from recovering food waste and renewing food processes having a strong local tradition and, in some cases, an ancestral history.

Historically, fermentation has been relevant in transforming a large variety of foods, increasing their nutritional value and shelf life. Pasteurisation, the appearance of electrical appliances such as refrigerators, and the development of other modern food preservation techniques have made certain types of fermentation less necessary and many forgotten products. Today, especially among the younger generation, we are witnessing the rediscovery and revival of fermented foods and traditional fermentation processes together with a growing interest in fermented foods from other cultures such as kombucha, kimchi, tempeh, kefir, and miso. Plant-based fermentation is aligned with the principles of the circular economy because it ranges from the valorisation of food waste to the adoption of natural, energy-efficient food processing, production, and preservation processes.

Beyond the production of alcoholic beverages, distillation also allows the production of natural extracts such as essential oils and hydrolats from wild and aromatic plants and herbs (leaves, flowers, fruits and twigs) and food waste such as citrus peels. Extracts obtained through distillation have been known since ancient times and used not only for cooking but also to alleviate the symptoms of diseases, flavour foods and, more recently, even to prepare liqueurs and cocktails with zero alcohol content.

We can look at fermentation, distillation, and other food transformations as a large catalogue of plant-based food spread across our planet. These food processes result from a slow accumulation of experience and knowledge that are now waiting to be re-discovered to understand their principles and values, not only nutritional but also social, economic and environmental. Distributed Design represents the ideal approach to study and experiment with these processes in a key of digital transformation and circular transition, making them accessible, renewable and sustainable even outside their contexts of origin.

Open Food Factory. Experimenting open and circular food process through Distributed Design

Open Food Factory is an experimental initiative conceived by Polifactory, the makerspace of the Politecnico di Milano, for the design and prototyping of innovative open-source solutions dedicated to plant-based food fermentation and distillation. Open Food Factory focuses on developing micro and self-production food processes connected to emerging food behaviours and regimes in a circular economy perspective. Developed throughout April 2022 and February 2023, Open Food Factory started with the launch of an open call for ideas. Twenty-six young designers submitted six proposals relating to fermenters and distillers. Three of these, two focused on fermentation and the other to distillation and extraction, were selected by a jury of experts in design, making, and urban manufacturing. The teams develop their projects in collaboration and with the technical-scientific support of Polifactory, working in the makerspace as "makers in residence." The designed and prototyped solutions were released and are promoted on the Distributed Design Platform.

IMAGE 1. The HACKO System for the preparation of Nukadoko with its elements and components

HACKO. An open-source kit for nukazuke.

Nukazuke is a type of Japanese pickles produced by fermenting vegetables in rice bran. Nukazuke is not an ordinary food preservation technique but a food processing technique. It is a practice hundreds of years old, and for the Japanese, it is considered more than a technique, but an art firmly rooted in family traditions, handed down from generation to generation. Nukazuke is healthy food because it contains good bacteria for the intestinal flora and, traditionally served at the end of a meal, can aid digestion.

Various vegetables are used to prepare Nukazuke, including roots such as radishes and carrots, or aubergines and cucumbers. Within a box, vegetables ferment covered by moist, salty rice bran called nukadoko. The colony of lactobacilli that proliferates in nukadoko transforms the vegetables into pickles in a few hours. Lactobacillus culture must be healthy to ensure that fermentation correctly works. Nukazuke preparation requires constant effort and care.

The microorganisms that make possible vegetable fermentation only survive if correctly aerated by preventing the overproliferation of anaerobic bacteria that are harmful to the fermentation process. Usually, nukadoko must be hand-mixed daily for a few minutes. In this way, it is possible to inoculate the harmless bacteria that live on our hands, let the nukadoko breathe and keep the colony of lactobacilli healthy. The correct handling and monitoring of the health of the nukadoko and the draining of excess fluid in the rice bran are fundamental for preparing nukazuke. All this requires experience, knowledge, and even mastery.

But how can such a healthy and sustainable but complex food processing process, deeply rooted in a local tradition, be made accessible?

The HACKO project tries to address this question by exploring the potential of distributed design and making nukazuke a more accessible food transformation, reproducing and adapting this process in a distributed way in different cultures. The Japanese entrepreneur, Kentaro Sohara, along with a group of young designers - Giovanni Bruno, Gaia Rubino, Martina Comola, Federico Denni, Andrea Somenzi and Valerio Libardo in collaboration with Polifactory - starts to translate his family's traditional knowledge on nukazuke into a kit composed of elements and accessories that can facilitate the production of Japanese pickles in different contexts.

For more than three months, Polifactory turned into a temporary food lab where a team of designers experimented with the preparation of nukazuke, ranging from using local raw materials to re-producing the techniques by unskilled people. This activity allows designers to understand fermentation by analysing its physical and chemical conditions. The experimental work has inspired the design and prototyping of HACKO, an open-source kit enabling people to prepare their Nukazuke using ordinary food boxes and a system of designed elements: a set of 3D printed trays of different shapes and sizes to regulate and facilitate the drainage of the nukadoko's liquids, a multipurpose tool that can assist the handling of the nukadoko (in case handling it generates allergic skin reactions) and, finally, a digital device to monitor humidity and temperature within the fermenter boxes, the two fundamental parameters to keep nukadoko healthy and maintain the ideal conditions for fermentation.

BREATH. A parametric valve for lacto-fermentation

BREATH project analyses traditional food preservation processes with a design perspective on the food of the (next) future. Conceived and developed by the young designers Alberto Ambrosini, Daniele G. Fotia, Alice Monti, Vittoria Pagliaroni and Luca Vergani, BREATH focuses on lacto-fermentation, a method of preserving food that does not require energy and allows each part of the food to be enhanced, enhancing the flavours and reducing waste. In addition, some foods preserved with this technique enable users to enjoy the umami taste by experimenting with recipes and flavours.

'BREATH brings people closer to traditional fermentation techniques using safe and easy-to-use tools supported by clear instructions preventing possible problem with poor food preservation.'

Lacto-fermentation is a simple technique applicable to almost all types of fruit and vegetables. The surfaces of these products already contain many Lactobacillus bacteria responsible for the fermentation process and only survive in an anaerobic environment. The fermentation process involves combining the cut vegetables with salt - which prevents the proliferation of other harmful bacteria - placing them in a jar and keeping them pressed under a glass or ceramic weight.

BREATH brings people closer to traditional fermentation techniques using safe and easy-to-use tools supported by clear instructions preventing possible problems with poor food preservation. BREATH is a three-elements system. A cap containing a valve and two silicone membranes ensures no spillage of liquids and replaces ordinary glass weights that hold food in the correct position. All the BREATH elements (including moulds for silicone membranes) can be easily 3D printed. The valve cap is parametrically designed and adapted to glass jars of different sizes, and 3D-printed moulds are reusable several times. BREATH has taken great care in the study and choice of materials to make the process effective and safe. The silicone membrane associated with the valve makes the cap impermeable by preventing air from passing through even the microporosity of its structure.

IMAGE 2. The BREATH System for lacto-fermentation with its elements and components

OLEA. An open-source distiller for essential oils and hydrolats

Distillation has always been a technique for extracting alcohols, oils, and essences from a large food variety, from fruit and vegetables to wild and aromatic herbs. Following the direction of developing healthier and more sustainable diets, it is interesting to experiment with steam distillation from a circular perspective. It means experimenting with food scraps and waste for distillation and with oils and hydrolats - aromatic water derived from the steam distillation of plant flowers and leaves - that can enrich the flavours of plant-based food.

OLEA is an open-source steam distillation system ideated by Giulia Chiggiato, Irene De Biasi, Chiara Guarino, Federico Montini and Vittorio Rinaudo by adopting a design approach influenced by the practices of making and citizen science. OLEA makes non-alcoholic steam distillation more accessible by working on the hacking and "reversible adaptation" of household items such as pots, kettles, and glass carafes readily available in our homes or easily purchased at low cost. In parallel, there is the issue of the design and customisation of technical parts and components to connect the various elements to configure the distiller.

As with HACKO, Polifactory hosted several experimentation sessions of the OLEA project. The first one verified the technical feasibility of the distiller, while the subsequent ones focused on the feasibility of the distillation process. This process involved Wood*ing - Wild Food Lab, a research lab exploring the use of wild food for food and human nutrition. The

IMAGE 3. The OLEA Distiller with its various elements and components

collaboration between designers, Polifactory, and Wood*ing has been fundamental to understand how to finalise the project and what technical aspects to focus on in the prototyping phase.

The OLEA concept is based on hacking and “reversible adaptations” of ordinary household items: a steel pot with a lid and colander, a steel steamer basket, and a glass jug with a small tap. An induction cooker can provide safe heat for distillation. Other small-size components are a copper tube, a small brass valve, and two silicone tubes. OLEA designs from scratch 3D printing elements to facilitate the passage and separation of essential oils, hydrolats (perfumed waters) and water. A 3D printed mould allows the copper tube to bend, creating the coil for distilling. A 3D printed double outlet tap - one for the oil and hydrolase and the other to empty the water formed by the melted ice - is installed on the glass jug, allowing the copper coil to maintain the correct position. A component that facilitates the separation of oil and hydrolysate and two 3D printed moulds used to create silicone gaskets that seal certain parts of the distiller complete the kit.

Open Food Factory: some lessons learnt

The first edition of OPEN FOOD FACTORY with the HACKO, BREATH and OLEA projects represents a real opportunity to reflect on some aspects that Distributed Design should consider in dealing with food transformation related to local and centuries-old traditions and new forms of micro and self-production.

The first reflection concerns how tacit knowledge, often embedded in traditional food transformations, can be translated into new forms of open knowledge, fundamental for implementing distributed food transformations. More specifically, open knowledge generation must combine respect for the original food transformation cultures and practices (traditional knowledge repositories) with the need to share information for replicating and adapting open-source processes locally.

The second reflection concerns the ability of Distributed Design to operate at various scales within a systemic complexity. The development of circular solutions enabling open and distributed food transformations must connect the micro-level (how the single solution works) with the macro-level by including externalities such as materials and energy consumption (how the food metabolisms work). Moreover, open food transformation developed through Distributed Design must comply with existing food laws concerning food-safe materials, the environmental impact, and food safety. The need for systemic abilities to manage the complexity of open circular food transformation can be satisfied using enabling technologies and design, control and verification protocols ensuring effective, replicable, and safe food transformation.

The third and final reflection focuses on the ability of designers to configure distributed and inclusive networks and communities of practice interested in plant-based food transformations. These networks and communities must include a mix of stakeholders from experts and specialists - from food to citizen science labs to other civic organisations interested in plant-based food practices not only in a dimension of circularity but in a perspective of more-than-human care (individual, collective, and planetary).

The projects implemented and the consequent reflections form the basis for elaborating the future model of what could be a true Open Food Factory, real and virtual places where distributed and circular food processes co-design, co-exist, experiment and develop.

Authors
Nanditha Nair

Where
Kochi, Kerala, India

Project type
Product

Indira Table Loom- Part of Smart Handloom Project

A table loom for weaving: making weaving looms anywhere in the world

IMAGE 2. A weaver setting her Frame loom to start working on it, photograph by Aji Lal

Project description

The Smart table loom is a foldable table loom with a user interface and electronic functionality, it can be carried around like a laptop. The user interface helps in converting the design created on textile design software into woven cloth. The electronic functionality helps in controlling each warp yarn. The weft yarn control is with the weaver as in any handloom. The user can continue weaving whenever and wherever with ease. The available table looms in the market do not have such “Smart” functionalities i.e., any design created on software can only be printed onto the cloth and not woven. Prototyping textiles would become easy for a designer and they would get to produce swatches before commissioning the whole yardage. Smart textiles can be woven easily with such a loom expanding the market for handloom weavers. New, younger weavers are encouraged to explore handloom weaving. Such a “Smart” loom is not currently available in India.

The smart handloom will be equipped with a design interface that is very easy to use. This will enable them to design and create new patterns easily. I believe that the Smart Handloom Project can be a watershed moment that allows the existing handlooms to utilise all the advantages of digital design and still produce specialised handcrafted products. This change will help create faster swatches, leading to greater design possibilities that ultimately help set up ‘weave on demand’ systems. The immediate benefit of such an integration shortens the production cycle of a particular type (Style, design) of weave from months to weeks if not days. In the long term, it will contribute to developing an open-source community of weaving practitioners. The traditional weaving communities will also transform, economically and socially, from poorly paid skilled labourers to in-demand specialists. They will become part of the global digital economy.

Project Goal	Status	Date
01 Foldable Table Loom	Completed	December 2022
02 Integrating electronic module to table loom	Yet to begin	Begins June 2023
03 Open source Community creation	Yet to begin	Begins January 2024
04 Integrating into Weavers0 looms	Yet to begin	Begins June 2025

The first objective of the project was to make a foldable table loom that would allow the user to continue weaving whenever and wherever with ease. Prototyping textiles would become easy for designers and they get to produce swatches before commissioning the whole yardage. To make these looms accessible to everyone, it has to be made-on-demand through Fab Labs and makerspaces which have low factory setup cost and produce mass yet customisable designs that are open, data-led, resilient, and circular. This distributed manufacturing disrupts the traditional 20th-century model of mass production by cutting out time-consuming and

expensive shipping, showrooms and storage. This helps to create weaving centres around the world quickly, sustainably, affordably and locally. This loom has four shafts, can be kept on top of a table and can be worked on like a laptop. This can be made using a laser cutting machine or a milling machine. The ready to assemble table loom has been designed parametrically to be able to adjust according to the size of the available material. It could be fitted onto a sheet of length 90 cm and breadth of 60 cm which is the size of the most common laser cutter bed in Fab Labs. The design comes with easy instructions to assemble. The loom can be made on wooden sheets or particle board sheets of sizes varying between three millimetres to eighteen millimetres.

Context and history

I self-learned about textiles and handicrafts and worked along with the weavers in various handloom clusters in India. There was a conscious effort from my part to better the lives of the artisans through design intervention and market intervention. One of the challenges I faced in learning about the craft was the lack of prototyping looms in India. I learned Computer Aided Designing and Digital Fabrication in 2020 through Fabacademy at SuperFab Lab, Kerala. I was inspired by the concept of Distributed Design and decided to use my skill sets for the digitalization of weaving.

What is the need it tackles?

The hereditary nature of knowledge transfer that allows families and communities to take up art and craft in India is sounding the death knell of this sector. Traditional practitioners typically do not want their children to take up this profession as the financial and social benefits associated are almost negligible in the current economic scenario. The professionals who are interested in exploring the possibilities of weaving are intimidated by the long learning curve and the relatively low design flexibility. These challenges call for a systemic change in terms of technology update that allows weaving to become a new-age skill that got democratised due to technological changes, like photography or graphic design. The latest invention in handloom is the Jacquard loom (1801) which consists of a set of interchangeable punch cards depending on the pattern to be generated. These cards bore either a hole or flat surface to raise or lower warp threads. This paved the way for the origin of computers as programming languages are made of 0s and 1s. A set of metal Jacquard plates needs to be designed and fabricated for every design required. Its making and installation are a time-consuming process. Also, control over every yarn is not easily possible. The prototyping table looms available in India are very costly, and are mostly imported from the United States of America. The first objective of this project was to make a foldable table loom that makes learning the techniques of weaving easier.

What is the global-local relationship of the project?

The consumer majority is moving fast into digitalization but the marginalised communities that include weavers seem to be disproportionately excluded. It not only increases the great financial inequality but weakens the chances to narrow the gap. There has been an increase in companies focusing on handmade goods in the last decade.

This trend was accelerated by the global demand for green consumerism and the massive social media campaign for slow, sustainable products. In the 21st century, green consumption has risen into a global trend, which inclines textile companies to be more environmentally friendly and to have a greener product portfolio to satisfy these new consumers' needs. Social media contributed to this trend, shaping consumers' attitudes into more environmentally conscious behaviour. Whether this trend resulted from altruism or egoism is a question that needs answering. It has increased the number of designers coming up with iterations of the existing product line that these weavers have been making for generations, many of whom seem to be running into obscurity within a couple of years.

This newfound attention that the handicrafts sector seems to be enjoying hasn't translated to an increase in wages or better working conditions. E-commerce companies market the history and the handmade tag of these crafts. This retro marketing banks on the power of nostalgia linking the customer and the brand on an emotional level by highlighting the usage of traditional handmade equipment by the artisans associated with the brand. This has only further deterred the brands from adapting to newer technology. The labour-intensive, back-breaking work that goes behind the creation of these handloom clothes is not rewarded monetarily. This disparity in wages deters the younger generation from continuing this as a career.

The sustainable methods of production practised by these communities need to be updated with the advancement in technology and re-equip them to practise their craft with increased productivity and better quality. There is a need to preserve and document this heritage. It also calls for exploring the possibilities of new methods of production. Artisans and weavers are the third largest segment among the poor in India. Even though the Indian government is implementing initiatives like "Make in India" and "Atmanirbhar Bharat"(Self-reliant India campaign), their dire position receives relatively little attention. Their struggle became even harder with Covid-19, due to the "non-essential" nature of the products they make.

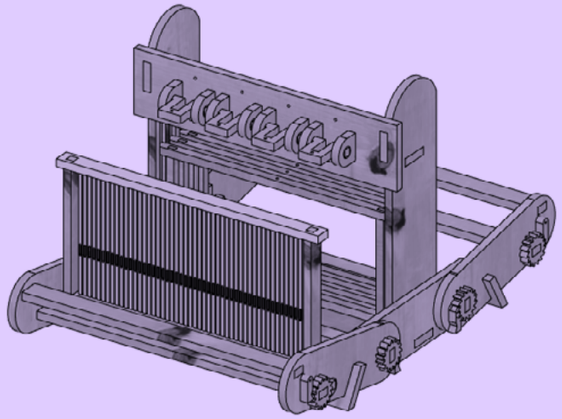


IMAGE 2. The design of the loom, design by author.

How was the development process of the project?

I was inspired by the simplicity of the loom designs of the master woodworking writer Franklin H. Gottshall and intended to design with the minimum possible pieces. A frame loom was reimagined to fit the table considering the size and movements of a laptop. The modularity of design was also a major concern as I intend to add the electronic functionality later on. The initial designs were created for wood with thickness between 8-12 mm and were intended to be cut on a milling machine. A version for 4mm craft Plywood that can be laser cut was made and prototyped in Fab Lab Barcelona in December 2022. Mr. Jogin Francis, my Fabacademy instructor at SuperFab Lab, Kerala supported me in this endeavour. The electronic integration and user interface are developed under the mentorship of Professor Philip Heidkamp, Chair Interface / Interaction Design at Köln International School of Design.

The name Indira is synonymous with wealth and is an anagram of the names of my parents.

What results did your project accomplish?

The foldable loom was made in different parts of India and was used by design students for prototyping. It also paved the way to start the electronic integration project. There has been a consistent demand for the loom among textile designers and design students. I'm in the process of setting up a production channel connecting the Fab Labs and makerspaces in India to make the loom available for those required.

IMAGE 3. Weaving society in Kerala, photograph by Aji Lal

Why is this Indira Table Loom distributed design?

Indira table loom is available through the website at www.soulsanchi.com and involves downloading the design that needs to be transferred on to the laser cutter or milling machine. To make these looms accessible to everyone, it has to be made-on-demand through Fab Labs and makerspaces which has low factory setup cost and produces mass yet customisable designs that are open, data-led, resilient, and circular. This helps to create weaving centres around the world quickly, sustainably, affordably and locally.

‘These challenges call for a systemic change in terms of technology update that allows weaving to become a new-age skill that got democratised due to technological changes, like photography or graphic design.’

Authors

Paola Zanchetta
from Brenchies Lab &
Metabolic Foundation

Where

Oranjestad, Aruba

Project type

Design Residency,
Product, Material R&D

PET Waste into Value

How to hack a dump, recycling PET waste

Project description

PET Waste to Value is the title of a design residency program to re-think the life cycle of PET plastic waste locally produced in Aruba, by transforming it into valuable materials and products with digital fabrication technologies. The project shows the power of design residencies, as meaningful collaborative events, where young designers & makers take an active role in tackling global issues driven by distributed design principles.

IMAGE 1. Recycled PET sheet

Context and history

From September to December 2022, due to her recent promotion from Fab Academy at Waag - Amsterdam. Distributed Designer Paola Zanchetta is called to work as a designer-in-residence on regenerative materials responses to the PET waste issue at the open maker space: Brenchies Lab, Aruba (part of the Metabolic Foundation, Amsterdam). Brenchies Lab is a collaborative effort of Arubians working toward a sustainable future. Among open-source science and educational projects, the Lab is hacking the local dump, preventing waste from reaching the landfill, being incinerated, and polluting the environment, by creating a resilient, self-sufficient waste management system that operates independently of the government.

The waste management system implemented by Brenchies Lab is similarly put into practice by the local project Gili Eco Trust, at Gili Trawangan, Indonesia. At the mid-term of residency, Paola had the opportunity to gather together with ten international designers and engineers at Fab Island Challenge to support Bali's emergent economy on waste management solutions. The knowledge-sharing playground at Jimbaran Hub was a key event to enrich Paola's knowledge on the field. Here she found inspiration for the experimentation process of her material's research and the residency's title. Her participation in the challenge served as a direct bridge of information between both organisations working in parallel on addressing the same waste problem from opposite world points.

What is the need it tackles?

On a daily basis, Brenchies Lab works on the sorting, cleaning, and recycling of the plastic waste generated in Aruba - the most popular residue due to tourism - which is collected from recycling garbage beans strategically distributed on the island. Private institutions that are aware of the plastic problem are also hiring Brenchies Lab's pick-up service to ensure the correct recycling of their waste. In addition to the collection service, the inhabitants of the island have the possibility of collaborating with the project by collecting, classifying and bringing their plastic garbage to the Lab, where it is recycled in exchange for a small fee (reduced if the waste is brought clean) for the project to remain economically sustainable.

Up to 60% of the plastic waste weekly collected by the team comes from single-use PET products, mainly transparent plastic bottles and food packaging. Currently, the non-industrial possibilities of recycling PET are limited. When the material reaches its melting temperature, it instantly becomes liquid, making it difficult to process by Injection, Extrusion, or Pressing if it is not mixed with other plastics. A practice that we want to avoid to ensure its future correct recycling!

Brenchies Lab has an efficient waste management system but lacks Industrial Designers focused on giving sorted waste a second life. Through collaborative market analysis, material research, and concept design, the designer in residence developed multiple prototypes using digital fabrication technologies to convert PET waste into valuable, durable products.

What is the global-local relationship of the project?

"Many small people who in many small places do many small things that can alter the face of the world."

- Tony Webster, East-Side Gallery, Berlin

In a super-connected world, what happens locally is capable of reverting to any other part of the planet. An example of this is how a plastic bottle is consumed on the coasts of Aruba, and how it travels through the Gulf currents until it reaches the beaches of the Canary Islands. This plastic bottle breaks down into small pieces called microplastics, which are ingested or penetrate the muscle tissues of marine species - including the smallest ones that are the base of the marine trophic chain, and ensure the preservation of oceans -, causing malformations, poisoning, and diseases of different kinds. But plastics are not only directly harming marine food chains. Plastics are polluting the air we breathe, the water we drink, and the food we eat. We are likely consuming the rough equivalent of a credit card's worth of plastic every single week, according to a study carried out by the University of Newcastle (Australia) and directed by WWF (Dalberg & University of Newcastle, 2019). There is a global health alert that affects both humans and nature, of which we do not yet know all the possible implications.

We live in a world of continuous change where mass consumerism is the order of the day and the processes of production and dissemination of media content influence individual decision-making. Since the start of the second industrial revolution and the establishment of a linear extractivist economy model, our civilization has considered nature as a storehouse of unlimited resources with which to mass produce and promote the concept of infinite human progress. It has been considered that we are capable of controlling nature at will. However, the planet dictates the possibilities of human socio-technical development and not the other way around.

We are producing twice as much plastic waste as two decades ago, and most of it ends up in landfill, incinerated or leaking into the environment. In this context of multi-crisis, there is an imperative need to locally rethink circular system solutions for plastic waste problems which can be globally distributed.

Although the PET Waste to Value project is currently implemented within the practical context of the Precious Plastic initiative in Aruba, the process can be replicated and distributed to any geographic point where the same plastic problem is affecting the environment and societies.

IMAGE 2. Paola's workspace at Brenchies Lab

IMAGE 3. PET recycled brown sheets into valuable prototypes

How was the development process of the project?

For the development of the design residency, the designer followed an experimental, spiral approach to product creation. Starting from the analysis of the plastic problem on the island, identifying that the main source of plastic waste sorted was PET, digging further into the issue, planning experimentation iterations with material boundaries, evaluating the results, and implementing the learnings in the design process.

The three main tasks conducted with this methodology focused on:

- Researching processes to recycle PET waste into new circular materials;
- Experimenting with the material's boundaries of recycled PET sheets developed already by Brenchies Lab;
- Designing and Prototyping products with digital fabrication technologies that suit the local market in Aruba, and that can also be easily globally distributed.

This methodology led her to the creation of products where the intersection of digital manufacturing technologies and wooden tools occurs. Where the most promising techniques researched with recycled PET waste sheets are featured. And where the following design principles apply:

- Mono-Plastic
- Easy to Assemble & Disassemble
- Plastic Dense
- Competitive price in the local market
- Displace already existing plastic products
- Design products that last
- Design for open Distribution

What results did your project accomplish?

The first spiral of product creation focuses on the development of joinery methods that can be easily reproduced, adapted, and expanded into modular objects where natural and artificial light play an important role. In fact, the main characteristics of recycled PET sheets are their brittleness (behaving almost like glass), and their joyful colours when light passes through the material.

The next design spiral focuses on observing the PET waste problem even more closely. The majority of the PET waste sorted at Brenchies Lab comes from transparent plastic single-use bottles. When processing transparent PET waste into recycled sheets, it turns brown. This colour is not as appreciated by local customers as the colourful blue or green outlets. There was the necessity of creating valuable products made with brown sheets. Designs that could catch the attention of customers, and give a second life to the majority of PET waste produced on the island.

The designer tackled this challenge by looking for a technique to present aesthetic products made from brown sheets. Minimal open-source designs, allowing its replicability, implementation, and scaling in the local market. Sewing turned out to be the most suitable practice. Due to the

presentation of a contrasting leather-like look in the products. Combined with CNC milling, bending with a heating gun, and moulding (moulds made with hard plastics, recycled metals, or cardboard) it was possible to create organic shapes.

But ... What happens with the PET waste produced while prototyping these ideas? To close the loop of the wasted material life, the designer researched a new way of processing PET waste into valuable material (which looks almost like porcelain) and applied it in the form of tiles for interior design. In this way, the residency program ended up digging into the last spiral of the PET waste issue.

Why is PET Waste into Value distributed design?

The open documentation of this project creates more sustainable processes for the manufacturing and distribution of recycled plastic products. It allows other communities around the globe to recycle local PET waste following the same principles, supporting the material's development, and enriching the project's knowledge. It empowers users to be part of the solution, creating regenerative, self-sufficient, and resilient networks which aim to find valuable solutions for one of the biggest current global plastic waste issues. And results in a project that strives for a more equitable and democratised world.

IMAGE 4. PET waste from prototypes transformed into tiles

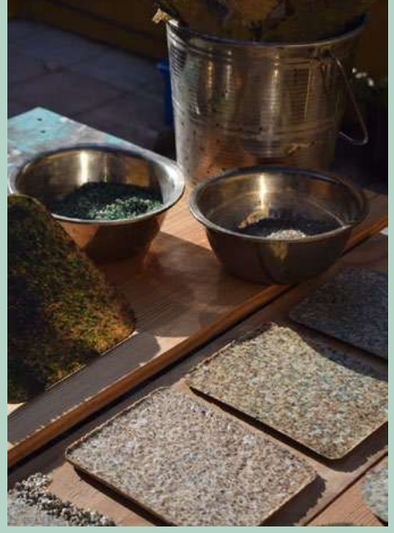


IMAGE 5. Recycled PET waste from prototypes

IMAGE 6. Recycled brown PET

IMAGE 7. Landfill at Gili Trawangan, Indonesia

IMAGE 8. Test sewing technique with brown PET recycled sheets

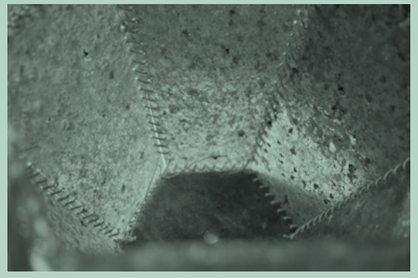


IMAGE 9. Prototype with sewing technique & brown PET recycled sheets

Authors

Veronica Tran, Gabriela Garcia, Julia Bertolaso & Sarah Muir-Smith supported by Public Art Park 22' - Testing Grounds

Where

Melbourne, Australia – & Worldwide

Project type

Participatory public art installation and workshops

Testing Oven

Testing Oven is an experimental wood-fired ceramic kiln

Project description

Testing Oven brings knowledge, material, and experience over a fire to share with the public, opening a conversation about the process of making with our hands. It connects potters, ceramic enthusiasts, curious minds, and food lovers who are interested in connecting with the community present at Public Art Park, Melbourne, and worldwide. With this initiative, we explored autonomous processes of building our own tools, knowledge sharing within networks, and participatory processes that enable public interaction within the creative process.

MAGE 1. A toddler plays with the materiality of the Testing Oven kiln, photo by Emma Byrnes

Context and history

The project was initiated through Testing Grounds' Public Art Park during the Melbourne Fringe Festival 2022. Starting both remotely and internationally, it began via a collaboration of designers based in Australia, Brazil and Spain. After a period of research around the broader context of material, food, and fire, the idea evolved into a project centering around an open-source kiln. The firing process and construction of the kiln are what makes it open and accessible, disseminated through printed media during the festival days, and it is also available through digital documentation <linktr.ee/testing_corner>. Created with the intention to collaborate with communities and various creative fields, Testing Oven was built with the motivation to form a community of people looking to create their own tools responding to their contextual needs within the practice of ceramic making. This project allows people and practitioners of the craft to access a kiln freely to learn about the processes and materials used to make this happen, allowing us to be more independent yet communal. We propose for the knowledge acquired in the processes to be shared more widely, with the intention of making the practice more accessible, keeping it alive for generations to come.

What is the need it tackles?

In a world with physical and digital divides, participatory experiences in the public realm contribute to the connection and the further development of local communities. Testing Oven is driven by the idea of forming connections with like-minded people, who are looking to increase autonomy in their creative processes, who want to be experimental in their practice, and who are interested in taking part in public and collective encounters.

What is the global-local relationship of the project?

Testing Oven invites the public to make, cook and bake together, interacting with the Queen Victoria Market in various playful ways during the Melbourne Fringe Festival in Melbourne. The design and the instructions of the project were openly published, both in a physical and digital format – as a printed poster and digital documentation - in order to be accessible beyond the duration of the event, allowing people from other parts of the world to experiment in building and firing with Testing Oven. Additionally, a digital community was created on Instagram (@testing_corner) allowing people who were not physically present to interact with the process happening in Melbourne during the festival and to become a digital point of convergence for the future unfoldings of the project.

How was the development process of the project?

The core of the initiative consists of an experimental wood-fired ceramic kiln, made with brick and composed of two layers – a food & ceramic chamber and a fire chamber. The different phases of the project include a building phase, with an open call for collaborators to come and help to build the kiln; a making phase, in which the ceramist Sarah Muir-Smith gave a workshop on ceramic modelling and about the process of saggar, a method of firing enclosed in containers; and finally, a firing phase, with activities involving ceramic firing and baking food. As a way to connect people with the participatory processes realised at the Melbourne festival and worldwide, an open-source documentation of Testing Oven was developed, expanding beyond the duration of the local event.

What results did your project accomplish?

Testing Oven provided people with an unusual opportunity to connect through making and to relate with other people using different materialities. As Mary Caroline Richards points out in her book Centering in Pottery, Poetry, and the Person: "As we come into touch with other beings, we discover ourselves. This is precise. As I experience the presence of a tree or a field or a stream or another person or a tremor that runs through me with a force of its own, I know myself through that experience" (p. 146, Richards, 1989,). The participatory building of the kiln has allowed the creation of an open space to experiment in various domains, the public and the personal, and for beautiful encounters to take place. Using

digital documentation, we expect people to build kilns attuned to their local conditions and start communities around their local creative practices. We also held an open and free pinch pot-making workshop with the public, succeeding in a level of engagement with others to learn how to make and fire their own ceramics.

Why is Testing Oven distributed design?

By providing instructions on how to build and fire with Testing Oven, the project becomes part of the movement of distributed design, allowing people to acquire this knowledge and adapt to their own contexts, in accordance with the local availability of materials and resources. The documentation of the project was shared in English, Spanish and Portuguese, allowing a broader audience to access the project. It also sums up the widespread knowledge of ceramic making, as an ancient practice done by humans, moved from generation to generation, adapting to local conditions and materials. Moreover, keeping track of historical modes of firing allows us to maintain this precious knowledge alive. For many ceramists, wood is more than just a source of heat for a kiln, it is about a process, and even sometimes a way of life. Since humans have first begun to understand fire-hardened clay, we have been making ceramics in pits and kilns. With so many fuel options currently available to ceramists, wood-fired kilns are more of choice than a necessity. While this practice isn't easy, the process creates unique outcomes that could not be achieved otherwise. With time, each piece teaches us more about our process and gives us a greater appreciation for the craft. The practice embraces unpredictability and the control that one must give up to co-exist and co-create with others.

IMAGE 2. The building process of Testing Oven. The image shows a pile of red bricks and two women building the kiln

IMAGE 3. Testing Oven kiln with fire inside and some pieces on the floor

IMAGE 4. The image shows the ceramist Sarah Muir-Smith giving a workshop about ceramic modelling and the process of saggar firing

IMAGE 5. The process of firing with the Testing Oven kiln, with a bit of smoke coming out and pieces on the floor

IMAGE 6. Close-up of a hand holding a ceramic piece, photo by Emma Byrnes

IMAGE 7. Participants developing their pots during the workshop on ceramic modelling and saggar firing

IMAGE 8. Three ceramic pieces from the first firing are displayed over the Testing Oven kiln

Authors

Zsofia Kollar, Leonardo Avezzano from Human Material Loop

Where

Geleen, The Netherlands

Project type

Material innovation

Human Material Loop

Textile innovation for the 21st century

Project description

Human Material Loop is a material innovation company developing technologies, materials and products from waste keratin protein fibre (hair) for delivering high-performance products for the textile industry with zero negative impact on the environment and the people.

IMAGE 1. 100% human hair sweater prototype, photography by Medina Resic

Context and history

Human Material Loop was founded by Zsofia Kollar in 2021 to create a true textile revolution and to show that people are not above but part of the ecosystem. What's really needed is a deeper shift in consciousness so that we begin to care and act, not just for ourselves and other stakeholders, but in the interests of the entire ecosystem in which all activities take place. If we look at nature, it does not waste anything, only humans do. We are the only species on this planet who decided to cover our bodies with materials that do not belong to us, with a reason to protect our bodies or express our identities. What does this extremely destructive practice say about humanity? And where does the current material usage put us within the ecosystem? The dependence and addiction of major fashion brands to synthetic fibres made from fossil fuels are fueling the plastic pollution and climate crisis, which have a major impact not just on our own health but on the entire ecosystem. What if we did not disturb the ecosystem, What if we could become part of the ecosystem again? What if the materials we used had zero negative impact on the environment? So, what can our textile technology tell us about our current culture?

The history of textiles is nearly as old as human civilization, and as time has passed, the making of textiles and the choices of materials have changed and technologies have developed. Wearing a piece of clothing is an entirely distinguishing feature of the human species and is found in most societies. Anthropologists believe that animal skins and vegetation were adapted into coverings as protection from cold, heat, and rain, especially as humans migrated to different climates. The clothes we are wearing and the textiles we are using represent the materials and technologies accessible in different civilizations at different times. The variety and distribution of clothing and textiles within a society reveal social customs and culture.

What does the current technology of textile production tell us about our society? The polluting and exploitative source of materials, the faraway production, and the extremely destructive chemical processes have a huge negative impact on the environment but also on a social level. In many aspects of today's world, the technology in other industries has evolved to make our lives easier, but the technology in the textile industry is far behind our high-speed travel and our smart homes. The fashion industry might give an individual an identity, but it also destroys the living environment.

What is the need it tackles?

Humans have altered 70% of Earth's land surface, causing soil erosion and poor air quality, polluting water, exploiting animals, and poisoning people. While we are destroying our ecosystem, our endless waste stream is going no elsewhere other than our backyard.
Every technology that has been created s
erves the comfort of humanity, every disruption of the ecosystem was because of our comfort; we have been selfishly exploiting everything around us, but aren't we all part of this ecosystem after all? Why do we behave as if we are above this ecosystem and believe we can exploit it endlessly? We've known for long enough that we cannot operate the way we do today. Recycled polyester is still releasing microplastic into our blood and lungs, vegan leather is still plastic, and we still poison millions of people every year with pesticides and other hazardous chemicals. We can believe in the fairy tale that putting a bandage on the wounds will heal the problem itself, but it is our duty to look the next generation in the eye and tell them we did everything to make a change.

It is no secret that the textile and fashion industries are the second-largest polluters in today's world, just after the oil industry. The current system cannot operate the way it does now. If we want to maintain this planet for future generations, we do not only need to alter our supply chains; we need radical changes. The largest portion of emissions arises from the cultivation of raw materials and transport.
Change is needed. We are the cause of the climate crisis and the disruption of the ecosystem, but we can be part of the solution. Human Material Loop is a material innovation company that develops technologies, materials, and products using waste keratin protein fibre (hair) to deliver high-performing products for the textile industry with zero negative impact on the environment. Our aim is to empower humans to be the solution to the problems we have created and lower the negative impact of the textile industry.

What is the global-local relationship of the project?

The mission is to develop high-performance textiles within a closed-loop recycling system & by using locally sourced materials the aim is to reduce the fossil fuels and associated

pollutants including greenhouse gas emissions required for shipping. By supporting local businesses the aim is to feed the regional economy. Small-scale local production helps to eliminate the waste of unneeded products made to adhere to overseas minimums, and reduce emissions and energy usage. Local production pushes for accountable ethical production and labour, where the environmental impacts would directly affect the consumers thereby eyes cannot be closed on overseas factory pollutants and working conditions.

How was the development process of the project?

In Europe alone, 72 million kg of human hair waste ends up in landfills or in incinerators, even though human hair is the same keratin protein fibre as wool. The most common interest in hair is focused on hair growth, hair types, and hair care, but hair is also an important biomaterial primarily composed of proteins, notably keratin. With the escalation of the global energy crisis and environmental risk, the unique benefits of biological fibres such as human hair have yet to be incorporated into our product cycles.Human hair's abundance, non-toxicity, non-irritation of the skin, high tensile strength, lightweight, thermal insulator, flexibility, and oil-absorbing capability as a material indicate great potential for incorporating it into our manufacturing system.

What results did your project accomplish?

The founders Zsofia Kollar and Leonardo Antonio Avezzano are not afraid to put their skin in the game. "We are game changers - and ready to prove it to the world." Hence the expedition to Aconcagua, the highest mountain in the world outside of Himalayas, to test one of their technologies in one of the harshest environments on the planet. "We are exploring different possibilities and applications since the beginning. You can have great lab results, but the real test of your technology is when you put it to real life situation."

Leonardo and his innate passion for the outdoors and the planet have led him around the world, from mountains to deserts, where Leonardo is most comfortable, he has broken records before but this time he was going up to the summit with a gear that nobody else wore before. A gear to protect him in -40 degrees celsius, a lightweight gear using human hair and its thermal properties. The outdoor gear using human hair outperformed all other high-tech products on the market.

IMAGE 2. Human Material Loop outdoor gear tested on the highest mountain in Argentina, photographer Claudio Fredes

Why is Human Material Loop distributed design?

Human Material Loop develops high-performance textiles from waste keratin protein (hair) within a closed-loop production system. How? A few times a year, everybody goes to the hair salon, but how many of you have ever wondered what happens to the cut-off hair on

IMAGE 3. Human hair blazer - Human Material Loop x HAEMD, photography by Nikola Lamburov

the floor at the salon? Human hair, after all, is the same keratin protein fibre as wool, and prior to the Human Material Loop, hairdressers swept the hair to their bin and threw it out with the rest of their garbage.

What appears to be absurd at first glance is that the most sustainable material we can use is our own waste, specifically our own cut hair. Because growing our own hair and getting a haircut to feel and look good does not degrade the soil, use pesticides, or pollute the water, and no one is harmed or exploited in the process. What can textiles developed from hair offer? A 100% biodegradable material with local sourcing and production, which not only cuts off transport emissions but also boosts local economies. a hypoallergenic material by nature, because there is no human on this planet who would be allergic to human hair. A material that is as strong as steel in the same diameter and can be stretched up to 1.5 times its original length before breaking. And, if you're concerned about privacy, cut-off hair contains no nuclear DNA, so no individual can be identified; the most that can be analysed is the individual's diet or vitamin deficiencies.

Human Material Loop was founded with a mission to create a true textile revolution, show that people are not above, but part of the ecosystem, and show that a zero-waste society is actually possible. Finally we humans can be the solutions for the problems we have created.

Sustainable hi-tech fashion – FashionTech via B.O.R Wearables

Merging tangible and intangible heritage, culture, and sustainability in wearable technologies/ Hi-tech Fashion

By Batoul Omar al-Rashdan from Studio B.O.R.

Sustainable 3D printing fashion is an innovative approach to designing and producing clothing that balances technology and sustainability. With the rise of the fast fashion industry, there is a growing demand for more environmentally friendly and ethical alternatives to mass-produced clothing. 3D printing technology offers a solution to this challenge by enabling me as a designer to produce unique and customised pieces that are not only stylish but also sustainable.

3D printing technology works by laying down thin layers of material to build up a 3D object. In the fashion industry, this technology can be used to create intricate designs and patterns that would be difficult to achieve with traditional manufacturing methods. In addition, the ability to customise designs for individual customers makes 3D printing an ideal solution for sustainable fashion. This eliminates the need for large quantities of unused stock and reduces waste associated with overproduction.

Another advantage of 3D printing technology in sustainable fashion is the ability to use biodegradable and environmentally friendly materials. These materials, such as bio-based plastics and biodegradable cellulose, are designed to biodegrade naturally in the environment, reducing the impact on the planet and reducing waste. Additionally, 3D printing technology allows for the use of recycled materials, further reducing the environmental impact of the fashion industry.

BLLURA MUSA is a 3D-printed dress for a character inspired by myths and legends that merges various technologies and methodologies to create a unique and stunning piece of wearable art. The dress is inspired by the Dead Sea in Jordan, which is a unique natural wonder that is facing various environmental challenges. The dress not only serves as a tribute to the beauty of the Dead Sea but also as a statement about the importance of protecting our natural resources and the environment.

This “distributed design award 2022” winner project is created using 3D printing technology, which allows for the creation of complex geometries and shapes that are impossible to create using traditional manufacturing methods. The dress features intricate crystal patterns that are 3D printed and grown using a combination of computational couture, electronics, and bio-dyed crystallizations. The dress also features two layers in turquoise and navy blue that mimic the waves of the sea where lab-grown crystals had been grown on for optimization of mimicking dead-sea crystals.

IMAGE 1. Bllura musa

Part of this wearable had been designed to change colour based on temperature. The thermochromic 3D printed accessories of BLLURA MUSA change colour with temperature as you move closer or further away from the shoreline. As the temperature gets warmer, the colour of the 3D printed pieces turns into a bright turquoise colour. The dress’s colour changes to a dark navy blue as the temperature gets colder. In addition to reflecting Bioluminescence via 3D Printed Glow in the dark.

The headpiece of the dress is also 3D printed and crystallised using onion peels as biochrome/ biodye. The neopixels are coded to light up the 3D printed crystal geometry and the optic fibres with crystals grown on, creating a stunning visual effect.

The concept behind the dress is to showcase and highlight the unique beauty of the Dead Sea in a contemporary and futuristic way. The dress serves as a reminder of the importance of protecting our natural resources and the environment from abuse and neglect. The Dead Sea is a unique and fragile ecosystem that is facing various environmental challenges due to economic interests. The dress is a symbol of rebirth and awakening, representing the idea that we can protect and preserve our natural resources if we choose to do so.

BLLURA MUSA is a stunning piece of wearable art that merges various technologies and methodologies to create a beautiful and unique dress. It is a beautiful and powerful symbol of the need for environmental awareness and action. In addition to being a great example of Sustainable Hi-tech Fashion highlighting a sustainable concern as an optimization of the term “Sustainable fashion”.

Sustainable Hi-tech Fashion combines traditional cultural heritage and intangible values with the latest advancements in wearable technology and sustainable materials. 3D printing technology is one of the main driving forces behind this field, enabling the creation of unique and personalised pieces that are not only environmentally friendly but also integrate local cultural elements and traditions.

As a sustainable Hi-tech fashion designer, Studio B.O.R, I aim to create pieces that are not only stylish and innovative but also have a positive impact on the environment and the communities

they represent starting with my Jordanian culture. I took the BLLURA MUSA concept further and created a few pieces in the “Ready to wear” collection and accessories through my online shop platform “studiobor.io”.

The merging of intangible cultural heritage and sustainability in wearable technology is a crucial step towards creating a more sustainable fashion industry that is mindful of its impact on the environment and local communities. In addition to the environmental benefits, 3D printing technology also offers the opportunity to incorporate local cultural elements and traditional techniques into designs. This not only helps to preserve cultural heritage but also provides a unique and personalised touch to each piece of clothing. Furthermore, the use of local materials and traditional techniques can provide economic benefits to the communities, helping to revive local economies and support sustainable development.

The fusion of traditional and contemporary design has been a trend in recent years, with designers looking for ways to bring traditional crafts and art forms into the modern age. In this case, my aim is to present traditional Jordanian embroidery in a contemporary Hi-Tech form. I wanted to use digital approaches to explore how the gradient differs based on the customised input, chosen over criteria. This input is inspired by Jordanian embroidery patterns and these “X”s resemble the cross stitches.

To achieve this, as a designer, I had chosen to use Grasshopper, a popular graphical algorithm editor for Rhino 3D, which allowed me to create generative designs. By using Grasshopper, was capable of creating a deconstruction gradient from each inspiration. This means that the embroidery patterns can be broken down into smaller components, which can then be used to create new designs.

The aim is to create a 3D-printed version of traditional Jordanian embroidery, using the cross stitch as the basic cell generator. This enabled variation in the height of each cross stitch, creating a unique and contemporary interpretation of the traditional craft unlike the traditional low-tech mechanism of embroidery which has one monolayer height.

The result is a fusion of hi-tech design and tradition, resulting in a unique and beautiful piece of art. The use of technology to explore traditional crafts is an exciting and innovative way

IMAGE 2. Biomask, photography by Claudia simonelli

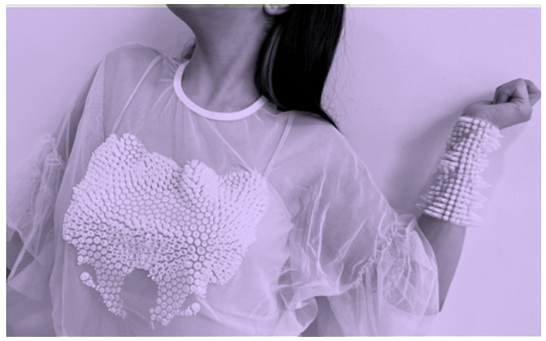


IMAGE 3. Bllura musa ready to wear, photography by Claudia simonelli

IMAGE 4. Bllura musa 2 ready to wear

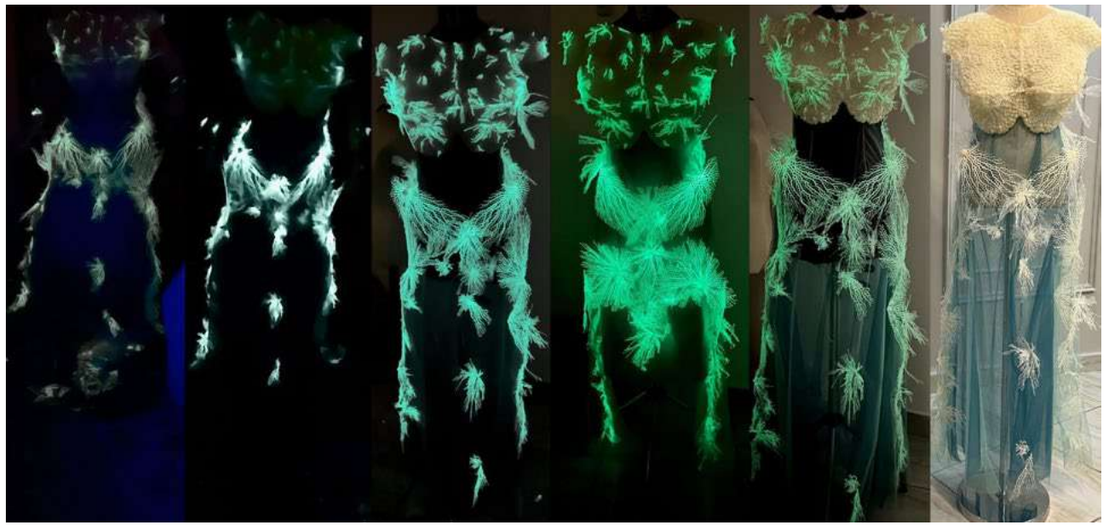


IMAGE 5. Bllura musa 2

to create new designs. This approach opens up a world of possibilities, allowing us to push the boundaries of traditional crafts and create new and exciting works of art.

Recent years have seen a growing movement towards finding more sustainable and eco-friendly alternatives to traditional materials. Another approach is to explore new materials that are crafted from sustainable sources and can be used for a range of products and applications.

In this context, the use of bio-silicone and bio-resin made from food waste has gained attention as a potential solution to reduce the use of traditional plastics. Onion peels that I used have also been found to have properties that mimic gold, making them a valuable resource for the development of bio-resin.

The development of these bio-materials requires a combination of traditional craftsmanship techniques and modern technology. By leveraging new tools and resources, was capable of exploring the properties of sustainable materials and developing innovative products that are not only eco-friendly but also functional and aesthetically pleasing, like the Traditional Mask (Burgu’) had been explored via bio-materials mimicking the coin to create “Bio-Coin”. I have also produced other accessories using this “Bio-Coin”, like bracelets and necklaces found on the “studiobor.io” online store.

In conclusion, sustainable hi-tech fashion is not only about creating environmentally friendly fashion but also about connecting the past, present, and future through technology, heritage, and culture. The use of digital fabrication tools, computational design processes, and alternative materials creates opportunities for sustainable solutions, reducing waste and promoting a circular economy. By using technology to create fashion, we can create a more sustainable world.

Designing for Agency

Expanding on how we learn design and who we learn it from, this chapter delves more deeply into what we can learn to design for: creating and reclaiming agency. The era of the consumer is drawing to a close and reflective, critical and political design approaches are helping facilitate the establishment of the citizen, who participates and collaborates in the design process. Ultimately, people become agents of design, regardless of their area of expertise or background. By obscuring the division between designer and user, we are able to create more useful, accurate and empowering tools, interventions and methodologies. The work featured in this section makes the case for a shift to: design for each; decolonising design; design as a strategy for intervention; design of provocation and more.

Chapter 04

Provoking Manifesto: design with activism

By Natalia Pérez-Orrego from Universidad de Medellín-Colombia

Every act of design involves the construction of a transformative and disruptive aesthetic experience on what we already know and that, from different materialisations, allows us to project a bodily and discursive performance with the world; that is to say, the action that is designed is also a political experience, since it implies a change in our ways of acting in the social context, as well as the construction of new subjectivities. Thus, the intertwining of aesthetics and politics in design is inseparable. Still, it is not addressed as a holistic experience design in the designers' thinking process.

'If design in its breadth is the enabler of human artifical nature, it is not only in charge of adding value, but also of constituting the value of life interactions.'

It is true that the intrusion of design into the realm of politics is somewhat strange, since its field has usually been dedicated to technological, technical, or productive efficiency to add value. However, the act of designing has endowed us with an artificial world in which we have been able to construct our own human nature, so it cannot be separated from the political action that this artificial world proposes, its separation has brought us various repercussions: consumerism, hyperproduction, poor waste disposal, pollution, inequality, to name a few. If design in its breadth is the enabler of human artificial nature, it is not only in charge of adding value, but also of constituting the value of life interactions (Buchanan, 2001).

This text then contributes to the discussion that different authors have addressed on the political dimension of the act of designing (Buchanan, 1989; Thorpe, 2009; DiSalvo, 2010; Markussen, 2013), and from which I intend to expose the relevance of interweaving aesthetics and politics for today's designer to address the conflicts of production and consumption in which he has participated by favouring the industry, the market, and the user. The 21st century designer is reflective, critical, and generative and is committed to the problematization and resolution of complex systems and environments (Buchanan, 2001). They are not only a bridge between industry and the user, but a new subject who uses their own aesthetic and political criteria to project experience as a strategy for intervention and relationship with the world.

In this reflexive direction, the object of disciplinary study then lies in designing the action and discourse that we as humans will have in everyday life, individual or collective, when using the artificial productions arranged by the design itself (González, 2015); it is to design action as an act of expression that brings together action and public discourse as forms of production of individual and collective meaning, to build and be part of social plurality (Arendt, 2005). Therefore, it is necessary to train a new professional who resorts to the use of aesthetic and political criteria as operations of rhetorical expression to analyse, argue, persuade, deliberate, and project a strategy of intervention and relationship with the world, from which they model their activist intentionality.

In that sense, the Provoking Manifesto, is presented below as a mobilising discourse, as a tool where designers bring to the surface the problem or controversy, the performative change, and the transformative scope of the proposed action, as well as their own position and political action from what they design. This Manifesto is derived from the Design Framework: guidelines for provocation, proposed to project the experience of interaction as an experience of critical-creative participation, or also, as a critical and speculative experience (Pérez-Orrego et al. 2022)

In addition, I will present how this Manifesto, which seeks creative and generative agency in the other, has stimulated the design students of the Faculty of Design of the University of Medellin-Colombia, to compose their own discursivity and materiality of possible bodies in the class exercise: Me and otherness, from the production of their own visual, textual, and facial manifestos.

Why provoking activism?

Let's imagine for a moment the possibilities of value that design can bring to everyday life without being closely related to industrialization and consumption. This image is almost unimaginable today: ornaments, furnishings, clothing, and architecture have been created since the Stone Age with the purpose of qualifying our daily coexistence with the environment.

Crafts, for example, clearly demonstrate the dialogue of value (Grisales Vargas, 2015) that creative invention maintains with culture and its territory carrying out its material and symbolic shaping processes. The archaeological findings of various civilizations show the close relationship that material invention has had with the qualification of everyday life: Egyptian textiles, Japanese ceramics, Chinese metallurgy, Mayan architecture and pre-Columbian ornaments, among others, are expressions that make visible other values of human material expression.

Although, as history tells us, the purpose of the material world has not always been that. It is not but to return to the expressions of hierarchy and power that, for example, the French monarchy of Louis XIV externalised with the ornaments and the decorative excess of royal attire and castles; or with those that Catholicism demonstrated itself as divine heir with churches, jewellery, and papal attire since the Middle Ages. Or as the most current purpose we know of design: when it begins to be valued as the decorative ornament that would favour the economic consumption of the incipient industrial products thrown by the first industrial revolutions or for the economic relief of the great depression of 1929, or of the interwar and postwar period in Europe and North America.

In the historical line that can be traced from the Renaissance to the present day, design has been used mostly to serve the economic or social power of different institutions or doctrines, it is Modernity where the design profession is moulded and used to add value to modern life, it is the period where the power of change that resides in the aesthetic is put at the service of a higher transforming power as the orders of progress.

However, this gregarious and limited utility vision of design has already been transgressed when it comes to express its aesthetic power as an activist weapon. The social purpose of bringing art to the everyday life of the Bauhaus School, originated in designing the reflective and disciplinary autonomy (Horta Mesa, 2012) necessary to authorise itself as a profession that studies the creation of meaning and language as an agency of transformation of human social life. In this sense, design during the twentieth century was recognized through different experiences of proximity and distancing with art the energy of social change that underlies its aesthetic nature (Pérez-Orrego, 2017), and, for the 21st century, it allows it to know itself as a discipline that studies the problems and phenomena of human social interaction, to reshape or transform them into actions and discourses others that the aesthetic experience makes possible.

Thus, the task of design acquires an expanded function: it not only adds value to everyday life, but shapes interactions with life. The object of disciplinary study then resides in designing the action and performance that human beings will have in everyday life, individually or collectively, when using the artificial productions provided by design itself. It is the awareness that design creates modes of being, and therefore, an ontological construction of being (Fry, 2012;

Escobar, 2019). But it is not that as designers we do not recognize it, it is the biassed productive and economic relationship that clouds the fact that the creative project involves technical, functional, sensorial, and political projections with the world. As humans, we are makers of ourselves (Sennet, 2009).

Interaction between aesthetics and politics

To deal with the design of human action or activity closer us to a dimension that is rarely premeditated in the creative process of interaction: the political dimension. The construction of meaning reaches its maximum expression when the individual interacts with objects, products, or experiences in the public and social scene, recognizing its own political dimension and agency.

Hanna Arendt, in her text The Human Condition, had already presented 'action' as the distinctive activity of the political subject insofar as this, being an act of expression, brings together the act and public speech as forms of the production of individual and collective meaning, to build and be part of social plurality.

The act without speech fails to project its meaning, and speech without act does not project the veracity that acting provides as evidence of what is spoken; it is from this symbiotic relationship that Arendt defines action as the human condition that makes it possible to be (politically) in the world: "[...] a life without action and without speech is dead, literally dead for the world" (Arendt, 2005, 200).

In this way, designing for action is then responsible for the projection of potentialities for bodily and discursive action for the development of a subject with political and social agency in the public arena. That is, to project an interaction between the subject and the public, between the subject and the other; and, like all design, it designates an intentionality or purpose of action (bodily and discursive), that is, an activist manifestation.

The characterisation of a design that enhances interaction with the world, the production of meaning, expression, and human language, is an epistemological perspective consolidated since the 1960s from the reflections raised to the training plans of design professionals and their development with the industrial, cultural, social, and political sector. What do designers' study? How is a design professional trained? For what purpose are they trained? These have been questions with which the study of the act of design and its impact on the designers' design work has been deepening.

Authors and compilers of design studies as Victor Margolin and Richard Buchanan (1995) or Klaus Krippendorff (2006) have estimated the discursive and reflexive turn of design as an intentional rhetorical production, that is, as the construction of the artificial language that enables human interaction with the environment; a distinction promoted in 1969 by Herbert Simon when he distinguished the processes of inventive thinking and the possible as a science of the artificial (1973).

Design as rhetorical and for interaction project needs other skills for designer education, even more when in contemporary times it is not enough to master the stylistic and ornamental to get involved in the problematization and resolution of complex systems of the social and cultural context (Buchanan, 2001). It is an education in which the designer is not only a bridge between industry and the user, but a new professional who resorts to the use of aesthetic and political criteria as operations of rhetorical expression to analyse, argue, persuade, deliberate, and project a strategy of intervention and relationship with the world.

The designer, always trying to propose resolutions in the face of the indeterminate, has reflection as their main creative activity (Schön, 1998). The expression that the designer throws as a material or formal result is nothing more than a bet of critical discernment that exposes their own resolute position in front of the world. They are not a professional separated from their subjectivity by the supposed objectivity they must maintain to distance from criticism, is not an actor in the industry who dominates the script in favour of market efficiency and productivity, is not a creator without a social and political position because their projects do not only respond to consumption, is not a professional without philosophical conviction for human life and the living ecosystem that surrounds them.

The designer is today a thinker and producer of actions for the artificial life that we have fabricated for ourselves and that today we even need to transform, because by not having correlated many of these material productions with this reflexive as well as systemic consciousness, we have put life itself at risk. Buchanan's distinction about design is more resonant today than ever in pursuing this professional conduct: "[...] The essential humanism of design lies in the fact that human beings determine what the subject matter, processes, and purposes of design should be. These are not determined by nature, but by our decisions." (1995, 55)

Thus, the designer's task is no longer situated in the sphere of productive or functional efficiency and novel stylistic appearance, but in being part of the conscious and reflexive production of humanism itself. In this sense, the designer is an activist who mobilises and intentionalises forms of action as a generative strategy for social interaction, using aesthetics and politics for this purpose.

This activist intentionality has a semantic equivalence with the definition that Vilém Flusser described in his article About the word design (2002), as a cunning, deceitful or trap plan, a more than appropriate definition to present the activist designer as a conspirator who provokes, with traps and mechanisms, the generation of new forms and mobilizations of behaviours and conducts. This rhetorical understanding of activism, and of design itself, configures it as a generative and mobilising provocation, not restrictive or destructive.

'The designer's task is no longer situated in the sphere of productive or functional efficiency and novel stylistic appreance, but in being part of the conscious and reflexive production of humanism itself. '

So, to enhance a conscious and visible activism in designers, I will expose previously the design Framework: ***guidelines for provocation***, proposed to project the experience of interaction as an experience of critical-creative participation or also as a critical and speculative experience (Pérez-Orrego et al. 2022). Then, I present the ***Provoking Manifesto*** as a mobilising discourse, as a tool where designers bring to the surface the problem or controversy, the performative change, and the transformative scope of the proposed action, as well as their own position and political action from what they design.

Guidelines for Provocation

The provocation is the mobilising action for the event of the interaction experience. It makes possible the singularity of the event, it bothers, challenges, and throws towards otherness. Thus, thinking of it as the design centre of the experience not only means creating a rhetorical anatomy from the incitement, but also a structure or design framework with which the interaction of possibility can unfold.

The most interesting conceptual principle of this bet is in the conception of experience as an act of possibility, of poetic creation and that is constituted, therefore, as an act of knowledge for the production of meaning from authors such as John Dewey (1949; 1960), Gilles Deleuze (1965), and Martin Jay (2009).

That conception determines that an interaction experience is a Critical-Creative Participation (Cr-CP) (Pérez-Orrego, 2018), so that the dialogue and the engagement that an interaction supposes can be exposed. In this direction, this type of experience is defined as an event for discussing and resolving problems, in which the participant embodies criticism and the construction of meaning towards issues of a controversial nature.

Thus, for the design of the Cr-CP, as a provocation experience, three design guidelines are proposed: intellectual risk, generative challenge, and embodied futures.

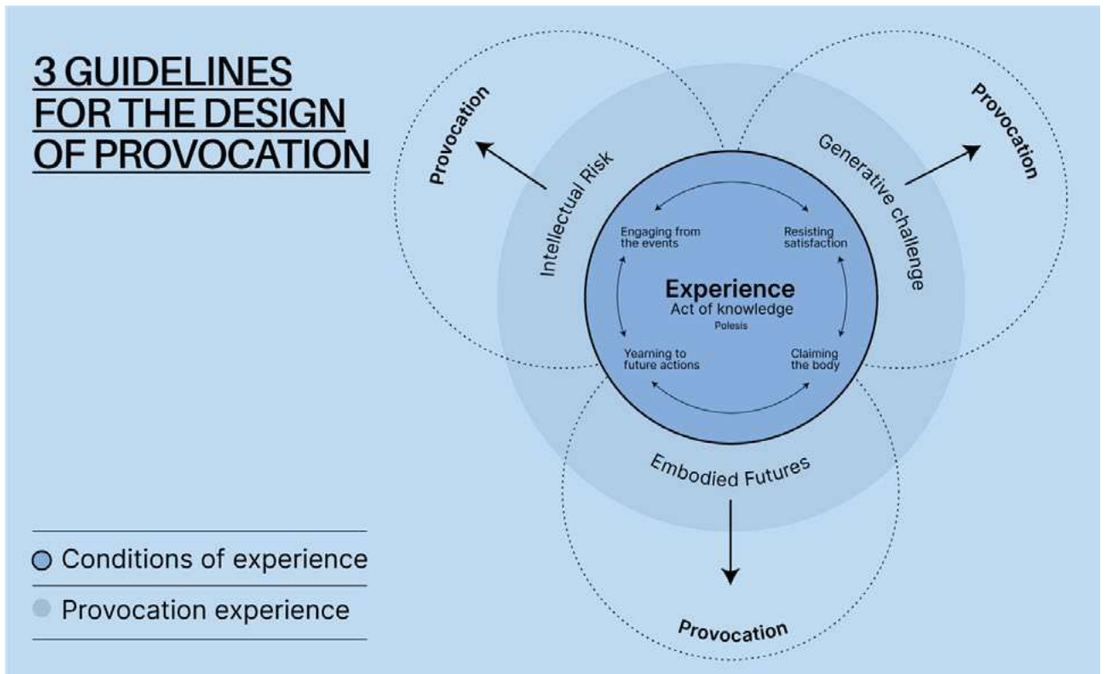


IMAGE 1. Guidelines for the design of Provocation. in (Pérez-Orrego et al. 2022)

Guideline 1: Intellectual Risk

Intellectual Risk is the challenge that threatens the comfort with which interaction is sought towards the discursive composition of the participant. He does not want disclosure, or transparency; on the contrary, he wants the resistance of the aesthetic question and to build meaning from poiesis.

- **Without controversy, there is no conversation.**
Nothing is more provocative than the dispute that lies within a controversy. The tension of opposing forces or the paradox that arises from a controversial socio-cultural situation is a magnetism for interaction. It is not possible to discuss what is unquestionable, what is already taken for granted does not suppose a singular experience.

- **Confront the participatory forms.**
Challenge participation from new interaction interfaces and resort to new formats for discussion, opinion, and dialogue. It mixes possibilities for resolution or critical speculation, allowing for participatory diversity and prior knowledge.

- **Failure is my learning.**
It causes the appearance of the error as a subversive act for the creative opportunity. It bothers in search of new unknowns, open questions, questions and encourages the participant to creatively explore other possibilities.

Guideline 2: Generative Challenge

The generative challenge is the guideline with which creative intervention is encouraged for exploration and experimentation as an interaction experience.

- **I think from my doing**
Provocation stimulates creation, rather than standard satisfaction. It mobilizes the imagination by involving the interaction between doing and words. The result is far from being a paradise. it does not seek calm.

- **My body doesn't act the same as yours**
Each body responds, thinks, and feels differently; act from the circumstances lived. If experience is an event, it is because it enables the singular circumstance that each actor supports it. The designed experience may formulate an initial interaction encounter but never determine a single end. we do not know in advance who will act in it.

- **Fluency by creation itself**
Shorten the mediums of creation, facilitate inventive exploration, and encourage co-creation with others.

Guideline 3: Embodied Futures

Embodied futures result from personal interpretation with which the participant expresses their transformation and the production of meaning obtained after this event.

- **Yearn otherness**
Take risks to create and be another. It supposes a new social visibility, it is transfiguration, mutation. It is not an event if this is not an experience of change.

- **I want to do more with this**
It is the intrinsic expression to participate more, to know more. Develop new attitudes or behaviors in other territories and diverse experiences. Stimulates attitudes such as resilience, adaptability, leadership, responsible decision-making, and awareness of global risks.

- **Connect with my context**
It connects knowledge and lived experiences with its habitual context to transform it. I socialize what I have experienced with others and motivate them to live the experience or to promote a new community of practice.

Although the proposal of these 3 guidelines to provoke an experience of interaction is clear, their application in different projects has revealed the need for a designer who faces them with the courage to produce not only an aesthetic transformation but also a social, cultural, and political action in the other. This is why the Provoking Manifesto appears as a metadiscursive declaration with principles that provoke the designer provocation. It is a conspiracy for designing with activism. And there is no other way to expose the content of a provocation than using the manifesto form, as Julian Hanna says (2019).

Provoking Manifesto

Intellectual Risk is the challenge that threatens the comfort with which interaction is sought towards the discursive composition of the participant. He does not want disclosure, or transparency; on the contrary, he wants the resistance of the aesthetic question and to build meaning from poiesis.

[A conspiracy for designing with activism]
This is a mobilizing discourse for designers who want to provoke action, change, and transformation in others. To turn themselves into activists who provoke activism in others. Is a tool to bring to the surface the problem or controversy, the performative change, and the transformative scope for the interaction experience design.

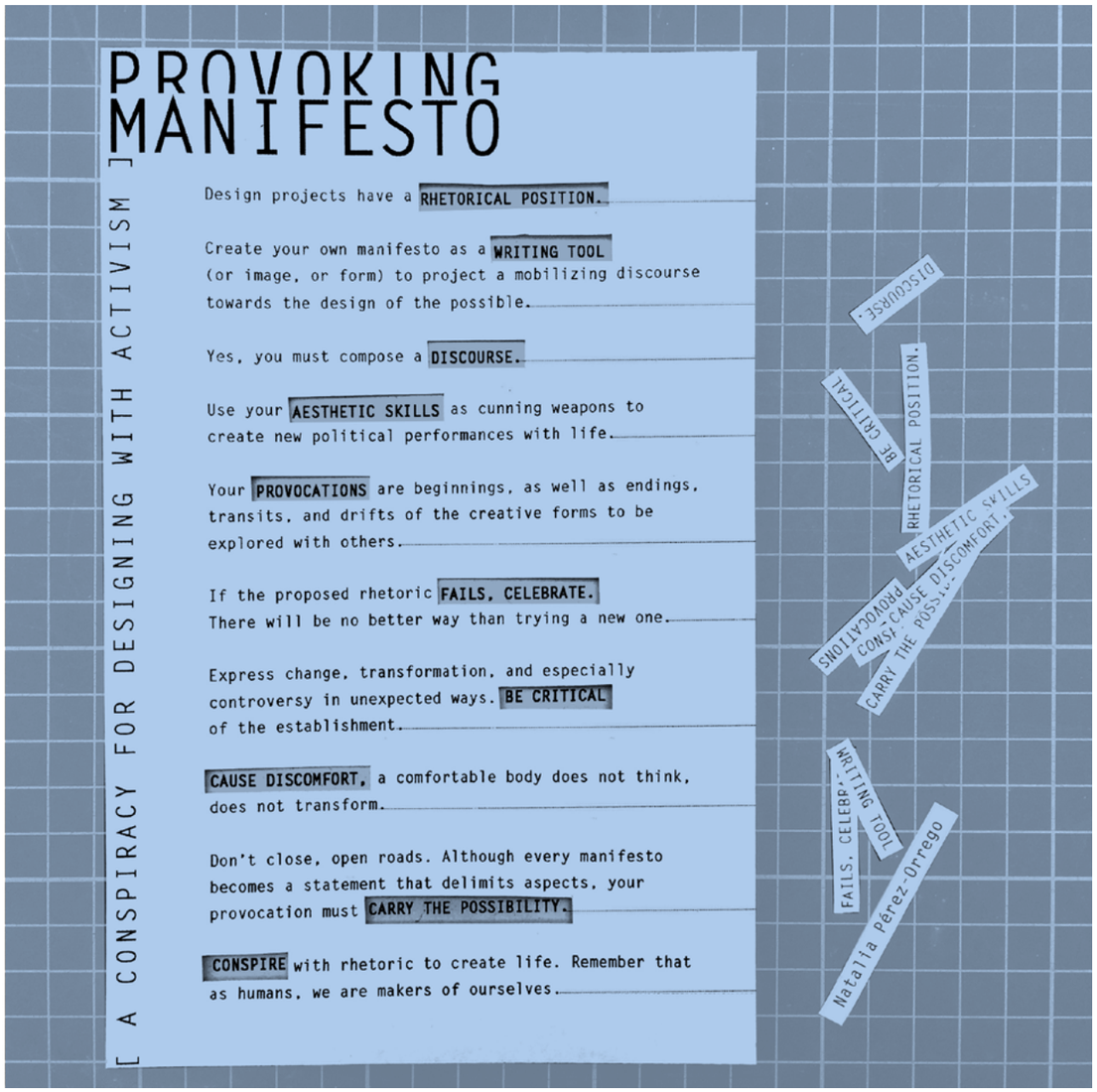


IMAGE 2. Provoking Manifesto. Author's creation

IMAGE 3. Visual Manifestos. Design Workshop 1 - Design Faculty - UdeM

Me and otherness [body manifestos]

The Provoking Manifesto is performed with design students from the Faculty of Design of the University of Medellín-Colombia, to provoke in them the creative and generative agency of their own discursiveness and materiality. In the class exercise: Me and otherness, they propose discourses of possible bodies from the creation of visual, textual, and corporal manifestos.

The 1st semester exercise[1] begins with the assignment of an indices of the text by Jean-Luc Nancy (2007): 58 indices on the body. The extension of the soul; with which the student begins her/his discursive creation from the question: what is a body? This first step conditions them to take an introspective look at the self, define some characteristics, and reflect on the spiritual composition and cultural identity of the body through writing. The textual manifesto is a discourse that is perfectionated along with the other manifestos of the exercise, both in the use of words and in the format in which it is made known.

The second manifesto is the visual one. This is produced on a B/W photograph of the student's face. It is a photo-collage workshop in which six possible visualizations of bodies are created through different compositional strategies such as: cutting, adding, subtracting, folding and widening, among others. Formal composition is also explored through drawing and the application of different materials that have a rhetorical link expressed in the textual manifesto.

1 The projects presented were created in 2022 by the students of Design workshop 1: Edward Adrian Londoño, Juan Pablo Gil Gómez; Laura Victoria Vallejo Restrepo, and Manuela Duque Ramirez.

Finally, when a connection between the visual and the textual manifesto is reached, they move on to 3D mask production, with a gestural and embodied nature to be shown, along with the final textual manifesto, in a running of possible bodies through the university campus. The result is, undoubtedly, a designer with a broader discursive eloquence: visual, textual, and corporal, but above all, aware of their role in the transformation of social, cultural, and political concepts, in this case, the concept of the body through rhetoric.

IMAGE 4 & 5. Textual Manifesto. Design Workshop 1 - Design Faculty - UdeM.

IMAGE 6. Me and Otherness results. Design Workshop 1 - Design Faculty - UdeM.

Final Provocation

The strategy of the manifesto, as a stimulus for rhetorical production, is one of the most interesting tools to promote the research for the singular and the disturbing change to provoke. It should be noted that, although it is proposed here to engage the open possibility, this is generally known as a closed medium that exposes a declarative perspective of intentionality but to claims the proper and active voice of the socially conscious designer.

The Provoking manifesto is a way to move from a technical designer to a critical humanist designer. In the circumstances of contemporary society, it is even more necessary that designers face the complexity of current problems with an aesthetic and political emancipation that introduce them into research, analysis and understanding of contemporary phenomena to provide more complex and expanded solutions than those they have been developing so far as a product esthetician for the industry and the market.

In summary, the general framework of these two proposals puts on the table ways of exploring and thinking discursivity to achieve a mobilizing and activist behavior so that the contemporary designer, by providing aesthetic and political intentions for social interaction, contributes to the reflection and creation of humanism itself.

Civic design: from activism to located collective intelligence

By Domenico Di Siena

Introduction

Both activism and civic design seek to improve the social, economic and political conditions of communities, although they differ in their tools and strategies. Activism focuses on mobilising and fighting for social rights and social justice, while civic design focuses on creating impactful solutions through inclusive processes of collective intelligence that involve multiple actors in the co-creation of concrete proposals.

Through citizen engagement, civic design seeks to foster sustainable and effective solutions that address specific issues. In contrast, activism not only advocates for social rights and social justice, but also nurtures social and political awareness and activates citizens to promote social change through direct action.

In short, civic design and activism share the common goal of improving the social, economic and political conditions of communities, but differ in their approaches and strategies. Civic design focuses on fostering participatory and inclusive processes to generate impactful solutions, while activism strives for social rights and social justice, activating citizenship and nurturing social and political awareness.

In this sense, civic design should not be seen as an alternative or an enhancement of activism, but rather as a professional practice that complements and dialogues with activism. Civic design facilitates the transformation of activists' demands into concrete and inclusive solutions by facilitating processes that include the participation of other actors who are not considered activists, but who are equally important in defining issues and finding solutions.

In this article, we explore how civic design can be used as a practice to strengthen activism and to improve the effectiveness and sustainability of its processes.

To this end, we will present a tool called the Collective Intelligence Canvas, especially designed to accompany activist demands towards the activation of collective intelligence processes capable of generating proposals for the transformation and improvement of the territory.

What is activism?

Definition of activism

Activism can be understood as a form of political and social action that seeks to promote significant changes in society through the organisation and active participation of citizens. The aim of activism is to achieve social and political transformation through the struggle for rights, values and justice.

Activism can take many forms, including protests, demonstrations, awareness-raising campaigns and other direct actions. Activists are people who are committed to a cause and are willing to take concrete action to achieve their goal.

Some of the defining characteristics of activism include:

- Active and committed participation of citizens
- Struggle for rights, values and justice
- Using concrete and visible actions to achieve their objectives
- Strong ethics and morality driving political action
- A wide range of forms of participation, including protests, demonstrations, awareness-raising campaigns and direct actions.

In short, activism is a form of political and social participation that seeks to bring about meaningful change in society. It is a manifestation of citizen participation and the struggle for rights, values and justice. It is a way of exercising the political and social power of citizenship and achieving real change in society.

'Civic design and activism share the common goal of improving the social, economic and political conditions of communities, but differ in their approach and strategies.'

Challenges of Activism

Activism plays a key role in the defence of rights and the struggle for social justice. However, it often faces challenges in engaging with the public administration and in establishing a dialogue with other communities of citizens who do not see themselves as activists or who are not driven by the same logics of advocacy. The tension between activists and public administration can limit the ability of activists to achieve their goals and fight for their rights and values. The public administration may be seen as a barrier or obstacle to the realisation of activist goals, while activists may see the public administration as an enemy or as an oppressive force. This tension can have negative consequences for both activists and the public administration, as it limits the ability of both sides to work together to build lasting and sustainable solutions. It is therefore important to address this tension and find a way to resolve it in order to improve citizen participation and build consensual solutions.

It is important to note that activism often faces strong opposition from the public administration and those who hold political and economic power. This opposition can take the form of repression and violence, or a refusal to listen to activists' demands and take concrete steps to address their concerns. In addition, activists often face internal challenges, such as a lack of unity and fragmentation of activist groups, which can hinder activists' ability to achieve their goals. Although many activists are willing to collaborate, they often lack the tools to do so effectively. They may also lack confidence in the administration's ability to coordinate genuine participation of all relevant actors.

Activism and co-creation can be complementary to achieve effective social transformation. While activism is fundamental to mobilise and give voice to

citizens, co-creation allows for the definition and realisation of proposals through the participation of different local actors and diverse communities. Collaboration and openness to new ways of working are fundamental to building inclusive and sustainable solutions.

It is important to highlight that co-creation does not mean renouncing the goals of activism, but rather strengthening them with a more holistic and inclusive approach. To this end, civic design provides tools and methodologies that encourage the construction of collaborative and participatory solutions, which can generate more effective solutions with greater social impact.

In this regard, we will look at how civic design can help create inclusive and collaborative processes that involve all stakeholders, including activists, public administration and other citizen communities.

What is Civic Design?

Definition and characteristics of Civic Design

Civic Design is a practice that focuses on the design of citizen participation processes that promote inclusivity and collaboration in the definition of solutions to specific problems of a community or territory. It is based on transdisciplinarity and the valuing of situated knowledge, in which professionals place their skills and experience at the service of the community from a collaborative perspective.

Civic Design seeks to promote Collective Intelligence through processes and methodologies that enable the meeting and collaboration of multiple actors located in a specific territory; it seeks to address citizen participation in a structured and meaningful way, recognising that it is a complex process that involves various phases and elements.

Often, citizen participation is reduced to a simple consultation process that results in an infinity of proposals with no capacity for synthesis. Civic Design, on the contrary, seeks to create a balance and a dialogue between the specialised knowledge of technicians and civil servants and the situated knowledge of the inhabitants and communities that inhabit the territory.

By involving local actors and the community itself in the definition of objectives, strategies and actions, a greater capacity for synthesis is built and a more effective dialogue between the different actors is achieved.

The civic designer becomes a facilitator who makes their experience and knowledge available to facilitate exchange and collaboration between local actors. The aim is to generate an environment conducive to co-creation, enabling the emergence of more effective and sustainable solutions. This involves defining how the different actors will interact, in what places, with what types of activities and how often. The designer also designs dynamics and defines the technologies that will be used throughout the process, all with the aim of facilitating interaction between as many actors as possible and achieving together the definition of a solution to be implemented.

Co-Learning and construction of new imaginaries

The specificity of Civic Design lies in its ability to structure citizen participation as a process of co-learning and visualisation of new imaginaries. By generating a common understanding of problems and possible solutions, Civic Design paves the way for the co-creation of more effective and sustainable solutions. In essence, Civic Design creates the conditions necessary for citizen participation to occur in a meaningful way, primarily in the form of Collective Intelligence.

To achieve this, Civic Design uses a wide range of tools, techniques and methodologies that are tailored to the specific needs and challenges of each project. From organising participatory events and workshops, to data visualisation and prototyping, Civic Design focuses on designing solutions that engage citizens and empower them to be active agents in the process of transforming their communities.

In short, Civic Design is a professional practice that values citizen participation in all phases of the process of territorial transformation, from the identification of problems to the implementation of solutions. To achieve this, it uses dynamics of co-learning, co-creation and visualisation of new approaches, resulting in more effective and lasting solutions that address the complex challenges of today's communities. In this way, citizens are actively involved in the process and feel ownership of the solutions, which increases the legitimacy and long-term viability of the solutions.

The importance of involving local actors and building consensus

Civic Design is based on the premise that social and political problems require collaborative and co-created solutions, rather than imposed solutions from above. Civic designers work with a variety of local actors, including the community, non-governmental organisations, businesses, and public administration to identify problems and opportunities, co-create solutions, and build consensus.

'Civic design and activism share the common goal of improving the social, economic and political conditions of communities, but differ in their approach and strategies.'

However, this does not mean that Civic Design always prioritises the demands of citizens over those of the public administration. Instead, Civic Design seeks to establish an equal partnership between citizens and government institutions in making decisions and creating solutions to public problems. It recognizes the significant role that both parties play in generating effective outcomes and greater legitimacy in implementing solutions. Citizens bring their local knowledge, experiences, and unique perspectives, which can help to identify community problems and needs more accurately. Government institutions can provide resources, technical expertise, and authority to carry out initiatives and projects. By promoting co-creation and active participation of both parties in the process of designing and implementing solutions, Civic Design can improve the quality of solutions and increase trust and collaboration between citizens and government.

This collaborative approach is what makes Civic Design a practice that can harness and complement different forms of activism. By emphasising co-creation and active participation, Civic Design encourages the community to take an active role in shaping public space and infrastructure, leading to more inclusive and equitable outcomes.

The Relationship between Activism and Civic Design

Activism, by its very nature, is driven by great passion and commitment to a cause. However, it often lacks the planning and structure necessary to have a meaningful and sustainable impact on society. While it can help to identify and raise awareness of issues affecting communities, activists sometimes face obstacles in achieving their goals, especially when confronted by the public administration and some local communities that do not recognise themselves as activists.

In contrast, civic design is a systematic process that involves active listening and continuous learning. This process aims to build shared and well-informed visions that involve the community at all stages of the process. In this way, trust and legitimacy can be built in the process, which in turn can lead to greater acceptance of the proposed solutions.

Civic Design can enhance activism by encouraging a more inclusive and collaborative approach to the design process. By involving a wide range of stakeholders in the process, it can ensure that solutions are sensitive to the needs and perspectives of all groups in the community. This, in turn, can help reduce the tensions and conflicts that sometimes arise between activists and the public administration.

In short, Civic Design can complement activism with a more systematic approach to address complex problems, involve local stakeholders in the process of designing and building solutions, foster a more inclusive and collaborative approach, and work more effectively with public administration and other stakeholders.

Activating Collective Intelligence in an Activist Context

The Collective Intelligence Canvas

In 2019, I compiled in an e-book my reflections on the practice of Civic Design, together with the proposal of three tools that can help civic designers to design processes for the activation of collective intelligence in the territory. Among these tools, one in particular stands out, which I have called the "Collective Intelligence Canvas". This tool is conceived as a simplified guide to achieve this purpose.

Essentially the tool suggests 10 points to guide design and planning work. These ten points are: 1) team and driving group, 2) purpose, 3) people and communities, 4) communication and documentation, 5) spaces, 6) funding and resources, 7) timing, rhythms and cycles, 8) governance and methodologies, 9) prototyping and 10) physical-digital hybridisation.

It can be used individually, working in teams or through collaborative workshops. In the latter case, separate groups can be created to work only on one or some of the actions that make up the canvas and then share the result (this is more suitable for working with large groups), or you can work point by point as a group.

Different starting points can be chosen and different proposals can be proposed for each of the points. As we will see below, the tool includes a series of questions for each of the points. These questions help and guide us in defining the actions we need to carry out in order to structure a process that allows us to activate a dynamic of collective intelligence capable of generating concrete proposals to transform and improve the territory.

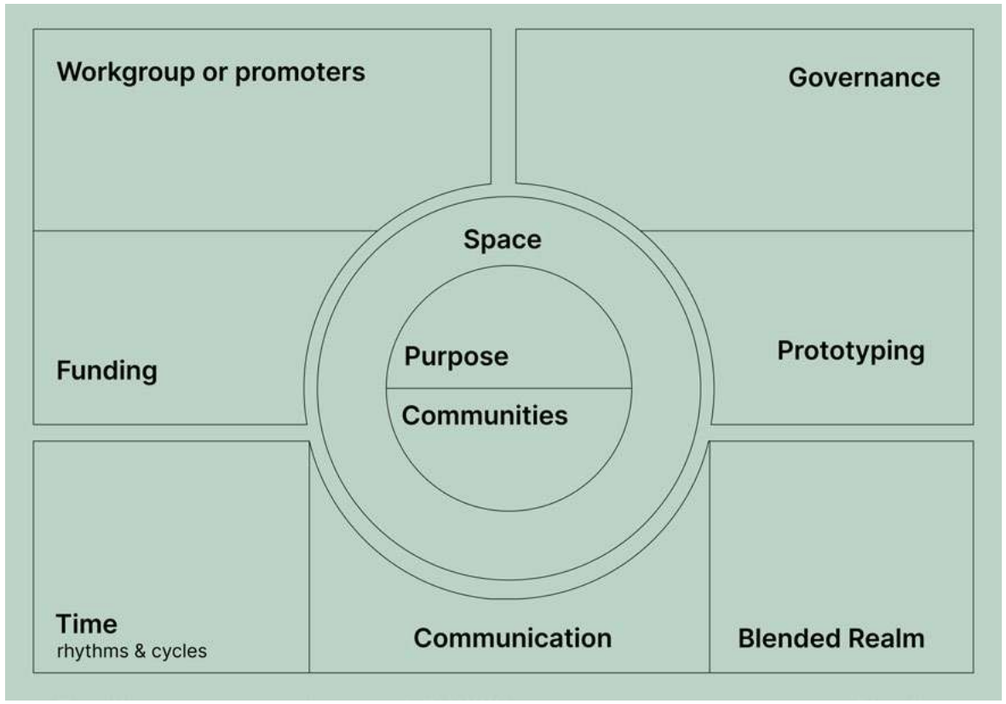


IMAGE 1. Collective Intelligence Canvas, 1st edition (2019)

Inclusivity and conviviality

In this article I would like to present an updated version of the Canvas, specially designed to complement activist processes and take them towards a dynamic of co-creation and collective intelligence. The Collective Intelligence Canvas can be very useful to help define a Civic Design process that can complement the dynamics that have been born from Activism. It does so thanks to its territorialised and process-centred perspective.

We want to rethink the tool in a way that respects and values the activist effort, providing those structures and care so that it can generate processes that are as inclusive and transformative as possible.

To this end, the tool moves from ten to twelve basic points to which we need to pay attention when planning our process. When we intervene in a context of activism or neighbourhood demands, I consider it absolutely necessary to include two essential actions: Inclusivity and conviviality.

Conviviality is an important aspect of the civic design process because it fosters collaboration, respect and inclusion in the community. In the context of civic design, the aim is to involve the community in the process of designing solutions to public problems, and conviviality is fundamental to achieving this goal.

Conviviality implies a pleasant and friendly environment in which people can feel comfortable expressing their opinions and working together to find solutions. When conviviality is promoted, it encourages the active participation of community members in the design process, which in turn helps to ensure that the proposed solutions are relevant and effective.

In addition, conviviality also helps to build strong and trusting relationships between community members and civic designers. This can be especially important when dealing with complex issues that may generate tensions and conflicts in the community. By fostering a convivial and collaborative environment, the likelihood of conflict and tension can be reduced, and a more inclusive and respectful approach to the design process can be promoted.

The other essential action is to promote in an almost obsessive way, I would say, measures that can constantly improve the inclusiveness of the process.

Inclusivity is a fundamental aspect of the Civic Design process, as it allows for the participation of a wide range of stakeholders and local communities in the design and decision-making process. While it is true that not all members of the community will participate in the process, it is important to ensure that those who wish to do so can do so in a way that is accessible, known and palatable.

Rather than focusing solely on representativeness, which can be difficult to achieve in a diverse and heterogeneous community, a radical inclusivity approach can be more effective. This approach focuses on creating an environment of openness and collaboration in which all stakeholders can actively participate in the design process. This involves ensuring that the process is accessible through multiple channels, including technology, printed materials, events and face-to-face meetings, and that it is communicated widely across different communities and stakeholder groups.

Radical inclusivity also involves recognising and valuing the perspectives and knowledge of all participants, including those who have traditionally been excluded from decision-making processes, such as ethnic minorities and low-income people. This means creating opportunities for members of these communities to participate in the process and providing them with the necessary resources and support to enable them to do so effectively.

In addition, Civic Design must be sensitive to the needs and perspectives of all stakeholders, not just the actors with the most power and resources. It is important that

civic designers work to understand and address the inequalities and barriers to participation faced by some members of the community.

In short, radical inclusivity is an approach to participation in Civic Design that goes beyond mere representativeness and focuses on creating an environment of openness and collaboration in which all stakeholders can actively participate. This can help ensure that the process is ethical and legitimate, and that proposed solutions are sensitive to the needs and perspectives of all communities and stakeholders.

IMAGE 2. Glocal Camp 2016 - Meeting in Paris of the CivicWise, international distributed and open network that promotes citizen engagement, developing concrete actions and projects based on collective intelligence, civic innovation and open design.

New version of the Collective Intelligence Canvas

Here is the new version of the Canvas, especially designed to help us in the context of Neighbourhood Activism and Claiming.

The new version consists of twelve points: Essentially the tool suggests 10 points to guide the design and planning work. These ten points are: 1) team and driving group, 2) purpose, 3) people and communities, 4) communication and documentation, 5) spaces, 6) funding and resources, 7) times, rhythms and cycles, 8) governance and methodologies, 9) prototyping, 10) physical-digital hybridisation, 11) Inclusivity and 12) Conviviality.

As we have already mentioned, the tool includes a series of questions for each of the points. These questions help and guide us in defining the actions we need to carry out to structure a process that allows us to activate a dynamic of collective intelligence capable of generating concrete proposals to transform and improve the territory, and in this case they also help us to understand how we integrate ourselves in a context of Neighbourhood Activism and Claiming.

It is important to note that answering all the questions is not a mandatory requirement to start the design process. However, they do provide guidance and a hierarchy of priorities that can be extremely valuable to designers and teams defining a process for activating collective intelligence.

IMAGE 1. Collective Intelligence Canvas, 1st edition (2019)

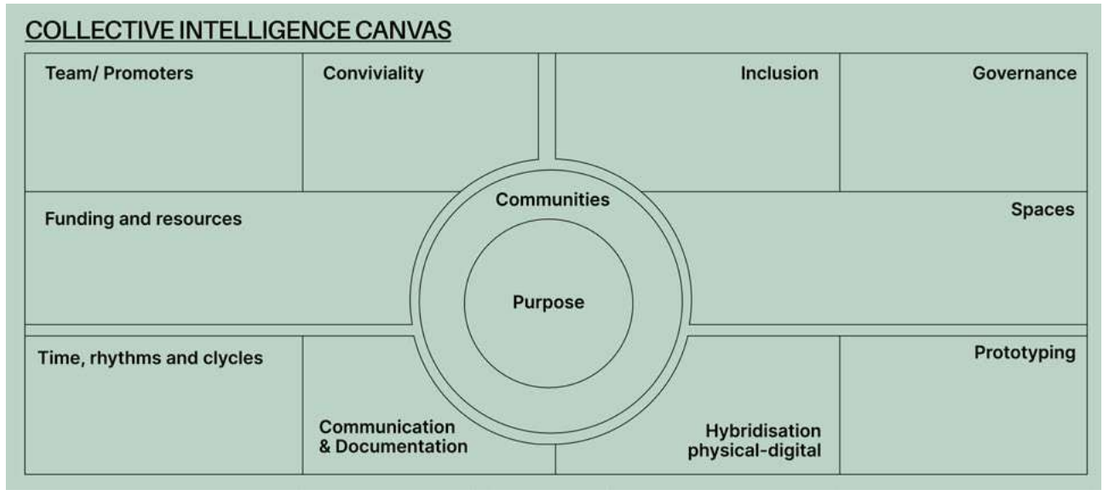


IMAGE 3. Collective Intelligence Canvas, New edition (2023)

1. Equipment and power unit

Reflect on the people who activate and develop the process and on the dynamics, causes and context that have generated the process.

- Who makes up the promoter group or working group?
- Are they also including people who were very much involved in the more activist and advocacy dynamics?
- How was the working group or promoter/activist group initially formed - was it self-initiated, commissioned or the result of another dynamic?
- Are the members of the working group paid or are they volunteers?
- Is the working group open to new members?
- Is it a multidisciplinary team, where each member has different skills and knowledge that complement the group?
- Is there cultural and ethnic diversity in the work team?
- Has gender diversity been considered in the composition of the working team?
- Are there team members of different ages and experience?
- Is the team committed to inclusion and equity in their work and in the wider community?

2. Purpose

Reflect on the results you want to achieve in the short, medium and long term.

-
- What is the overall purpose of the Civic Design process?
- What is the scope of the process?
- Does it focus on a specific problem or a broader issue?
- What are the specific objectives to be achieved through the activation of Collective Intelligence?
- What is the situation to be improved?
- Are there activist movements or initiatives that address the same issues?

- How do the objectives of the Civic Design process relate to the objectives of existing neighbourhood activisms and demands?
- What benefits do you want to generate in the medium and long term?
- How is the Civic Design process that we are going to activate expected to strengthen neighbourhood activism and demands in the short, medium and long term?
- What kind of concrete results do we expect?

3. People and Communities

Reflect on the people, actors, communities affected and those we will involve in the process.

- Who are the people or groups most relevant and/or affected by this problem in the local community?
- How can we identify and select the most relevant and committed local actors in the community?
- What is the social, political and cultural context in which the Civic Design process takes place?
- Who are the local leaders and influential figures in these communities?
- What actions can we take to build relationships of trust and respect with affected people and communities?
- How will potential tensions or conflicts that may arise in the process with affected individuals and communities who will not be involved from the outset be addressed?
- Do they see themselves as activists or in any case as part of active and engaged citizenship?
- Are there previous experiences of working with the local community and how can we draw on these for the Civic Design process?
- Are affected individuals and communities organised in formal or informal organisations or groups?

4. Communication and Documentation

Reflect on the form, protocols and tools we will use to document and communicate internally and externally all the steps, events, activities, achievements and discussions that make up the process.

- What communication and participation strategies will we use to engage affected people and communities?
- How is the information generated managed, archived and distributed?
- Who has access to information?
- What tools are used to improve documentation?
- What tools and technologies are used for working groups to communicate and coordinate?
- Is there a protocol in place to make information publicly accessible?
- Have protocols been established to produce briefing capsules that summarise the results and make them more accessible and digestible for all audiences?
- How can we use communication to make it easier for everyone, including non-participants, to monitor the progress of the process and make informed decisions in real time?
- What communication channels can be used to ensure that information is available in real time and to all relevant audiences?

5. Spaces

Reflect on the physical spaces to be used for activities and events throughout the different phases and cycles of the process.

- What space can we use for process activities and events?
- Are they open spaces?
- Are they private spaces?
- Are they public spaces?
- Do we have equipped and pleasant spaces?
- Are they spaces in the communities we will be working with?
- Can the spaces I will use alienate or discourage some communities from participating?
- Are there any legal or other limitations on the use of certain spaces?
- Have alternative spaces been considered that may be more inclusive and accessible to all communities involved?
- Has thought been given to the need to adapt spaces to make them accessible for people with disabilities or specific needs?

6. Physical-Digital Hybridisation

Reflect on the complementarity between the digital and physical sphere for all activities and strategies that make up the process in all its stages and cycles.

- What is the relationship between the physical and digital spheres of the process?
- What is the capacity to generate proposals and imaginary from the digital sphere that have an impact on face-to-face sessions?
- How does digital activity and participation influence face-to-face dynamics?
- How do face-to-face activities have continuity in the digital sphere?
- What resources and tools will we use to listen to and gather the needs and perspectives of affected people and communities?
- How can we use social media and other digital platforms to generate interaction and participation in the process?
- How can we use virtual or augmented reality to visualise the outcomes and impact of the process?
- How can we use technology to amplify the voice of affected communities and generate greater awareness and empathy in society?
- How can we use technology to make communities feel more empowered and connected to each other?
- How can technology influence the dynamics and outcomes of face-to-face sessions?

7. Times, rhythms and cycles

Reflect on the times, rhythms and cycles that structure the activities and phases of the whole process.

- When does the process start and end?
- What are the rhythms and cycles that shape the process?
- Are different times and paces of participation in different events and

activities promoted?
- Is there a system in place that allows people to be involved at different points in the process?
- Are there synchronous and asynchronous participation dynamics?
- Has time for rest and reflection been considered in the process?
- Have cultural differences in the rhythms and timing of the communities involved been considered?
- How is the progress of the process monitored and times and paces adjusted if necessary?
- Is there a strategy to deal with possible delays or unforeseen events in the process?
- Have the timing and pace of other projects or initiatives that may compete for the attention of those involved in the process been considered?

8. Prototyping

Reflect on the forms and activities we will use to test the proposals that are developed during the process.

- What kind of prototyping activity are we going to develop?
- What do we want to test with low-cost prototypes?
- How can the prototype be scalable?
- Which communities do we count on for prototypes?
- How can we leverage prototyping to involve other types of people and communities?
- How will the success of the prototypes be measured?
- What are the criteria for choosing which prototypes to develop further and which to discard?
- How will feedback from communities and individuals testing prototypes be retrieved?
- Can digital design and manufacturing tools be used to create the prototypes?
- Will end-users be involved in the prototype design process?

9. Funding and Resources

Reflect on the financing of all components, activities and people involved in the process.

- How is the process financed?
- What resources are available to us?
- Is the funding resolved before the process starts or will it be further worked on even during the activities?
- Are participants in the activities paid or do they receive some kind of financial contribution to cover expenses?
- Are there local stakeholders funding the project?
- Are accounts and information on funders publicly accessible?
- What is the total budget for the process?
- Has a financial plan been developed detailing the expected income and expenditure for the whole process?
- How is transparency in the management of funds and accountability to funders and the wider community ensured?

10. Governance and Methodologies

Reflect on the different formats of organisation and coordination of the people involved in the process, as well as the governance models and methodologies that will be used throughout the various activities that make up the different phases of the project.

- What methodologies will be used in the different phases and activities of the process?
- How are we going to communicate clearly the characteristics and mechanisms of governance?
- How will the work of the different groups be synchronised?
- What is the relationship between the working groups, coordinators and the communities involved?
- Is there a system in place to allow new people to join the coordination activities?
- How is diversity and representativeness ensured in working groups and decision-making?
- Is there a system for feedback and continuous improvement of governance?
- How is transparency and accountability in decision-making and process coordination promoted?
- Is there a code of ethics or conduct for those involved in the governance of the process?
- How are conflicts and disagreements between working groups and communities involved in the process addressed and resolved?

11. Inclusion

- Reflect on the actions, measures and methodologies to be used to ensure the greatest possible inclusiveness.
-
- What are the most recognisable spaces and activities for vulnerable communities?
- What languages will we use to include all communities?
- What schedules can we define to ensure that people who work and care for others can participate?
- What online events and dynamics can we promote to involve people who cannot participate in person?
- How do we promote the inclusion of people of different ages?
- What measures will be taken to include people from different cultural and ethnic backgrounds?
- Does the staff have the ability to work effectively with a wide range of stakeholders or have a greater affinity with certain groups and communities?
- How is the inclusion and participation of people with disabilities or special needs in the staff and civic design process ensured?
- Is there a zero tolerance policy for discrimination and harassment within the work team and in the civic design process?
- How can barriers to participation and collaboration, such as lack of trust, language barriers, and time and resource constraints, be overcome?

12. Conviviality

Reflect on the activities, strategies and dynamics that we will develop to promote conviviality among all the participants and the people involved in the process

- What physical and digital spaces can we use for people and communities to meet and interact in a natural and spontaneous way?
- What kind of recreational, artistic or cultural activities can we organise to generate a more relaxed and friendly atmosphere that fosters conviviality?
- How can we promote an atmosphere of trust and mutual respect between individuals and communities, so that they feel comfortable expressing their ideas and opinions, even if they are divergent or contradictory?
- What activities or events could we organise for individuals and communities to get to know each other and build stronger relationships?
- What kind of group dynamics or facilitation tools can we use to generate a collaborative and teamwork environment that fosters conviviality and creativity?
- How can we involve people and communities in decision-making and in defining the strategies and actions to be implemented, so that they feel protagonists and responsible for the civic design process?
- How can we address conflicts that may arise in the process in a constructive and collaborative manner?
- What roles can existing institutions and organisations play in promoting conviviality in the civic design process?
- How can we integrate the practices and knowledge of local communities into the civic design process to foster greater conviviality?

Examples

Examples of projects combining activism and civic design show the ability of this approach to transform the tension between activists and public administration into a process of co-creation and collective intelligence.

Participatory design of public transport routes
In this type of project, civic designers collaborate with activists and community members to develop public transport routes that meet specific community needs, such as access to important services or reduced travel time. Residents provide valuable input by sharing information and suggesting routes that are more efficient and convenient, giving them a greater sense of involvement in creating solutions that directly benefit them.

Building on activists' previous work to raise awareness of the importance of an efficient and accessible public transport system, civic design can help engage residents in identifying specific issues and creating practical solutions that address community needs. Collaborating with activists and civic designers can generate more inclusive and equitable solutions that reflect the needs and perspectives of the community. In turn, this can increase the support and legitimacy of proposed solutions with the implementing authorities. By working together, civic activists and designers can create more effective and sustainable public transport solutions that benefit the entire community.

'Collaborating with activists and civic designers can generate more inclusive and equitable solutions that reflect the needs and perspectives of the community.'

Pedestrianisation of streets and squares
Civic designers, activists, and local authorities can collaborate to create pedestrian-friendly urban areas that prioritise the safety and well-being of pedestrians and cyclists. This involves identifying suitable areas for pedestrianisation, reducing traffic speeds, and introducing green spaces and street furniture. Residents can participate in the process by identifying areas and proposing specific solutions, while activists can raise awareness and lobby authorities to create more pedestrian zones. Civic designers can complement this work by involving the community in the design and planning of pedestrian zones to ensure accessibility and safety for all community members, including those with disabilities or physical limitations. Collaborative efforts between civic activists and designers can create equitable solutions that consider the needs of the entire community.

Renewable energy projects
Collaboration between civic activists and designers can be particularly advantageous when it comes to renewable energy projects. Activists can help increase awareness about the importance of transitioning to renewable energy and reducing dependence on fossil fuels, while civic designers can identify opportunities to implement renewable energy technologies in local communities and co-create customised and effective solutions with residents.

One example of a successful renewable energy project resulting from the partnership of activists and civic designers is the installation of solar panels on community buildings. Activists can raise awareness about the benefits of solar energy and motivate residents to support the project and contribute to its construction and maintenance.

Civic designers, on the other hand, can collaborate with residents to identify community buildings that are suitable for solar panel installation, taking into account factors such as solar exposure, building size, and roof structure. Involving residents in the design process ensures that community-specific needs and concerns, such as accessibility, safety, and aesthetics, are addressed.

Overall, the collaborative approach of civic activists and designers in renewable energy projects helps ensure that solutions are inclusive, effective, and sustainable in the long term, reflecting the needs and perspectives of the community. By working together, renewable energy solutions can be created that not only reduce the carbon footprint but also improve the quality of life for residents and foster a stronger sense of community.

Conclusions

In conclusion, Civic Design offers an effective and sustainable approach to enrich activism with a process of co-creation and collective intelligence. By engaging local actors, building consensus and designing processes of citizen participation, Civic Design enables civil society and public administration to work together to address social challenges effectively and fairly. Through a combination of creative and participatory methodologies, Civic Design can help overcome the limitations of activism and establish a more productive and sustainable relationship between civil society and government.

It is important to note that while activism remains a key tool for defending rights and promoting social justice, Civic Design offers a more structured and sustainable approach to transforming demands and needs into concrete solutions with impact. Furthermore, Civic Design does not seek to replace activism but rather complement it by offering a more collaborative and consensual approach to addressing social problems.

One of the important aspects of Civic Design is the emphasis on designing comprehensive processes that consider both effectiveness and legitimacy. Specialised professionals are needed to ensure that the solutions generated are more inclusive, fair, and effective for all parties involved. By involving local stakeholders throughout the design and planning process, Civic Design strives to build bridges of dialogue and collaboration between the community, activists, and public administration.

The effectiveness of a process is not the only factor to consider. The legitimacy of the process is crucial to ensure that the outcomes are sustainable and accepted by all parties involved. In this sense, Civic Design is a valuable tool as its focus on co-creation and citizen participation can help ensure that the process is legitimate and that the proposed solutions reflect the needs and concerns of the community.

In summary, Civic Design is a powerful practice that can complement and enhance activism, while also fostering collaboration between civil society and public administration. By engaging local actors and building consensus, Civic Design can help create effective and sustainable processes that prioritise the needs and concerns of the community, while also ensuring the legitimacy and fairness of the process.

ImPulse

Towards establishing pediatric cardiac surgery training in Gaza

Bashar Zapen from Sustainability Design Lab – Muthesius University of Fine Arts and Design

Introduction

Congenital heart diseases [CHDs] are structural abnormalities in a newborn's heart muscles or vessels that occur when they do not form correctly in utero (Mayo Clinic, 2022). CHDs are the most common congenital disease in newborns, accounting for over a quarter of all severe congenital deformities that require surgical intervention worldwide. The global average incidence of CHDs is approximately eight cases per thousand live births (Zaqout et al. 2014). However, politically and economically constrained areas like the Gaza Strip to have a higher baseline incidence rate of ten per thousand, which increases significantly during times of conflict. For example, during the Israeli-Gazan conflict in 2006, the admission rate of birth deformities increased to around forty per thousand, and the first military offensive in Gaza in 2009 led to another increase, reaching sixty-three cases per thousand (Abed et al. 2014).

Although the direct cause of CHD is unknown, there is a clear correlation between the occurrence of CHDs and various factors, including genetic predisposition, the mother's quality of life, exposure to toxic materials, external stressors such as wars and conflicts, and hormonal medication misuse (Zaqout et al. 2014). Unfortunately, these factors have contributed to the abnormally high incidence of CHDs in Gaza, where there is a lack of local or permanent pediatric surgery staff. Furthermore, my interviews for this research have confirmed that no trained surgeons who can treat CHDs currently reside in the Gaza strip (A. Kerr, pers. comm.). As a result, I chose Gaza as the geographic case study for this research and the lens through which I formulate my design project's objectives and constraints.

Surgical treatment of CHDs varies depending on the type and severity of the defect. While some cases require complex surgeries to repair the heart or blood vessels, others can be managed with medicinal treatment without surgery. Cardiac surgery is a highly technical, complex, and risky procedure that demands extensive practice from heart surgeons. Pediatric cardiac surgery is even more challenging due to newborns' delicate and soft hearts, which require critical decision-making from surgeons that can affect a child's life quality and longevity. Furthermore, the child's social environment can also be impacted, as parents, siblings, and even entire neighbourhoods are part of the broader structure surrounding the child, amplifying the pressure on pediatric cardiac surgeons to become masters in their craft.

This craft is in critical danger if training programmes continue with their traditional paradigm of opportunity-based training where the only chance to develop surgical competence is by practising on actual patients.. As I will discuss later, pediatric cardiology residents are receiving fewer and fewer opportunities to practise surgery on live patients, thus prolonging their residency and drastically reducing their manual dexterity skills and competency. Herein I raise the significance of incorporating emerging technologies – such as 3D printing – in medical training programmes as they have the potential to avert cardiology from the danger of losing this craft.

Including 3D-printed heart modules in hands-on surgical training programs has positively impacted trainees' comprehension of congenital heart diseases and their ability to treat them (Hussein et al. 2020). More importantly for Gaza, 3D printing can serve as the basis and framework for establishing its first pediatric surgery training program. By taking steps towards establishing a local pediatric cardiac surgery team, Gaza will have the opportunity to save the lives of "the remaining 30%".

Mastering a Craft

'Cardiac surgical trainees must form an intimate connection between their hand and brain to master their craft, conducting a dialogue between practical skills and thought.'

Cardiac surgery is a young discipline as the first successful open-heart surgery using a heart-lung machine was performed less than 70 years ago when patients' deaths were the default instead of the exception (Cohn, 2003).

The hardest part of heart surgery may not be the surgery itself but getting the opportunity to perform it due to the competitiveness of training programmes accepting only one trainee per year. The residency is exhaustive and intensive, however with repeated practice, trainees improve and achieve an "economy of motion," resulting in a harmonious dance between trainer and trainee in the operation room, as in Figure 1 (Fedak, 2018).

Richard Sennet's book, The Craftsman, argues that craftsmen – in this case, cardiac surgical trainees – must form an intimate connection between their hands and brain to master their craft, conducting a dialogue between practical skills and thought. With enough repetition, skills become ingrained and available without conscious effort, allowing for improvised steps in surgery.

Competency-Based Training

Germany's traditional surgical training programmes were divided into two years of general surgical training and four years of specialised training in the student's desired discipline. However, most trainees aspiring to become heart surgeons choose to train in cardiology departments, skipping the development of fundamental skills in general surgery training (Wick et al. 2020). To remedy this, a generalised curriculum that applies to every surgical discipline was introduced in 2018. The new competency-based curriculum emphasises hands-on surgical practice and divides the residency programs into cognitive and surgical competencies (ibid.).

The six-year period of cardiac surgery training requires a minimum of 48 months in a cardiac surgery department, six months in the emergency department, six months in the intensive care unit, and an optional 12 months in any associated medical discipline. Trainees must also complete a "logbook of cardiac surgery," documenting the required number of surgeries – or cases – at an increasing level of complexity they must assist in rather than solely relying on the number of hours in operation rooms (Wick et al. 2020).

Losing Craftsmanship

Competency-based training in Germany has improved the quality and consistency of graduating cardiac surgeons. Still, it has also prolonged the time it takes for trainees to gain essential surgical skills due to the removal of a strict timeline for training and the restriction of work hours (Nissen et al. 2020). Furthermore, the increase in high-risk cases – which trainees are not allowed to treat – and emphasis on minimally invasive procedures has also reduced teaching cases and limited the opportunities for trainees to practice hands-on skills (Yanagawa et al. 2020). Additionally, digitalisation has reduced manual dexterity in medical students, further limiting their competence and confidence in their handwork.

The pandemic has also posed unprecedented challenges to cardiac surgery training programmes, forcing many to reallocate residents to other areas of need – such as the ICU – and adopt virtual communication, severely limiting surgical education (Hemelrijck, 2021). Furthermore, as trainees' technical skills and manual dexterity have suffered considerably over the last two years, simulation training has remained woefully underutilised, further exasperating the pandemic's damage to training programmes. Hence the need for optimal and well-structured surgical training programmes that are immune from external factors and emergencies such as pandemics or political conflicts.

Gaza's Predicament

To understand Gaza's high number of congenital heart diseases, it is crucial to consider the region's geopolitical situation. Israel imposed restrictions on Gazans' freedom of movement in response to the Palestinian uprising in the late 1980s by requiring difficult-to-obtain permits for work and travel (K. M. Butt and A. A. Butt, 2016). In 1995, Israel constructed an electric fence and walls around Gaza, isolating it from the rest of the Occupied Palestinian Territories and the outside world (Figure 2). After Hamas seized power in 2006, Israel intensified its restrictions by imposing an airtight blockade, controlling Gaza's airspace, water territories, and two of the three border crossing points (ibid.). This has effectively halted the movement of people in and out of the region and catastrophically worsened Gaza's economic and humanitarian situation.

Dual-Use Policy

Israel's restriction of movement imposed on Gaza is not limited to people; it also controls the import and export of goods in the territory. The blockade was instated in 2007 with a "dual-use" policy that restricts the entry of any goods that the Israeli-led siege deems to have a military use in addition to their intended – and arguably – civilian use; the policy also covers nutrition imports (p. 25–33, World Bank Group, 2019). Since 2007, Israel has progressively expanded the list of items under the "dual-use" policy to include 117 items. The list consists of vague and non-descriptive categories such as "communication equipment, communication support equipment, or equipment with communication function" (ibid.). This ambiguous categorisation routinely inhibits the import of everyday-use items such as life supplies, home appliances, and more specialised items such as medical equipment (p. 164–217, Amnesty International, 2022). In my phone interview with Prof. Haj-Yahia (S. Haj-Yahya, pers. comm.), a heart and transplant surgeon and consultant at Assuta Medical Centre, Tel-Aviv, Israel, he stated that the European Hospital in Gaza could not replace or order repair parts for the damaged primary medical devices and equipment. In addition, some machines, such as ultrasound and vaginal ultrasound devices, that are crucial for detecting and treating CHDs in fetuses were also prevented from entering Gaza (S. Haj-Yahya, pers. comm.). While import permit applications are approved or denied based on multiple factors and policies, most rejected applications are attributed to the "dual-use" policy (p. 164–217, Amnesty International, 2022).

The De-Development in Gaza

The blockade continues to exert its heavy toll on Gaza's basic infrastructures and quality of life. The collective punishment of Gaza's civilian population has created impossible living conditions, most prominently housing shortages, inaccessibility to water and electricity, unemployment and poverty, food insecurity, scarcity of educational equipment and supplies, building materials, and essential medicine and medical care (p. 164–217, Amnesty International, 2022). This heavy toll has been exacerbated by the four major wars the region has witnessed during the past 15 years, which effectively guaranteed the collapse of Gaza's healthcare system and economy (ibid.).

For instance, during the May 2021 war, the Israeli bombardment damaged four hospitals run by Gaza's health ministry and two hospitals run by Non-Governmental Organisations (Figure 3). Thus, six out of Gaza's eleven primary health centres were damaged last year alone (UN News 2021).

Furthermore, this infrastructure damage prompted the transformation of specialised departments in the remaining hospitals into Intensive Care Units [ICUs] to accommodate the high number of emergency patients. Through an e-mail correspondence with Dr Al-Azab, the consultant and head of the pediatric cardiology unit at the European Hospital in Gaza, he explained how Gaza's medical teams had to turn the only pediatric cardiac department in Gaza into an ICU unit during last May's events, as well as previous times of crises (A.-R. Al-Azab, pers. comm.). Consequently, this severely limited the number of pediatric cardiac surgeries possible inside the region.

Gaza's Heart Problem

The average incidence of congenital heart diseases in the Gaza Strip is 10 per 1000, which is 25% higher than the accepted global estimate of 8 per 1000 (Zaqout et al., 2014). This rate has slowly crept up over the years. The overall birth defects [BDs] rate in 2006 (39.5/1000) alarmingly increased by 2010 to reach 63 cases per 1000 newborns, with CHDs being the most commonly reported form of BDs in both years (Abed et al., 2014). This increase is correlated with the repeated wars on Gaza, as one study found a 30% increase in CHDs in 2009, almost a year after the first Gaza War in 2008 – titled Operation Cast Lead by Israel (Naem, Mansour, and Elessi 2015).

The absence of previous and sustainable registration systems has made it difficult to pinpoint the exact cause of CHDs in the Gaza Strip; however, it is clear that exposure to toxic metals from highly destructive weapons of war – that of the US and Israeli production – is a significant cause of the increased prevalence of CHDs in the region (Abed et al., 2014). Toxic metal particles can enter the bodies of prenatal mothers through inhalation, ingestion of contaminated water or food, and even skin contact. In addition, in utero, exposure to metals found in weapons such as mercury –heavily used during Operation Cast Lead – has been directly associated with CHDs in Gaza (ibid.). Moreover, exposure to teratogenic materials released by weapons is not limited to times of conflict, as another likely factor is exposure during rubble removal of shelled buildings or through the dissemination of weapons' poisonous fumes in the open air long after the fact, as shown in Figure 4 (Forensic Architecture, 2015).

IMAGE 1. Glocal Camp 2016 - Meeting in Paris of the CivicWise, international distributed and open network that promotes citizen engagement, developing concrete actions and projects based on collective intelligence, civic innovation and open design.

Finally, a positive association was identified in the Gaza Strip between the oral intake of the drug dydrogesterone during the first trimester of pregnancy and the likelihood of CHDs in the mother's offspring (Zaqout et al. 2015). The drug was famously withdrawn from other parts of the world due to its apparent side effects, yet it is commonly prescribed in Gaza to reduce the risk of miscarriage under severe stress in times of conflict (ibid.).

Congenital Heart Diseases

Congenital heart defects typically develop during the first six weeks of pregnancy as the heart begins forming and beating. To inform my design project, I consulted with Dr Alan Kerr, a New Zealand cardiac surgeon who has volunteered in Gaza and the West Bank for the past 20 years. Dr Kerr identified four common congenital heart diseases in Gaza: Ventricular Septal Defect, Atrial Septal Defect, Patent Ductus Arteriosus, and Tetralogy of Fallout.

If left untreated, these conditions can have severe consequences, including reduced life quality and expectancy, financial and social strain on families, and premature death. (Sasson and Schachner 2021). Unfortunately, no pediatric cardiac surgeries can currently be performed in Gaza, including non-complex cases. This highlights the dire situation of Gaza's healthcare system (A.-R. Al-Azab, pers. comm.).

Medical Permits & The Remaining 30%

Despite the substantial damage to Gaza's healthcare infrastructure brought by May's 2021 events, the infrastructure required for cardiac surgery remains intact at the Shifa Hospital in Gaza City and the European Gaza Hospital in Khan Younis (A. Kerr, pers. comm.). Nevertheless, neither of these can be utilised to treat pediatric diseases due to insufficient medical and technical supplies – denied entry by the dual-use policy – and the lack of necessary trained personnel, such as pediatric surgeons, pediatric cardiac intensivists, and pediatric nurses (A.-R. Al-Azab, pers. comm.). In addition, Dr Kerr detailed that there have never been permanent pediatric cardiac services in Gaza. The only services within the area were provided by the visiting humanitarian and medical missions sponsored by the Palestine Children's Relief Fund [PCRF]. Such humanitarian missions were also the only way to bring the materials necessary for pediatric cardiac surgery into Gaza (Figure 5). However, the visitations typically occur intermittently and have been indefinitely suspended since travel restrictions were put into place due to the ongoing pandemic (PCRF 2020). Consequently, PCRF shifted their current efforts to secure Israeli-issued medical permits for Gaza's pediatric heart and cancer patients, allowing them to travel outside for treatment rather than relying on the halted medical missions.

Hospitals in Gaza make thousands of medical permit applications for their pediatric cases per month, with the primary destination of the permit applications to hospitals in East Jerusalem, West Bank, and Tel Aviv (World Health Organization, 2019). Unfortunately, the approval rate of medical permit applications has been dwindling from 2012's above 90% to 2018's 61% approval rate (ibid.). According to my correspondence with Dr Al-Azab, all pediatric patients requiring surgery are stabilised with medical treatment in Gaza and then referred to West Bank or Israeli hospitals. Each referral often requires multiple applications – with an average response time of 23 working days – until Israel's transfer approval is obtained. Moreover, as many patients are already at a critical stage of their illness while applying for permits, extended delays and waiting periods often come at the cost of their lives (World Health Organization, 2019). There are no reports of the current approval rate by the World Health Organization;

IMAGE 2. Palestitian candidates practising suturing patches on cow aortas in the BSSC programme

IMAGE 3. The 3D printed module of Janan and its internal components

however, Dr Kerr's colleagues in Gaza's hospitals reported that around 70% of the child patients successfully obtain permits. In addition, only one adult can accompany infant patients receiving a medical transfer permit. Unfortunately, when I asked about the fate of the remaining 30% of patients denied permits, Dr Kerr believed they all eventually died. Some could survive for a short period, but they quickly become inoperable due to the rapid deterioration of their health. While a few reach adulthood, they often have severely reduced life quality and expectancy (A. Kerr, pers. comm.).

Surgical Outreach Missions

It is often stated that the ultimate goal of humanitarian assistance is to "teach a man how to fish," and this attitude aligns with the wishes of Palestinian medical students, whose main complaint is the lack of infrastructure and access to surgical training under Israeli occupation (Holmes, 2011). However, a fundamental flaw of surgical training conducted by outreach missions is the lack of sustainable and long-term training programmes that local collaborators could carry.

Stressing the need for long-term training infrastructure, a Palestinian surgeon survey suggests that 92% of medical students desire protected time for surgical training with expert volunteers during outreach missions (McDow et al., 2019). Furthermore, most survey respondents revealed that they learned most efficiently by practising the new technique on patients or animal-harvested tissue, as shown in Figure 6 (ibid.).
All surgical outreach missions to Gaza were halted at the pandemic's start (PCRF, 2020). While the medical missions resumed at a limited capacity in 2022, it remains complicated to train a new generation of pediatric cardiac personnel in Gaza due to the lack of infrastructure, equipment, materials, travel permits, and, most recently, the pandemic.

Simulation Training

Surgical training has evolved, but the traditional “see one, do one, teach one” method remains the norm. Simulators, including low and high-fidelity ones, have been studied and tested with encouraging results (Grall, Ferri, and Nicot, 2021a). Simulation training is a viable alternative to on-patient training for practising high-risk skills. Emerging technologies in surgical training include open-field cameras, telemedicine apps, social networks, serious games, virtual reality, and 3D printing.

Using emerging technologies in surgical training reduces learning time, operating time, and complications. In addition, social networks and 3D printing are affordable and accessible, with 3D printing being the best for developing psychomotor skills (Grall, Ferri, and Nicot, 2021). However, there are obstacles, such as start-up costs, model complexity of developing new models, and the open-mindedness necessary from trainers and trainees (ibid.).

3D Printed Hearts

Anatomical heart models aid in pre-operation planning, patient education, and clinical training. Traditional models can lack complexity, but 3D printed models, can recreate accurate and high-resolution structures, making teaching more engaging. Furthermore, studies show that 3D printed models enhance trainees’ anatomical understanding, especially with complex congenital heart diseases like tetralogy of Fallot that require a keen special knowledge of the heart’s internal structure (White et al., 2018).

Pediatric cardiac surgery is highly complex due to the sheer size of a newborn heart — about the size of a strawberry — and delicate vessels, leaving no margin for error and little chance for recovery from mistakes. As a result, trainees have limited opportunities to gain hands-on experience, prolonging their training compared to adult cardiac surgeons. To address this, surgical simulation has become increasingly demanded by students, with some programs using animal hearts for hands-on practice (Yoo et al. 2017). However, these hearts do not faithfully represent patients with unique or even common deformities. Image 4 shows how 3D printing offers a significant advantage by creating models

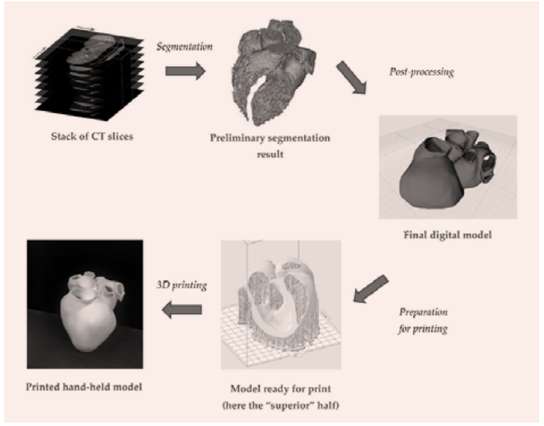


IMAGE 4. The process of converting the medical images into a 3D-printed heart model (Bertolini, Rossini, and Colombo 2021)

based on genuine patient hearts using volumetric image data from CT, MRI, or ultrasound scans. Those 3D-printed heart models can offer a comparable haptic experience to animal hearts and a more ethical option for surgical training due to their faithful representation of a patient’s heart and deformity.

Furthermore, 3D printing allows consistent and repeatable practice of treating a specific defect until mastery is achieved. Objective and consistent heart models may also provide a foundation to easily quantify and evaluate trainees’ and experts’ surgical skills and competence. For example, a recent study assessed the technical performance of 30 surgeons with varying experience who were required to perform an arterial switch procedure twice on 3D printed models. Participants received verbal feedback from a lead proctor after each attempt and showed marked improvement and quicker performance during their second attempt (Hussein et al. 2020). This encouraging finding supports the importance of simulation training as it provides a deliberate, objective, and repeatable practice method in congenital heart surgery training.

Surgical Training 2.0

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Surgical Training 2.0

Introducing 3D-printed heart models in surgical training programmes can make training sessions more objective and standardised, allowing for better assessment of trainee performance. For pediatric cardiac surgery, 3D printing is a promising and affordable technology to develop surgical skills as it eliminates the reliance on low-risk patient cases for hands-on training, thus making it possible to conduct training sessions on schedule or even on demand. Therefore, an ideal pediatric cardiac surgery training program would include theoretical knowledge acquirement, practical practice on 3D models, virtual exploration of newborns’ anatomy, serious gaming, and assessment through telementoring technologies (Grall, Ferri, and Nicot, 2021b).

Attitudinal Design

The meaning of design has evolved and become confusing over time. Design critic Alice Rawsthorn defines design as a positive agent of change that interprets and responds to shifts in various contexts. In her book, Design as an Attitude, she highlights how professionals address contemporary challenges such as climate change, dysfunctional healthcare, political crises, and social justice through an attitudinal approach.

Attitudinal designers often work independently from their fields to pursue their political, cultural, and ecological concerns. However, they also collaborate with other specialists to define their unconventional work methods (Rawsthorn, 2018). To address significant issues, designers must possess an attitude of resourcefulness and inventiveness instead of relying on traditional design processes. Moreover, attitudinal designers must be open-minded and bold to embrace their chosen cause and draw from the expertise of professionals in other fields and the lived experience of the people they wish to assist. By embodying design as an attitude, people will be readier when attitudinal designers reach out to them and more open to engaging with their noble pursuits (ibid.).

Rowthorn defines Forensic Architecture [FA] as an attitudinal design initiative. Directed by Eyal Weizman, FA is a research agency at Goldsmiths, University of London, investigating human rights violations. They partner with various institutions and collect data from multiple sources to reconstruct the incidents using spatial and architectural analysis technologies (Figure 11). Their success highlights the benefits of opening design processes to the input of other disciplines and stakeholders.

Resourcefulness

Forensic Architecture conducted a comprehensive investigation of the Gaza strip, which significantly influenced the global discourse and court proceedings related to the frequent military offensives in the region. One of their reports, which examined the use of white phosphorus by the Israeli military during the 2008 offensive, highlighted the devastating impact of this weapon on urban environments and civilians through smartphone and satellite imagery (Franke and Weizman, 2014). Unlike targeted weapons, white phosphorus can affect military targets and innocent civilians. Israel's High Court was presented with the report, and subsequently, the Israeli military announced that it would stop using white phosphorus in populated areas. Although the announcement did not officially cite FA's investigation, a senior Israeli commander noted in an interview that white phosphorus "doesn't photograph well" (ibid.).

A later FA report analysed the third offensive in Gaza in 2014, presenting evidence of indiscriminate and disproportionate Israeli aerial attacks killing civilians and injuring thousands more (Weizman, 2017). The first and third offensives on Gaza that FA investigated have been associated with a significant rise in congenital heart diseases in the region six to twelve months after the events (Abed et al., 2014). While there is no current data on the prevalence of CHDs since the military offensive in May 2021, an increase in the demand for congenital heart surgery can be anticipated.

To save the lives of the remaining 30% and establish the first local pediatric cardiac surgery team in Gaza, we must accelerate the surgical training of resident physicians and medical students through innovative means, including simulation training and emerging technologies. To better understand the resources available to fabricate training materials in Gaza, I contacted FA for their research and connections with local institutions. They referred me to Dr Tarek Loubani, a Canadian doctor, humanitarian activist, and founder of the Glia Project.

The Glia Project uses customised 3D printers to produce medical hardware in resource-limited settings like Gaza. They also repurposed printers during the pandemic to make PPEs for medical personnel and now fix medical devices in local hospitals and clinics by 3D printing spare parts (Loubani, 2021). This makes the Glia Project an "attitudinal project".

FA referred me to the Glia Project to produce components for the simulation training module for the pediatric cardiac surgery team in Gaza. 3D printing is the most promising method to bypass the blockade's restrictions, as design files can be sent online and then 3D printed locally, effectively bypassing the blockade. Thus, 3D printability became the main criterion in my design process.

'By using 3D printing processes, the variety and complexity of CHD modules can be quickly and inexpensively increased.'

Inventiveness

Another criterion for the simulation training module is accurately representing the anatomy of a congenital heart deformity. As discussed in Section 5.1, a relatively faithful recreation of a congenital heart can be created from extracted volumetric imaging data, such as patients' CT and MRI scans. Therefore, I obtained publicly available pediatric patient scans from the online community embodi3D and later processed the files using specialised and license-free software democratiz3D to convert the 2D image data into 3D models. A raw 3D model of a congenital heart was then cleaned and internally sculpted in the open-source software, Blender, to represent the heart's chambers and vessels, thus creating an anatomically correct 3D model of a healthy congenital heart.

The healthy heart model is the foundation for the sculpted CHD modules designed for surgical training. Therefore, by referring to the list of the most common CHDs in Gaza that Dr Kerr gave me, I have created four additional heart modules with the specified structural deformities, as demonstrated in Figure 12. I designed the heart modules with the consultation of medical students of Christian Albrechts Universität in Kiel and the guidance of my expert surgeon contacts. However, due to the complex structure of the tetralogy of Fallot – which is a combination of multiple structural abnormalities – I opted to sculpt the fourth heart module to represent Pulmonary Valve Stenosis instead.

During my correspondence with Dr Kerr, he recognised the benefits of using modules to train surgeons on adult heart surgery. Nevertheless, he highlighted the wide variability of pediatric diseases as a challenge to implementing simulation models into surgical training programmes (A. Kerr, pers. comm.). Fortunately, by using 3D printing processes, I can increase the variety and complexity of CHD modules quickly and inexpensively. Furthermore, as rare diseases and high-risk cases arise, it is possible to convert those novel patients' scans into training modules. This would allow pediatric cardiac surgeons – whether senior or junior – to practice and rehearse those high-risk operations repeatedly and confidently until mastered before laying a scalpel on the patient.

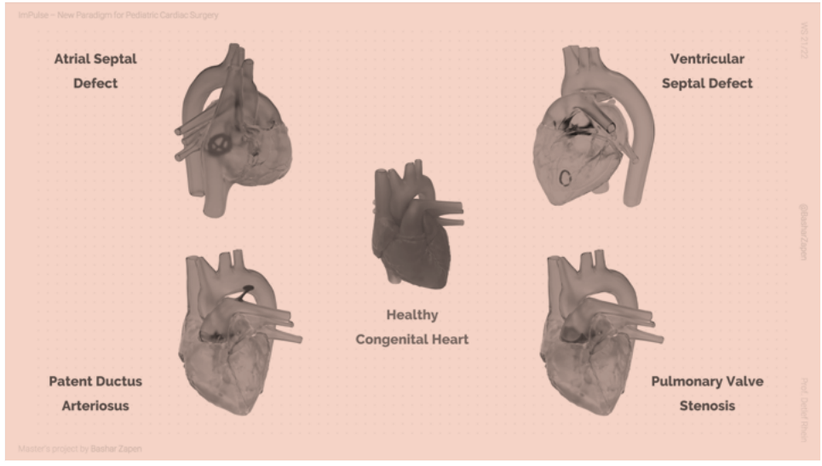

IMAGE 5. The models are transparent to highlight the internal deformities of the four heart modules

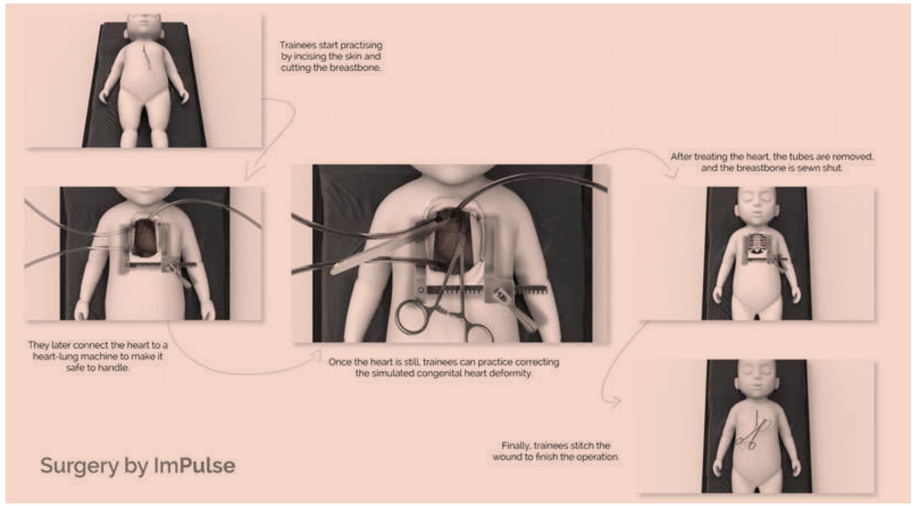

IMAGE 6. Some of the surgical steps possible to perform on Janan

Trainee Centric

The main objective of surgery simulation training is to develop confidence and competence in trainees' technical skills and manual dexterity. However, a surgeon seldom operates on a patient alone without the collaboration of colleagues. As discussed in Section 2, every operation room witnesses a dance – whether harmonic or awkward – between expert surgeons and their apprentices. This dance extends to everyone in the operation room, from surgical nurses to anaesthetists, revolving around the patient's heart. Therefore, for simulation training to develop the interpersonal skills of surgical trainees, I ought to reproduce the experience of operating on a patient in the design of the simulation training module. Thus, I created a 3D printable patient model named Janān to contain the various components essential for imitating the experience of operating on a newborn.

Furthermore, operating on a heart model only covers a specific technical skill in a procedure that typically takes four to six hours. For instance, all CHD corrective operations listed by Dr Kerr require open-heart surgery. Due to their invasive nature, patients must be put under general anaesthesia to guarantee their health and the operation's success. The surgeons later perform cannulation, attaching tubes to the heart's great vessels and re-routing the blood from the patient's heart to a heart-lung machine to stop the heart's beating motion and allow the surgeons to operate on the heart safely. Once the deformity is repaired, the heart is rewarmed and started again, and the tube connections are removed. Lastly, the surgeons sew shut the breastbone and the skin, hopefully concluding the surgery. Accordingly, every step in the procedure requires a different surgical skill, tool, and specialist. Hence, as shown in image 6, the simulation training module I created included the numerous steps leading to the defect treatment and the collaborative work necessary for the procedure's success.

By placing the CHD modules inside a neonatal module, trainees could better understand the scale and positioning of the heart and the required steps to gain access to it. Moreover, my goal in humanising the module is to help trainees develop general empathy and a deep and vital association with their future patients. Finally, I designed Janān to be entirely 3D printable to make it possible to create high-fidelity and high-resolution simulation training modules in economically and politically constrained areas such as the Gaza Strip. Furthermore, all design files will be freely published to help surgical trainees worldwide develop their skills.

Conclusion

Gaza's congenital heart problem may not have an immediate or obvious solution to alleviate its disastrous implications. The only viable and sustainable solution is establishing a local pediatric cardiac surgery team to provide patients with the necessary medical care. The team's services would benefit patients who can or cannot leave the besieged strip, potentially saving countless lives that are otherwise deemed to indefinitely wait for their unforeseen fate — the remaining 30%.

However, any attempts by Gaza's medical schools to build traditional pediatric cardiology programmes – that require the physical attachment to an experienced surgeon for a minimum of five years – are destined for failure due to the many constraints and limitations addressed in this paper. Thus, training programmes must adapt, develop, and revolutionise their surgical training paradigm to overcome such challenges. Furthermore, every pediatric patient is a high-risk case, so if Gaza's medical institutions aim to develop the surgical skills necessary, they ought to liberate the trainees from the total reliance on low-risk patients in favour of more robust and reliable methods and technologies.

Access to simulation training modules would give trainees a platform to improve their surgical skills continuously and consistently while also minimising the patients' risk and exposure to potential surgical errors in hands-on training. Moreover, simulation modules can be used for rehearsals before operating on rare or exceptionally complex cases, reducing the risk of complications or mortality in those patients. With the ability to fabricate high-fidelity modules, simulation training can become a viable alternative to live-patient practice and an ideal supplement to the trainee's logbook.

I propose that any future training programmes in economically and politically constrained areas akin to Gaza would have to incorporate simulation training into their training programmes modelled after Germany's competency-based system, leveraging its advantages which are field-proven with the quality and consistency of its graduating surgeons. Nevertheless, even with simulation training, establishing the first pediatric cardiac surgery team in Gaza will be a long and complicated process.

According to Dr Kerr, the only tangible and immediate solution to the training problem would be encouraging more outreach missions to visit Gaza, during which, master surgeons from the volunteering teams would train the local staff on pediatric cardiac surgery. However, as medical missions last from two to six weeks, I want to highlight the importance and potential benefit of using telementoring methods and simulation training modules to continue those training sessions beyond those few weeks. With the right attitude, resourcefulness, and inventiveness, I aim to help establish the first pediatric cardiac surgery team in Gaza in five years, if not even less. That is my impulse.

Recommendations

The themes and issues I address in this publication cannot be thoroughly explained in such a short article. Therefore, I encourage readers to explore the references or my complete master's thesis to gain a better understanding of Gaza's healthcare system and the reality on the ground.

As I update this paper for publication, the war on Ukraine continues with no end in sight, and the full impact of the devastating earthquake in Turkey and Syria is yet to be seen. Unfortunately, I anticipate a sharp increase in CHDs as their conditions closely resemble Gaza's after military offensives, further worsening the burden on those affected regions. While ImPulse cannot provide immediate relief, it is imperative to continue the research and development of the project to achieve its intended impact. Please feel free to reach out if you have any leads or would like to help in the development or clinical testing of ImPulse.

From accessibility to inclusion: Dreamy case-study

Methodology for the design of a device that meets specific needs

By Miriam Ronchi and Andrea Avalli

'We are aware that we are all different, so why do we have to adapt to standard projects?'

In recent years, design has faced a new theme linked to the healthcare world. It deals with the design and creation of devices and prototypes, which respond to the real needs present in the daily life of people with disabilities or suffering from pathologies, which compromise their usual actions. The design takes place through software dedicated to 2D and 3D modeling, while for the realization of the project rapid prototyping machines are used, such as 3D printing, laser cutting, CNC milling, vinyl cutting, Arduino and many others. This instrumentation allows you to create customizable prototypes for the specific needs of the person. Furthermore, once parameterized, they can be adapted to people who have similar needs, so as not to focus on the individual, but to extend the project to all those who need it, thus making it inclusive.
In 2001, Gillo Dorfles, in his text "Introduction to industrial design: Language and history of mass production", defined the requirements that an object must meet in order to belong to the field of industrial design: seriousness, mechanical production and a good aesthetic quotient.

If we focus on seriousness, or rather the reproduction of the product in series, a doubt immediately arises. How can an object adapt to the physical and psychological needs of each individual person? So how is it possible to design a solution that can respond to the problems of people with different needs? Without underestimating that within this user group there are numerically smaller groups, with different needs, sizes and abilities; how can the designer develop solutions that simultaneously adapt to the greatest number of users? The "Glossary of Ergonomics" defines Design for All (DfA) as follows:

"type of design centered on disability which consists in designing environments, products, services and systems such as to be sufficiently flexible and usable directly (i.e. without having to resort to subsequent modifications or additional elements) by people with a wide range of abilities, in relation to the greatest possible number of situations that may arise in the course of existence.

So let's go see the seven principles that a DfA project must follow simultaneously.

The first is "Fair Use": a design must have the fewest differences between users of different abilities. The aesthetic component must also be taken into consideration since the product in question must convey desirability thanks to its appearance, to avoid the feeling of isolation that the person with disabilities could experience in front of a product designed specifically for them.

The second is "Flexible use": a design must adapt as much as possible to a wide range of abilities and disabilities. The task of the designer is therefore to put the user in the position of being able to choose the most convenient path according to his characteristics. Furthermore, the user must be facilitated in carrying out the action he performs on the product itself from the point of view of precision and accuracy.

The third is "Simple and intuitive use": the usability of an object must not depend on the cultural level, language and attention span of the user; rather it is the designer who must have important forecasting skills to imagine all the possible reactions that the multiple users could have. The interaction between device and user must indeed be simple and intuitive, as the device must refer to a conceptual model already known and memorized by the patient, in order to make it familiar and close to his knowledge. Furthermore, the clarity of the cause-effect connections is fundamental. It is necessary that the user receives exact feedback, i.e. return information following the actions taken.

The fourth is "Perceptibility of information": the communication of information must be comprehensive and take place regardless of the environmental context or the user's sensory perception capabilities. This can take place through various types of communication: graphic, verbal and tactile. If the object is made up of several elements, it is advisable to differentiate them, through a different colour, a relief or a brand. By making it easier to receive instructions and suggestions and considering the compatibility with tools used by people with sensory limitations, we can get very close to a product that is actually "for all".

The fifth is "Error tolerance": the project must be designed to minimize risks, accidental actions and any errors as much as possible. The study of the arrangement of the elements therefore becomes fundamental: the main or most important ones must be easily accessible, while the dangerous ones must not be present, or at least not exposed. In the event of an error, there must be the possibility to undo it or the presence of a warning and protection system becomes essential.

The sixth is "Containment of physical effort": the user of the project must be able to use it effectively by making the minimum effort, also considering the maintenance of a physiological body position. It is also necessary to limit repetitive actions and sustained physical effort. Finally, the seventh is "Measurements and spaces for approaching and using": a project, to be defined as DfA, must take into account dimensions and spaces for approaching, accessibility, maneuverability and use without hazards, regardless of the user's posture or ability to move. The elements that make up the device must be clearly visible and easily accessible, whether the user is seated or in an upright position. Variations in the size of the hand and the size of the grip must also be foreseen and the presence of an adequate space to allow the user who needs it to make use of personal aid or auxiliary systems.

Design for All aims to simplify everyone's life with products, environments and communication systems for which there is no need to make adjustments for a specific user. Limiting this philosophy only to individuals with disabilities (visible or not) is very simplistic as we must understand that each of us is a possible (healthy) bearer of health complications which, in the future, could manifest themselves on a physical, sensory or other level.

The decision to adopt a universal design is also advantageous from an economic point of view. Cost tracking and the final price are recurring issues in the industry. In some situations, designing "for everyone" can mean adding elements of considerable cost. In this case it is necessary to focus on two aspects: it is necessary to ensure that the high cost is compensated by an equally high longevity, and to refer to the principle according to which form follows function, thus accepting to partially sacrifice the formal-aesthetic factor in favor of the functional one.

It can be enlightening to study cases of companies that have achieved important goals by applying the principles of the DfA. The Center for Universal Design, in its project "Studies to further development of Universal Design", collected a series of cases representing attempts to incorporate UD into products, environments and elements for buildings. One of the companies analyzed was IKEA, which in order to reduce economic costs and be able to offer the customer a product with an advantageous price, chose to package unassembled furniture.

To eliminate additional translation costs and avoid customer confusion, the step-by-step instructions accompanying the assembly process are simple illustrations. This brings us back to the third principle of the DfA: simple and intuitive use.

But let's take a step back: before the Industrial Revolution, people self-produced the tools necessary for their work and domestic activities, thus representing the user who personally took care of and worried about the usability of their artifacts. These were perhaps ergonomic in the most absolute way, as they conformed to the anthropocentric requirements of the same hand that produced them, invented for a real need of the user/producer. Later, due to the great increase in demand, the Industrial Revolution develops. The first industrial products were appreciated and considered innovative above all for their technological and functional quality. There was no concern for the user's overall well-being.

With the outbreak of the Second World War, the serious problem of social reintegration and the improvement of the life of thousands of war mutilated people arose. Each person with disability becomes a separate case, needs an individual solution and therefore a separate project. Institutions specialized in physiological, perceptive and rehabilitative research begin to develop.

'Each person with dissability becomes a separate case, needs individual solution and therefore a separate project.'

The awareness of ergonomics led to the crumbling of the concept of the average person in health, "intact" and in full intellectual capacity. Focusing the design on them led to the paradox of planning projects for a rare, or even non-existent. In the future, ergonomics will be able to create products that are increasingly designed for a universal user, seeking the qualities of simplicity, adaptability and unequivocalness.
We are aware that we are all different, so why do we have to adapt to standard projects?

At this point it is necessary to go one step further, going from Design for All to Design for each "Design for each" refers to the idea that products, services, and environments should be designed with specific users and their needs in mind. This approach takes into account the unique needs and preferences of individual users, and may involve customizing or adapting products to meet those needs.

"Design for all," on the other hand, refers to the idea that products, services, and environments should be designed to be usable by as many people as possible, regardless of their abilities or disabilities. This approach seeks to create inclusive design solutions that work for a wide range of users, including people with disabilities, elderly people, and children.

When it comes to accessibility, both "design for each" and "design for all" approaches are important. Designing for each person's unique needs and preferences can help ensure that everyone has access to products and services that meet their specific needs. At the same time, designing for all can help create more inclusive products and services that are usable by everyone, including people with disabilities. By taking both approaches into account, designers and developers can create products and services that are truly accessible and usable by all.

Hence our reflections on the creation of objects that help the individual in everyday life, following the methods of Design Thinking and Double Diamond as the cornerstones of our design method.

Design Thinking is a method focused on the resolution of complex human needs and problems, through a set of tools, technologies, processes, people and creative thinking. The goal is to generate value for the user through innovative solutions, feasible from a technological and economic point of view. The Design Thinking method was originally born in Stanford University and is divided into 5 phases: Empathize, Define, Ideate, Prototype, Test.

Empathize is the first phase and aims to collect data, do a lot of research and direct interviews to learn about users' daily lives, what they do and how they do it, their actions, what they think, say and feel. The collection of this data is fundamental, it must be reorganized in order to proceed to the next phase.

Define is the second phase and is used to identify and define the real needs of the user, i.e. those that are not satisfied by the objects offered on the market. In this phase it is essential to make a well-defined collection of the problems that have emerged and the common experiences of the users.

Ideate is the third phase and consists in a brainstorming of the information, needs and problems collected previously, with the aim of finding solutions and creative ideas. In this phase the quantity is predominant compared to the quality, i.e. you have to give free rein to the imagination of the team to generate as many ideas as possible, the actual functionality will be evaluated at a later time.

Prototype, is the fourth phase of the creative process and consists in the creation of "raw and dirty" prototypes of the highest quality solutions to the problems that emerged in the previous phases. The goal is to test them on users and analyze through the feedback received what works and what needs to be improved.

Test, is the fifth and final phase aimed at testing the effectiveness of the product created by submitting it to the initial users, to understand if the problem has been solved (or improved), if it meets their needs and to collect further feedback to apply to the product.

After learning the design methodology of Design Thinking we came across a more specific and suitable methodology for the development of projects designed to solve a specific and complex need, called Double Diamond.

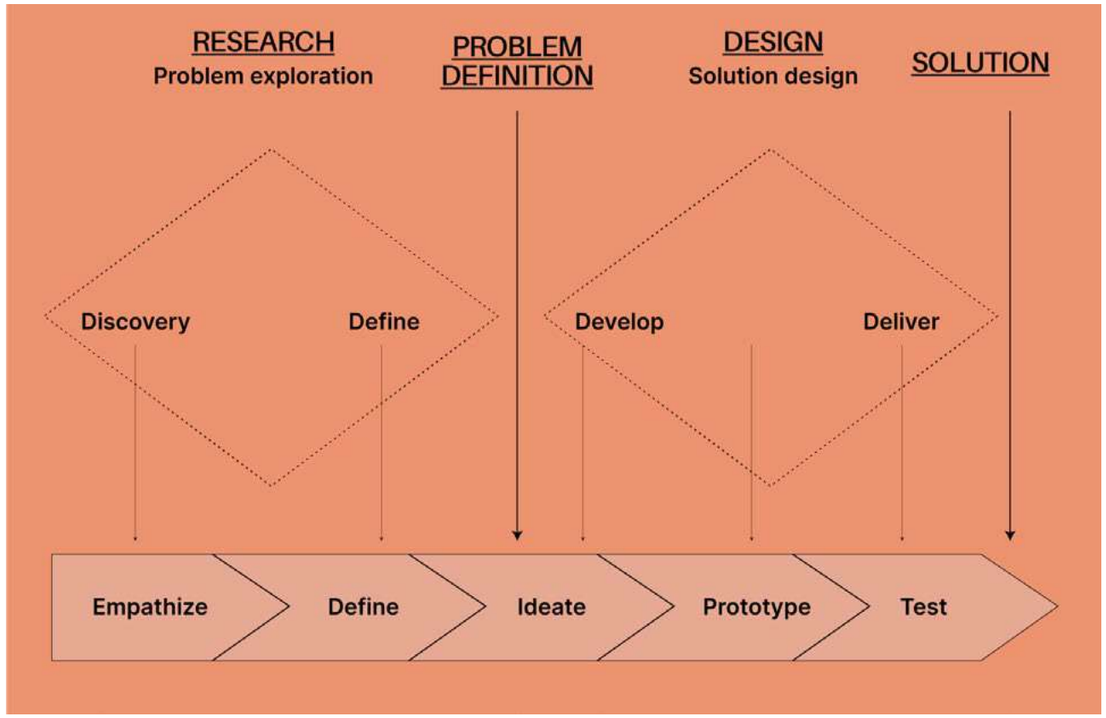

IMAGE 1. Method for project development through design thinking and double diamond

To define the Double Diamond methodology, as we can see in the image, there are two diamonds, which represent the creation processes: one of research and exploration, and the other of designing the solution.

In the first diamond it is necessary to understand the problem, through the collection of data and information demonstrated by the user. It is the divergent phase of discovery.

In the next phase we enter convergent thinking, during which we give order and priority to the collected data, increasingly narrowing the field with the aim of identifying the real problem we intend to solve. It is the convergent phase of focusing: define.

We have reached a central point: the definition of the problem. If the problem is not accurately defined, subsequent steps to look for a solution will not produce any valid output. The most suitable solution in this condition is to retrace the processes of the first Double Diamond.

Let's start again with a divergent phase, i.e. a highly creative phase of developing ideas without any filter, based on previously defined problems, giving importance to quantity rather than quality. It is the divergent phase of development: develop.

Once the criteria have been set, the ideas are selected, in search of solutions which, in the case of Design Thinking, satisfy the objectives of desirability, feasibility and viability.

The last converging phase consists in testing the prototype with the user and receiving the first feedback. It is the converging phase of delivery.

These design processes are born to be cyclical, therefore non-linear, in which returning to the previous steps is completely normal, in order to be able to make a targeted design.

<u>Dreamy was developed following these two research and design methodologies</u>
Our creative process began with the analysis of the user's problems and needs. The person in question has a tumor mass on the neck, positioned between the ear and Adam's apple. Peaceful rest is not possible during the night, this is because if the head is tilted towards the shoulder, the tumor crushes the trachea and the carotid artery, causing major discomfort with dangerous consequences for the subject's health. The solution we came up with was to create a personalized pillow capable of limiting large movements, especially involuntary, of the person during the night's rest hours.

Dreamy, the name we have chosen to give to the project, consists of a central cervical pillow, while on the sides, in a specular position, we find stiff sponge protections, to limit the movements of the head, without binding it in a specific posture. We wanted to give the spongy part a rounded shape, not angular, to give a feeling of softness and comfort. Furthermore, the internal part, where the cervical pillow is inserted, is rounded to take up the features of the face and ears, making it "tailored".

The cushion will have two variants of use, based on the comfort and needs of the person: lying down or sitting, thanks to the supports that allow you to modulate the most suitable position. If used lying down, Dreamy will be positioned at the head of the bed, replacing the "classic" pillow, but maintaining the familiar and standard position to which we are accustomed. During the night the person in question will maintain a supine position, to take advantage of the benefits of the object and to rest in total safety, having the protection of the sponge structure. While if a semi-seated position is preferred, Dreamy will be fixed, using rails on a back support, creating a sort of chaise-longue in the bed.

During the design phase we noticed that if the rest takes place in a sitting position, an involuntary opening of the mouth occurs, caused by a loss of control of the jaw, which would cause a crushing of the tumor mass. To avoid this risk we have created an accessory capable of giving support to the jaw. It consists of three adjustable bands positioned as follows: one in the upper part of the neck, one in the back, and the last one in the lower part is characterized by a chin rest.

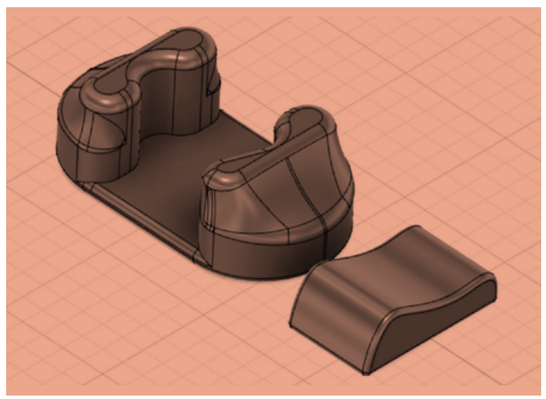

IMAGE 2. 3D modeling Dreamy prototype with parametric software.

In order to be able to carry out this project, we relied on the world of digital manufacturing, made up of easy-to-use and low-cost machines which, thanks to dedicated software, allow the design and creation of (experimental) 3D objects.
Digital manufacturing machines can be divided into two macro categories: additive machines, which add material such as the 3D printer and subtractive machines, which remove material, such as CNC milling and laser cutting.

The process started with the measurement phase, using a classic "seamstress meter" we measured the dimensions and measurements of the affected areas (neck, head, shoulders and back) of the person. With a 3D scanner and the use of the photogrammetry technique, we detected the surfaces involved and thus obtained a model that perfectly reflects reality. This mesh was then manipulated and made into a 3D drawing, obtaining a "cast" on which we could model our project.

IMAGE 3. Dreamy prototype

From this 3D model we have detected the actual dimensions and the curves necessary for the creation of a "raw and dirty" cardboard prototype. The first prototype was tested to evaluate its dimensions and real size on the person. In this phase it was useful to carry out an in-depth research of the materials to be tested in the final prototype. In the research we identified polyurethane foam, to make the lateral support structure, EVA to cover the foam, which makes the prototype softer to the touch

and antibacterial, while a rigid wooden base is essential to give the cushion more resistance. Finally, for the inside we thought of a pillow with cervical support.

After gathering feedback from this test, we edited the internal curves in the 3D model and prepared the CAM, and then proceeded to mill the polyurethane foam. The CNC milling machine is a digital manufacturing numerical control machine. This tool does subtractive machining, therefore it starts from a block of raw material and digs level by level through a spindle until the desired object is obtained. With this machine we have also milled the wooden base which follows the measurements of a normal cushion. The next step was to glue EVA onto the foam, experimenting with different types of glues, due to their chemical composition they risked corroding the foam. Finally, we covered Dreamy by sewing two types of pillowcases, making them completely removable to allow constant sanitization.

At the end of the prototyping process, the testing phase began. As the structure of the double diamond teaches us, in order to create an object perfectly tailored to the person, there are a series of tests and trials to be carried out, some of which will give positive feedback, others negative, useful for understanding how to improve the project. Often this phase can lead to feelings such as bewilderment and dissatisfaction, especially if we are dealing with projects that we have been working on for months or years; but that's all part of the design world. To better understand this concept we could see the planner/maker/designer as an inventor. Having to create an object from scratch, which has never existed and still does not exist, we have no yardsticks, or at least in most cases not enough; which is why the testing phase is so essential.

In our specific case we started by testing Dreamy in a supine position with the intention of giving back, even in part, a little independence to the user. We knew it wouldn't be easy, as the person in question had been sleeping for 10 months in a sitting position, but the experimentation step is needed for this, to test, improve, and test again.

The feedback we have received has been both positive and negative. The negative ones mainly concerned the physical repercussions that the user felt during the hours in which he remained lying down: feeling of suffocation, pain in the cervical area, difficulty in keeping the body in axis and in the same position for a prolonged period such as the night. Despite this, we all agreed that the path was the right one, changes simply had to be made.

We therefore decided to evolve the project into the second version: Dreamy 2.0, i.e. maintaining the same cushion, but positioning it for use while seated, thanks to a lumbar and an axillary support. For the lumbar support we decided to make a structure to be placed in the bed with manageable degrees of inclination. Thanks to the joints, the inclination can be adjusted from 15° to 30° allowing the structure to be adjusted according to need. While the axillary support allows the subject not to slip in bed during the hours of night rest. They are designed to be removable if the person wants to change position. The new structure will help keep the neck in axis and the correct position in the structure, leaving a wider but controlled space for movements.

The final step will be to share the project and the drawings on open source platforms to make it inclusive and useful for everyone, a design philosophy followed by many outstanding practitioners of distributed design, including designers, makers, projects, events, and institutions who apply the principles of distributed design in innovative and impactful ways. Here are a few examples:

- **Open Source Ecology (OSE)**

OSE is a global network of makers and designers who use open source principles to design and build the next generation of industrial machines and tools. The organization's goal is to create a world in which everyone has access to the tools and resources they need to live a healthy, productive life.

- **Local Motors**

Local Motors is a global community of makers, designers, and engineers who collaborate to design, build, and sell a range of innovative vehicles and products. The company's approach is centered on co-creation, with members of the community contributing to every aspect of product development, from concept to final product.

'Thanks to digital manufacturing and rapid prototyping, it is possible to build unique pieces, designed for the person and at affordable prices, without negleting the aesthetic side.'

- **Public Lab**

Public Lab is a community of practitioners who use open source methods to address environmental issues and promote environmental justice. The organization's work includes developing and sharing open source tools and techniques for environmental monitoring and analysis, as well as advocating for the rights of communities to access and use environmental information.

- **WikiHouse**

WikiHouse is an open source platform for designing, building, and sharing sustainable and affordable housing. The platform includes a range of tools and resources for designing, fabricating, and constructing houses, and encourages collaboration and co-creation between designers, builders, and communities.

- **Fab Labs**

Fab Labs are a global network of digital fabrication workshops that provide access to a range of tools and equipment for designing, making, and prototyping. The Fab Lab network is based on the principles of open source design, collaboration, and sharing, and is designed to promote creativity, innovation, and entrepreneurship in communities around the world.

The purpose of our work, in addition to that of designing solutions to specific needs, is to make people talk, also through this article and the project itself, and give space to the communication of this still too little known topic. Also because, as makers know, more professional and non-professional figures are involved (such as designers, engineers, users, caregivers, doctors, physiotherapists, therapists, etc.), to arrive at a complete design under all the various disciplines.

Information is essential at this point as people need to know that there may be solutions to their needs. Moreover, the increase in demand would lead to special attention from the upper levels regarding these issues, with the ultimate aim of protecting the professional figures involved, creating ad hoc laws, and above all the increase in funding for research on the design of this type of projects.

In conclusion, with this article we want to raise awareness of the issue of Healthcare Design, which is still too little known in the world. We would thus like to leave a method that facilitates communication, in the design phases, between the various professional figures, who work together to solve or improve real problems: "Manifesto of Co-design for health and care", written by OpenDot in collaboration with the TOG Foundation. The design is defined as human-centered and verticalized in the healthcare sector. Thanks to digital manufacturing and rapid prototyping, it is possible to build unique pieces, designed for the person and at affordable prices, without neglecting the aesthetic side.

1. Listen and observe

Co-planning means creating a space where all opinions, skills and experiences matter and are needed, it means implementing a process based on listening.

2. Teach and learn

We are all experts in something and mutual training is essential: doctors, designers and people with disabilities, experts in their condition, share knowledge and skills, crossing them.

3. Speak the same language
Breaking down the wall of anglicisms and specialized terminologies in favor of a common language understandable by all.

4. Sharing the real need
The goal is to solve a real need, small or big it doesn't matter, what matters is to focus on the why, the how comes later.

5. Thinking and planning together
Moments of sharing, exchange and collective planning guide the group towards the final idea, stimulating everyone's creativity in thinking of new and innovative solutions capable of responding to real needs.

6. Materialize the idea
The production of a first prototype allows, thanks to software, digital manufacturing technologies and rapid prototyping, to touch, explore and test the idea. And, last but not least, personalize it.

7. Prototype, prototype
The prototyping phase is a spiral process: the designs improve as the versions increase, in the face of a constant dialogue on how to perfect the object.

8. Replicate, scale, share
An object well designed for the individual can be useful and replicated to meet the needs of others as well. This is where the value and philosophy of open source comes into play: sharing the process and the final solution is a way to enrich the project and broaden its social impact.

"Nowadays, health and care have technologies and methodologies at their disposal that could definitely transform them, bettering the quality of life of the millions living with disabilities, both physical and cognitive, whether temporary or permanent. Those are new tools that allow us to adapt, personalize and even create more effective solutions from scratch. We are one step away from being able to take care of each other, as people with unique tastes and necessities, not just as patients of a certain pathology."
If we had to think about the reason why design was born, therefore as an aid to people in daily life, it is natural to ask how it was possible to arrive today at a niche, inaccessible and above all exclusive design; Is it possible to go back to the main purpose of design?

The answer of this article is yes. Thanks to Design for All, Design for each and Healthcare Design it is possible to improve people's daily lives.

Design should be for everyone.

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Design should be for everyone.

Authors

Esther ten Zijthoff, Michael Wittmann, Mimi Hapig, Franziska Wirtensohn from Soup and Socks, e.V.

Where

Katsikas, Ioannina, Greece

Project type

Project (Community Centre)

Habibi.Works

An intercultural makerspace and Fab Lab for people on the move

Project description

Habibi.Works is an intercultural makerspace and Fab Lab situated in Katsikas, northwest Greece. It is situated over the road from Katsikas “hospitality centre” - a camp built to accommodate over 1000 refugees and asylum-seekers during the long periods entailed in awaiting decisions on their asylum applications. Founded in 2016 in a context of increasing precarity for people on the move, Habibi.Works is designed as a platform for education, empowerment, and community. In this makerspace, participants are treated as the experts of their own lives and accompanied to design and create their own solutions to the challenges they face.

IMAGE 1. Habibi.Works

Habibi.Works is comprised of 15 working areas which include carpentry, metalwork, bicycle repair, electronics, sewing, sports and plastic upcycling; a MediaLab with a computer lab, laser cutter and 3D printer; a creative atelier; a multilingual lending library, home to various language cafes and a ´storytellers lab´; and a music studio. A community garden grows produce incorporated into daily meals prepared in a community kitchen. Visitors to the space have free access to tools, material and guidance in each working area. The areas are supervised by an international team which includes individuals from the refugee and asylum-seeker community. One of the key values of the space is that everyone be regarded at eye level, thereby empowering each individual to learn by doing and capitalising on each interaction as a mutual learning opportunity.

Context and history

The Habibi.Works makerspace was developed in response to a perceived gap in the humanitarian landscape in Greece. More specifically, there was an evident lack of approaches which actively involved members of conflict-affected communities (in the case of Greece, refugees and asylum-seekers entering Europe through the Mediterranean/Balkan route) as protagonists in their own lives. Instead, humanitarian entities offered unsustainable “solutions” based on imported “one size fits all” approaches which had little impact on the long-term reality of individuals in this context and which stripped the individual of agency. Putting the makerspace model to work in this context has offered an alternate path through which refugees and asylum seekers are regarded at eye-level, empowered to use their existing know-how and unfold their full potential. Habibi.Works has been implementing this approach since 2016.

What is the need it tackles?

Habibi.Works offers a counter-solution to aid mechanisms which strip the individual of agency and choice, by implementing the do-it-yourself knowledge-sharing models of a makerspace to the humanitarian context. For the primary population the project works with (people on the move), needs are mulit-faceted; acknowledging this, Habibi.Works aims to make an impact on various levels.

Living Conditions
In the context of a refugee camp and extremely limited financial support, individuals on the move face the challenge of securing basic daily items including clothing, food, and hygiene items. Living conditions in the camp are an additional challenge: there is little privacy and an increasing degree of scrutiny due to increasing security measures and limitations on movement. Through Habibi.Works´ various working areas, individuals can address some of these needs by designing and devising their own solutions, as well as making basic repairs to items already owned. As an additional example, the remote location of the camp, paired with expensive and unreliable transport as well as limited financial support, means transport to the urban centre is a challenge; this need led to a permanent bike repair workshop and bike rental system being implemented in Habibi.Works.

Mental health
People on the move experience long waits on their asylum applications, during which they remain isolated and have little to no access to adequate services, education or employment. This has repercussions on individuals´ mental health. Through participatory learning and the opportunity to grow and employ existing skills, participants in Habibi.Works have expressed a positive impact on mental health through (re) gained self-confidence and reclaimed agency in a context that is otherwise limiting and reduces them to their basic needs and political situation.

Access to education and employment
The opportunity to learn and share skills, as well as access learning modules within the various working areas, opens up additional opportunities for participants both in this context and later in their journeys. More concretely, our MediaLab also supports individuals in creating CVs and cover letters.

Social exclusion
Individuals on the move face high barriers to integrate into society, enforced through physical distance from urban centres and the requirement to live in so-called “hospitality centres” and camps, in order to access basic support services. Additional language challenges and anti-migrant rhetoric make connecting with the local community even more difficult. Habibi.Works aims to create a safe space in which encounters can take place between communities that are otherwise distanced, and where individuals of diverse backgrounds can meet, collaborate and co-create.

Lack of information and awareness
By sharing information about the lived reality for people on the move, advocating for humane and dignified responses to migration, and generating counter-narratives to anti-migrant rhetoric, Habibi.Works aims to increase awareness and change the narrative around people on the move.

IMAGE 2. Co-creation gets all ages and backgrounds involved!

IMAGE 3. A bicycle is kitted with a back rack to facilitate transport of items between the camp and the city centre, a 7km bicycle journey

What is the relationship global-local of the project?

Habibi.Works connects its support on a daily basis with ways to contribute to a critical discourse on an European and global level through expressing a disagreement with the term “refugee crisis”. The carrier of a symptom is rarely the cause of the crisis. A more systemic overview is required: the symptoms along the European borders are not caused by the people who flee their countries. They are the consequence of global interrelations and conflicts, which lead to exploitation, war, persecution and poverty. These conflicts are at least partly the offspring of the colonial legacy, of racism and of the exploitation of human and natural resources (Brand and Wissen, 2017). The most obvious symptoms in this humanitarian and political crisis – the conditions in camps, for example – are caused by political unwillingness to provide more suitable, dignified and sustainable solutions. Thus a relevant aspect of care can also mean re-framing discriminating terms in (everyday) language.

Habibi.Works situates its mission, values and activities in response to the following global challenges: Marginalisation of people on the move, fuelled by anti-migration politics and rhetoric and exclusionary and isolationist policies; Inequalities and power imbalances inherent in humanitarian emergency responses; and the climate crisis.
Habibi.Works promotes circularity, the re-use of resources, and renewable energy sources. Examples include our community garden, our plastic upcycling lab and a general focus on repair over repurchase.

What results did your project accomplish?

In the 6 years of its existence, the Habibi.Works project has impacted the lives of more than 8000 vulnerable persons, and been the site of countless individual projects and creative enterprises.

An important result of Habibi.Works´presence and platform is also the awareness of discriminating power structures. This awareness is a precondition for critical reflection and the possibility to address these inequalities.

IMAGE 4.. An expecting father builds a crib in our wood workshop

How was the development process of the project?

Since its foundation, Soup and Socks developed from providing selective emergency aid, to creating a community kitchen within Katsikas refugee camp, to implementing the long-term project Habibi.Works since 2016. From its inception, Habibi.Works´ has grown and evolved to meet the changing needs of the community it works with. Partnerships with other like-minded organisations has enabled important expansions, such as the establishment of a community-led sports programme (Habibi and Sport with Refugees) and the setup of a plastic upcycling lab (re.works) on the premises.

Why is Habibi.Works distributed design?

As part of our makerspace approach, the information, processes and designs implemented in the project are open-source and transparently shared. The knowledge base, comprised of designs, technologies and processes is regarded as an open commons to draw from and contribute to. Further, our approach challenges mass consumption and mass fabrication models.

Authors

Borbála Moravcsik from Fab Lab Barcelona at the Institute of Advanced Architecture of Catalonia

Where

Barcelona - Spain, Nagykovácsi - Hungary

Project type

Tools & methods

Crosshabit

A distributed participatory game for strengthening the playing communities

Project description

Crosshabit is a collection of distributed participatory methods and tools, and a playful research. It is about empowering children's decision making, while raising awareness about their right of freedom of expression in local communities and in urban areas.

IMAGE 1. The CNC cut elements of the participatory game

Context and history

Crosshabit is a collection of distributed participatory methods and tools, and a playful research. It is about empowering children's decision making, while raising awareness about their right of freedom of expression in local communities and in urban areas. It aims to examine the effects of the built environment on the youngest generations and their own effect on the spaces. For the aim of showing their different eye-levels, which could create a kind of dialogue about our emergent topics for better, common solutions.

The project Crosshabit started as a thesis research project, for local communities, at the Master in Design for Emergent Futures course at IAAC, under the incubation of Distributed Design, as a scholar of theirs. Later on, the project won an Academic Excellence Award for the most impactful project.

Throughout the year, the aim of the thesis project was to reach a 'new kind of impact', locally and globally as well, by following the principles of Distributed Design. This 'new kind of impact' is looking for ways to be able to see each other's eye-levels in our everyday systems. Due to the increasing urbanization and radical changes in society, or even in our environment, it is important that future generations are aware that their decisions matter and that their decisions can have an impact. As well, us adults need to be aware that an important aspect of children's rights is their freedom of speech, and therefore they should also have an important role to play, when we think about our environment and our future. Thus, the main objective of my research and methodology building was to strengthen these in our communities through participatory planning and co-creation.

I think that our urban spaces consist of many opportunities to be a platform to learn with children about the importance of social self-determination and productive citizenship, while shaping inclusive spaces and futures for all.

What is the need it tackles?

Playing communities

There were forgotten times, when children were free around the city and only their imagination created limits in their play and development. Then the 'intervention' of having more and more cars on the streets, developing a rushing culture and society displaced them from their "natural learning environment", where children and adults were all included and kind of equal citizens. Besides the technological innovations, the changing views of parenting and education formed the role of children in our society as well.

We can think of two changing cases, for example: In the 1970's Colin Ward, a British anarchist and writer, wrote about the relationship of children and their built environment, in his book: Child in the city. His experimentation was about the effects of the built environment on the children and their effects of the children on their built environment. He explored the uniqueness of the children's presence in the city, **how they can turn the space into play and how play can turn people into good citizens.**

Such as when in 1996, a UN conference on Human Settlements (HABITAT II - UN Center for Human Settlements) was held, where it was declared that "the well-being of children is the main indicator of a healthy place to

live, a democratic society and good governance", and the initiative was born as an intervention in the system of that society. The launch in 1996 marked the beginning of an extraordinary movement, which was joined by several Member States. As the movement developed, the need for sharing experiences grew. Mobilizing more and more people, from political representatives and social groups to academic organizations, the media and the business sector.

When we hear these terms, my research suggests that it is easy to associate them with playgrounds, parks and colorful schools, but this system should be much more complex. The concept of a child-friendly city actually began with the integration of the Convention on the Rights of the Child into the environment, and its practical application.
UNICEF defines the concept of a child-friendly city as follows:
"A child-friendly city (CFC) is a city, town, community or any system of local governance committed to improving the lives of children within their jurisdiction by realizing their rights as articulated in the UN Convention on the Rights of the Child. In practice, it is a city, town or community in which the voices, needs, priorities and rights of children are an integral part of public policies, programs and decisions." (UNICEF, Child Friendly Cities and Communities Handbook, April 2018)

Changing dialogue
Now we live in a present, where these past interventions; changes of laws and mindsets could create the art of being able to talk about these topics, to be aware of the importance of them. Such as having rights, as the rights of a "misrepresented community", of the children.

The state of art I would like to move a bit more forward in this sphere with my interventions, is to use these rights as educational tools and methods. To help children know how they can communicate their ideas, how they can transform their environment hand in hand with adults, and how they can feel safe and included in their own spaces. Just like Colin Ward, I want to see spaces which not only include children and enable them to playfully move around, but actually help them to learn through imagination and sensing. Spaces which include all of us, enables conversations and reflects on the needs of the youngest ones.

How was the development process of the project?

Embodied participation
When building the participatory processes, tools and methodology; I worked with two local communities and built everything step by step with them, through co-designing sessions. I worked with two local, yet global schools, both in Barcelona, a public and a private one, and started planning the work with a Hungarian public high-school as well. With outstanding educational practitioners, in two very similar projects and spaces alike, in two very different countries with various educational systems. I am more than grateful to these communities, that I could learn from their perspectives. We could build up a system of educational participatory games together, by working, playing and learning together in a playful research and co-creational processes.

My aim is to distribute Crosshabit to local communities, to help them understand what we can achieve by participatory and co-creation methods. I wish to do so through local communities, decision makers and networks, where we can reach out to design students, including these kinds of methods in their studies, while designing for and with their own local communities.

What results did your project accomplish?

Thus far, one of the results of the workshop series embodied an open source, digitally fabricated and tool free participatory game, connecting urban design principles and the state of art of children rights. The game invites people together to reach common goals in topics, such as:

- How important it is for us to have space to play and rest
- How important it is to feel safe in our spaces
- How important it is to learn from our environment

While building together the parts of the game, which are all representatives of children rights, if we can work together in the game, build together and talk to each other, we can build urban artifacts out of them. There are two possibilities of the game, one is a free play where kids and adults can freely build whatever shape they want, but collaboration is a must. And the other challenge is the facilitated side of the game where through following the task, the players can build public furniture as "embodiments" of the above mentioned topics.

The methods and tools are implementations of participatory planning in a building game. The toy aims to bring up emergent topics while making, building and strengthening the playing communities.

IMAGE 2. Co-creational workshop for designing our own environments, Barcelona Montessori School

IMAGE 3. Workshops about the effects of our built environments, Barcelona Montessori School

IMAGE 4. Learning about rights and decision making through building, Ateneo de Fabricación del Parque Tecnológico

reCOVER

3D printed orthosis utilising distributed additive manufacturing

Georgina Török, Dávid Gál & Balázs Rados from reCOVER

Inspiration

reCOVER is a product-based service that uses 3D scanning and 3D printing to create a personalised fixation device (orthosis) suitable for treating bone fractures, bruises, injuries and diseases requiring ligament, tendon, nerve and other immobilisation, realised by distributed manufacturing.
Two years ago, the story started as a typical university design thesis project: trying to solve a real world problem with advanced technologies. The pandemic brought the importance of medical tools to the forefront, so founder Georgina TÖRÖK decided to focus on developing a medical device. There are many pictures of printed casts on the internet, but this technology is not yet available in Hungary. She looked at how to make it easily available - in her country and worldwide. The team is Georgina TÖRÖK (founder and industrial design engineer), Dávid GÁL (industrial design engineer) and Balázs RADOS (mechanical engineer and economist).

Issues with the traditional cast

Orthotics are traditionally made by hand, as these products are highly personalised. Each patient and injury has different needs and anatomy, meaning each device is personalised. 3D scanning and 3D printing, known nowadays but rarely used for creating immobilisation devices, offer several advantages over the widespread use of plaster casts and their negative characteristics. Today's modern medicine is based on personalised treatments, which custom-designed devices can help. The currently used immobilisation procedures, both traditional and plastic casts, have several drawbacks and are outdated in many respects. They are uncomfortable to wear for weeks because of their weight and hygiene reasons, and it also delays the healing of wounds and sutures that occur during fixation.

Today, the lack of specialists is also a major problem in the care system: plaster casting is a specialised profession which unfortunately seems to be disappearing. The number of well-trained and experienced labour is decreasing.

The process

Compared to a conventional workflow, which relies on analogue methods such as casting to capture patient's anatomy and create tooling that can be used to build devices manually, reCOVER uses locally caught 3D scan data with enough geometry information of the injured limb, therefore the patient's physical structure is recorded easily.

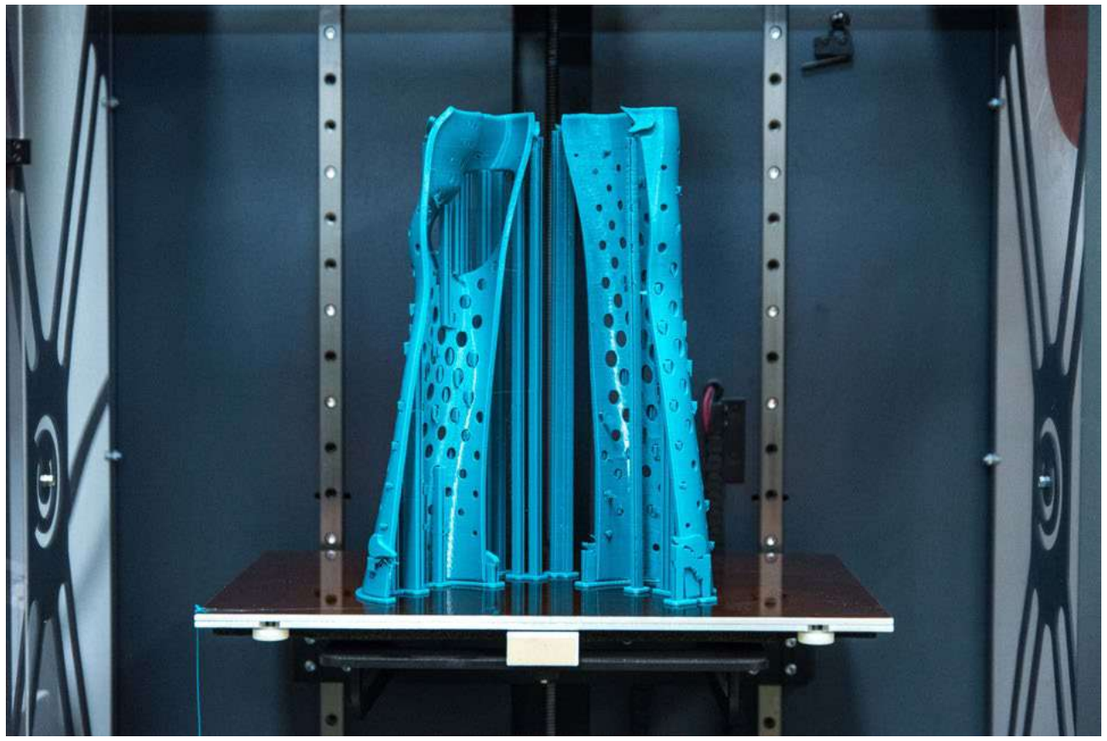

IMAGE 1. The second orthosis prototype, photography by David Pap
IMAGE 2. reCOVER fits, photography by David Pap

The data then transforms a previously created parametric master model into the desired shape automatically, placing the joints and ensuring that the orthosis is not only manufacturable, but also easy to fit. The next step is topological optimisation, a mathematical method (Solid Isotropic Material with Penalization - SIMP) that minimises the weight of a structure and, meanwhile, maximises the stiffness to achieve an extremely lightweight orthosis especially compared to traditional plaster. Waterproof, easy to apply and well-ventilated due to its perforated design, it facilitates medical check-ups and, last but not least, is removable, thus ensuring an early start to rehabilitation.

Originally the orthosis was printed with Fused Filament Fabrication (FFF) from polyester thermoplastic (Polyethylene terephthalate glycol). Still, with the rise of higher-end selective laser sintering (SLS) printers, they now form the basis of production. Once a device has been 3D printed, it is still necessary to do a fit test with the patient. If significant changes are needed, the design can be modified and reprinted.

The aim is to make the recovery period more comfortable and enjoyable for the patients and to provide a modern and medically sound alternative to plaster casts. These features also summarise the value proposition of reCOVER for end-users and physicians.

The process

Distributed manufacturing, bringing the on-demand production closer to the end users rather than shipping the printed pieces, is a viable option for building these devices and a tool for fundamentally shifting how and where these devices can be delivered. Distributed manufacturing uses a network of geographically dispersed manufacturing facilities that are linked. The concept becomes flexible and scalable by creating a reCOVER orthosis closer to the source of need by expanding external 3D printing networks.

Turning to a decentralised production model improves sustainability: reducing carbon footprint while having a fast response and agile supply chain. Only data travels.

Turning to sports

The potential clients include amateur and professional athletes who have an increased benefit in reducing the recovery time from their injuries and rehabilitation processes early. Now reCOVER builds a relationship with sports clubs who are interested in their rapid and effective recovery.

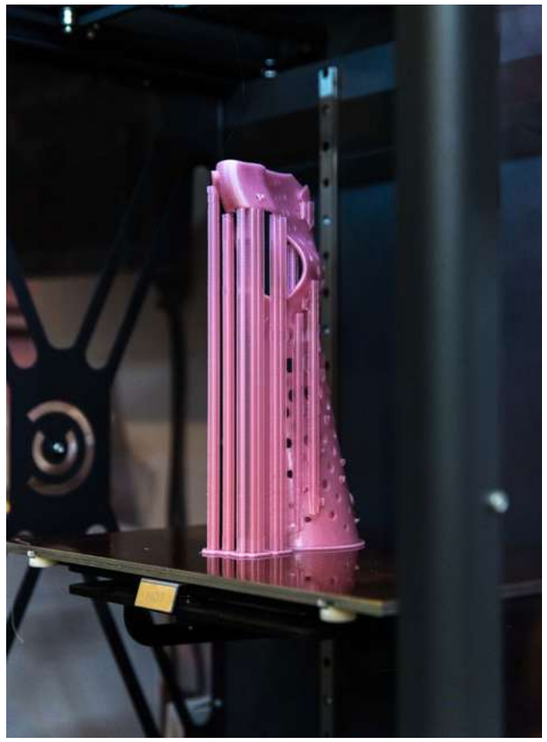

IMAGE 3. The first orthosis prototype, photography by David Pap

Fab Lab Budapest

The development process was done at Fab Lab Budapest, joining the Lab's talent nurturing activities in 2021. The Distributed Design member's B2B leading service is R&D and prototype development for technology and design-driven projects.
"We provide access to our 3D scanning and 3D printing equipment and helped reCOVER in the user test as much as we could with our expertise", claims David, CEO of the LAB.

IMAGE 4. reCOVER team, photography by David Pap

IMAGE 5. User test, photography by David Pap

IMAGE 6. reCOVER, photography by David Pap

IMAGE 7. topological optimised, photography by David Pap

Tech Humanism and the commoning of knowledge

In a tech-defined era, how might we collectively and responsibly manage the commons--the physical (and now digital) spheres and their environmental, economic and social resources? Yes, tech and global connectivity can be used to extract and exploit. But it can also be used to connect and empower us. It can be used to enhance well-being and access life saving tools. And it can be used to facilitate the exchange of knowledge, value and power. In a book filled with examples of using technology and data to design products and processes for reciprocity and agency, we close with a chapter exploring our relationship to the ever expanding commons.

Chapter 05

Embracing openness; Why cede access to design?

The case for opening up design as a means of activism

By Alex Kimber from AKD (Alex Kimber Design)

Designers ought to open up design. This means giving access to knowledge and resources, power in the process and autonomy over the final product. In all three aspects, this will involve designers understanding, using and contributing to the digital commons to some degree, as well as opening up in other ways. But, why ought design practitioners open the design process? After all *we* are the professionals. Come to think of it, what does openness even mean?

Openness could be many things, from the particulars of a copyright licence to simply being a more amicable person. Here, I'd like to frame openness as contributing to and engaging with the digital commons, specifically within my own expertise of product and industrial design. As to the motivation for this sharing, how might designers use openness as activism and why should we?

Fundamentally, design is a plan to make something. Whether talking about "planning" the verb or "a plan" the noun, design is about setting an intention to shape the world around us. We have an almost sacred opportunity here, unlike the beasts we cohabit the earth with, to consciously decide what the future should be and materially alter stuff to make the things we want. Many religions teach it is a holy duty, like Adam and Eve to steward the earth and use up our God-given resources. Whether you buy into this theological reasoning (I'll leave you guessing where I stand), design is nothing short of a political act and certainly has ethical implications. Even if you don't really feel that the innocuous widget you've made is all that Karl Marxy, you have made a string of decisions along the way to determine how the final design should be. This is you enacting your power.

That is why, in the spirit of this book "Driving Design", I want to steer clear of the bottom line argument as much as I can. Not that profit is unimportant, or even problematic in and of itself, but I'd like to keep to the notion of opening up design as a form of activism (Alastair Fuad-Luke, 2013). It is important we are clear about our motivations and bias when making these decisions and engage with the discourse of design, much like how activism wrestles with the discourse of politics. Design is valuable to business, but we're examining the drives and ethics of designing.

Delineating further, I think the case can be made that across different aspects of design we should add to, support and use the digital commons. For the uninitiated, if you imagine how wood in the forests, fish in the sea and the minerals in the earth are common resources for us to extract, then digital commons are similarly practicable resources, widely available and typically found online. That's not to say the commons are to help yourself - just look at illegal logging in the Amazon, deregulated whaling and blood diamonds. The commons, digital or otherwise, is about democratic governance of resources, as well as about open access. It's a management issue as much as an ownership one. Admittedly, the impact exploiting digital commons is less than natural commons, simply because they are near infinitely scalable, but the way we engage with these commons is still social and political.

Tying this together then, since the prerogative of design is political and there is a growing digital commons in the context of product design, then a discursive case needs to be made as to why we ought to contribute to this space and exactly how this will work.

Sharing is caring

The moral obligation to share is complex and will of course relate to your beliefs, perspective and context, but the ethical reasoning for sharing can be illuminated by a few different perspectives: utilitarianism, altruism, mutualism and social justice. Utilitarianism holds that the best action is the one that maximises overall happiness or pleasure. From this perspective, sharing can be seen as moral because it brings benefits to a larger number of people and increases overall happiness. Altruism is a selfless concern for the well-being of others. In this sense, sharing is a moral act because it is motivated by a desire to help others without seeking personal gain. Mutualism mimics symbiosis in nature, with cooperation and mutual support, but has roots in anarchist thinking too. Sharing can be seen in this light as moral because it enables individuals to work together to achieve common goals and support one another's aims. Through a social justice lens, sharing can be seen as moral because it can help to reduce inequalities and create a more equitable distribution of resources.

Whichever view you personally vibe with, there is little doubt there is a moral foundation to sharing resources, which should inform our judgments in both our professional and personal lives. After all, didn't your parents tell you to share your toys with the other kids?

A less altruistic, although perhaps mutualist or utilitarian argument for sharing is in the law of reciprocity. It is in our psychology to feel like we owe it to others who share things with us. It's why free samples are a great marketing strategy. I have already mentioned that I don't want to stress the financial opportunity from open source business models too hard in this article, but the law of reciprocity extends to more than monetary gain. It could be the case that contributing to the digital commons with quality and valuable content encourages others in the community to share with you resources that may aid your specific problems. Open source karma. This is not the strongest argument, nor is it particularly tied to design activism, but it is worth mentioning there are many things we stand to gain from opening up.

'Contributing to the digital commons with quality and valuable content may encourages others in the community to share resources that may aid problem solving.'

Global community

Ok, so it's a nice idea to share stuff, but with everybody? Why the digital commons and not just sharing among my friends? I'd like to parse two things here. Firstly, by reiterating that the meaning of commons is not just a big give away, but about deciding the rights, governance and management of resources collectively, or at least transparently. Reframing the perspective on open source from making your hard work available to others for free, to one where we are publicly negotiating the terms on which the work can be shared, used and copied. This is a fruitful semantic difference to make, if more designers felt secure in exposing their concepts for a greater good.

Secondly, whether we like it or not, we live in a global community. The internet, affordable travel and supranational institutions have made the world a much smaller place and our interconnected systems, from supply chain to banking, have made us ever more interdependent. World wide shocks, such as Covid-19 and the war in Ukraine have highlighted both the fragility of our networks and their spread. Any designer working today

and into the future must see that they design in, with and for a global community. Digital commons is in part about rolling with this change and coming to terms with the abolition of borders when it comes to the free flow of ideas.

In any case, Intellectual Property (IP) protected or not, someone across the world has already copied your idea and started reproducing it the day after your product launch. Plus, they've figured out how to make it cheaper and have ripped off all your marketing content too. The expensive patent you took out won't protect you over there, but with the help of Amazon your keen copycat can sell their knock-off next door. At least by engaging with the commons, you can retain some control over the terms in which your IP is stolen and even remain competitive by rethinking your business model away from exclusivity. This is more about risk mitigation than activism in itself, but I think the IP system could do with a bit of a shake up. It is somewhat defunct and predicated on foundational concepts, frameworks and arguments from before the internet, before mass media and before global supply chains. Perhaps even the existential threat of environmental collapse is exacerbated by capitalistic structures, which is not an insignificant reason to at least re-examine closed IP protection in our interwoven world.

Sustainability

If we care a lot about sustainability and contend that design can be marshalled as a force for sustainable change, then we should be reflective and critical about how we design sustainably. We must accept the concern of ecological, social and economic sustainability is unfathomably complex, and consequently the designed intervention too. So mind-bogglingly complex, in fact, that it would be arrogant to assume any one designer, design team or design centric organisation could offer a wholly original idea and still be viable and holistic. There are those that try, like Bjarke Ingles' plan to literally redesign planet Earth (Fairs, 2021), but I'm not convinced one could gather enough knowledge and insight to centralise such an effort. Even if Ingles is omniscient, there are ethical implications to reserving the decision making power regarding the continuation of all life on earth for a middle-aged white bloke. It is fundamentally important, if we wish to design for sustainability, to contribute to a healthy open source IP system and broad digital commons. Only through collaboration and the sharing of wisdom from various local, regional, national and international perspectives might we build collective knowledge and clear the foggy shroud that masks our path toward sustainability.

'It is fundamentally important, if we wish to design for sustainability, to contribute to a healthy open source IP system and broad digital commons.'

A Framework for Aspects of Design to Open Up

At this point, I want to propose a framework for discussing how we might open up design. A word to the wise: don't take this structure too seriously. The design process is considered by most people who know something about the matter to be ambiguous. So when someone comes at you with an easily digestible, step-by-step, 3 part framework for analysing design, be cautious.

Anyway, here's my easily digestible, step-by-step, 3 part framework to help structure the argumentation. There are three aspects or perspectives of design that in my view could be opened up from the exclusive domain of control of professional designers, particularly with regard to digital commons: Knowledge and resources; Power in the design process and; Autonomy over the product. This is not a model for the design process, a unique theory of design or even an exhaustive list of how open source content can be used in design. It is a means of describing and understanding how design in a broad sense can be made more open, for the purpose of activism, with reference to digital commons.

Knowledge and resources

The know-how, resources and means of production. This includes the tools and techniques to develop the things you need, or even the designs themselves freely available to replicate. This would also include making data, research and education more attainable to better inform others' work, as well as making the local manufacturing capability possible, such as democratising 3D printing. This whole aspect of design and industry self-evidently lends itself to the digital commons, which we can already see from the mass of maker projects and open source thingybobs already available.

Power in the design process

Decision making authority over the designed outcome. This is about giving more folk the mandate to determine what the elements of the design should be. Here, we're going beyond ethnographic research and using people to inform the design process - which should be standard practice anyway - but actually handing over a degree of control in the process. I have chosen the word "in" the design process very carefully, as opposed to "over" the design process, because this encapsulates the role for a professional designer to facilitate the process. Whether you call this approach user-centric design, participatory design or co-design, we're trying to involve people in the process itself.

This perspective less obviously connects with the digital commons, but it does in a few different ways. It could mean a collaborative and communal development process, where the design documentation and relevant data are shared distributively to be worked on by many participants simultaneously. It could be a more restricted development process, but leading to a configuration tool for users to adapt their designs freely, utilising mass customisation, while also making the subsequent plans available to be manufactured locally.

Autonomy over the product

Control, access and a greater degree of ownership over the product and its materials. Opening up the product in this sense is somewhat meant literally, as in being able to disassemble the parts, components and substrates of an object. Design for disassembly, repairability and reassembly is a sound enough idea for eco-design, but it also extends to user autonomy. People should be empowered to exert their agency over their physical things. In my view, there's a User Interface and User Experience (UI/UX) dimension to this, in terms of designing products in a way that makes their construction, and therefore deconstruction, intuitively understandable.

This relates to digital commons by making data and information about the products we own more accessible, such as service documentation. It could also be tied back to the first aspect, of knowledge and resources, by sharing open source designs and know-how that produce more enabling and freeing goods.

Historical Precedence - Knowledge and resources

Examining historical examples of opening up knowledge and resources, as a form of activism, we see a long and rich precedence for doing so, from Martin Luther to the enlightenment, motivated by a cause - sharing information for its own sake.

The Jane Collective (Haberman, 2018) was an underground network of feminist activists who provided illegal abortion services, prior to legalisation. They formed in Chicago in 1969, providing counselling, referrals, and information to women seeking abortions, using an anonymous telephone line. This work can be seen as a form of information activism when such knowledge was difficult to find and often suppressed. Other counter-culture movements

at the same time, like UK pirate radio stations and punk zenes (Nicolov, 2017), can all be seen as precursors to the modern information activism movement.

The project Code of Conscience (Webcore n.d.) is an example of developers banding together, yet collaborating with industry, to use open source code for direct activism. They write code for machinery like logging equipment, to disable it if it enters a protected wildlife area, in effect creating an invisible shield around biodiverse regions. All the cogs of knowledge sharing working in harmony for the purpose of activism.

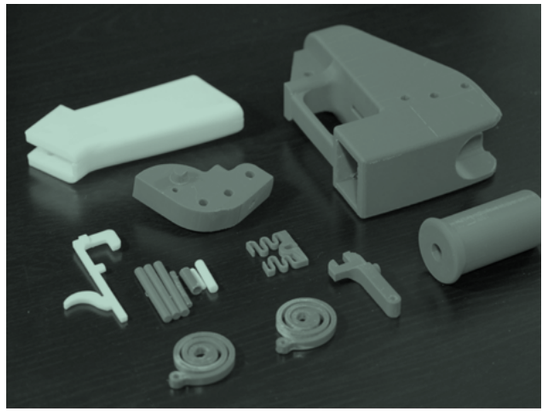

IMAGE 1. Parts of Liberator 3D-printable gun, designed by Defense Distributed and banned in US. https://commons.wikimedia.org/wiki/File:Liberator.3d.gun.vv.02.jpg, Vvzvlad. CC-BY-SA 3.0

A more sinister example of opening up design as a means of activism is the infamous "Liberator". The world's first 3D printed handgun (Shannon, 2014). Cody Wilson and his company Defense Distributed released a pistol design almost exactly a decade ago, with the aim of making gun manufacturing more accessible and supporting the right to bear arms. I have no qualms in categorically stating I despise the creation of this weapon and cannot accept the fundamental arguments behind the US second amendment. (Full disclosure; I have personally been a competitive target shooter as a sportsman, in the UK where guns are strictly regulated and rightly so.) It should be recognised that design activism we may disagree with is design activism nonetheless. The Liberator could even be argued to be a kind of critical design, although I'm sure every design academic would shudder to think so. This goes to show just how discursive design can be. We have an obligation to engage with the space, put forward our arguments and be proactive in designing for good. So when those with extreme views like Wilson use the digital infrastructure of distributed design, which they inevitably will, we must combat this with our own design activism in this space. Much like the internet itself, which can be a cesspit of hatred but when regulated effectively and engaged constructively is greater than the sum of its parts.

Historical Precedence - Power in the process

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Historical Precedence - Power in the process

Opening up the design isn't just making the plans available and asking folk what they want from their things. Most people couldn't care less about the design process. But I think the ideal of opening up extends to the final end product itself; making products more honest, accessible and submissive to users.

Truth in design can be found in Palladio to Brutalism in architecture and Bauhaus thought in design. Ideas like ensuring the materials and manufacturing processes used to make the design are not hidden from the aesthetic of the piece. This honesty serves to make the construction of the design clear to the viewer, as well as the purpose and function.

A great example of an open source method that aids understanding, modularity and interoperability over design and architecture, done in a distributive way, is Open Structures ("OpenStructures" 2007). They have taken the idea of grids in graphic design, and applied it to product design and architecture, so that fixing points and part sizes are modularised, across product categories, leading to an ecosystem of things that are comprehensively and comprehendingly remixable.

A potential future for ceding access to design

IMAGE 2. FOG shower - double tab, by Jonas Görgen, shared on the OpenStructures platform. https://openstructures.net/faq?section_id=open

Seeing that there is a curious moral imperative beyond profit for sharing resources and a rich history of releasing knowledge, involving people in the making of things and designing things to be more affectable, we might identify a model and a future for opening up design, by means of engaging with the digital commons, driven by activism. Following the work of so many others, we can voluntarily, carefully and professionally cede control over design and no longer act as gatekeepers to the means of production. How might this be put into practice?

Conjure before your mind's eye, dear reader, some notional design practice. It could be a freelancer, could be a full blown agency, but in some capacity we are convincing a professional industrial design practice who would in conventional terms be the sentinel of design exclusion to open up. How might they (and by extension ourselves) cede control, give to the commons and take part in their design activism?

Knowledge and resources

Our firm could contribute to the commons simply and directly with open designs that can be easily replicated. Although open design is tried and tested, there's still much more experimentation to be done, especially with sustainable open

design business models. Sharing the technical know-how, expertise and design methods behind open design development would also help our practitioner engage with the discourse and framing of the commons, as well as the content. They might be active in the research, development and application of open standards and self-regulation. As mentioned before, this goes beyond the idea of just sharing but the governance of the terms on which we're sharing. Organisations like the Internet of Production Alliance ("Internet of Production" n.d.) are a rallying point for this kind of work. Lastly, our designer might openly share the datasets they're using in their development, or be transparent about the publicly available datasets that their designs utilise. For example, sharing publicly the anthropometric data used in the form development of a design, along with parametric models so that others can appropriate and adapt the work with their own, contextually more appropriate, data.

Power in the design process

Beyond getting out the post-its, coffee pot and biscuit tin for a jolly focus group, our progressive thinking practitioner could gather a community around a design project and pool the development effort. Platforms like Wikifactory facilitate communal product development, with a branching version control system for open documentation, so that the decision making over the design is tracked but open to members of the community. Sharing best practices and frameworks for participatory design, would allow our opening-up designer to help others with co-design. They could share the source code for an algorithmic design publicly. Now this point does sound like it ought to be categorised under my "Knowledge and Resources" perspective. Two things, 1) no conceptual model is perfect, I warned you earlier and 2) the designed outcome of an algorithmic, perhaps machine learning-based, design is not fixed. The parameters, functions and inputs of the program are determined by the designer. By sharing the source code that generates a 3D design, much like the open source software community, to be edited and used elsewhere, our designer is unknowingly inviting a collaboration to determine the outcomes of many scripts. Similarly, but retaining a greater degree of control, the designer could develop a configurator tool, for users to manipulate an adaptable open design, within fixed parameters. Thus giving others interacting with the commons some say in the customisation of the open source design.

Autonomy over the product

As for the designs themselves, our forward thinking professional would develop as many of their works to be disassemblable and reassemblable as possible, with only the tools available to most folk, as defined by open conventions and standards. A democratic and user-centred design for disassembly. They would support, as thoroughly as possible, a trail of accountability over the materials, components and parts of their designs, by developing and applying ideas like the product passport, such as ("The EU Digital Product Passport" 2023). They might also contribute to and draw from open repositories of design elements, like standardised fastening approaches, so that others can understand and reference the various construction elements. Naturally, our designer would share openly, under a Creative Commons licence, all design documentation, like exploded diagrams and so on, but including in the information clear descriptions of

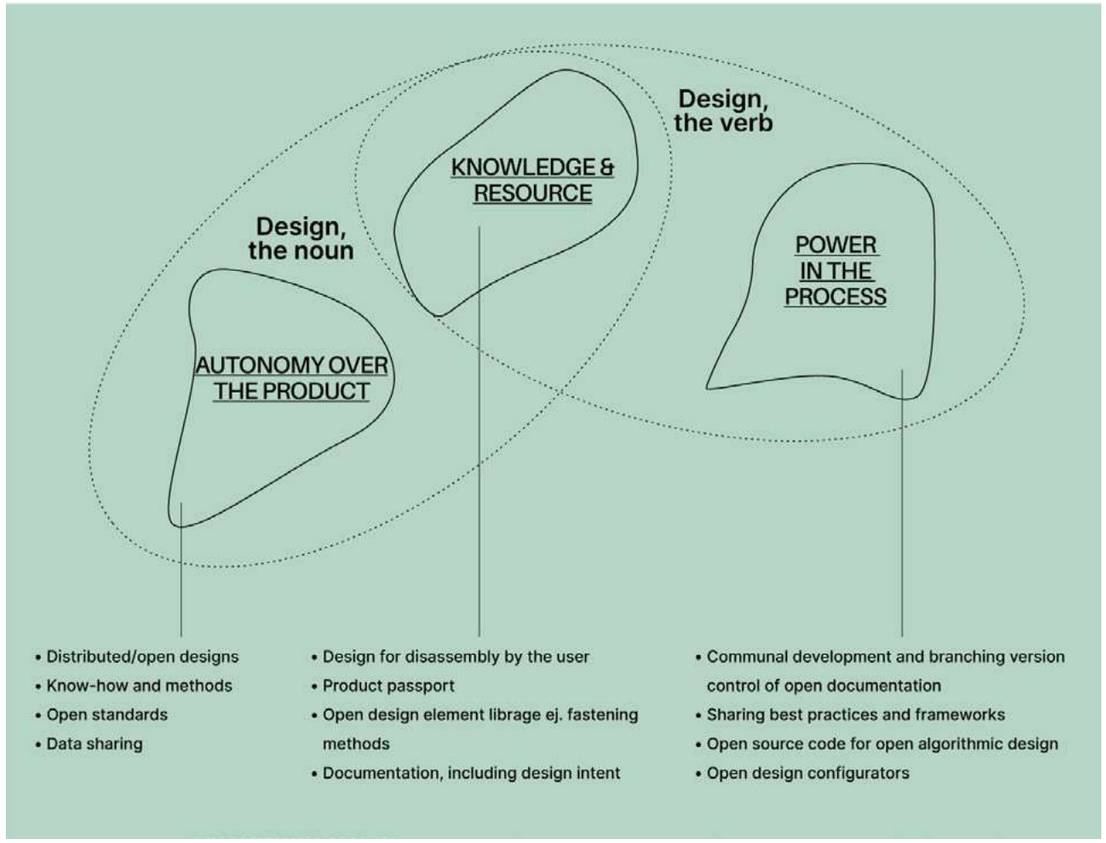

IMAGE 3. Visual diagram of the aspects or perspectives on design that might be opened up, as well as contributions to the digital commons

design intent. This might include specifying in the services documentation the reasoning, trade-offs and even conflicts of interest behind every design choice that informed the final outcome, which could be logged methodically by the designer throughout the development process.

Conclusion

By applying some or all of these approaches, as well as dreaming up some of their own, our hypothetical designer would be opening up design, both in terms of the designs themselves and the act of designing. They could then use this engagement with the digital commons, with their content and discourse, to propagate new futures and drive forward their design activism. This argument is far from complete, in fact I'm sure there are plenty of good reasons for certain kinds of design exclusion. However, it must be beyond reproach that there is some case for sharing, collaborating and relinquishing control over design, beyond the motivation of personal gain but for political ends. I have proposed a few ideas here and sourced a number of historical precedents for these notions, but it is now up to you to consider how and why you ought to open up the way you shape the world around us.

Radical Data

Claiming data as a tool of resistance and liberation

By Jo Kroese & Rayén Jara Mitrovich from Radical Data

IMAGE 1. Radical Data cofounders, Jo and Rayén, on the roof of their studio in Barcelona.

We are Radical Data

Who are Radical Data? At Radical Data, we are claiming data as a tool of resistance and liberation.

We are a collective of mathematicians, technologists, dancers and designers who believe that data, used with care, can move us towards a world that is autonomous, just and joyful. To bring this we design data tools that are infused with queerness and decoloniality, such as our work on Self, Comapping and the Gratitude Machine.

We're also aware of the ways data is used to pursue antagonistic goals such as oppression, homogeneity and flatness. We design things that can obstruct this, such as Dirty Data, or at least map what is happening, such as Security Vision, so we can understand it and later figure out how to obstruct it.

We'll use these five projects (Self, Comapping, the Gratitude Machine, Dirty Data and Security Vision) to show how the values of distributed design – community, interoperability – can power the use of data as a tool for radical changes.

Self: An app to support researching our bodies, with all their messiness

Our project Queering the Quantified Self, applies queer and disability theory to the Quantified Self, a discipline that focuses on measuring the body.

The Quantified Self has historically been pushed by healthy, straight, cis men trying to become more productive. We were interested in using similar techniques to achieve different goals: how can it be used for a trans person medically transitioning? A chronically ill person to get through the day?

To support this, we created Self. Working in collaboration with Odd Studio and funded under the European Union's Horizon 2020 framework, we've been building Self into a full health app. It is the first health app to take seriously the foundations of research: experimentation. This, combined with Self's openness to measuring anything (from our sleep to our toe that itches when it is about to rain), means we can start to understand the weird, beautiful bits unique to each of us.

'As people become closer to their bodies, we think people will not only be happier, healthier and less scared. We think they will also be nicer to others, listening to what their bodies tell them about right and wrong and how to be kind.'

Comapping: Participatory mapping tools for communities

Maps have a history entwined with the history of colonialism (they only got accurate when Europeans were taking other countries' resources as efficiently as possible).
Today, we tend to see our public space through the lens of the monolithic Google Maps, our cities reduced to the places where we can buy a coffee or new shoes.

Comapping is a project to support communities mapping in themselves to tell different stories. So far, we've released three tools (the Comapping Suite) and have run projects in Berlin, Chile and Argentina exploring topics such as gentrification, memory of state crimes during dictatorships and where to find community support during an emergency.

Despite the historic drive of colonialism and capitalism to develop mapping technologies, we see maps as able to rewrite and expand the intimate, communal experiences of where we live. Through workshops, data walks and the creation of our open-source software, the project supports communities to use participatory mapping to share who they are, where they live and what's important to them.

Gratitude Machine: Using AI to decolonise ourselves

The Gratitude Machine is an AI that is learning how to be thankful. You can submit a 'thank you for…' message to train the model and teach it what gratitude looks like. In response, the machine will reply to you with two more thank yous, multiplying your original gratitude.

The machine was born in 2020 to reroute the now-ubiquitous GPT series of AI – then described as the "the world's most dangerous AI" – to be a tool for contemplation, ecological thought, communion and prayer. They were co-created with Milton Almonacid, a Mapuche researcher, and released with backend support from Ricardo Wölker. Their birth was inspired by Mapuche indigenous cosmology and a treatment for depression where the sufferer must repeat the words 'thank you thank you thank you' repeatedly.
The piece premiered at MozFest and lived briefly as a website (server for AIs are expensive), since then we're always happy to bring it out for workshops and exhibitions.

Dirty Data: A Messy Counter to Surveillance Capitalism

Many of the world's richest people make their money by watching us. What they find out (where you go, what you buy, what porn you watch) is used to restrain us, to prove our guilt if ever necessary, and to sell us shoes.

The usual approach to internet privacy is to hide data. A less common and more lo-fi approach is to fill our data with sh*t.
Dirty Data is a simple app that opens a tab and makes thousands of fake searches.

IMAGE 2. A still of Silly Walks Against Surveillance Capitalism, another project interested in the use of bodies and data

Creating fake data makes our individual data hard to understand and sell. The real data gets lost among a pile of realistic looking searches. It also makes big tech's AIs less effective, making everyone's data less valuable. Of course, with cat and mouse games in internet privacy, these rich people could figure out the patterns behind the realistic searches. Our feeling, though, is that they can't be bothered. For all big tech is lauded as super smart, a lot of the time they don't need to be so they aren't.

Security Vision: An interface to the hidden world of AI surveillance

Sometimes a data situation is so complex or secretive that the first approach needs to be to simply understand the situation. This is the case with AIs used in surveillance, where those using them and selling them aren't too keen on that being public knowledge.
As part of a €2 million collaboration with Leiden University, Radical Data have been documenting and visualising the use of AIs in surveillance across the world. The result is an interactive 3D network visualisation that displays the connections between AI projects and the organisations developing and funding them. Through the interface, academics, activists and the public can explore, filter and map the role these systems play in our lives.
Whilst our ethics at Radical Data favours intervention, we see this step of understanding and exposing as a first step to effective active resistance.

What's next

There are many organisations working to criticise the roles data plays in our lives. However, we feel these questions and possibilities are too powerful to only criticise; we must be willing to enter into the messy reality of creating alternatives with what we have. Each of these projects is imperfect in different ways. But we prefer to keep creating.

We are a collective with open doors and open minds for walking the next steps towards radical data. People joining us guide our work in new, unknown directions. If you see yourself being the next to walk through that door, let us know.

The Gratitude Machine. *Info*.

Thank you for the sun. Thank you for the rain. Thank you for the softness. Thank you for the way your hair plays in the light. Thank you for the rain. Thank you for the softness. Thank you for holding me. Thank you for the rain. Thank you for the softness.

Image 3: A screenshot from the Gratitude Machine

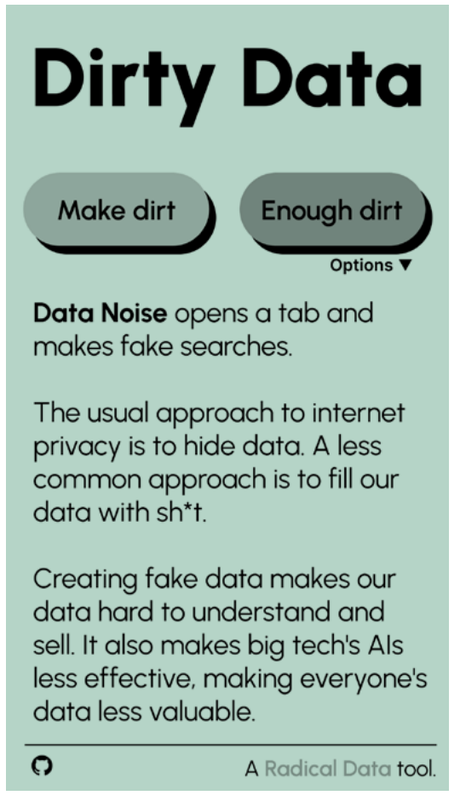

Image 4: A screenshot from the Gratitude Machine

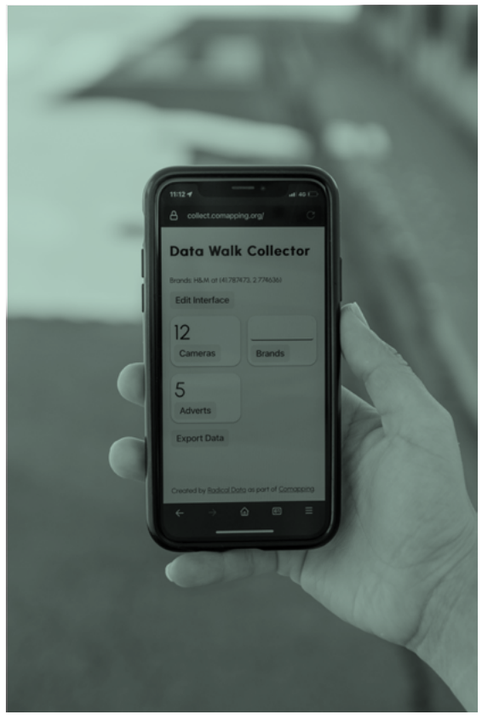

Image 5: A comapping data walk in Berlin, run in partnership with Guerilla Architects

IMAGE 6. A still of Silly Walks Against Surveillance Capitalism, another project interested in the use of bodies and data

Authors

Katerina Troullaki, Kostas Latoufis from Wind Empowerment

Where

Global network

Project type

Association, manufacturer

Wind Empowerment

Association for the development of locally manufactured small wind turbines for sustainable rural electrification

Organisation description

Wind Empowerment (WE) is a global association for the development of locally manufactured small wind turbines (LMSWTs). Inspired by the open designs of small wind expert Hugh Piggott, the appropriate technology movement of the 1970s', the current makers movement, and the values of openness, collaboration and conviviality in technology production, WE aims to support rural electrification through open technologies and the local manufacture of small wind turbines (SWTs). It provides a global platform for knowledge sharing with the overall aim of empowering more people across the globe to be able to harness the power of the wind for self-managing their energy and providing access to sustainable electricity to underserved and marginalised communities.

IMAGE 1. WE members performing maintenance activities in the Vercors Mountains during the 6th International Wind Empowerment conference in France. Photography by Luiz Villa

WE brings together practitioners, researchers and organisations whose activities span from research and development, education and knowledge transfer to the local production and provision of products and services. WE members operate on the basis of openness and collaboration in knowledge and technology production, making WE a global database of distributed knowledge and a place of synergistic knowledge creation on wind energy. Today Wind Empowerment represents 37 member organisations, consisting of wind turbine manufacturers, NGOs, research groups, social enterprises, cooperatives, training centres, as well as hundreds of individual practitioners and researchers across the world.

Context and history

In 2008, Hugh Piggott published a detailed manual on how to build small wind turbines using simple tools and techniques and mostly locally available materials (Piggott, 2008). The open nature of these designs allowed initiatives around the world to modify and complement them to meet different needs, address different challenges and utilise different resources. The need for networking and knowledge sharing between these geographically dispersed initiatives, and the potential for collaborative synergies, gave birth to Wind Empowerment. The association was founded in 2011 at the World Social Forum in Dakar, Senegal by 18 organisations active in the field of locally manufactured small wind systems. In 2016, WE was formally registered as a Charitable Incorporated Organisation in the UK.

WE serves its members as a knowledge sharing platform, as well as by empowering them to perform joint projects and interdisciplinary research around locally manufactured small wind turbines. Six working groups bring members with shared interests together to collaborate and share knowledge. WE uses various digital tools for its members' communication, including discussion forums, news articles, webinars, social media platforms and a Discord channel. WE also organises physical meetings for its members, most importantly a biannual international conference where members discuss their experiences in person, share practical skills and build trust and partnerships. Following events in Senegal, Greece, Argentina, India and an online conference during the pandemic lockdown, the 6th WE conference took place in 2022 in the south of South France.

What is the need it tackles?

In remote, off-grid places, small renewable energy systems can provide a sustainable electricity source for underserved communities. In such places, grid extension is considered impractical and uneconomic, while diesel/petrol generators are not a viable solution for poor communities. These communities use kerosene and biomass for lighting and cooking, resulting in unhealthy and unsafe living conditions.

Rural electrification in developing countries should be considered as a poverty alleviating action, with access to sustainable energy being a key driver to human well-being. By providing an alternative to the use of kerosene and biomass, millions of deaths a year may be avoided. Providing health clinics with electricity, enables the refrigeration of vaccines and improves health provision in the surrounding communities. Access to electricity allows for clean lighting throughout night-time hours, allowing students to continue schoolwork past sunset. Electricity also allows for mobile phone charging, use of television and personal computers in schools and common spaces, and lighting in public spaces, increasing safety.

In the right context, small wind turbines can address the electricity needs of rural communities. The option to manufacture SWTs locally offers a number of additional benefits, such as lower costs, a shorter supply chain for spare parts, local capacity-building for operations and maintenance, and the creation of local employment. The open nature and adaptability of the designs enables marginalised communities with

no other sustainable alternatives to meet fundamental everyday needs. Wind Empowerment aims to act as a catalyst in empowering more people across the globe to be able to harness the power of the wind and provide access to electricity to those that really need it.

What is the global-local relationship of the project?

The development of LMSWTs has followed a cosmolocal production paradigm, bridging a global community engaged with design with local initiatives manufacturing SWTs in distributed contexts. A global community of practitioners and researchers has access to and continues to develop SWT designs and associated equipment. These designs are then manufactured in local contexts by distributed initiatives which utilise local materials and resources. Wind Empowerment is a key intermediary organisation enabling this cosmolocal paradigm: i) by providing a global platform for knowledge sharing and collaboration, ii) by accumulating the experiences of local projects and systematising them to enrich common knowledge, and iii) by providing local initiatives with resources to empower their activities.

What results did your organisation accomplish?

The Wind Empowerment association has brought its member organisations together in six biannual international conferences since 2011 (Senegal, Greece, Argentina, India, Online, France), has organised several regional meetings in Europe on specialised themes, such as open source data logging for SWTs, and has fostered knowledge sharing and collaboration through webinars on more than 15 different topics related to LMSWTs. At the same time WE has initiated a diverse range of projects, with the aim of bringing its members' diverse skills together to solve problems on the ground. Some highlights are a series of collaborative rural electrification projects in Ethiopia, the development of open source data loggers and charge controllers for SWTs, the development of wind water pumping applications for small wind, and the publication of detailed maintenance manuals for LMSWTs based on the field experience of its members. Furthermore, WE has developed a market assessment methodology which systematises the viability of LMSWTs for sustainable rural electrification in different contexts, and has applied this methodology in Ethiopia, Malawi and Nepal, in addition to a global market assessment for small wind. WE has also focused on collecting and systematising its members' experience on 'Delivery Models', which encompass the local adaptation of strategies for addressing barriers and utilising available resources, for the sustainable delivery of LMSWTs to those who need it most.

IMAGE 2. Manufacturing small wind turbines with university students during a workshop in the Semara region of Ethiopia in 2015. Photography by Kostas Latoufis.

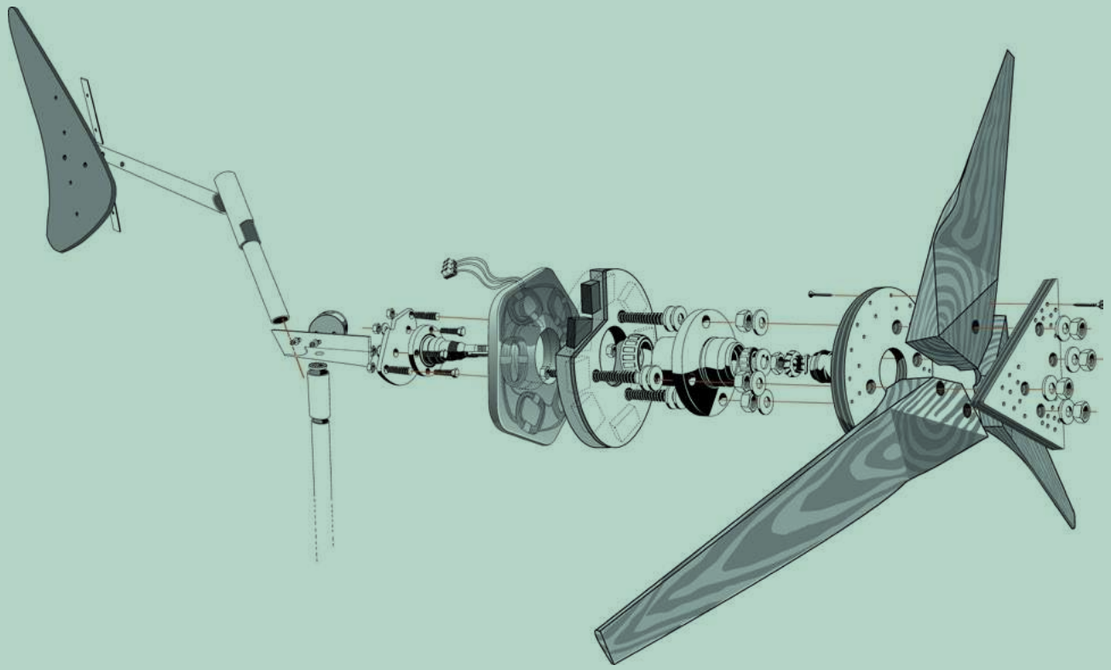

IMAGE 3. Exploded CAD illustrating the components of the smallest small wind turbine described in Piggott 2008. Image courtesy of Roland Beile and Tripalium.

Why is Wind Empowerment distributed design?

Wind Empowerment was founded on the basis that solutions have already been found to many of the problems faced by its members. What has been missing is the connection between the people who have the solution and others who are facing the same problem. WE thus empowers distributed actors to design solutions that are appropriate for their local context, and attempts to accumulate and systematise this distributed knowledge in order to make it openly accessible, strengthen and multiply it.
The technical design of the SWT itself is accessible to anyone who wishes to modify and improve it, and some research groups within the WE community have indeed engaged with this endeavour. However, modifying the SWT design is not practically accessible to all local initiatives, as they may not have the capacity to understand all its technical details. On the other hand, the basic SWT designs used by WE members allows for adaptation in terms of materials and manufacturing practices depending on what is available in diverse local contexts. As a result, various SWT ecosystems have evolved across the globe that differ in the ways, actors and culture for producing, maintaining and embedding SWTs in social life. Besides the design of the technological aspects of a SWT system, local initiatives are engaged with the design of business and social models to deliver the technology to rural communities, i.e. delivery models. The places where LMSWTs are installed are so diverse that these delivery models may only be developed in a distributed way. The design of this social aspect of technology is thus unavoidably distributed. LMSWTs are actually a characteristic example of a technology that cannot flourish in distributed contexts if not locally adapted.

Authors

Gaia Rubino from Polifactory, Politecnico of Milano

Where

Milan, Italy

Project type

Product, process-technique

Repairables

Distributed design for distributed repairing

Organisation description

The Repairables project concerns the design of a repair process-technique that combines distributed design and digital fabrication for the realisation of a system of iconic, configurable, 3D-printable micro-elements called ‘repairers’ - which allow a user to design and realise their own customised repair. Hence, distributed repairing.

Context and history

Making durable and circular products is essential to reduce the consumption rate of raw materials and energy and thus negative environmental impacts. Over the past decade, various communities and citizen movements have brought the importance of repair to the attention of their socio-economic systems.

Repair is considered one of the most effective strategies to extend product life and close material life cycles and has a direct influence on design processes. Repair processes are inextricably linked not only to the things we repair, but also to infrastructure and organisational processes. Repair practices play first and foremost an important role in the mutual interaction between human and technology, a role associated with highly specific knowledge about things, equipment, processes and interventions.

In our contemporary society, the traditional figure of the object repairer is gradually disappearing. At the same time, however, organisations and individuals are emerging who are the bearers of new and renewed repair cultures and practices. But at the same time, not everyone knows or has the skills to repair. ‘Enabling repair for everyone’ captures the meaning of my project. Repairing something is not always seen as an easy, immediate and affordable action. Frequently, people desist from repairing an object due to lack of experience, manual ability, time and money. The idea behind Repairables is to facilitate the temporary repair of many everyday objects by making the repair fast, easy and without requiring any special manual skills, but by stimulating users to design the repair work according to the object to be repaired, the damage to be repaired and taking into account the relationship that exists with the object and respect for the object itself.

What is the need it tackles?

Repairables are open source components designed to be easily customisable, easily and quickly produced by the end user through 3D printing to enable them to repair different types of objects. They are elements designed for temporary and precautionary repair, clearly visible, easy to apply but also easy to remove with the possibility of leaving no trace of its use.

Repairables are:

- Elements inspired by the most common, conventional, popular and iconic repair techniques, to make their function as explicit as possible;
- Elements that do not affect the damaged object, but are designed for temporary and reversible repair, easy to apply but also to remove, they leave no trace of their use but can enable professional repair;
- Elements that can be produced on-site, on-demand through any FDM 3D printer in any Fab Lab, and can also be used by users without specific repair skills or expertise;
- Elements visible in such a way as to make their repair function explicit, in a logic of stimulating circularity.

The aim of the project is to build an initial set and, in the future, an expandable ‘library’ of open source elements that can be used for the temporary repair of objects.

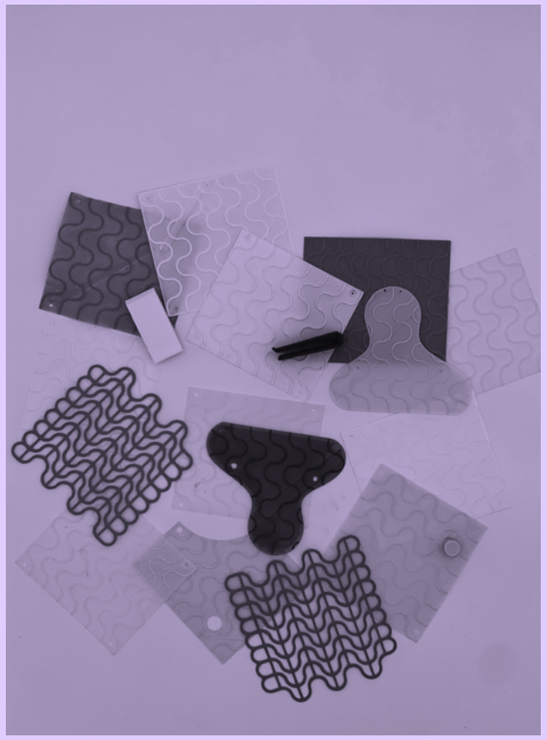

IMAGE 1. Overview of reparaibles. In the picture there are some examples of patches and a clip

Fundamental to the design and development of the Repairables project were two Fab Lab members of the Distributed Design Platform: Polifactory of Politecnico di Milano and Happy Lab in Vienna. The concept was verified and validated through a co-design session organised and conducted with repair and digital fabrication experts from Happy Lab during the Re:pair Festival in Vienna. The design and prototyping of the Repairables took place during the time spent at Polifactory as Talents in Residence. The prototypes designed and prototyped at Polifactory were used in a repairing workshop held in November 2022 at the ConservaMi tool shop in the Giambellino suburb of Milan, together with a group of citizens.

What is the global-local relationship of the project?

The project, as will be explained later, aims to repair broken objects. Everyone has been in the situation of having to repair an object, so it is both local and global in scale. The fundamental concept of Repairables is that through open source and distributed production, it is always possible to have an ad-hoc repair for whoever is in need.

How was the development process of the project?

Repairables constitutes the project part of a Master's thesis entitled 'Repairables - designing open source solution for "distributed repairing"' developed at the School of Design, Politecnico di Milano, in the Master's Degree Course in Integrated Product Design.

The idea behind the Repairables project came about as a result of a preliminary research that, after critically analysing the movements, users who are part of or seek to get in touch with the world of repairing and having listened to and talked to professionals working in this field. As a result of the research carried out and the various interviews conducted, a number of needs and issues emerged regarding the topic of do-it-yourself repair of objects, especially the occasional and temporary repair of non-technological objects, with which relationships are often established that go beyond their mere use.

The basic concept is that humans are driven to repair as a result of the strong and intimate bond they develop with the object they wish to repair. As a consequence, being able to 'generalise' and realise a universal repair technique is improbable. More reasonably, repair can be seen as a design action that can follow a general process, but whose execution then takes place in a specific context on a specific object. Following the paper by Julie Madon: "Free repair against the consumer society: How repair cafés socialise people to a new relationship to objects", (Madon, 2021) it was realised that the repairer-carrier dialogue depends on the repairers themselves. In substance, repair is an action that requires tacit or explicit knowledge.
As a result of this, it can be said that few people actually know how to repair or how to approach repair despite the fact that they want to interface with it. According to Hans Tan (designer, curator of the 'R for Repair' exhibition and professor at the University of Singapore) and the history and tradition of repair, it must be visible and add value to the repaired object, as if to emphasise its own passing as a result of the intervention. The repair trend--following the interview with Happy Lab and also the workshops they will be holding during the Re:pair Festival-- is that of digital fabrication. Even some of the professionals interviewed have bought a 3D printer to make broken parts that are no longer produced or to make components to fix broken machines. The problem for this repair-person is that they do not have the modeling knowledge to be able to realise their projects.

So, a systemisation of all the thoughts from the research and analysis part led me to focus on the design of an expandable set of open source and distributed solutions based on distinctive and configurable elements.

Context and history

The project grew out of my master's thesis at the Politecnico di Milano, School of Design, for the Integrated Product Design course. The project, in its embryonic state, was presented at HappyLab in Vienna, developed at the Polifactory and then tested during a repairing workshop held in November 2022 at the ConservaMi tool shop in the Giambellino suburb of Milan, together with a group of citizens.

IMAGE 2. Repairables, repairing a coat and a cap

IMAGE 3. A picture of the workshop

Why is Repairables distributed design?

Distributed design is collaborative, sustainable/circular, open and ecosystemic. But net of these values at present, there is still a lack of open source object repair solutions that are viable through distributed production models. Considering that repair is in fact one of the four "R's" of the circular economy, it is therefore interesting to explore and verify the existence of a design opportunity space that can unite open and distributed design and repairing by hypothesising on solutions that can stimulate the development of distributed repairing or distributed repairing forms.

The breakage of an object is an event that may occur in a unique and unrepeatable way or circumstance or, on the contrary, it may be common and repeatable to the breakage of many other similar objects owned and used by as many people. Consequently, it is interesting to consider the combination of the general openness of the design process for repair with the customisation requirements of each repair.

By exploring the role of Distributed Design for Repairing, it is therefore possible to define the concept of distributed repairing on which the Repairables project is based. Distributed repairing refers to enabling and inclusive repair practices that are easily accessible to a user who has the desire or need to repair an object without prior knowledge. More specifically, Distributed Repairing and the Repairables project propose a rapid and temporary repair process-technique, at a largely sustainable cost, which uses the principles of distributed design and the advantages of 3D printing to be able to repair the damaged object with time and precision.

Authors

Mitalee Parikh, Daan Sonnemans, Tomas Die & Kate Armstrong

Where

Bali, Indonesia

Project type

Challenge

Fab Island Challenge

A design challenge to inspire the regenerative economy in Bali.

Organisation description

The Fab Island Challenge brought together local and global innovation communities to propose meaningful interventions to enrich, empower and scale emerging realities. For ten days, global networks and the local Bali ecosystem converged to propose and prototype design outputs that address local problems. It was organised during the Bali Fab Fest - a unique event that brought together the 17th annual Fab Lab conference and the Fab City Summit. The Bali Fab Fest was held in Bali, Indonesia, from the 12th to the 22nd of October, 2022. The theme 'Designing Emergent Realities' was aimed at helping accelerate the island's transition toward a more nu regenerative economy.

IMAGE 1. Prakash Labs team visiting local fishermen to explore opportunities to use boats in water sampling efforts

Context and history

Bali's over-developed tourism has been threatening its environment, culture, religion, and economy. This suffering can be characterised by water shortage, environmental degradation, sanitation issues, over-crowded destinations, loss of authenticity, and higher cost of living (Sperling, 2020). With the Covid-19 pandemic lockdown in the country, there was an opportunity to reimagine a model of sustainable tourism. A chance for the international community to leave behind a more positive and sustainable legacy.

What is the need it tackles?

The Bali Fab Fest was a unique event that brought global networks of digital fabrication, green technologies, and digital innovation together with Bali's local innovation ecosystem under the theme 'Designing Emergent Realities' to explore meaningful applications of digital fabrication. The Fab Island Challenge was conceptualised as a unique collaboration format that rallied experts, enthusiasts, global leaders and other practitioners of design, making, digital fabrication, organising and eco-activism from around the world. By curating them into teams that ideated, designed, prototyped and tested solutions collaboratively on some of these most pressing issues around sustainability and life systems, we brought together local and global knowledge to address some of the island's biggest challenges.

Based on the ideas and prototypes created during the Challenge, the local initiatives were presented with a chance to be supported with seed funding to implement the innovation beyond the event. This was an experimental and sustainable approach to address local problems with local resources coupled with global knowledge to make meaningful interventions in the host Island of Bali.

What is the global-local relationship of the project?

The Challenge was conceptualised around the potential of local and global innovation partnerships. In line with the Bali Fab Fest ideology "think global, act local", as well as the traditional Balinese philosophy of "Tri Hita Karana", the final projects were evaluated on these design considerations:

- Local Balance - Human Well-being, Community Development and Environmental Regeneration.
- Global Innovation - Technological Feasibility, Global Scalability and Innovative Methodology.

How was the development process of the project?

People from around the world were invited to work in teams and focus and learn about a specific local initiative on the island of Bali, with the aim of proposing and prototyping design outputs to win seed funding for its implementation. First, on-ground issues were identified by Fab City Foundation by partnering with local Balinese innovation initiatives. The Foundation team visited and worked with many local partners whose potential challenges

worked with many local partners whose potential challenges addressed the most pressing issues around sustainability and life systems in these urgent areas of intervention:

- Waste management
- Water conservation
- Food security
- Regenerative materials
- Sustainable mobility
- New Learning models
- Preserving natural ecosystems
- New systems of value and exchange

After understanding the individual needs from the local partners, an open call was launched for applicants from around the world, aiming for people with various skill sets, working on projects, technologies or organisations relevant to the challenge themes.

The profiles aimed for were:

- Local and global experts: Local and global experts and enthusiasts such as students, academics, professionals and other practitioners of design, making, digital fabrication, green activism and community organisers who bring their skills to the challenge.
- Technologies and methodologies: Existing projects, technologies or methodologies that deal with or might fit into one or more of the challenge areas.
- Networks and organisations: Networks and organisations of practice that add value in the form of specific knowledge, skills or experience, including universities, advocacy movements and communities of practice.

As a result, over 200 individuals, many as a team or an organisation, from more than 30 countries, applied to be part of the Fab Island Challenge. Amongst many other professions, digital makers, design researchers, biologists, fashion designers, entrepreneurs and eco-activists coming from around the world from cities like Semarang (Indonesia) and Barcelona (Spain), all the way to Kumasi (Ghana) and Yucatán (Mexico). Many from the ASEAN region also applied from Malaysia and the Philippines.

Additionally, challenge organisers supported participants to be able to attend the Challenge. Selected participants were eligible to receive a microgrant, as an individual or in a team, to support their travel to Bali. This support came as a Skills Grant for individuals, a Project Grant for groups of 2–3 people, or an Organisation Grant for groups of 4–5 people, ranging from EUR 400 to 4000.

Next, the challenge teams were curated by Fab City Foundation. Through an extensive selection process, participants were shortlisted and curated into teams that matched their interests, profiles, backgrounds, skills, projects or technologies with their preferred challenge themes, while ensuring diversity of creative minds within each team. The aim was to work together by bringing multiple perspectives and experiences to focus holistically on proposing solutions or design outcomes to the challenges.

IMAGE 2. Biomaterial weed mats developed from waste for farming communities by the winning team and local partner Kopernik Photography by Angela Barbour

Before coming to the event in Bali, two virtual introductory sessions were organised. The first was to onboard the participants to the Fab Island Challenge and explain the overall operation. The second was to introduce team members to each other, meet the local initiatives and introduce the challenges.

What results did your project accomplish?

The Fab Island Challenge created a reciprocal impact for both the host country and the global community. The challenge enabled a global collaboration between more than twenty countries. It provided direct value to the local communities in the form of solutions to pressing issues. For the global community, it provided a new perspective on culture, innovation, impact, and collaboration.

For the local initiatives that hosted national and international participants, the Fab Island Challenge has promoted the identification of the stakeholders whose contributions will be transformative in addressing Bali's urgent issues. Three initiatives received a combined USD 12,000 to develop the proposed solutions further. In addition, the Fab City Foundation will further support them through a six-month acceleration program.

Finally, Bali Fab Fest provided a stage for these initiatives to address a global audience. The event activated networks and creative communities in Bali - that are strengthened now more than ever - to develop solutions with the support of the Fab City Global Initiative, through connections with Fab Labs and Fab Cities.

- 200+ villages collecting waste support the development of organic waste conversion through Empowering Sustainability with Plastic Exchange's challenge solution.
- 40+ Students learned about foldscopes and are still propagating the knowledge in their own capacities through the Looking Closer with Prakash Labs challenge.
- 20+ farming families' work made more efficient, less intensive, and enabled to receive higher income through the efforts of the Supporting smallholder farmers with Kopernik challenge.
- 15 plastic recycling businesses are now part of a tight-knit community supporting each other and encouraging more entrepreneurs to join recycling plastic efforts through the Precious Plastic community challenge.
- 04 local waste conversion businesses receive increased monetary support through the Waste to Value Communities with Nusa Sentara challenge.
- 02 amputees empowered with 3D-printed prosthetics and a network activated to continue working toward the goal of making 1000 prosthetics with Printridi and FabCare.
- 01 local crab fishing community will have more agency over their energy consumption and generation as a proof of concept enabled by the efforts of Balon Balon Ijo, the Floating hydrogen pods with Cesar Jung-Harada to scale the solution in other parts of the region.
- Measuring the impact of the 150+ recharge wells and mapping the

- water table will enable better water management of Bali's freshwater table with the ingenious solution by the team of Water for Life with IDEP Foundation.
- New approaches and possibilities opened up in designing joineries with the local craftspeople to aid bamboo constructions through the Making connections with BambooU challenge.

Why is this (your project) distributed design?

Indonesia limits the import of certain goods into the country, underlining its belief in local production. Nevertheless, the Fab Island Challenge brought together global knowledge from over twenty countries with great local minds in a purpose-driven setting. This started conversations about the main problems the Balinese communities are facing today. The acknowledgement of these problems offered a massive energy boost to local initiatives.

Bringing global experts, in a multitude of different fields, broadens the horizon of possibilities for local initiatives. It shows the range of potential solutions to solve their problems. New perspectives result in different approaches to problem-solving. Bali's local initiatives gained access to the methodologies and technologies used by the Fab Island Challenge participants to develop the prototypes. This resulted in the rapid development of solutions that empowered the local hosts in dealing with the pressing issues they faced. The Fab Challenge will be continued in 2023 in Bhutan and again in Bali, led by the Fab City Foundation team who will further develop the program with the vision of further distributing the format in collaboration with local communities across the globe.

IMAGE 3. Winning team for Plastic Exchange showing various solutions they developed to aid community plastic recycling efforts, photography by Plastic Exchange Team

'The Fab Island Challenge was conceptualised as a unique collaboration format that rallied experts, enthusiasts, global leaders and other practitioners of design, making, digital fabrication, organising and eco-activism from around the world. '

Lemna

Distributed food - sensing, monitoring and agritech

Ruben De Haan & Vikrant Mishra - Alumnus of Master in Design for Emergent Futures 2021, from IAAC and Fab lab Barcelona

Lemna is an open-source umbrella initiative that explores agri-tech and ways to grow + monitor your own food. The subject at the core of this study is Lemna minor, which is an aquatic freshwater plant with promising traces of proteins and properties of bioremediation. The project came to life during the Master in Design for Emergent Futures program at the Institute for Advanced Architecture of Catalonia in Barcelona, Spain.

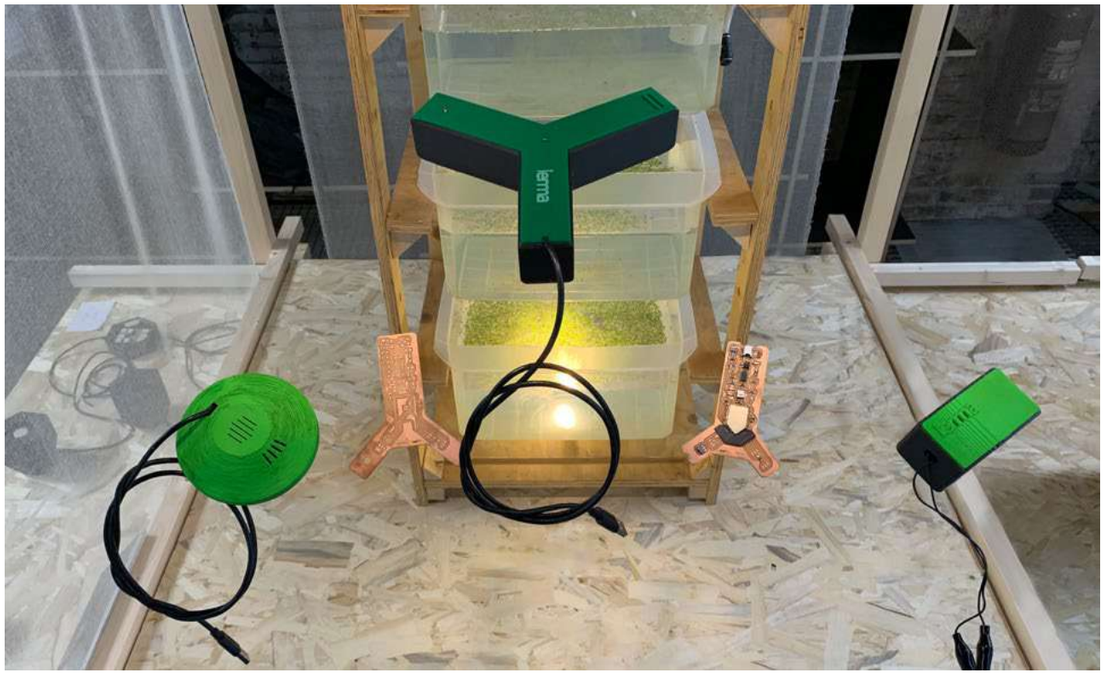

IMAGE 1. Project constituents

Starting from a concise desk research, the project quickly transitioned into a four-month development phase of platform, hardware and context. During this period, ‘Growing, Sensing and Applying’ represented the overarching focus areas. While extending these into tangible practices, certain artefacts were sketched, developed and adjusted to break open previously hidden aspects of the media, kickstart conversation and display new perspectives and possibilities around water lentils in direct proximity of the cultivator, consumer or cultivating consumer.

IMAGE 2. Oracle Gen 1

The project touches upon a series of urgent scenarios like future-food alternatives, rural futures and shared-learning. Since its kick-off, it has resulted in a series of approaches comprising development of a Growth incubator, Oracle - a hybrid medium monitoring device, a growing station, and a series of consumable products. The project is currently on-going, exploring various transitions towards biologically-revitalised futures. Lemna has an open-source Discord channel that helps keep the conversations about transparency and food active.

IMAGE 3. Gen 1 (Internals)

IMAGE 4. Oracle Gen 3 PCB.

Oracle: Generations I and II

Oracle was developed to grow and monitor the health of plants in a healthy and efficient way. The data could help in tweaking the nutrition and strains of proteins grown for consumption at a later stage. The same system could be used by multiple individuals for any plant or medium, be it aquatic plants, terrestrial plants or even compost.

Oracle mini is the second version, being more compact, tactile and efficient. The buoyancy of the device was improved by reducing circuitry, size of the sensors used and redesigning the enclosure. The data from these devices was monitored real-time on a dashboard, processing Musquitto or MQTT protocol between the DigitalOcean server and the ESP32 present inside the Oracle. Future modifications are incorporating a ESP32-WROOM-DA-N16 chip, which provides stable WiFi + Bluetooth connectivity, facilitating Intra-communication across Oracles and cleaner data collection.

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IMAGE 5. Dashboard

the Oracle. Future modifications are incorporating a ESP32-WROOM-DA-N16 chip, which provides stable WiFi + Bluetooth connectivity, facilitating Intra-communication across Oracles and cleaner data collection.

Lemna challenges the current status quo of society in many good and bad ways. It helps filter food that ends up on our plates through variables controlling the 'bought' food like quality control, policies and government-devised regulations. The ideologies around open-data, sustainability and regenerative diets have become prominent and widely spoken only recently. As the climate crisis is peaking, more and more people are becoming part of the conversation + shifting around environmentally low-impact and personally high-impact solutions. Lemna is only a stepping stone, while many other impactful outcomes are still budding through the uncountable bright minds of the world. These agents of instigating change will help in asking all the right provoking questions. Where does my food come from? Who controls it? Would Lemna's solutions promote self-reliance and healthier lifestyles? Is a healthier lifestyle going to contribute to a better economy and society, and to what extent? Does collecting data from plants and nature do any good or only satisfy the human idea of control and security?

What's next for Lemna is the creation of a series of ready-to-consume products. The preparation would follow zero-waste processes derived from various cultures like India and Lebanon. The products will use sustainable manufacturing techniques like lactic and acetic fermentation for a longer shelf-life. The goal of the brand is to make consumers, food experts and health enthusiasts interested in the advantages and values of traditional knowledge systems.

While most spoken heritage continues to get lost in the hyper-consumerist era, Lemna would ensure that it employs individuals and communities that care about the same. All of this is to make sure that our products revive the necessary and come back to the planet. The samplers and tasters for the same were last displayed at the Con-serve pop up at 'Leka' during the MDEFest on 26 and 27 July '22.

Join the movement @lemna_food on Instagram.

IMAGE 6. Brand tags

'A series of urgent scenarios like the future-food alternatives, rural futures and shared-learning'

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CHAPTER 3

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CHAPTER 4

Designing for agency

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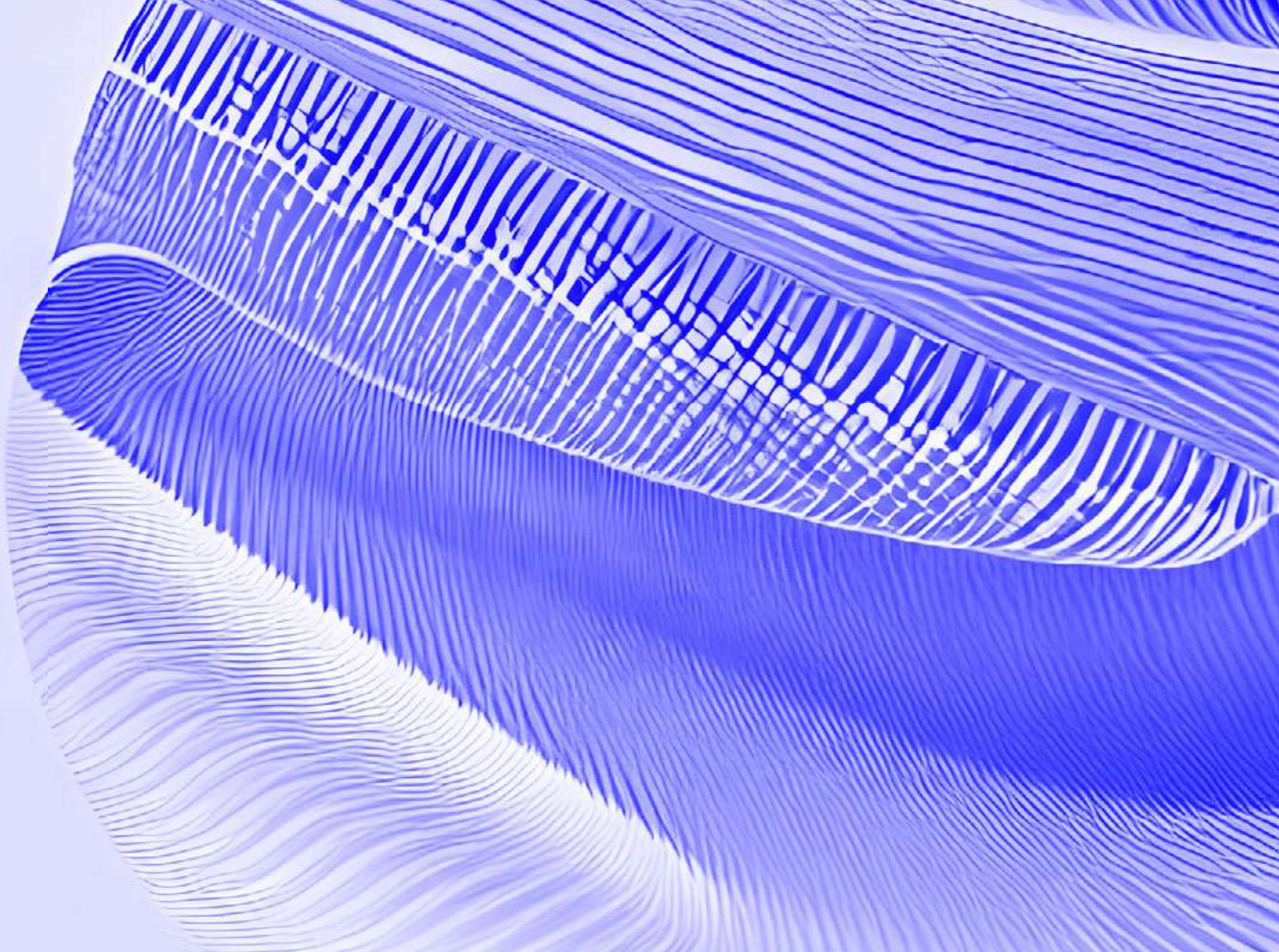

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Driving Design is a non-exhaustive collection of articles, reviews, and profiles that represents and highlights the motivations, opportunities and challenges that drive the practitioners and the field of Distributed Design.

The book curates a collection of works under five umbrella themes, each of which offers the space for the Distributed Design community to share their vision, approaches and areas of exploration to answer who and what are the drivers of Distributed Design.

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