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The seventh Relating Systems Thinking and Design (RSD7) symposium was held at the Politecnico di Torino, the 23-28 October 2018, for the first time in Italy, defining an important collaboration among the institutions that founded the informal group of Systemic Design Research Network (SDRN) in 2012. Not by chance, this symposium has seen the official establishment of the Systemic Design Association (SDA), with a public announcement during the first day. A new phase of the association and of the RSD symposiums started by proposing an inclusive approach to expand the membership and engage different systems- and design-oriented professionals and researchers, while looking after a strong identity of systemic design as a discipline.

The proceedings show the huge amount of contributions we received from all over the world that have inspired more than 200 people in Turin. The aim was to promote international debate on the multiple applications and purposes on which the systems thinking in design is developed towards sustainability. The symposium generated nurturing interdisciplinary collaborations and discussions, involving academics, designers and professionals. “Challenging complexity by Systemic Design towards sustainability” was the leitmotif of all RSD7 starting from the workshops, through the keynotes, the plenaries and the parallel speeches, and closing with the de-conference at Monviso Institute.

Four workshops were organized by international experts, coming from Smart Circular Economy Network, University of Brighton, Ellen Mac Arthur Foundation, Namahn center and ShiftN. Around 100 attendees had a full day workshop in which they investigated the theme of complexity, declined through different areas: IoT, material/immaterial places, Circular Economy and Systemic Design. At the end of the the day, the workshops’ results were shown in a plenary session and discussed all together with a breaking ice kick-off.

From 24th to 26th October, we had the proper symposium with 6 inspiring keynote speakers, 3 plenary sessions, and 76 presentations in the parallels sessions. We evidenced all the contents through abstracts, presentations and working papers, as well as videos and sketch-notes.

The RSD7 keynotes offered an inspiring range of perspectives on systemic design, emerging from different disciplines and experiences from all over the world. They brightly explained how Systemic Design can effectively integrate systems thinking with design to address complexity, by creating new resilient and sustainable systems in very diverse contexts. We decided to interview them and provide to the whole community a short video to have a glance of their contribution.

The plenary speakers were invited to explore special themes of interest for the community: the newborn Systemic Design Association, the pioneering activities run by Ellen Mac Arthur Foundation and the stimulating Systemic Design Toolkit.

The presentations in parallel sessions were dense and reflected the tracks we proposed. Here we have condensed the wide variety of contributions:

- **Policy design and decision-making** (Innovation in territorial governance, Strategies for sustainable innovation, Design thinking for decision-making, Democracy and responsibility);
- **Industrial Processes and Agrifood Systems** (Industrial ecology in a Circular Economy, Sustainable innovation in industrial development, Sustainabili-
ty of agro-industrial systems);
• Socio-technical Systems in the Digital Age (User interaction and enhancement in the age of AI and autonomy, Internet of Things for sustainability, Information technologies in the design domain, Systemic Design for learning from data);
• Territorial Metabolism and flourishing economies (Local resources innovation transitioning to a Circular Economy, Sustainable development of regions and bioregions, City metabolism and urban ecologies, Interdisciplinary models for economy-design, New ways of communicating economic systems)
• Social Care and Health Systems for Sustainable Living (Sustainable innovation for health systems, Patient empowerment and caregiving, Systemic innovation in social care, Social Flourishing & Cultural Sustainability);
• Models and Processes of Systemic Design (Systemic Design theories, Innovation processes in complex systems, Systems and design thinking in education, Historical perspectives on Systemic Design).

The process to select the best presentations was crucial and it required double (and in some case triple or more) reviews, trying to provide a wider spectrum of experiences. In the end, the success rate was 48%. About two third of the presenters have submitted working papers.

The conference was also enriched by the exhibition “Visualizing Complex Systems”. The ability to collect, cross-check, visualize and study quantitative and qualitative information about phenomena and their patterns is itself at the core of the project, becoming strategic for enabling new systems thinking and their design application. Identifying the relationship between components, thus guaranteeing personal expression, horizontal communication and visual thinking, is the first step to enhance a more conscious and transparent decision-making process with a perspective of sustainability.

During the 7th edition of RSD we also experienced some moments of relaxed “learning-and-doing time”, during the "Books and Beers" events and the De Conference Event. In fact, at the end of each day, 3 decompressing "Books and Beers" were hosted in the close venue of Eataly. On that occasion, 5 recently published books were introduced to the audience and discussed in a more informal environment.

After the conventional RSD symposium, for the first time in its history, we proposed a 2-days De-Conference event, to favour networking, deepen conference topics and have a relaxed “learning-and-doing” time in a beautiful natural environment. It took place at MonViso Institute, in the community of Ostana, and it was organised in collaboration with ETH Zürich.

Lastly, I would like to take the chance of this publication to thank the international scientific committee because in the preparation phase they always pushed me towards higher and higher goals. A special thank goes to all the keynote speakers to have been central actors of this conference, sharing their inspiring experiences and knowledge. Finally, I would like to thank the local organizing committee because they supported me in every request and with great confidence in our capacity.

RSD7 and SDA chair

Turin, 29.03.19
The Fibonacci’s sequence (also called “golden ratio”), indicates a sequence such that each number, starting from the third, is the sum of the previous two. The beginning of the sequence is thus:

1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, 1,597, 2,584, 4,181, 6,765, 10,946, 17,711, 28,647 ...

This sequence (present in various natural forms such as in beehives, in the arrangement of leaves on a branch, in sunflower seeds and in the development of the shell spirals) surprises us with its rapid development, which quickly achieves truly considerable numbers. Each number represents itself a quantity, or a specific dimension, which however acquires a different value in the whole of its continuous additive relationships. In the same way, the actions we daily perform seem to concern only us or a limited area of interest. Rather, they are part of a totality of actions that grow on a context, from a little region to the whole world. On that view of mutual relationships, the value of what we do is essential and the approach we have becomes fundamental. If we adopt an individual perspective, people, things and situations will be separated both from each other and from their context, generating acquisitions, strong contrasts, conflicts, speculations and destruction. On the other hand, by achieving a more spontaneous vision of relationships with the others and the surroundings, a new positive system of life and use of resources is obtained, aiming at the common good and not just at the individual.

The Systemic Approach, in fact, is a new way of acting based on two simple guidelines:
- to activate positive relationships between the various subjects (people, activities),
- to manage resources, so that the outputs of a system are the input of another one.

In this way, the totality of relationships and flows of matter in transformation generates a new social, cultural, ethical and productive system. This will create a new economy in which everyone is involved and actively participates. Consider the relationships in a collaborative way connects the single units into a cohesive whole, in which the strength of all becomes the strength of each one. The different components, linked in collective action, perform a single little action that exponentially becomes great.

Luigi Bistagnino

Luigi Bistagnino is an architect and designer, based in Turin, Italy. Founder of the research group on Systemic Design at Politecnico di Torino (POLITO) aimed at developing products and processes in order to obtain zero emissions. He is founder of the Systemic Approach Foundation (www.systemicfoundation.org) and he contributed with numerous essays and articles to many important national and international journals. He designed objects currently in production and won national and international design prizes such as “Il Compasso d’Oro ADI”. Among his main publications: Systemic Design, Slow Food (2011); microMACRO, Edizioni Ambiente (2016).

Systemic Approach generates a new cultural paradigm

KEYWORDS: Systemic Approach, Mutual Relationships, Input - Output

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My intent with the title is to evoke a listening through the double meaning of “salis” implicit in Pliny’s original phrase “addito salis grano.” The word “salis” not only refers salt, it also refers to wit. I am exploring the idea that acting with wit and intelligence means we should not take our models of the world too seriously. Models and frameworks enable us to make sense in the same way that a map helps us navigate, but unlike physical maps where there is a correspondence between land and notation, our conceptual territories are cultural and dynamic, so our maps (models, frameworks) should be used with a grain of salt and we should be willing to adapt them. This adaptive cognitive process is evident in the evolution of ideas related to the adaptive cycle, namely around patterns of the development and disintegration of systems.

I thus follow the evolution of some of the insights associated with the adaptive cycle. Resilient systems arise through an interplay of transformation and persistence in a shifting balance between the internal connections required for the system to be a system, and the external ones that enable it to persist in a context. As systems arise and disintegrate they do so embedded in and interacting with other dynamic systems at other spatial and temporal scales. As they intersect and interact they become a panarchy rather than a hierarchy.

As a second thread I weave in an awareness that we humans are the ones who develop the concepts that I present, (including this one about developing concepts) and that we do this through our recursive and recurrent consensual coordinations of actions and ideas in language and culture. In tracing how we may have developed ever more complex sets of distinctions and how we live these as our various realities, I note that we can easily find ourselves living in a name-based and somewhat rigid sense of reality. Thus our realities may also be seen to exist as adaptive cycles. Further, in any of these realities those regularities of experience that are not named disappear from our thinking and are very difficult to re-evoke or define in language. However, I note that our cognitive abilities are not limited to language, we also exist in an internal panarchy of relationships that resonate with the external panarchy in ways that we may become aware of as we implicitly operate in a panarchic interplay of design cycles.

I conclude the presentation with a deeply held desire. I would like us humans to remain the kind of beings who live in reflexive awareness of our systemic dynamic flow in a relational embeddedness.
The presentation explores approaches and interventions implemented by The Future of Hope Foundation (TFoHF) to engage marginalized members of society, specifically women and girls in Zimbabwe. With limited resources and many heavy responsibilities as well as lack of exposure to innovative initiatives, vulnerable women, girls and orphans in communities are unable to engage in socio-economic development and to reach their full potential. They are in a continuous struggle just to survive. In a country where almost 10% of the population is orphans, 70% of the population lives in extreme poverty and political and economic turmoil are on the rise there is need for innovative interventions to enable these vulnerable groups to sufficiently provide for their primary needs and concerns as this is the foundation to achieve sustainable living.

TFoHF leverages agro-biomass, the most abundant resource in most poor communities, to secure sustainable livelihoods and incomes through their Mushroom based Integrated Food Production System (Mushroom based IFPS). The Mushroom based IFPS addresses many challenges facing vulnerable women and girls. Of special note are issues relating to land ownership, control of own food and income source as well as access to market. By harnessing the power of collaboration, TFoHF is able to mobilize community women as mentors for young girls orphans and community leaders to support community Mushroom based initiatives from initiation stage to market linkages. These collaborations provide the base for building healthy Communities where children, women and all of life, can thrive in peace, freedom and happiness - healthy Communities that nurture and promote good ethics, good education, good health and care for the natural ecosystems. Responsible engagement, accountability and proactivity are modeled and prioritized over self-pity and victimhood.

To date, TFoHF has reached over 2000 people in Zimbabwe and built a model that can be easily replicable across the African continent and beyond. The work carried out over the years does not only serve to mark an end to victimhood through responsibly engaging orphans and vulnerable groups to become change agents and leaders but, it provides basis for research and further improvements of this initiative that has such great potential.
During the past decades the praxis of design has been extended, it has been increasing its areas of focus, from its traditional territories of a problem-solving activity that shapes products, communication and environments, to a broader practice that approaches more complex subjects, such as the social, territorial and organizational issues. In order to address the complexity of these new approaches design is evolving into a new cultures that are very diverse and emergent, these design cultures require a new characterization for its understanding. A way to approach this phenomenon is to observe the areas of focus or the “new” outputs that these practices are producing, certainly some authors have pointed out on these possible two ways to give understanding about them; I propose a third way to approach this issue, focused on its processes, carrying out qualitative and quantitative research methods to give understanding on how these advanced design cultures are generating new kind of design processes.

Some of the keys to give light on the advanced design processes are anticipation, strategies and competencies; advanced design processes are more anticipatory, they have a longer-term look because the design focus is on paradigms changing, they operate in the strategy level, because they switch from the traditional problem-solving approach to an opportunity-finding approach, and by doing this anticipatory, strategic processes they require (and develop) new skill and competencies. These advanced design competencies can be discriminated from the traditional design competencies, by using a learning system perspective we can be able to comprehend how design operates on this extended (or advanced) territories, and how individuals, groups and organization develop knowledge and expertise from its practices.

Making a historical review on the different points of view about design learning, this conference go from the seminal approaches of Schön’s reflection-in-action postulates, passing through the design management approaches form the 90’s, and Nelson’s expertise propositions, or Cross and Leifer design thinking examinations, this conference presents the framework for the competencies and knowledge generation inside the design processes. And by introducing the systems and information theory references presents a series of tools to observe and understand the phenomena of learning situated within the confines of the advanced design cultures.
There’s a gap between the intended outcomes of policies and the lived experiences of people affected by those policies. This gap arises, in part, from differences in the decision-making of policymakers and members of the public. Policymakers are empowered – they control public resources and have a mandate to deliver services. Their professional training and the culture of government tends to be progress-minded, rational, and technocratic. Meanwhile, the public they serve is often disempowered – by class, race, neighborhood, or life circumstance. Even privileged citizens often have limited engagement with government decision-making. Further, members of the public approach policy issues pragmatically, informed by both their cognitive load and their biological experience – both factors that policy is often loath to engage.

I discussed how designers attempt to bridge this gap through interventions in the policy decision-making cycle – from preliminary problem recognition and agenda setting to policy implementation and evaluation – with specific reference to Public Policy Lab’s work with veterans dealing with mental-health issues, with low-income families seeking social services, and with applicants to social/affordable housing.

Next I described shortfalls of current design interventions in policy and service-delivery systems. First, designers often amplify complexity – but complexity burdens the poor, who have fewer resources to spend navigating it. Second, designers seek to reform the state’s engagement with the public, but replicate the state’s extractive posture: we collect peoples’ stories, harvest their life experiences for our gain, even engage them in co-design, where their labor becomes our deliverable. Third, by working inside systems, designers accept status quo inequality. At our best, we engage in meaningful research and design with marginalized peoples. But collaboration does not compensate for systemic racism and poverty.

To conclude, I proposed that designers engaged in policy and systems change design new, adjacent policy systems, rather than to continue to renovate broken policies; recognize the primacy and requirements of the human body, as mechanism through which people engage with and are affected by policy systems; and more consciously identify and address imbalances in power in the systems in which we intercede.
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At the RSD5 symposium in Toronto (2016), Namahn and shiftN presented the first version of their Systemic Design toolkit and assessed its fit to practice in the conference workshop. Since then, the original authors have collaborated with Peter Jones (OCADU) and Alex Ryan (MaRS Discovery District) for continued development of the toolkit towards a mature version, ready for general use.

A panel session was presented at the RSD7 Symposium in Torino to present the release version of the toolkit.

**Why a Systemic Design Toolkit?**

After 7 years of RSD symposia, we believed some concern could arise that the field might be too dominated by academic studio-led methods and projects. We had not seen a movement toward pragmatic practice development, applying the learning from RSD to preferred methods and guidelines. With this collaborative methods toolkit, we wish to offer the Systemic Design community a set of thinking-and-doing instruments.

Changing a system requires the involvement of the actors within the system. We need their knowledge, capabilities and motivation to initiate and foster systemic change. This toolkit establishes a common understanding and language, enabling dialogue among the actors and other stakeholders, including a diverse designer team. It offers methods and hands-on tools for co-analysis of complex challenges, co-design of advanced concepts, and co-creation of systemic solutions.

The methods and tools build upon the research of prominent systems thinkers and design thinkers such as Russell Ackoff, Donella Meadows and Christopher Alexander. The methods in the toolkit are explained by their prominent theories.

The tools have been continuously improved during project work for clients and academic teaching by the authors. Many cases are available from the authors’ work in healthcare, government, and industry to demonstrate the fit of methods to these applications.

**Guidelines and Underlying Principles**

The toolkit was developed with the following principles in mind:

- **Participatory:** “No single profession, group or organization can successfully address today’s societal challenges alone” (Sharon Matthias and Jess McMullin, RSD6). The application of Systemic Design demands the participation of stakeholders across existing social systems boundaries. Unlike other disciplines of design, Systemic Design has no model of the end user or consumer. It only has participants, who may live in different social systems that must be understood.

- **Anticipatory:** All systems change leads us to a design for futures, but we must always ask “whose future?” The worldviews, goals and values of participants in multiple future contexts must be included and represented through foresight-led systemic design methods that enable stakeholders with variety of temporal reasoning capacities to equally contribute to future systems design.

- **Externalising Knowledge:** A common understanding can only truly be
achieved if the underlying thinking process is shared by all. The toolkit makes the underlying theoretical concepts and design decisions explicit. The (Nonaka and Takeuchi) SECI knowledge model (Socialization, Externalization, Combination, Internalization) explains the diffusion of knowledge and uptake of new practices.

Presence Producing: Systemic Design is practiced through engaging activities that produce an intense feeling of “here and now” (Piotr Michura and Stan Ruecker, RSD6). During these activities, the participants challenge and shift the system boundaries towards new forms.

Empowering: The Systemic Design activities aim to help the participants to collectively make sense of the challenge and provide them with plans of action they can carry out in the systems they are ordinarily entangled in. The activities transform them into agents of change in their daily field of action.

Multi-level and Multi-perspective: The design process supported by the toolkit is distinguished by continuous modulation between levels of abstraction by alternately ‘zooming out’ of the system and ‘zooming in’ on the stakeholders

Formative Contexts: The toolkit doesn’t aim to offer a well-defined sequence of methods but rather a grammar that allows the designers to bring the Systemic Design vocabulary (the methods and tools) together in a way that makes sense for a given project. The order of activities depends on the context of application and social dynamics of the moment, a process of designing for formative contexts (Ciborra, 2002).

Open-ended: Consequently, unlike other disciplines of design, Systemic Design is not bound to a specific outcome, be it a product or a service, or the creation of a single solution. Systemic Design aims at identifying, developing and stimulating interventions to change and self-adapt the system on the way.

Panel Proposal

A panel discussion was proposed to accomplish 3 aims: To announce the toolkit as a new resource included in the SDA membership launch, to share the toolkit in an open dialogue about its use and value, and to encourage dialogue about the state of the art of practice.

The panel follow consisted of brief presentations from the authors, who self-moderated an interactive discussion with the audience to engage people in the following questions:

- What makes the toolkit state of the art? What are the relevant criteria in practice to qualify a systemic design toolkit?
- What other toolkits or “methods collections” exist today in the intersection of design and systems thinking? Are these actually state of the art or improved legacies?
- What are the key practice areas in which the toolkit will be of value? Where will we see it deployed earliest?
- How do we intend to enhance and update the toolkit? What feedback from the practice are we looking for?
- Do we even need a toolkit? What are the alternatives to a structured methods collection?
Future Development

As a system of practice, the Systemic Design Toolkit is in its initial stages of development and use and is expected to continue in a dynamic state of constant evolution, incorporating ideas, theories and approaches from other contributors. To that end, the core team represented by the authors agreed to engage in a long-term collaboration aimed at sustainable bringing this body of knowledge to a higher level.

REFERENCES


The Systemic Design Association (SDA) was founded on 23 October 2018 as a not-for-profit association, registered in Norway.

The SDA charter and organization were formulated in the founding meeting at Politecnico Torino 2018, to formalize the creation of a membership society associated with the RSD community. SDA is led by former RSD chairs and scientific committee members, and is established to facilitate the emerging systemic design practice and research community represented in the RSD symposium. The inaugural board members of the Systemic Design Association include:

- Chair: Silvia Barbero (Politecnico Torino)
- Vice-chair: Birger Sevaldson (AHO)
- Secretary: Jenny Darzentas (Aegean)
- Treasurer: Benedicte Wildhagen (DOGA)
- Board member: Peter Jones (OCAD University)

Formerly known as the Systemic Design Research Network, SDRN was a cooperative educational group founded in 2012 with the following aims:

- To advance the practice of systemic design as an integrated discipline of systems thinking and systems-oriented design
- To convene an annual international symposium, Relating Systems Thinking and Design (RSD)
- To advance the knowledge, theory, and publications in the domains of systemic/systems-oriented design and industrial and social systems design methods in systems practices.

History

The SDRN was founded at AHO, Oslo School of Architectural and Design, in partnership with OCAD University, Toronto and was organized by a standing committee of six co-organizers Silvia Barbero, Jodi Forlizzi, Peter Jones, Harold Nelson, Alex Ryan and Birger Sevaldson. In 2016, Politecnico di Torino (with a Systemic Design graduate program founded by Aurelio Peccei) joined the SDRN and hosted RSD7 in 2018.

SDRN is a cooperative association based on both academic and industry relationships, and invites faculty and students worldwide to participate in events and share research. We are a member group of IFSR and host a moderated, open online community. RSD participants are invited to join the online forum, and are welcome to participate with us in future activities: workshops, publishing, symposium events.

As organizers of the Relating Systems Thinking and Design (RSD) symposium, discourses and publications have been developed for the following areas of research:

- Strategic Design and Social Systems
- Systems Oriented Service Design
- Advanced Design Methods and Systems Thinking
- Systems Theory in Design
- Teaching Systemic Design and Systemic Literacy

Systems theory and design developed clear interdisciplinary connections during the era of the Ulm School of Design and Buckminster Fuller’s design science, resulting in the design methods movement (informed by Rittel,
Alexander, JC Jones and Archer). However, in the recent decades this co-evolution has not persisted, as each field has specialized in preferred core disciplinary methods. Practitioners in both systems science and design have attempted to entail the more effective models and techniques from the other field, but usually in piecemeal fashion, and only if a problem was so suited or if supported by clients. Systems thinking has generally considered design thinking a soft complement, or analogous to creative planning. Design schools and consulting practices have developed well-packaged presentations of “systems change” approaches, but these are poorly supported by systems theory, interdisciplinary courses or rigorous systemic methods.

Now we call on advanced design practice to lead programs of strategic scale and higher complexity (e.g., social policy, healthcare, education, urbanization) we have adapted systems thinking methods, creatively pushing the boundaries beyond the popular modes of systems dynamics and soft systems.

Systemic design is distinguished from service or experience design in terms of scale, social complexity and integration – it is concerned with higher order systems that entail multiple subsystems (that might be defined services). By integrating systems thinking and its methods, systemic design brings human-centred design to complex, multi-stakeholder service systems. It adapts from known design competencies – form and process reasoning, social and generative research methods, and sketching and visualization practices – to describe, map, propose and reconfigure complex social systems.

The proceedings of the RSD Symposia have developed since RSD2 as a kind of foundation for the emergence of research (techne and empirical studies) and inquiry (praxis and phronesis) defining the discipline. As scholarship has further evolved through these discourse communities, we have curated and edited a series of journal publications in FORM Akademisk and She Ji (primarily) as well as an edited volume in the Springer Systems Science series. New courses are showing at universities in Europe and the Americas, beyond those represented in the RSD discourse, as the interdiscipline grows in depth and applicability.
Practitioner insights on systemic change from the New Plastics Economy initiative

At the Ellen MacArthur Foundation our mission is to accelerate the transition to a circular economy. Through our systemic initiatives we aim to transform key industries from a take-make-dispose model towards a circular economic one. This keynote aims to share some practitioner insights the Foundation has gained in effecting systems change, especially from its longest standing and most successful initiative to date, the New Plastics Economy initiative.

- **Get the system in the room:** To change the system, it’s important to get the system into the room. For plastics, we set out to gather the world’s leading polymer manufacturers, packaging companies, consumer goods brands, and recyclers, plus governments and NGOs – representatives of the entire system.

- **Lead with a positive vision:** Arguably one reason the circular economy has gained so much momentum is that it lays out a positive vision we can collectively move and innovate towards. We found that it’s crucial to define such a vision because in the early stages of an initiative there no consensus on the target state.

- **Portfolio of solutions:** At beginning of the initiative we had discussions among participants about “the thing” that would allow a breakthrough: A new technology? Government policy? Practical demonstration projects? Company commitments? More evidence? More public awareness? What we have learnt is that a portfolio of well-coordinated, mutually reinforcing interventions is necessary to build momentum across industry, governments, and public.

- **Reject incrementalism:** Given the scale of the challenge and the exponential increase in linear material flows, it became clear that we would have to go beyond incrementalism. In fact, 40 years after the introduction of the recycling symbol, fragmented and incremental efforts only brought us to 10% recycling of plastics on a global level. Hence finding solutions with the potential to scale across the system is essential.

- **Influential nodes:** It’s impossible to move everyone at the same time and important to identify the most influential nodes in the system that can help reach a tipping point. For plastics these were mostly leading brands and retailers who make important decisions on how to package their products, whether to rely on single-use packaging or not, whether to use virgin or recycled materials, etc. With the Global Commitment of 150 international companies, we’ve seen how leading brands have a ripple effect both horizontally (to other brands and retailers) and vertically along the supply chain (e.g. to the packaging manufacturers).

- **Global and local:** A global perspective and alignment is essential to tackle global issues, yet ultimately change often happens at a local level. In the initiative, we aim to represent this by driving action worldwide through the Global Commitment and helping put in place national implementation plans known as Plastics Pacts.

- **Love the problem:** Perhaps most importantly we need to love the problem and be comfortable with what is an often challenging and iterative learning process. Design thinking applied on a systems level (e.g. empathy for stakeholders in the system, prototyping and testing across the system, quick iterations, cross-disciplinary and cross-value chain collaboration) can help us on this journey. We have therefore developed The Circular Design Guide resource as a free online tool to support individuals to start applying design thinking in the context of the circular economy.
1 | POLICY DESIGN AND DECISION-MAKING
The Canada Learning Bond (CLB) Lab is a systemic design project that was born out of behavioural insights (BI) trials. The integration of BI and systemic design continued to characterize this project as it unfolded, making it a compelling case study on the complimentary of these two disciplines in driving public sector change from within. The Innovation Lab in Employment and Social Development Canada (ESDC) is a Government of Canada innovation unit that engages with Canadians, stakeholders, and internal clients to gather new to develop and experiment with new approaches that are responsive to the needs of Canadians. With the CLB Lab, we embarked on a journey to understand the needs of Canadians living with low income to help increase the uptake of the CLB.

About The Canada Learning Bond

The Government of Canada encourages parents to save for children's post-secondary education using Registered Education Savings Plans (RESPs). This includes the CLB, which is available for eligible children from low income families. When a parent goes to a private RESP provider and opens an RESP for their eligible child, the government will deposit money in the account towards the child's post-secondary education (Parkin A., 2016). As of 2015, CLB take-up was 33.1%, with 1.8 million children yet to receive it (ESDC, 2015).

Research Approach

BI letter trials had indicated that simple changes to the messaging around the CLB would have limited impact on program uptake (ESDC Innovation Lab, 2017) and led to the conclusion that a system design approach would be an effective approach to understand the complex dynamics surrounding uptake (Richmond B., 1993). To understand this complex challenge, the Lab adopted a systems-level approach, which enabled us to explore the many individual-level and system-level factors that are entwined with parents’ willingness and ability to save for their children's education. It also enabled us to better understand and consider factors and ideas that traverse program and jurisdictional boundaries. Understanding the challenge required working closely with a broad variety of actors in the system, starting with end-users (Canadian families with low income). The team interviewed people where they felt most comfortable: some welcomed us into their homes where we had conversations over dinner; others met us in community centers and other public spaces. The team met with parents, grandparents, youth, and children, including Canadians living in rural, as well as urban communities, and in First Nations communities. Workshops were held with parents and youth, using innovative techniques to facilitate the conversations surrounding education, decision making, and savings. The team also worked closely with other key actors including various government departments, RESP (i.e. financial advisors, financial institutions and scholarship trusts), not for profit organizations (who promote the program to their clients), teachers, academics, and other subject matter experts. These players were involved at every stage of the process, to leverage system-wide knowledge and insights (Sedlacko M. et al, 2014).

At early stages of research and problem identification, stakeholders were engaged through interviews and workshops to co-develop a systems map. The map centered around three behavioural anchors -motivation, capability, and opportunity- drawing from a behavioural sciences model called ‘The Behavioural Change Wheel’ (Michie S. et al, 2014). This provided a coherent
framework for the systems map and enabled identification of leverage points tied to behavioural outcomes. This phase also included a theory of change analysis to make assumptions embedded within the program explicit (Weiss, C. H., 1995), examine evidence pertaining to these assumptions, and identify contextual variables to focus the design thinking inquiry.

Insights

Exploring the program and its intent from the perspective of the families it was designed to serve revealed useful design insights:

1. Awareness is an issue. Clients need to be better informed about what is available to them.
2. Promoting the CLB requires a multi-sectoral effort.
3. It’s complicated: the messaging, choices, and process can be overwhelming.
4. Parents need to feel safe when investing for their children.
5. Aspiration isn’t enough. The systemic barriers to education are too hard for some families to overcome alone.
6. People aren’t finding their path. This is resulting in lost potential for themselves and Canadian society.
7. The needs of the present compete with the needs of the future.
8. For some, avoiding embarrassment takes precedence over asking for help.
9. Foundation identification is necessary for full participation in society.

These insights helped us uncover opportunities for shifting the approach. This process enabled us to generate a number of innovative solutions, some incremental and some transformative, that can be tested to see whether they could trigger the desired changes in the system.

Implications

By integrating tools and methods from human-centred design, systems thinking, and behavioural insights, the ESDC Innovation Lab championed a holistic approach to understanding the needs of low income Canadians within the Government of Canada. By integrating systemic thinking into our experimentation, ideation, and innovation processes, we nurtured a long-term outlook on the program that adapts to diverse populations over time. The experience of leading a design-based innovation process from within the Government of Canada, in close collaboration with those directly responsible for program delivery, has yielded many lessons in driving change from within. The success of this project and its ability to spark innovation and support meaningful change has been shaped by deliberate attention to
deep collaboration, respectful negotiation and mobilization of leadership. By embedding our internal client on the innovation team we developed a key bridge to implementation of ideas. However, systemic design is ideally suited to identify cross-cutting opportunities, and finding a home for implementation of ideas that do not fit discretely in one home organization requires a more extensive search for champions. Nonetheless, our evolving approach is enabling a sustainable and ethical innovation strategy. In doing so, we see change. It is fostering a cultural change in our organization and has sparked conversation across government on the interplay of how we understand our clients, their needs, and the prioritization of sustainable policy frameworks.

REFERENCES


The paper provides a case study of WEMOBILE’s activities in Pakistan, which uses a qualitative, design led approach to study perspectives and practices of stakeholders from public, private and civil sectors of society to gender transport poverty. Methods include co-design workshops such as world Cafés, dialogic inquiry, (auto) ethnography (video and audio recording of daily experiences), and surveys. The findings are used to generate a holistic understanding of women’s mobility problems, “to synthesize separate findings into a coherent whole” (Gharajedaghi 2011).

By using an empathic approach, the WEMOBILE project will analyze the contextual ecosystem of women’s mobility in Low- and Middle-Income Countries (LMICs) through a systemic design lens to comprehend the structural barriers, systemic architecture of the problem, interconnections and linkages with other elements and factors, and the gaps which hinder the effectiveness of existing solutions. The analysis will lead to designed systemic interventions and improvements in the current solutions for policy designers and decision-makers.

**KEYWORDS**
empathy; co-design; gender sensitive transport; systems thinking; SUMPs (sustainable urban mobility plans); LMICs; WEMOBILE project

**WeMobile- Women’s mobility**

WEMOBILE (funded by AHRC under the Global Network fund) is a collaborative, international project between UK, Pakistan, Malaysia and US which aims to use empathic and participatory design approaches to enable policy designers and other stakeholders to understand women’s mobility problems in LMICs. Women’s mobility has been recognized as a key issue by the United Nations. UN Goals 11 (make cities inclusive, safe, resilient and sustainable) and 5 (achieve gender equality and empower all women and girls) can be framed as complex issues which ‘cannot be adequately comprehended in isolation from the wider system in which they are part’ (Burns, 2017).

Transport poverty (Lucas, et al, 2016) and the associated, multiple levels of deprivation experienced by women is a wicked problem (Rittel and Webber, 1973). These are defined as social or cultural problems difficult or impossible to solve, for example, because of incomplete or contradictory knowledge, the number of people and opinions involved, the large economic burden, and the interconnectedness with other problems. Woodcock (2012) represented the whole journey experience in terms of a user-centred model which recognised the role of external, social and cultural factors effecting user’s interactions with the system. This did not acknowledge the effects of the system on the user. The potential role of designers as catalysts in this space e.g. in framing problems, bringing disparate parties together (e.g. in focus group and co-creation activities) and in envisioning solutions in the transport domain has been recognised (Woodcock, 2016). Crucially, an approach is needed to untangle wicked problems, such as gender transport poverty. The paper argues that systemic design research may provide this.

The global investment in sustainable transport measures in response to pollution, congestion, poor health and depletion of earth’s resources has seen a growth in systemic thinking e.g. by linking transport to health, quality of
life and accessibility (to key services e.g. education, leisure, and employment and health services). Systemic thinking may be evidence in transport planning (e.g. in the development of urban master plans or SUMPs (sustainable urban mobility plans) in Europe. However, the experience of transport users is still difficult to obtain or incorporate into planning processes. The usefulness of Distributed - Social Impact Assessments (or Gender Impact Assessments) may be curtailed by insufficient resources to conduct such an assessment (especially in smaller schemes), lack of suitable research methods, holistic inquiry, or political will. As such user engagement often fails to rise above level of information on Arnstein’s level of participation (1969) and there is a need to understand the systemic landscape and use better methods of user engagement to develop culturally sensitive, local, sustainable mobility solutions.

WEMOBILE aims to capture and (re)present the problems women in LMICs face in their everyday travel (e.g. from street harassment, to cultural taboos which forbid use of certain forms of transport, to the design and operation of poorly integrated transport services). Whilst all sectors of society may face such problems, the burden of women is disproportionately higher as they earn less and take on multiple roles (e.g. wage earner, housekeeper and care giver). Mobility issues in LMICs are wicked problems, systemically linked to many socio-political and cultural problems. It is not just about taking longer and more inconvenient ways to make a journey or being denied the ability to make that journey it is the wider implications of this e.g. stress of managing unintegrated journeys, ill health caused by exposure to high levels of pollution whilst walking, injuries sustained while riding side-saddle on motorbikes or by trapped clothing on vehicles. These are systemic issues. The Centre of Economic Research Pakistan survey found that nearly 30% of respondents considered it “extremely unsafe” for women to walk in their neighborhood, and around 70% of male respondents discouraged “female family members from taking public wagon services” (Sajjad et al., 2017). The gender gap in policy designers and transport service providers means that women transport users in LMICs not only do not have a voice, but that there is an urgent need to find new ways of presenting their problems to increase not only gender sensitive transport planning but also to provide methods and information for more human-centered approached to the development of sustainable transport systems.

Pakistan’s Demographics and Safety conditions

According to United Nations, “sixty per cent of the global population lives in Asia (4.4 billion)” (Population, n.d.). The 6th Population Housing Census of Pakistan (Provisional summary, 2017) shows the total population of Pakistan to be 207.7 million, with 106 million (51%) men, 101 million (49%) women, and 10,418 transgender persons. For Punjab (province) there are approximately 1 million more men than women. Lahore, where this study takes place, is the second most populous city with 11.1 million population (Provisional summary, 2017).

“In Punjab, the female Labour Force Participation Rate (LFPR) in 2014-15 was 27.8% as compared to the male LFPR of 69.4%. According to UN Data (Adult literacy rate, n.d.) literacy rate of female aged 15 years and older in 2005 was 35.4% while men age 15+ were at 64.1%. Men have a higher literacy rate and higher participation in the Labour Force.

According to Punjab Gender Parity Report 2018 (Punjab gender, 2018), the total number of vehicles owned were 1,649,044 vehicles in 2017, out of which “1% of vehicles were owned by women and 99% were owned by men.” The licences situation seems to be bleak as well. “While 5.2% of licences were issued to women, only 1% of women had a vehicle registered in their name” (Punjab gender, 2018). These figures clearly show a gender gap in terms of employment across all sectors and in transport (as measured by car ownership. In order to develop a more nuanced understanding of barriers to women’s mobility the WEMOBILE team used interviews and design approaches to understand and characterise women’s journeys.
Our analysis develops an understanding of mobility systems and structures using the '10 stages of women,' which divides women into ten age groups. For each age group, the factors of mobility, barriers, primary occupations, and roles differ. Figure 1, below shows stages with their primary occupations and social expectations.

In the dependent phases at the beginning of life, journeys are made to school/universities/offices, meet friends and family, attend events and gatherings, and for shopping. Modes of transportation used are:

- Public transportation: buses primarily
- Rideshare: Careem and Uber
- Private-personal transportation: Personal/Parent’s/Guardian’s cars or motorbikes
- Private-public transportation: Rikshaw, Chingchi, Taxi

Mobility barriers include:

- High dependency on others which limits freedom and independence and thus their exposure and growth. Same aged males have a fair amount of independence to walk to destinations, socialize with friends on the streets or play outside the house.
- Exposure to unsafe modes of transportation: harassment, rape, discomfort, kidnapping and human trafficking, murder
- Unable to walk or bicycle on the streets due to cultural and societal norms.
• Cultural norms which restrict women from leaving the house or from working
• Start of the influence of the dual role of women in terms of earners and domestic workers. No matter what kind of work they do, they are expected to fulfill all responsibilities of the house.

Figure 2 shows the characteristics of the self-sustaining phase in terms of transportation options, barriers, and leverage points. The transportation options for women in different stages and the barriers, fears, and limitations they face is summarised in Figure 3.

Although the government supports projects such as safe cities, metro bus services, women on wheels and others, their role is fairly limited. The biggest gap in these interventions is the disconnect with other gender related issues and efforts associated with mobility e.g. bus services are improved but harassment issues are not addressed. Moreover, there are disconnects in the interventions by the three sectors i.e. private, public, and government due to lack of collaborations and discrediting each others work instead of building upon them. Figure 4 illustrates this.
Conclusion

To conclude, the system largely lacks a gender sensitive and user-centered approach, data, and holistic strategies which connecting solutions to the resolution of issues across the domain. System archetypes such as "shifting the burden", "fixes that fail", and "limits to success" (Braun, 2002) exist causing ideas and plans to fail in achieving the desired impact. To address a systemic design research approach can enable sectors to collaborate to form holistic strategies and implementation plans, dividing responsibilities and financial burdens. Stakeholders will have to be involved at every stage, empowering them to participate with not only suggestions but also actions.

REFERENCES


Urban policies and urban planning progressively acknowledged food as a fundamental issue of the urban system and as a tool for design synergies. Among other cities, Turin is moving toward an urban food strategy, gathering in an integrated perspective many practices and policies from local authorities, market actors and food movements. Universities (University of Turin, Politecnico of Turin, University of Gastronomic Science) play various role in this perspective, both in promoting and supporting policies and practices, both producing, collecting (among the different food actors at the local level) and sharing knowledge about how the actual urban food system that nourish Turin works. That is necessary background to go further in defining goals and targets for a food policy at the local-metropolitan level.

The Atlas of Food of Metropolitan Turin (Atlante del Cibo di Torino Metropolitan) is a project developed by three universities: University of Turin, University of Gastronomic Science, and Polytechnic of Turin. It is an original, trans-disciplinary, ambitious research project, collecting and producing different kinds of materials (texts, visuals, maps), from various sources (academic research, mass media, etc.). All the knowledge produced and collected by the Atlas of Food is used to analyse and represent the Metropolitan Turin food system, in order to support public policies and private initiatives.

The core of the project is the development of a methodology of analysis of urban food systems based on the realization of a multimedia, interactive, participated Atlas of Food, centred on the metropolitan city of Turin. The Atlas of food collects and organizes information and data about the food system at the metropolitan scale (the former province of Turin). The online web platform of the Atlas (www.atlantedelcibo.it) presents the collected and newly produced, in the form of maps, and visual and textual materials, searchable and partially editable by the web community and by the actors of the food system. Data are participatory regularly updated, basing the methodologies of civic participatory mapping of First Life, the civic map-based social network used for the participatory mapping activities of the Atlas of Food. Scales of the analysis and of the representation of the food system vary according to the treated issues, coherently with the transcalarity of food flows and networks. This flexible spatial approach helps in understanding the complexity of the food system and the connections between
its multiple parts in and around the urban milieu (according to the systemic approach).

**General goal and specific objectives**

The general goal of the project is to develop and implement an interdisciplinary methodology of food system analysis and assessment, at the metropolitan scale, through traditional charts and maps, participatory mapping and a strict relationship with social networks, for field action. The Atlas of Food of Turin, has the following specific aims:

- to provide an open access tool, collecting and representing data, information and ideas about the food system at the city-region scale;
- to support the public-private network which is working at the establishment of a food commission, through analysis of the food system, development of scenarios and suggestions for the food strategies, design solutions aiming at the enhancement of sustainability, equity, participation and resilience of the food system;
- to increase the awareness of the actors of the food web about food, fostering the visibility and sharing of the issues linked to the different phases of the food chain;
- to provide a platform where the stronger and weaker actors of the food chain can virtually meet, reciprocally know, share ideas, creating an opinion making critical mass able to address food policies;
- to monitor the food system regularly with a participatory approach, reporting changes, trends, opportunities and threats.

**Expected results and spill-overs on the metropolitan food system**

The Atlas of Food can support the development of a resilient urban (food) system, because it stimulates the creation of a consistent database and repository of information about it.

The research group carries out this work in strict collaboration with public authorities and agencies, other research bodies, private businesses, NGOs and other community groups. This variety of public and private actors helps to guarantee the reliability, the transparency and the regular update of the information presented by the website. The participatory approach concerns not only the data collection, but also the elaboration of development and policy scenarios, towards the planning of an efficient, resilient, fair and sustainable metropolitan food system, where food and its connections a role of social, economic and cultural capital.

**Progress of the research**

The first Report on the state of the Metropolitan Turin Food System, produced within the framework of the Atlas of Food, was presented in May 2017. It is divided into three main sections: a) a review of already existing maps and representations about the food system (a map of maps), which are critically reviewed and organized, in order to produce a catalogue of the different existing representations; b) a collection of static maps, specifically produced for the atlas, representing data about the food system coming both from official archives (e.g. census) and from users and actors of the food system. The static maps will be open to updates and corrections, following the suggestions of users; c) a platform for users-generated, dynamic, interactive maps, based on crowd mapping and the integration with social networks. It provides a first cross-cutting and integrated reading of the main features of the metropolitan food system.

For the RSD7 conference, the goal of the research is to represent the evolution of the food system in Turin at the metropolitan scale, especially in the perspective in which the systemic approach could help to design a new economic model: a Circular Economy perspective that has the aim to define better the role of the food for the Circular Cities.
Planning activity from the Atlas of Food data collection: RePopp

By overlapping the analysis of the recovery system and redistribution of food surpluses for social purposes with the production of food waste from different forms of distribution (Large Organised Distribution, neighbourho-od stores, markets, farmers’ market and GAS), the Atlas of Food pointed out a potential leeway of intervention for new ways of value creation and optimisation.

Once identified the critical hotspot and source of leakages in city district markets, the attention has been focused on the market of Porta Palazzo, the largest outdoor European market. Here the City of Turin, two companies Novamont and Amiat/Iren Group, Association Eco delle Città, with the scientific coordination of the University of Gastronomic Sciences has developed the project RePopp - Porta Palazzo Organic Project. By applying the Circular Economy principles to the fruit and vegetable market and with the involvement of the “Sentinelle dei rifiuti” (Waste’s sentries) and the “Ecomori” (asylum seekers volunteers), food surpluses are every day (from Monday to Saturday) recovered from the market stalls, stocked in a stall granted free of charge by the municipality and redistributed by filling and redistributing fruit and vegetables crates, in order to satisfy the demand of a family of 3 persons for two days, considering the quantitative and the nutritional needs. Along with the recovery and redistribution of food surpluses, RePopp works to increase awareness and education to differentiate properly the organic waste with a widespread campaign of communication, to provide civic and environmental information for asylum seekers, to create activity of entertainment about food waste and integration. The project also aimed at encouraging a good integration of asylum seekers thanks to the daily and direct relationship with market operators and the creation of a network in solidarity with the beneficiaries of food surpluses. Since the beginning of 2018, 50,170 kg of food have been collected.

In 2018, the project obtained a special mention from the international prize Milan Pact Awards, created to supports new urban food systems and stimulate the exchange of practices and learning between signatory cities within the frame of the Milan Urban Food Policy Pact (MUFPP); RePopp won the “food waste” section as example of “Circular Markets, an efficient waste collection system for the largest and most culturally diverse food market in the city and the largest open air market in Europe. The project highlights the relevance of data collection from different sources and food areas to design new solutions and alternatives.
It is not common to think of democratic regimes as designed objects. The connection between design activity and the stuff people consume is more obvious than the connection between design activity and the system through which a people governs itself. However, it is also clear that implementing the transition towards sustainability is both a matter of material production and political will. Recently Ezio Manzini identified the connection between design, democracy and sustainability when he argued that since democracy is a resilient system it is the only regime in which we can imagine a sustainable future society (Manzini, E., 2017).

This paper reports on a systemic design project that investigates the network of influence between New Zealand’s democratic system and its transition to sustainability. New Zealand is a sovereign state that includes a territory in the Southwest Pacific Ocean, a nation of 4.9 million people, and a system of government that is a parliamentary constitutional monarchy. By most international standards, New Zealand appears to be stable, well governed, and committed to a climate resilient future. If New Zealand cannot make sustainability work, then the chance of larger industrialised countries making it is even slimmer. Examining the lessons yielded from the analysis of New Zealand’s situation outlines some of the challenges of sustainability more generally.

This paper takes a constitutional realist theoretical perspective to identify the entities that influence how public power is exercised in New Zealand (Palmer, M., 2006). Constitutional realists attempt to understand the whole system by examining not only the texts that codify constitutional laws but also the structures, principles, conventions and even culture that form the ways in which public power is exercised. Constitutional realism and systemic design share the commitment to analysing the whole system in context and the aim of synthesising information across disciplines and scales (Ryan, A., 2014).

New Zealand presents the image of a ‘clean and green’ environment, but it is debatable how accurately this image depicts reality. For example, rapid intensification of agriculture has caused nitrogen pollution of many of New Zealand’s rivers and lakes. Similarly, New Zealand presents the image of a progressive Western democracy, but in reality New Zealand’s political system is rather peculiar. New Zealand does not have a written, codified constitution that sets out the basic rules and values under which New Zealand governs itself (Palmer, G. & Butler, A., 2018). New Zealand is one of only three countries in the world that has an ‘unwritten’ constitution; the other two countries being Israel and the United Kingdom. Much of the New Zealand constitution is in the form of unwritten conventions and norms. Consequently, New Zealand’s constitutional arrangements are flexible and constantly evolving.

Scholars might see this incremental approach to constitutional design as a strength; after all, they could argue that an unwritten constitution is an ‘agile’ system that can more easily be adapted to the changing needs of the society. Similar arguments are found in design research regarding sociotechnical system design, for example Don Norman and JP Stappers have argued that incrementalism is the best approach for dealing with complex problems such as sustainability (Norman, D. A., & Stappers, P. J., 2015).

An unwritten constitution was fine when New Zealand was a smaller country and we agreed on many things. But the New Zealand of today is larger and more diverse than it was 50 years ago. Back then, elections provided adequate security against misrule and there was less need for further checks and balances on public power. Now New Zealand faces big disruptive policy changes, such as the transition towards sustainability, that require a framework of government that can meet the ‘needs of the present without Constitutional Realism and Sustainability: Lessons Learned From a Systemic Design Investigation of New Zealand’s Democratic System

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Constitutional design; Policy design; Democracy; Transition design; Visualisation.
compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development, 1987). Therefore, the key question that this project seeks to answer is, What constitutional system can balance short-term incrementalism with the long-term commitment to sustainability?

New Zealand is not immune to international political trends, such as Brexit and Trumpism, that are changing how democracies function. The New Zealand style of government is already authoritarian and the trace of colonialism remains in its constitutional structures. New Zealander’s rights and freedoms could wither away without greater controls and oversight on government power. We need a constitutional system that is resilient to the shocks and emergencies that we already know about and those that we cannot foresee. In this paper I argue that New Zealand has reached a point in time where it needs a codified constitution that is easy to access and use. We need to be able to increase understanding about how our government actually works and what are the rights and freedoms of individuals in our democracy. Furthermore, these rights should include environmental rights that secure ecologically sustainable development and protect the environment for present and future generations.

My arguments for constitutional change draw on the outputs of a GIGA-mapping project that aims to visualise New Zealand’s ‘unwritten’ constitutional system. GIGA-mapping is a systemic design technique that maps a system visually to reveal relationships and issues that may be difficult to see when the subject matter is explained in words or numbers alone (Sevaldson, B., 2011). The project draws on research that identified 80 constitutional elements found in various New Zealand government acts, laws, treaties, conventions and instruments (Palmer, Matthew S. R., 2006). The GIGA-map then situates these constitutional elements within the broader context of New Zealand’s sociotechnical system. The map visualises the entities that have significant impact on the system but are not considered as formal parts of the constitution, for example pressure groups, media and political parties. This approach enables the resilience of the system to be judged as a whole. Visualising New Zealand’s ‘unwritten’ constitutional system within its broader sociotechnical context will help to secure understanding of the interdependencies between political power and sustainability. With this understanding New Zealander’s can implement a programme of democratic renewal and policy design for sustainability.

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Canadian and provincial governments have had science, technology and innovation policies since 1968 (Doern et al, 2016), but with mixed results in spurring business innovation and commercialization (Jenkins et al, 2011). Furthermore, Canada’s strengths in the primary and resource sectors, and the non-metropolitan regions that host them, have been overlooked by innovation policy in favour of sectors usually associated with urban centres (e.g. ICT, biotechnology) (ibid). Non-metro regions represent one third of Canada’s population and employment, and over one third of GDP (FCM, 2016). Non-metro regions face challenges in terms of demographic change and decline, price fluctuations on primary goods, and declines in manufacturing and agricultural employment (CRRF, 2015). Such regions would benefit from tailored innovation strategies to update existing sectors and create new economic niches, countering outmigration and the view that rural areas are now more places of consumption rather than production, and to expand production beyond single-commodities (OECD, 2007). This paper will propose the theoretical basis and justification for a framework to design innovation strategies for non-metro communities. The framework will aim to deal with the social and environmental challenges these communities are facing, as well as rejuvenate/diversify their local economies.

Non-Metro Regions: Europe and Canada

In both the EU and Canada, and in contrast to urban regions, non-metropolitan regions face a series of limitations that make it more difficult to have the type of economic growth associated with innovation and technology sectors, and which make the regenation of traditional industries different. They do not have the agglomeration of services and activities that enhance economies of scale, nor is there proximity between a larger number of actors to facilitate knowledge exchange (Ashton et al, 2016; Culver et al, 2015; Doloreaux and Dionne, 2008; Hall et al, 2014; Naldi et al, 2015). Lower levels of capital and fewer experienced entrepreneurs exist in non-metro regions, while these same regions can be buffeted by global market forces due to the prominence of primary/resource sectors (Doloreaux and Shearmur, 2006). Furthermore, while the literature generally portrays research intensive Post-secondary institutions (PSIs) as important catalysts of innovation (Doutriaux, 2003; Wolfe, 2005), non-metropolitan regions in Canada tend not to have the most research intensive PSIs in their community (i.e. U15). Where PSI institutions do conduct R&D, they must balance between conducting research with interests from outside the local community for reputational gain with providing knowledge for a community that may have lower levels of absorptive capacity/abilities to use the research produced (Cohen and Levinthal, 1990; Kempton, 2015). What non-metropolitan regions require, and would lead to smart innovation policies, is a localized evolutionary and co-generative approach, which should be better able to engage local stakeholders than past policy attempts (e.g. EU LEADER programme; Dargan and Schucksmith, 2008).

Innovation, RIS3 and Regional Development

Innovation is the application of new products, processes, services and organizational methods for commercial or social purposes (OECD, 2005). Research and Innovation Strategies for Smart Specialization (RIS3) is a policy approach developed in Europe (EC-IIPTS, 2011; Foray at al, 2009; OECD, 2013) to foster regional development in a way that: a) leverages the R&D strengths in science and technology across multiple regions; and b) applies them in contextually appropriate ways to enhance local socio-economic productivity. As initially developed, however, RIS3 would not be able to deal with the...
likely gaps in entrepreneurial skill and low innovation system development in many non-metropolitan regions (Teras et al., 2015); this paper will recommend the necessary adjustments.

RIS3 was developed to address uneven regional development in Europe with the idea that cutting edge General Purpose Technologies (GPTs - e.g. nanotech, biotech, information tech) would be developed in regions with strong R&D (e.g. Cambridge, UK; Basel, Switzerland); and regions with less advanced R&D capacity could then develop GPT applications for sectors in their local economy, leading to more efficient use of research and innovation investments (Barca, 2009; Foray et al., 2009). Further, RIS3’s focus on local knowledge strengths, and pulling knowledge into the region for local needs, would aid Canadian non-metro regions.

I have critiqued RIS3 and propose a dynamic, evolutionary and socially inclusive institutional approach (Mastroeni, 2016; Mastroeni et al., 2013; Rosiello et al., 2015). I frame market changes and policy implementation as a series of consecutive events, with system evolution shaped either by agent activity or institutional influence (Carlsson and Stankiewicz, 1991; Mastroeni et al., 2013; Teubal, 1997). I further describe four features:

The first is the framework’s ability to deal with complexity and uncertainty. The complexity stems from regional economies having context-specific challenges different to each other, and the wide variety of stakeholders across different industries interacting and exchanging knowledge. Adding an evolutionary approach would keep system-complexity and regional specificity at the forefront of analysis.

The second is in contrast to the original RIS3’s assumption that private sector entrepreneurs will be present locally to identify opportunities for innovative application of knowledge and GPTs (Foray et al., 2009). In non-metro communities, skilled entrepreneurs and the support-structures that aid them may not be fully developed (McCann and Ortega-Argiles, 2011). Equally, public sector ability to enact change cannot be assumed (e.g. lack of resources, competence, will). Instead, all community members are potential entrepreneurs, emphasising multi-stakeholder dialogue (Mastroeni et al., 2013).

The third looks to avoid too much specialization (Asheim et al., 2011; Saviotti and Pyka, 2008) as too little economic variety reduces a system’s resilience to change (Cooke, 2009). The adjusted framework instead encourages “related variety,” new economic activity formed by new (re)combinations of knowledge held in the community (Asheim and Grillitsch, 2015; Mastroeni et al., 2013).

The fourth promotes strengthened communication and trust relationships between stakeholders, improving knowledge exchange and collaboration to address the uncertainty in the innovation process (Gertler and Wolfe, 2004; Langlois and Robertson, 1995; Morgan, 2007).

**Evolutionary RIS3**

The theoretical framework will include two heuristics/tools and a foresight method respectively: an Evolutionary Life Cycle (ELC), Innovation Matrix (IM) and Three Horizons foresight method.

The ELC heuristic frames innovation systems as moving through different phases: a background/pre-entrepreneurial phase, a pre-emergence/launching phase, and an emergence phase (i.e. critical mass) (Avnimelech and Teubal, 2008; Rosiello et al., 2013).

Movement through phases is determined by the region’s ability to provide a set of functions such as research and development, skill building and access to training, commercialization, and finance (see figure 1). Since an innovation strategy would not be able to realistically correct all weak system functions simultaneously, the ELC helps determine what the system weaknesses are, and the timing as to what functions to address first.

The IM was used in the region of Bavaria by Bayen Innovative, a governance agency for regional development (Cooke and Eriksson, 2011). The IM was used to identify “adjacent possible” areas of innovative activity, i.e. new ni-
ches for economic activity combining the knowledge needs with the knowledge strengths of different regional stakeholders in unexpected ways. It does so by laying out different economic activities that are important to the region along the y axis, and the knowledge that is being developed and/or available to the region along the x axis). Community stakeholders, including local PSIs, add their insights to the matrix (not limited to a 2x2 structure) through round-table discussions or interviews, and in the process have their contributions scrutinized by other stakeholders. In our framework, it will help analyze knowledge complementarities in non-metro regions, combining that of participants in established industries, local PSI, and some extra-regional participants to identify potential knowledge complementarities and synergy leading to innovation.

The Three Horizons foresight method will also be applied (figure 2). It maps shifts from the established, status quo patterns of social and economic activity (Horizon 1), towards new ways of doing things to better fit the changing regional conditions (Horizon 3), through a transitional stage that responds to the shortcomings of the present (Horizon 2) (Sharpe, 2013; Sharpe and Hodgson, 2014). The Three Horizons approach helps identify potential areas of conflict in the transition from H1 to H3, and helps to facilitate positive rather than conflicting interactions amongst these interests. Three Horizons can be used for a variety of forward-looking timelines (5 yrs, 20 yrs, etc.), can help to plan action attempting to reach a desired future, and is relatively easy to explain and teach to community stakeholders/participants.
Man has been fascinated by space since the beginning of civilization. There have been major advancements made in this field over many years. But if history has been witness to anything, it is that, for every advancement we’ve made, we’ve left something behind. Space missions over the past many decades have left behind over 7500 tonnes of debris in orbit. But it is still a problem which is out of sight, hence out of mind.

There are millions of objects in space, most of which are too small to be able to track. Recent trends show that the number of launches are increasing each year. Thus, the amount of debris is only going to increase. This problem is a complex one since space is a global resource, and there is no central authority to keep a check on it. Satellites play such an important role in all aspects of our lives, that a threat to them is a threat to our current way of life.

Over the years, there have been inter country disputes, increased tensions and unchecked misuse of space. The president of United States recently announced that Space is a place for war. If this problem is to be solved, there has to be cooperation at a global scale. Major policy changes and space laws need to be implemented in this field, along with co-operation on a large scale. Fifty years back, everyone was dumping plastic into the oceans, thinking that they were so large that a few bottles won’t make a difference. Now, there are huge islands of ocean plastic floating in the Pacific. Space debris is very similar to this problem, and we are at the advantage of not having gone too far yet.

As designers, we may not have all the answers, but we can ask the right questions. Systems thinking allows us to associate seemingly unrelated aspects of the problem, and connect people from different fields. We have the advantage of looking at the entire picture in a holistic and unbiased way. A problem as complex as this needs intervention at multiple levels. It is a problem that is going to have major repercussions in the coming years, and needs foresight, which we attempt to add through this project. Through this project, we are expanding the boundaries of design. Design thinking is rarely used in the space industry and employing it on a system level is what is needed to solve the problem of space debris.

As part of the project, we met with professionals, engineering students, policy makers, academicians and researchers. We organised co-creation workshops with school kids as well as scientists at the Indian Space Research Organisation (ISRO). Dividing the scientists into groups based on temporal scenarios, such as ‘past’, ‘present’ and ‘future’, we came up with diverse solutions. We drew connections at each stage. We translated the raw ideas that kids came up with to tackle space debris into feasible solutions, using scientists’ expertise. We collated data from multiple primary, first hand sources and used it to come up with solutions.

Due to the importance of policies in solving a problem as huge as space debris, we developed a first draft of a national policy for space debris. The policy lays down the guidelines to be followed by any space agency operating within the country. It also proposes maintaining a registry of space objects in orbit. It suggests a method to carry out threat assessment of a particular space debris. We also introduced a credit system for all space operators within India. This policy not only regulates private and public parties of the space industry, but also give guidelines for possible future scenarios. A major aspect of space debris as a problem is that relatively less people know about it. Even within the science community, many people know about the problem, but aren’t working towards it.
There is a need for awareness among the masses. The more people know and understand the problem, the more brains working towards it. As designers, we can act as facilitators to promote awareness and dialogue about the topic. To do this, we developed the character of ‘Satellite girl’ and made a comic series, showing the effects of Kessler’s syndrome and how it can devastate the 21st century world. We developed two directions of speculative scenarios; a utopian future showing how global cooperation can bring about a positive change for mankind through space technology, and a dystopian future, that shows the after effects of a Kessler’s syndrome.

The final systems intervention in the subject was in the form of solutions. Talking to people, employing co-design methodologies and iterating on ideas helped us to come up with potential solutions to help tackle space debris.
These solutions could be as basic as redesigning a satellite to as complex as changing the whole system of how we launch and collect satellites. This is an ongoing project, and we hope to use systems thinking in more innovative ways to tackle this issue on multiple levels. We plan to pitch our policy draft to law experts, our ideas to ISRO and our awareness campaigns to publishing houses. We will be following up on our previous stakeholders and constantly contacting many more. We also intend to propose a Life Cycle Assessment (LCA) model for space flights.

We would like to visualize all the different aspects of Space and sustainability and make people aware about the problem at hand. We want to create a common platform for people from different expertise levels to come together to solve this wicked problem. Democratization of space is something that our project also has in mind. We hope that this project will give enough clarity and push to the right people in the right direction, so that we can start working towards solving the issue. By clearly stating the future steps and sustainability opportunities, we hope to not repeat our past mistakes.

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According to the UN there is need to attain 17 heterogeneous goals with 169 different targets in order to reach sustainable development. Is this programme strong enough to become successful? The decisive point for assessing its quality is whether it offers only a catalogue of demands or an integrated concept. Satisfying human needs whilst respecting the limits of the biosphere with future-capable forms and rates of production and consumption are of central importance. But an alternative approach to civilizational progress has to outline as well that kind of eco-social transformations by which these requirements could be realized. Major transitions of this type should be multi-dimensional. They have to provide the capacity of simultaneously altering several dimensions of human life: social and ecological as well as economic and political.

Re-directing human progress cannot be done by means of superior ethics and good will alone. Instead, effective forms of management and governance are required. Realizing sustainable development in practice takes place under conditions of targeting-conflicts about priorities, utilization competences about resources as well as divergent interests and contrasting visions of how “our common future” should look like. Facing “great challenges” of humankind therefore means tailoring well-designed interventions in the ongoing dynamics of existing patterns: in communicative culture as well as in material culture, in the organizational sphere as well as in the technological sphere.

Two promising research perspectives working on the development of solutions for the above framed problems concern leading principles and generative forces. With leading principles for eco-social transformations the emphasis is on efficiency, sufficiency and consistency. They respond to different groundings and favour distinct instruments. They are supported by different arguments and seem to be excluding each other, as suggested by the semantics of “hard” and “soft” sustainability. We can understand them as strategies that are competing for attention on the public agenda: for being accepted and having the chance to become converted into practice. Besides focussing on the advantages of a balanced approach further research and development (above all in “sustainability science” itself) should concentrate on delivering fresh understandings and novel concepts like the cradle-to-cradle approach.

The guiding question for this research perspective reads: How to combine these strategies with effective principles of design such as to enable far reaching transformations in material culture and social life?

The other research perspective deals with generative forces that link valuable personal resources like awareness, imagination and motivation to institutional transactions and social change. The social sciences provide three well-known categories: actors, cultures and systems. What kind of conditions and drivers for eco-social transformations can be identified within these contexts? How do they correlate with generative forces?

After giving an overview we will focus on the field of organizational cultures and their relationship to generative forces. Here, they are stimulating creativity, innovation and entrepreneurship, finding novel solutions to old problems and other understandings of conflicts, that may lead to new beginnings and vital reforms. Approaches for utilizing generative forces in this field (that is: mobilizing and organizing them in multiple arrangements like innovation hubs, business theatre or systemic constellation work and world cafés) are now originating from sources as different as academic innovation research, professional consultancy practice as well as civil society move-
ments. Of special interest here are artistic installations and performances (resuming ideas of anthropological art and social plastic) because they have a unique capacity of opening horizons and transcending limitations while intervening in public spaces of urban life-worlds as well as private enterprises and public administrations within functionally organized labour-worlds. As guiding questions for this second research perspective we can note: How can we identify and understand generative forces? Which are their general characteristics and which peculiar traits can be observed? What are viable forms of evoking and expressing them in order for them to flourish in eco-social transformations?

Making use of generative forces to enable and facilitate purposes seems to be easy. But first of all we have to satisfy one precondition: becoming more sensitive and capable to perceive and recognize them, tracing their signature within the turbulent climate of modern world. Hence, my contribution to RSD7 will neither offer fixed understandings of problems nor stubborn repetitions of common solutions. Instead, the focus lies on outlining fresh perspectives for doing research and development as well as on sharing insights and seeking partners for organizing sparkling dialogues and future collaborations.

REFERENCES


New Brunswick is expected to have the worst economic growth out of the ten provinces in Canada in 2018 (Jones 2018). Passed over by large resource projects and hit hard by the collapse of the cod fishery in the early 1990s, the province is currently experiencing a wide range of societal and demographic challenges as a result. At the same time, New Brunswick’s population is both aging and in decline. The first wave of Baby Boomers are retiring and there aren’t enough people to fill the jobs that will be coming available. This has triggered the province to undertake an unprecedented immigration challenge to offset the coming workforce losses. This demographic trend is being witnessed in rural areas across the developed world with ever declining birth rates leading to population decline.

The recent uptake of public sector innovation labs by multiple jurisdictions across Canada raises the question of how to integrate their findings into the milieu of traditional policy development (McGann, Blomkamp, and Lewis 2018; Westley et al. 2015). Bringing people together and holding productive conversations is at the heart of how social labs deliver value. To do this effectively various practices from the methodology known as The Art of Hosting and Harvesting Conversations that Matter (AoH) have been employed by New Brunswick’s Social and Public Innovation Lab, NouLAB. This proposed paper will look at how engaging multiple stakeholders – including public servants – with a variety of tools in a participatory process can improve outcomes in policy development across New Brunswick. Engaging non-traditional policy actors in the design process requires strategies taken from a variety of disciplines. NouLAB uses tools from AoH as well as Theory U, Human Centered Design, Systems Thinking, Google Sprint and Social Labs methods in order to build lab experiences and to frame the issue at hand (Hassan 2014; Scharmer 2009). Lessons from this process can potentially be applied across jurisdictions worldwide.

NouLAB, New Brunswick’s Social and Public Innovation Lab was developed out of the need for new approaches to tackle complex, systemic challenges. NouLAB is housed under the Pond-Deshpande Centre at the University of New Brunswick, giving it an outsider view to government and allowing it to ‘hold disruptive potential’ (Tönurist et al. 2017, 16). Across the province, challenges ranging from nursing shortages, rural revitalization, housing for individuals with complex needs, poverty reduction, and others have been undertaken by the NouLAB facilitation team.

In September 2017 the first multi-year standing lab undertaken by NouLAB was launched on the topic of Economic Immigration (“Economic Immigration Lab || NouLAB”). The first cycle lasted four months and produced eight prototypes, each with unique contributions to answering the question of ‘How might we attract, welcome and retain newcomers to contribute to the New Brunswick economy?’ The second cycle, completed in mid-April 2018, focused in on the themes of employer support and newcomer integration. For this cycle, a five-day Google Sprint-inspired format was taken. Teams came in pre-formed and with an issue related to immigration. The implementation of this Google-developed format on social issues presented an opportunity for learning for the NouLAB team. Overlaying the skills of Art of Hosting, Systems Thinking, Theory U and more, teams were able to frame their problem, develop a prototype with input across sectors and test it on users within five days.

These two cycles are now complete and the tracking of the prototypes is underway. Using a developmental evaluation approach to determine the expe-
rience of the participants and the success of the prototypes, the NouLAB team aims to identify the strengths and weaknesses of the hybrid approach that constitutes their social lab practice (Patton 2010). The facilitators’ learning curve to establish group norms, support diverse participation, identify power and privilege, and work towards agreed upon objectives within teams are topics that have significant importance to the field of social labs (Quick and Sandfort 2014). Of specific interest is how public policy is being influenced by the government employees’ learning and capacity building within the lab. The personal transformation journey has been identified as the biggest leverage point to change the system. In accordance with Theory U’s Iceberg Model of systems change (Scharmer 2009), values and beliefs are where change can be most easily impacted by individuals in complex systems. This change is tracked through the new relationships formed in lab processes and multi-sectoral teams that continue beyond formal lab engagements and workshops. Surveys and reports to track changes through time are carefully maintained through the NouLAB’s evaluation process.

Our paper will discuss: the disruptive potential of NouLAB as a Public and Social Innovation Lab, situated as a programme of the Pond Deshpande Centre at UNB, the role of participatory and reflective practices and the transformative journey of the individual as paramount to the process of systems change, and our learnings from the establishment of NouLAB’s hybrid approach to running a Social Lab.

**REFERENCES**


The paper will present the Stimulab program, a program for innovation in the public sector in Norway. The design of the Stimulab program was inspired by amongst others, Systems Oriented Design (SOD) approaches and techniques. This turned out to be useful in general and a requirement for success for the most complex projects in the program.

We will present two cases in the framework of Stimulab especially with the design consultancy Halogen. These two projects were especially challenging because they were crossing institutional barriers and contained multiple stakeholders. In the end we will present a discussion on what kind of learnings and generalizations this has lead to.

Background

Public sector need to strengthen innovative capabilities to be able to solve citizens needs and reduce management resources.

To increase public sector use of service design and to bring forward more examples of public innovation, the Ministry of Local Government and Modernisation established a two-year trial program in 2016. The task of developing the program was assigned to the Agency for Public Management and eGovernment (Difi). Due to the emphasis on design they entered into a partnership with DOGA. The result of our collaboration is the experimental program StimuLab.

Since improving complex public issues can lead to substantial socio-economic benefits, the Difi DOGA team decided to emphasize such issues, as they tend to be left untouched due to their level of complexity, e.g. sectoral responsibility, lack of financing and coordination challenges. The DOGA partner were aware of how SOD can bring a much needed, richer understanding of a given challenge, including relationships and regulations embedded in complex issues, somewhat risky choice. This was of vital importance to the project. The StimuLab platform The program provides cross-disciplinary support, guidance and financial resources for innovative public projects.

In this way, StimuLab is testing new ways of working to improve services, systems, procedures, regulations or the exercise of authority on state- and municipality level.

The Stimulab platform was built around the following elements:

1. Difi + DOGA as catalyst - utilize existing public ecosystem for innovation in new ways.
   a. Stimulating cooperation across sectors and levels of government
b. Finding the flex in regulations and procurement processes  
c. Focus on impact, but be explorative  
d. Reduce risk and catalyze innovation

2. Utilize the market and make demands for competence configuration to handle complex issues - required skills: (Systemic) Design methods in lead, Change management, Impact assessment.

3. Method for Complexity: StimuLab rethinks how we apply design methods to explore complex public issues.  
a. Demand for a Trippel Diamond approach, emphasizing the DIAGNOSE PHASE, to ensure a systemic understanding of the situation and exploring & reframing of challenge.

These elements were informing the selection of public actors to be invited to the project and they were forming the call for project assignment that went out to the service design companies in the Oslo area and that were defined in the contracts.

StimuLab grant to procure experts:  
• 2016 - 2017 NOK 5 + 5 mill.  
• 2018 NOK 10 mill.

Two Cases

Halogen, in collaboration with Rambøll Management Consulting, qualified to take on two cases from the Stimulab pool of public service providers. The projects were presenting very different topics, organizations and type of case owners but shared a very high level of complexity. The main challenge was the need for crossing disciplines and silos to induce change. How to frame the project in a way that allowed for cross-disciplinary work was a major challenge. They both had been through a variety of different attempts of improving their respective service systems, but there had been few successfully implemented changes over the last 5-10 years.

Through applying SOD as a central methodology, supported by service design, KPI’s and change management - the teams could visually frame the challenges and focus efforts on leverage points in the organizations. Co-creative methods give shape to both interventions and the contextual support needed to create a healthier working environment around the projects in terms of collaboration, communication, financial and legal issues and regarding the relationship between the actors involved. SOD brings a richer understanding of the elements the given service is built on and relations holding the elements together. It helps the teams think broader on what and how interventions can be shaped.

The first project initiated was a project around how to manage citizen’s right to drive (Førerett). This project is still ongoing. The second project was around the governmental initiatives to reduce human trafficking in Norway, this project is being politically decided on as this abstract is written.

License to drive – SOD supported changes

Four directorates moved from working in parallel and unsynchronized disconnect to actual co-creating a seemingly marginal and unimportant service of reassigning driving licences to people who have lost them for medical or legal issues. The process of systematically untangling and innovating in this cross institutional problematique turned out to be both interesting and relevant for a larger audience within the government. Lack of political attention has shifted through realizing there are significant organizational and economical savings to be made and the cross-directorate collaboration has inspired a renewed funding for a long-term development program with political support.
Human trafficking - SOD supported changes

One department, municipal actors and a network of NGOs\(^1\) lacking a clear organization are now being re-organized with a focus on the victims of human trafficking.

Lack of collaboration and leadership is being addressed through a reorganization and implementation of better service delivery frameworks, collaboration channels to strengthening each other’s efforts.

The previous change initiatives where little cocreation had been applied is being addressed with a renewed focus and understanding of why and how services can be improved together.

Discussion

We are starting to find ways to untangle and co-design services for very fragmented systems that cross disciplines and organizational silos. Systemic approaches and in this case SOD is required to achieve success in such cases.

The current migration of service design into public services needs to be able to distinct the relatively ordinary (though complicated) projects from those that are truly complex. The challenge in the complex problems lies on the systemic level and it is often an issue caused by missing relations and assumptions on how flexible the systems that enable the given service are. SOD brings a promising perspective and methodology for co-designing relations and connections across organisational and professional boundaries.

\(^1\) Key Performance Indicator
Increasing inequality, rising social unrest and climate change suggest new approaches to economic growth are needed. Motivated to understand why the current economic system appears to be failing us, and what a human-centered approach might bring to the challenge, this research study investigated both current and alternative narratives on economic growth and how a participatory approach to reframing might enable change to a more desirable alternative.

Much has been written both in favour of, and in dissent to, the current orthodoxy around economic growth. Alternative ways of seeing and approaching economy have been proposed since its inception. Not in abundance, however, are comparative views of alternatives. In addition to providing a comparative view of three different narratives on economic growth, this study brings the perspective and tools of human-centered design to a complex systems challenge and proposes taking the value of design thinking and a prototyping mindset beyond service delivery to the level of policy research, design and development.

Two primary phases and approaches were used in the research process. In the first phase on ‘understanding the narratives’, Causal Layered Analysis (Inayatullah, 1998) was used to understand the causes, processes and outcomes of economic growth, as well as alternatives to it, based on interviews with six subject matter experts working in the areas of, or related to, economics and economic policy. The three narratives that emerged included the current growth-first narrative, which came to be called “domination” based on its dominance-based logic and the self-interest that exemplifies market fundamentalism; an emergent narrative, named “participation” for its orientation toward increased social and economic participation within international and national agendas for inclusive growth; and a speculative narrative, which took the name of “freedom” because it embodies notions of independence, self-determination, autonomy and democracy.

In the second phase on ‘exploring change’, the freedom narrative was used as an input to reframe economy and engage two groups of stakeholders in a simulated participatory role-play experience addressing the question of How might we get to a more inclusive economy? The role-play was structured around Roman Krznaric’s “Rough guide to how change happens” (2007) and used non-experts in a generative activity for exploring change and probing potential relationships for future stakeholder engagements. Outputs from this second phase informed five candidate strategies for change intended as proposals to encourage policy influencers and policy makers to adopt and evolve a richer set of policy research and development tools.

As powerful as Causal Layered Analysis and role-play were on their own as primary approaches in each phase of the research study, a key outcome of the project was that Causal Layered Analysis and role-play used in combination may be an even more powerful approach for engaging diverse stakeholders as participants in their own collective futures. More specifically, having stakeholders use the reconstructed narratives from Causal Layered Analysis to explore change in the context of role-play, they can iterate on the system itself. In this way, narratives can be used as both representatives of the change desired as well as probes for change, and through simulated enactment of the alternative, stakeholders in the system might themselves begin to enact the change in the world.

This paper is structured in three parts. First, a brief overview of three narratives on economic growth is provided and conveys key insights about those
narratives based on Causal Layered Analysis. Second, an approach to engaging diverse stakeholders using role-play for exploring change at the system level is described, along with how radial convergence mapping can be used as a visual analysis tool to understand stakeholder relationships and inform iterations on systemic challenges. And third, ideas generated in the context of research on economic growth, and lessons learned from the use of role-play, are put forward as approaches for engaging the makers, influencers and receivers of public policy.

Readers of this study might find useful its coverage of alternative narratives on economic growth and how they compare; how role-play can be used for its transformational potential among a group of diverse stakeholders to help empower people outside the system of typical decision makers, to discover new relationships and to be used as a rehearsal method for future stakeholder communications and collaborations within a system; and how role-play might be used as a generative approach for candidate strategies for change, including potential new tools for policy research and engagement and using narratives as probes for testing readiness for, and resistance to, change.

This study will be useful to both academics and practitioners interested in how a human-centered and systemic design approach might be brought to the challenge of policy research, design and development.

Figures

Figure 1: Project Structure & Methodology Overview

Figure 2: Comparative Stakeholder Relationships Map
REFERENCES


This paper is part of an ongoing PhD research dealing with the construction of a methodology of mapping-and-designing things from a relational-thinking point of view. The methodology is developed through the dialogue of a theoretical and a practice-oriented part: the logic’s scheme evolves through experiments and testing applications. The current paper focuses on how two testing case-studies in the city field give feedback to the logic, to its potential applications and its connection to design.

**Research-theoretical framework**

Central idea is the relationality: we concentrate on relations of things, in terms of potential interactions and connections, not only physically and materially, but also immaterially (i.e. information). In this context, inspired among else by Cilliers’ (1998) and Batty’s (2013) thinking, the city is understood as an open dynamic complex system, being composed by constantly changing relations among heterogeneous parameters. We focus on the complexity emerging from the relationality of the city, when considered as networks of places. We think of ‘place’ as something dynamic (Massey 1993). We give emphasis on the connections of places, intending to embed their immaterial relations generated by information, always in connection with the material ones.

The main research question is how we can analyse and at the same time compose design proposals for the city in regard to its multiplicity, its relationality and its constant changing.

We set mapping as a key starting point. We argue, following among else James Corner (1999) thought, that it is a process, which can be both analytical and generative. By mapping we refer to the whole process that produces any kind of written description, highlighting that it is intentional, made by a specific subject within a specific context.

Aim of the methodology is to create a tool: of a generative analysis for decision-making processes; capable of analysing an object (here the city) in regard to its parameters of multiplicity; that enables us to decompose and recompose an object. The multiple new reorganisations of an object feed the generative capacities of the tool. This generativity is not promoted towards a direction of an increasing complexity, but as a way to reveal it, to understand, to explore and at the same time to manage it through abstractions.

**Description of the methodology**

The methodology is composed of three levels of actions. In the first, we gather data: different mappings, following a sampling logic. The second concerns the analysis and the organisation of the data in order to define the translation parameters among them. In the third one, we test the methodology in different case-studies. This level enables back and forth transitions between generalisations and specifications, while it makes the logic adaptable to different processes and contexts.

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1. The PhD title is ‘The Relationally Composed Object: Description and Design’. It is supported through a scholarship by the General Secretariat for Research and Technology (GSRT) and the Hellenic Foundation for Research and Innovation (HFRI).

2. As this is an ongoing research, parts of this paper are already published in previous publications of the author (initial main source Stamatopoulou 2016). This paper contains new material added: the second testing case-study of the methodology and the comparative consideration of its affect to the evolvement of the ongoing development of the methodology.
Let us explore it through the two case-studies. The one is an experiment of 26 mappings of public space Athens, carried out in a postgraduate course.

The other one, which is more recent and ongoing, concerns 31 descriptions of a specific park in Athens, made by different subjects, belonging to different agents related to it. These were extracted from the published discourse about the city. In both cases, data are organised and visualised into an “interactive open map”, composed of a database (mapping in their original form), a table and a map. The horizontal axis of the table integrates references to the gathered mappings and the vertical one the properties (of the mappings) list as organised in categories. On the map the different references to physical locations are codified and noted as dots, lines and areas. The data-base, the table and the map are interconnected through options of
Figure 4: Sample of the 26 mappings of the first case-study as codified in dots (reference to specific location), lines (reference to path), areas (reference to more abstract areas).

Figure 5: Scheme of the table's organisation
selections: for instance, selections on the table can activate networks on the map; selections on the map can indicate properties of locations. The data-base, the table and the map are interconnected through options of selections: for instance, selections on the table can activate networks on the map; selections on the map can indicate properties of locations.

**Athens center case-study**

Firstly, combinations of selected properties on the list can activate references and implied relations among references on the map. For instance, if we select the property open editable file on the table, then...
the mappings with this property are highlighted along with their references to the city on the map. This way, we can see the spatial expression of one or more properties. Considering that through these actions all the relevant references to the city are getting connected, what we see on the map is a network, that we have created through our interaction with the system. The value of such actions is not the creation of connections; but our capability of seeing how these interrelations, deconstruct and at the same time reconstruct the map and the “city”. The properties list is a key-point here: although it changes and adapts depending the context, it functions as a cluster of parameters in regard to which an object can be decomposed and recomposed, it can be multiplied. Another option is to select a location on the map, which shows us which mappings include reference(s) to it as well as their properties on the table. This way, the properties attached to any location on the map can be detected.

From these simple actions, one can see not only how locations and information are related but mainly how information affects the relations of locations and how relations of locations reveal relations of information.

**Park case-study**

The location we selected before is a node of networks. Such a node can be further analysed in a zoom-in logic, as attempted in this second case study of the park. Every node on the map of the Athens centre case study might be another system or a network, revealing more details about its “internal” relations.

As in the previous case-study, we can make the same actions in the system of the open interactive map. For instance, if we select the property “approach through history” on the table, we see that 4 matched descriptions. Accordingly, we activate their references (in red) to the physical terrain of the park. These are some first simplified steps of abstracting the complexity of all the mappings and descriptions.

**Perspectives of design logics**

![Figure 9: The map of the park including all the codified references of the 31 descriptions.](image)

![Figure 10: The map of the park including all the codified references of the 31 descriptions.](image)
The question of how all these options might be integrated or even feed relevant design logics is what remains important in this paper.

Firstly, the interactive open mapping system, as a logic, can produce urban design and strategy proposals attached to the analysis actions. Through this application, we can detect, indicate and, thus, propose, locations and areas for further interventions. Our proposal is not limited to the definition of the locations and the limits of their field, but it integrates the terms (i.e. concepts and the meanings or the relations with other locations), the briefing.

For instance, if we want to reveal a location’s properties (i.e. Syntagma square), we have to focus on the mappings that include and relate it to other places. In this scenario, we choose the location on the map, and 11 mappings, including reference to it, get highlighted on the table along with their properties. This way, we have activated all the other locations to which the 11 mappings refer to. All these locations are related to the Syntagma square, as this is caused though the 11 mappings. If a place is among else its relations with other places, then we can argue that the Syntagma square potentially extents to everything we see in black on the map. This way, we can approach any location, through the lens of other, related to it, places. Considering that a designed intervention is capable of affecting other nodes or relations, we can think of intervening to a place without doing something directly to it, but to its relations.

By making different selections, going back and forth the map and the table, we can zoom in a specific location and proceed to more concrete proposals by setting hierarchies of what we see. Let us suppose that we want to make a proposal for the Syntagma square in regard to the combination of the concepts of the commons and of the Otherness. Here we see which mappings refer to the Syntagma square in regard to these two concepts and the created networks.

Let us see how the same logic applies in the case-study of the park.
By clicking to the property “problems”, we realise that this red set of networks on the map is composed of diverse types of networks: some relations might be conflicting while others trigger attractions. The conflicting relations, can be for instance revealed through information attributing ‘negative’ properties. These make the physical distances even larger. Accordingly, cases characterized by complementarity and consistency bring locations closer. In order to understand this better, we have noted in 4 different colors the references made by the four descriptions. Additionally, we have translated all the references in positive and negative, according to the attributed properties, as set in their context. By connecting all the negatives and all the positives, two types of fields of forces arise: an attractions’ one and a repulsions’ one. Through this step, we open perspectives on how we can use back and forth actions among relationality and territoriality. Additionally, to the revealed networks, we can go deeper on the issue of the park’s “problems” by activating further properties noted on the left of every map. These, by implying problems or properties related to them can enrich the description of the problems of the park (in regard to more parameters
such as time) and feed even more targeted proposals. Looking comparatively at the potentialities emerging from the two cases, we think of mapping- and-designing by revealing and setting hierarchies in multiple networks and scales of complexities, by looking at the same time the whole city field and a specific location, along the in-between networks in regard to parameters we set. Zooming-in and zooming-out are potentially endless and they can work as actions mutually developed. This methodology is a proposal for a holistic approach of things, encouraging the synergy between relationality and territoriality, between analysis and design, between diverse scales and points of views.

Figure 15: Three of the maps showing the different references to the park by three different descriptions along with the positive and the negative field of forces shaped by the properties attributed to specific locations inside the park.

Figure 16: The merging of the diverse networks among the diverse descriptions on the map: this way areas of conflicting approaches or increased interest might be revealed.
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Policy innovation to face complex problems

Society, meant as an aggregate of people interacting with each other in a more or less ordered community, is by definition complex. The relations among its elements (i.e. the people) have different properties that create a distinctly complex system. For instance, as one of the characteristics of complexity theory, they have a nonlinear behavior, meaning that they might respond in different ways to an identical input depending on the circumstances (Byrne, 2002). While it is largely recognized that evolution increased the complexity of social environments (Bar-Yam, 1997), the quick diffusion of digital communication channels and tools (i.e. ICTs) has radically increased the number of interactions among humans, diversifying nature (i.e. digital messaging) and amplifying scale (i.e. social network platforms), thus increasing de facto the complexity of the social system (McChrystal et al., 2015). Indeed, if on the one hand, the technological progress brought a range of benefits like higher connectivity, quicker mobility or easier flow of information, on the other hand it also carried new and critical social and ethical challenges, both on a micro scale (i.e. privacy issues), and on a macro one (i.e. migration). These increasingly complex sociotechnical problems are challenging both the traditional models and solutions used by governments for regulation (the traditional policymaking process), and the old process of public and private innovation (new disruptive technologies like AI or blockchain will radically modify some of the workings of civil society like the type and distribution of jobs).

Focusing on governments and their traditional model to produce and enact regulations, the main reasons behind this scenario can be further described using the following categories:

- Procedures, that are often inappropriate for the scale and speed of technological change, as more often the traditional process for policy development and implementation is linear and deterministic;
- Organizational structures and procedures, that are often inadequate to support the new need for policy innovation determined by the current scenario (i.e. old silos structure);
- Citizen engagement, that is often not appropriately applied to the design and development of policy.

Building on this, the public sector at large needs a renovation, that can include the advantages of Digital Government, modernization of procedures and organizational structures, as well as the development of new ways to include citizens as new sources of solution and generation of public value.

Design for policy and Complexity theory to aid policy innovation

Due to the scenario described, institutions around the world are looking for and experimenting with new approaches to transform the public sector, also looking at design as a potential source of new methods, principles, and tools (Junginger, 2017). In the last decades, design has increasingly accepted this new area of work, evolving its interests toward intangible solutions and acting in what Buchanan (2001) defines third and fourth orders of design, that is working, studying and experimenting on interactions (third order) and systems (fourth order). More recently, Norman et al. (2015) have described how design can play an active role in reducing political, social and cultural disruption while building more resilient solutions alongside optimizing resources. Furthermore, Bason (2017) has underlined the potential...
of applying design practice in public sector and administration using three dimensions:

- Exploring the problem space
- Generating alternative scenarios
- Enacting new practices

Interestingly, he argues that ethnographically-inspired design approaches can support and inform the process of identification of policy needs, by understanding people’s needs and wishes. Beyond people centricity, the relevance of design approaches for government also lies in the ability to map and visualize information and languages (Mauri and Ciuccarelli, 2016), thus helping insights emerge and create a shared vocabulary with citizens to start social conversations (Manzini, 2015). One of the essential aspects of this generation of alternative scenarios in complex systems of stakeholders is the ability to trigger a debate based on a desirable vision of the future. Therefore, we can say that design scenarios use creativity to enable collaborative ideation and prototyping (Kimbell & Bailey, 2017), an aspect that is particularly relevant to renovate current policymaking practice. However, traditional design practices are not yet accustomed to handling complexity for policy formulation, as until now they have mainly been focused on tangible policy outputs (i.e. public services), and would therefore benefit from further understanding about how to integrate and handle a complex system to understand new social challenges and devise solutions to them. The aim is therefore to support this through proposing an integration between complexity theory and design for policy aiming at policy innovation.

From a theoretical point of view, these two areas have a common ground, for instance:

- The object of the analysis is in both cases a complex system, its elements, their relations and characteristics (i.e. emergence);
- The perspective on the system takes into consideration all its elements with a holistic approach, in contrast with a reductionist one.

From a practical point of view, few experiences and projects can be found in which the concepts of complexity theory are beginning to enrich the design process (i.e. healthcare system design). However, structured reflection and enquiry about how to connect these two areas can seldom be found, and here lies the contribution this paper aims at making. In particular, the intention is to begin to work on a shared vocabulary, methods, and tools that embedded in design for policy could significantly advance the knowledge of both areas as well as innovation in policymaking.

**Research design: Focusing on the intersection between Complexity, Policy and Design**

In order to comprehend the connection between complexity theory and design for policy, the research selects and analyses the scientific papers published in the last ten years in the most accredited databases (WOS and Scopus) produced with references to the topics of Complexity Theory, Policy Design and Design for Policy, either looking at how these are connected or to extract the most relevant principles for each, for further connection.

Regarding complexity, special attention will be paid to the scale of the system, as its complexity is highly influenced by the number of interactions and increases when the number of interacting elements increases.

In the area of Policy Design, the discussion will reflect on those contributions that frame policy formulation as a design problem to understand where/how design is already considered part of the process and where this process can be further supported by principles coming from complexity studies.

Finally, literature in the area of Design for Policy is analyzed to match the characteristics of this activity with the above areas and create a more compelling understanding on the topic.

The knowledge retrieved from this research will be analyzed placing concepts in a matrix based on Buchanan’s fourth orders of design, declined
by Jones and van Patter (2009) in the four domains of design, arguing that "many more will be engaged in the Design 3.0 and Design 4.0 activity spaces with more knowledge and better tools". In our research, these are considered as four distinct design domains from design 1.0 to 4.0 and are useful to understand two aspects: the scale of the system and the kind of design domain (fig. 1).

Based on this, the most relevant domains for our research will be the third and the fourth because connected to organizational structures, social systems and policymaking, thus these will be the object of literature mapping. Moreover, the policy cycle defined by Howlett and Ramesh (2003) and further illustrated by Junginger (2015) (fig. 2) will be used to understand where the activity of design mainly plays a role in the formulation and ideation of a policy.

Finally, these theoretical models are matched to map scientific papers and arguments built by other scholars following the structure provided in Table 1 below.

Table 1: Example of how the mapping tool will be used

<table>
<thead>
<tr>
<th>resource</th>
<th>1st domain</th>
<th>2nd domain</th>
<th>3rd domain</th>
<th>4th domain</th>
<th>identifying policy need</th>
<th>clarifying policy need</th>
<th>formulating policy</th>
<th>implementing policy</th>
<th>evaluating policy outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>x</td>
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</table>

Conclusions

The mapping tool proposed through the table will generate insights on how in the last decade the conversation around the introduction of design methods and processes in policymaking has evolved also in connection to complexity theory, and what theoretical elements can be useful to create a share language and vocabulary for mutual enrichment and disciplinary enhancement. This analysis creates a base of knowledge from which other scholars and researchers might work to share a research field that connects complexity theory and design for policy, thus contributing to make use of complexity theory in design for creating value and not to perceive complexity as a problem.
REFERENCES


Understanding variations of entanglement and complexity: A way to influence expectations of Service and Systems Oriented Design in public sector

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KEYWORDS  
Cross-sectorial public innovation;  
Policy design;  
Public innovation;  
Cross-disciplinarity;  
Models.

Introduction

This presentation will introduce a simple way to distinguish low or high-levels of regulatory and cross-sector entanglement and complexity in design-lead, public sector projects. A basic ordering to support understanding and assessment of cross-disciplinary needs, including systemic design, as well as substantiate realistic expectations of what design-lead projects can result in, over time. The insights are based on experiences and learning from StimuLab, a Norwegian government experimental program, which I have co-designed.

Background

During the last decade, Service Design has proven to be well suited to improve and innovate Norwegian public services, which are better for the user and provide a more efficient use of resources for management. One example from 2013 is the project, 'If the patient was to decide' at Oslo University Hospital. The service design project lasted approximately five months and managed to reduce the waiting time for breast cancer diagnosis by 90%. Together with several other excellent cases, this has resulted in a rapidly increasing interest and high expectations at political level along with public sector in general, that Service Design can provide significant and concrete contributions to public services.

To increase public sector use of Service Design and to bring forward more examples of public innovation, the Ministry of Local Government and Modernisation established a two-year trial program in 2016. The task of developing the program was assigned to the Agency for Public Management and eGovernment (Difi). Due to the emphasis on design they entered into a partnership with DOGA. Both government agencies have responsibilities to develop and innovate public sector.

The result of our collaboration is the experimental program StimuLab. The program utilizes existing public ecosystem for innovation in new ways (Difi + DOGA), to reduce risk and catalyze innovation. It stimulates cooperation across sectors and levels of government and find the flex in regulations and procurement processes. StimuLab focus on impact but urge exploration. In this manner, StimuLab is testing new ways of working, to improve services, systems, procedures, regulations or the exercise of authority.

The StimuLab platform:

We have chosen to utilize the market to develop and deliver solutions together with the public actors. Furthermore, we demanded a specific competence configuration from the market, to strengthen their capacity to handle

1 The Project was funded by DOGAs Design-driven Innovation Program: https://www.designit.com/work/designing-out-waiting-times
complexity. Service design (including Systems Oriented Design) must be in the lead, supported by change management and impact assessment. This demand has resulted in new, fruitful collaborations between design agencies and management consulting companies.

Problem statement

Based on the promising results from previous service design projects, such as “If the patient was to decide”, the assignment from the Ministry of Local Government and Modernisation emphasized that StimuLab projects must deliver real results for real users, by the end of 2017.

During 2016-2017, StimuLab has supported and funded 8 projects with a total grant of NOK 10 mill. Improving a complex public issue can lead to substantial socioeconomic benefits, but they tend to be left untouched due to e.g. sectoral responsibility, lack of financing, absence of functional methods, coordination challenges etc. StimuLab has specifically pursued several such challenges. However, unlike “If the patient was allowed to decide” which was realized in approximately five months, untangling complexity on state level involves many actors placed across several sectors and requires more time than a typical service design project.

In our workings with StimuLab, we needed to create a better understanding of these variations, and also what this entailed, when it came to the Ministry’s anticipation of results.

Claim

In the StimuLab portfolio, huge variations in project properties have revealed themselves. By sorting the eight projects in a Pournelle chart we were able to support understanding and assessment of cross-disciplinary needs, as well as substantiate realistic expectations of design-lead project impact, in relation to where they are located in the chart.

I claim that:

• Increased understanding and awareness of variations in project properties, among designers and in the public sector, will help create more realistic expectations. High-level complex challenges in the top right quadrant require step-by-step development with multiple actors. They cannot be improved as rapidly as a service in the bottom left quadrant.
• Service Design in its current state is dominated by user-journey focus and
is not well-positioned to take on very high-level challenges by itself. Systemic capacity is useful, but not critical. In the top right quadrant, systems design capacity and cross-disciplinary approach is vital.

• The Pournelle chart sorting help to distinguishing tasks, so that one can allocate different design- and other experts necessary to tackle the challenge at hand.

To substantiate my claims the presentation will include StimuLab project examples as well as methodology in use, e.g. Systems Oriented Design, co-creative methods, impact assessment.

Conclusion

The great interest Norwegian politicians and public sector express towards service design today, represents a significant opportunity – but also a risk. If results are slow to appear, interest and opportunity may be lost. Both Service Design and Systems Oriented Design are relatively young disciplines, still in development. The simple Pournelle chart classification I have outlined could contribute to increase awareness of the variations embedded in public sector challenges, and what it will require to tackle complex, systemic issues.
INDUSTRIAL PROCESSES AND AGRI-FOOD SYSTEMS
The dark side of high tech precious materials recovery.
Overview on the critical issues, opportunities and best practices from a material library point of view

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Circular economy; Environmental sustainable processes; Ethics in design; E-waste; Recycled materials; Precious and non-precious metals; urban mining.

Eco-sustainable design strategies act as the liaison between different disciplines and professionals: the world of production and research, companies and the key issues of project development –economics, society and environment [Lerma, 2014]. Many of the environmental sustainability issues are either directly or indirectly linked to materials and their life cycle [Lindahl, Robert and Broman, 2014]. Environmental impacts occur at different stages of the life cycle, including the extraction, production, transportation and processing of raw materials, as at the stage when the product is actually used and disposed of [Vezzoli and Manzini, 2007]. Furthermore, a material can be considered eco-sustainable when it is effectively and efficiently used within a specific project and integrated into the entire application system. Moreover, it comes to environmental sustainability when opting for the use of materials and semi-finished products sourced from areas comparable to that where the company operates [Allione, De Giorgi, Lerma and Petruccelli, 2012]. Therefore, creating a network of contacts in the region able to assist manufacturing companies, particularly SMEs, when selecting their suppliers or researching and assessing local partners for processing operations appears as more and more necessary, but this approach cannot be always pursued.

Eco-sustainable design strategies play a role of utter importance for the development of innovative sustainable products and production processes [El-Haggar, 2007]. Specifically, in an evolving scenario of increasing dematerialization and greater complexity of objects, several specific materials already in production and those still being field tested, become more meaningful [Ferrara, 2004], such as those precious and not precious ones coming from the e-waste domain. The rapid expansion of technology and, what is more, the programmed obsolescence of these products, means that a very large amount of e-waste is created every year, every day, every minute [Baldé, Forti, Gray, Kuehr, and Stegmann, 2015]. Different materials are present in e-waste: the base metals include iron, copper, aluminium, nickel, zinc, selenium, indium, gallium and precious metals. Hazardous substances that can be found in e-waste include mercury, beryllium, lead, arsenic, cadmium and antimony instead. In addition, the larger material group consists of plastics, glass and ceramics [Fornalczyk, Willner, Francuz and Cebulski, 2013], adopted for the case and the outer part of the devices. The availability of these materials generated the new definition of “urban mining” as the activity of recovery materials from urban waste becoming “the mines of the future”, and providing materials for reuse and cutting costs and landfill waste.

The recovery of metals and precious metals from electronic waste (e-waste) has been in fact an important topic not only for economic aspect but also for recycling rare natural sources and reducing the e-waste to prevent the environmental pollution, in other terms, following the 7Rs Golden Rule usually adopted for a sustainable waste management [El-Haggar, 2007]: in order to achieve the correct use and application of materials from a green perspective, eco-compatibility must in fact be considered when they are chosen as much as when they are at the end of their life. Additionally, today’s materials are smart and encase an inner core of performance and function that could previously only be given by complex systems. Other key elements that have to be taken into account regarding environmental sustainability are the players involved in the design and manufacturing processes, the origin of the resources and the location of the suppliers and manufacturers and the development of further production [Ceppa and Lerma, 2014].
One possible eco-sustainable approach towards the issue of e-waste is offered by Circular Economy [Geissdoerfer, Savaget, Bocken and Hultink, 2016] and the related System Design thinking [Barbero, 2016], suitable for dealing with industrial processes strategically, and aiming at recovery precious second life materials to new applications, both into the same productive chain, or to new ones. With this approach, thousands of electronic appliances (such as audio-visual components, televisions, VCRs, stereo equipment, mobile phones, other handheld devices, and computer components contain valuable elements and substances suitable for reclamation, including lead, silver, copper, and gold) are dismantled, and their materials are divided in order to be conveyed to new productive chains, new productive systems and new proactive industries. Nevertheless this procedure still doesn’t avoid critical issues. As an example, this process entails social, environmental and legal questions, such as those generated by the uncontrolled movement of e-waste to countries where cheap labour and primitive approaches to recycling have resulted in health risks to local residents exposed to the release of toxins continues to an issue of concern [Ottaviani, 2018].

This investigation presents a panoramic overview, as well as the specific point of view of a material library on the topic. The aim will be showing the most recent data about the global amount of e-waste production, analysing the potentialities of innovation in terms of sustainable production and Circular Economy applied to the new application fields of these innovative -or renewed- materials in the Italian context, and showing how a material library can be valid support for the already existing SMEs, companies and designers in boosting this virtuous process. On the other hand, the most critical consequences of e-waste recovery are discussed and analysed, supported also by several case studies taken from the world of design and craftsmanship, dedicated to highlight this complex issue, showing how eco-sustainable design strategies can really trigger virtuous mechanisms of economic development.

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The situation of concern in this paper is that of Food Security. In a previous paper [Darzentas et al., 2017], the I KNOW FOOD (IKF) project and its composition and objectives were introduced. As its name suggests, an overall aim is to integrate knowledge about food systems. Also, the project examines these systems in the light of food system resilience. The project defines food system resilience as “the ability to learn, adapt and transform to cope with external and internal stresses and shocks in order to maintain stable levels of nutritious food supply”.

The word ‘systems’ is used in food studies very frequently, as the food research literature recognises the interconnectivity of various elements and talks about “the food system”, but it is easier to find research that deals with parts of systems independently. This has been changing, with more researchers trying to find ways to study food systems more holistically. Such research (Ericksen, 2008; Bland and Bell, 2017; Horton, 2017) on food security is working to draw in sources of multiple interactions, to identify key processes, drivers, multiple feedbacks and outcomes. This then leads to some thought-provoking perspectives on how components are interlinked and could potentially lead to “actionable improvements”. This wider, more holistic, agenda for food security research may include many different factors not apparently directly influencing food security, such as over-consumption of ‘bad’ food and obesity, to be studied along with more traditional foci such as increasing food production and improving food value chains. The IKF project belongs to this newer tradition of taking a wider, more holistic, perspective, and has a main objective to integrate many different types of knowledge about food.

Our approach is grounded in Systems Thinking and Design to capture, learn about and develop deep and shared understandings of the problem space of Food Security. Such understandings are necessary to move towards appropriate and robust design interventions. An initial step in this approach is to build a holon (Darzentas et al., 2017). We adopt the meaning of the Greek word ‘ὅλον’ which means ‘whole’ or ‘everything’, in relation to the problem space. The holon is not a systemic view of a complex problem, in our case that of food security. It consists of emerging stakeholders’ issues with the components and links considered relevant. To build a holon, design methods such as those informed by ethnographic as well as participatory activities can be used. In this process, a holon may be refined many times, as the learning and understandings deepen. The holon when ‘translated’ into a systemic language makes use of known tenets and principles of systems thinking. In this way, notions such as resilience can be examined using the Holon to situate them in the problem space.

IKF proposes the use of the lens of resilience to examine food security. Resilience has been conceptualised in at least three ways; as absorbing shocks, as preventing shocks, or as adapting to shocks whether in socio-ecological systems (Béné et al., 2016) or socio-technical systems (Taysom and Crilly, 2017), and in some cases more than one of these forms of resilience are apparent. For instance, an aid agency may provide first aid to help absorb the shock from an emergency, but also try to put in place preventative measures to resist unwanted changes, or even a development project to transform the current food production/consumption processes so that they are not vulnerable in the future to the type of shock caused by the emergency. Furthermore, despite the pervasiveness of the term resilience, it is generally considered, in current discourse, as a ‘good thing’. But resistance to change can mean that
undesirable states of systems remain (e.g., resistance to changing known ‘bad’ dietary habits). Finally, there is the problem to understand what impacts creating resilience in one part of the system may have on other parts of a system.

This paper presents ongoing work initially bringing researchers together into a shared space to develop understandings of the IKF objectives. A first step was to move from the ‘given’ system definitions (e.g., ‘supply chain system’, ‘healthcare system’, as well as ‘stock’ definitions of actors and roles (e.g., farmer produces food) to develop fresh understandings and reveal emergent properties. Although these researchers are just one group amongst the stakeholders engaged in IKF project, they are each working in partnership with the main groups of stakeholders. For example, researchers working with food producers meet with farmers’ groups whose motivation is exchange of information between themselves, and the researchers engage in social learning to immerse themselves in their world. In doing so, they bring a richer understanding of the motivations and values, the limitations and outside constraints that come into play in the farmers’ spheres of activity. Bringing these richer understandings to the building of a holon allows for differentiated emphases from the more commonly accepted ‘food systems’ actors allowing possible re-orientations.

Figure 1 below shows a holon created by the group of the researchers in 3 workshop sessions.

Already, some very promising preliminary observations emerged that demonstrate the usefulness of the systemic design approach, for the grounding of resilience in the project:

- A description of the situation of concern elaborated during the workshops shows interesting differentiations when contrasted with the official definition of Food Insecurity from the Food Alliance Organisation. Their carefully crafted definition, which is periodically reviewed, states that Food Security is:

  “A situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO-2001)”

In contrast, the workshop elaboration paid attention to human self-sufficiency, introducing the concepts of means, agency and knowledge as necessary to access food, in contrast to the ‘physical social and economic’ of the official definition. It qualifies food as being ethical, as well as nutritious, and affordable, and finally, they introduced the notions of care for the environment as well as the cultural acceptability of food, that do not exist in the FAO definition. Their final elaboration was:
"Enabling people to have the means, agency and knowledge to access ethical, adequate, nutritious, affordable, culturally and environmentally acceptable food"

• Acknowledgement of the influential role played by the stakeholder group termed ‘communicators’. This group includes people such as food journalists. Although the academic world recognises the importance of communicators, with whole journals dedicated to research, (e.g. the Journal of Environmental Communication), within the food security literature they do not seem to feature as a stakeholder group. Yet, evidence of their activity abounds, whether it is exerting influence on consumers via advertising; or their key role in informing and educating consumers about safe and nutritious food practices; or as conduits to filter and popularise scientific results to consumers with practical recommendations regarding dietary information. Of course, as everywhere, the role of information and communication as a powerful and influential tool is well recognised, but when dispersed into makers and writers of documentaries, newspaper articles, and commissioned reports, they are not easily recognisable as stakeholder group.

• The importance of the 3rd Sector: those with ‘on-the-ground’ knowledge, are those who can be said to be actively engaged in implementing resilience (whether trying to absorb shocks carrying out first aid in emergencies, or whether engaged, perhaps after a disaster, in trying to build resistance or to transform).

• The nature of the potential of stakeholders. Notwithstanding the many inequalities that are present, each stakeholder appears to have some mechanisms, to influence, affect, change, or even disrupt flows of material and of information within the holon. Further refinement may help to understand the nature of this potential.

The richness of a holon such as the one in Figure 1 offers an opportunity to identify some of the effects that an external stress/shock, for instance, might have within the captured holon. This may also then allow for some useful speculation on the type of resilience required to face up to those stresses. Of course, it must be said again that any capturing and understanding of the problem space is evolving iteratively, so that the holon may be refined again and again.

Figure 2 gives an example of the potential effects of the “external prodding” that an awareness campaign aimed at the consumers of food might have on some stakeholders.

Figure 2: Potential effects of the “external prodding”

By stressing or ‘prodding’ the system, it is possible to see where the potential ‘shockwaves’ hit. For example, in Figure 2 above, the awareness campaign aimed at consumers, may also affect others, such as retailers, and this may have a knock-on effect to the link between retailers and producers. The holons allow for creating understandings of what types of resilience are needed.
by the various stakeholders both to resist being affected by the shockwaves, or to have mechanisms in place to adapt to the shockwave. Identifying such pathways allows for understanding the possible forms that resilience, if required, could take. Translating into systems language provides a platform to move towards creating interventions where tried and tested design methods can be used. Again, it is emphasised that a very important benefit of the systemic design approach is that, because of the way the ‘paths’ to emerging subsystems are generated, the stakeholders involved in each one of those, can ‘meet’ again, when necessary, back at the ‘system’ (or translated holon), or even at the holon itself. That may be necessary because of the iterative nature of the evolving understanding and learning, as well as the dynamic nature of systems’ characteristics such as borders and environment which change continuously.

Thus, the holon offers stakeholders and designers a common platform of reference when needed to clarify and redefine evolving issues. Our work has shown that building a holon can be an important part of the process to reach not only deeper understandings of the problem space, but also to refine those understandings, to be able to illuminate them with the lens of systemic design, and to speculate on what design interventions towards what kinds of resilience within the system can be designed so as to minimise disruptions, and improve the nature of esistance where required.

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**KEYWORDS**  
Recycling and reusing textile wastes;  
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Textile recycling scenarios.

The textile is play a crucial role in the third economic sector in several European Countries. The fashion industry is considered as a benchmark of excellence in Italy and Italian fashion revenues are remarkable (Crivelli, 2017). But at the same time the textile system is extremely polluting and wasteful (Ellen Macarthur foundation, 2017). A large amounts of non-renewable resources are extracted to produce textiles; dioxide carbon emissions are realised in several stages over the textile’s life cycle; special wastes are landfilled (Wicker, 2016) both in upstream process (afterwards the production and the delivering) as well as in downstream process (once the textile is used). Less of 1% of materials used to produce clothes becomes part of a closed-loop recycling and less of 2% are recycled in other industrial activities. This is likely due to the currently manufacturing system that operates trough an almost linear way (Ellen Macarthur foundation, 2017).

Although the framework highlighted some good practices have been already carried out, showing how it possible use textile wastes in several sectors, including the building one. Building sector is only apparently far away from the fashion industry. A well known example of open loop recycling of fashion wastes used in construction is the California Academy of Sciences in Golden Gate Park in San Francisco designed by Renzo Piano Building Workshop. The thermal insulation materials have been made with over 200.000 pairs of discarded jeans. Transforming the textile industry according to Systemic Design principles is therefore possible, proposing a well known but fundamentally change: wastes and by-products due their properties might be assumed as inputs of new production systems. Such methodological approach makes it possible to meet the circular economy goals set out in current European Directive (European Parliament, 2018).

Based on these premises a research project titled EDILTEX (Carbonaro C. et al, 2018) – Innovation for reusing in textile companies – was carried out. The project was aimed at meeting needs to reducing environmental impacts of Small Medium Enterprises, in two textile and fashion districts (Tuscany and Lombardy). DAD’s research team of Politecnico di Torino was partner of the project dealing with some aspects related to reuse and recycling processes. The research was developed with the economic support of Fondimpresa inter-professional fund. Commitment and collaboration were implemented sharing knowledge, analysing the production systems and defining different waste disposal opportunities.

Bearing in mind the Systemic design objectives the research was split-up into stages: Need findings; Ideation and Prototyping; Monitoring; and new Business Strategy.

**Figure 1:** Ediltex project at a glance.

![Ediltex project at a glance](image_url)
Needs were pursued through environmental audits in order to point out the most important manufacturing findings and in order to characterise the wastes proprieties and how wastes could be reused and recycled (see figure 1). Matching the information collected in the ideation stage three scenarios were outlined. The first scenario was focused to enhancing textile wastes as Secondary Raw Materials (SRM) and/or by-products in existing recycling companies. Some opportunities were investigated (i.e. the manufacturing of building insulations materials for acoustic purposes) according to SRM features.

The second scenario was addressed to enhancing the textile wastes in on-line markets (market places). Within such the reuse or recycling chances are not predetermined. They depend on the supply-demand balance.

Finally, the third scenario was aimed at developing new building materials, basically through two activities trough a material sorting process and afterward trough a concept design.

The material sorting and concept have highlighted some physical properties such as: density; thermal conductivity; sound absorption coefficient. On the basis of the performances provided by the wastes further activities addressed to prototyping were planned. Two experiments were developed and some interesting achievements concerning the activities carried out were reached.

Some textile wastes (artificial fibres) were used as additive in the manufacturing of clay based plaster. Fabrics were shredded and dosed in defined quantity in the mix design of a selected number of samples featured with different densities. The research outlooks to improve the tensile strength and the alkali resistance. The shredded fabrics should absorb the tension on ceilings and walls and they should prevent cracks in the plaster.

Some polyester wadding wastes have been tested in order to assess their acoustic insulation potential. The wadding becomes the inner part of acoustic screen enables to improve the reverberation in rooms. The external surface is featured with leather or textile surpluses. Particularly leather is an easy maintaining material and overall it has self fire extinguishing characteristics. The concept and the prototyping were conceived as a building furniture shaped as a flat pillow sewed at the edges; the reuse of different trimmings allow to get a unique pattern in term of size and colour.

Monitoring is ongoing (will end by the second semester of 2019). The first tests carried out show that some requirements - normally taken into account in plasters and insulation panels - were met, demonstrating the potentiality to generate a zero wastes system and promoting symbiotic processes between only apparently disparate industrial sectors.

Finally, the business strategy definition has been focusing on the characterization of the value proposition as well as on the fine tuning of the recycling and reusing system. The transition from a linear production process to a circular one entails the implementation of current wastes collection and processing systems. Designing the supply chain is crucial part of the business strategy shared with the Small Medium Enterprises; Thus their wastes can be effectively exploited as secondary raw materials in an other manufacturing systems.

On the whole the outcomes show that a new perspective in textile production is actionable. It is based on the principles of circular economy and in accordance to a systemic approach matching together sectors such as fashion and building. Despite it is required to managing properly situations of complexity and uncertainty - in which there are no simple answers and lot of efforts are still necessary - a systemic addition is however possible: building and fashion makes “building the fashion future”.
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The food sector causes around 30% of global life cycle environmental impacts, mostly due to dairy and meat production and consumption. These impacts can be reduced through systemic innovation in how people relate to food, and consequently how and what they choose to eat (Tukker et al. 2011). New businesses are emerging that address sustainable food challenges, to reduce waste, water, energy use, and carbon emissions associated with food.

‘The New Farm’ is a recently established food innovation hub in the city of The Hague that has hosted a number of these emerging businesses. Examples include: Urban Farmers, a large aquaponics farm for circular vegetable and fish production; Haagse Zwam, which uses waste from coffee grounds to grow oyster mushrooms; UpTown Greens, which provides vertical farm units to restaurants. The New Farm is located in a low-income district and seeks to involve the local neighborhood as a focus use case. The hub is located in an old, refurbished industrial building. At the point of writing, it is at the beginning of its operations, with last constructions to create space for multiple restaurants to settle in the ground floor of the building. We seek to answer the following question: How can a local innovation hub serve to engage organisations in joint business experiments to design circular urban food systems?

This question is based on two insights from the field of sustainable innovation. First, any innovation activity for sustainability needs to look at multiple levels (e.g. products, business models and systems), with special attention to systemic levels (Ceschin and Gaziulusoy 2016). This is because sustainability problems can only be addressed through the connections and interactions between, for example, people, organisations, products and services (Meadows 1997; Boulton et al. 2015). The circular economy provides a useful narrative for such systemic innovation (Blomsma and Brennan 2017). It suggests that organisations jointly minimise a system’s resource inputs, as well as its waste and emission outputs. This can be done by narrowing (use less), slowing (use longer) and closing (use again) resource loops (Geissdoerfer et al. 2017). Second, while a lot research has been about ‘what’ is necessary (e.g. minimise negative environmental impacts), and ‘why’ (e.g. safeguarding welfare for coming generations), less is known about ‘how’ effective change can be created (Zollo et al. 2013). Conducting business experiments has been promoted as an actionable process for ‘how’ this can be done for circular economy (Bocken et al. 2016; Bocken et al. 2018). It works as follows: come up with new ideas, select the ‘best’ idea, and then get out of the building as quickly as possible to test critical assumptions about its desirability, viability and feasibility at the lowest possible cost and the least amount of time. Key here is to rapidly go through ‘build-measure-learn’ cycles to learn whether an idea works or not, and iterate or pivot after each cycle (Ries 2011; Osterwalder et al. 2014).

Conducting business experiments on a systems level requires a few additional considerations. First, they require open project structures and time to develop a shared vision among involved people and organisations (Konietzko et al. 2018). Second, they ideally focus on one location, one use case and one initial customer, while they also test the adaptability of value propositions to other contexts (e.g. other customers, locations, and use cases) (ibid.).

The hub is a purposed case that can enable systemic and collaborative business experiments. It focuses on one location and one use case. However, the tenants in the hub have not yet established a project structure for joint
experiments or a shared vision. This is the starting point for our research. We use four steps to explore the question: 1) 10 interviews with tenants and partners, 2) informal get-togethers between tenants, 3) business experiment design, 4) business experiment sprints with tenants. First interviews have revealed individual interests and the willingness for joint action. First informal get-togethers have helped identify common interests. Going forward, we seek to integrate this with a method for workshops to create a shared vision and conduct business experiments together with the tenants to answer the question.

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Natural fibers insulation panels: an adaptive production

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The research team recently developed an innovative system with low environmental impact for the production of semi-rigid panels for thermal and acoustic insulation, obtained from recycled sheep’s wool, from Piemonte region (Cartonlana insulation panel). Starting from the previous work, a new semi-rigid panel has been produced, combining sheep wool with hemp technical fibers (Fitness insulation panel). The research activities have been developed by a multidisciplinary group, which includes a textile company, Davifil (owner of the Cartonlana patent), the Biella CNR ISMAC (specialized in macromolecules and the textile fibres), the Department of Architecture and Design - Politecnico di Torino (expert in low-environmental-impact building components), and Assocanapa, which promotes the cultivation and valorisation of hemp.

Both the sheep wool and the hemp used for the insulation panel production derive from agri-food systems and are wastes from already existing production chains. Wool comes from Piemonte region sheep breeding; it cannot be used in textile industry, due to its dark color and/or poor quality: fibers are too thick, and irregular length also. Sheep wool is usually washed and dried, but still contains plant debris trapped amongst fibers. As for hemp, treatments on the raw wool are reduced to a minimum, in order to minimize the energy consumption for the production of the panels.

Cartonlana and fitness

The panels have two main innovative features: unlike the already existing hemp and wool insulation mats, they are semi-rigid products and they has a low environmental impact, as shown by the Life Cycle Assessment. Their stiffness comes from the production process, where the keratin of wool fibers works as a binding matrix and constitutes a rigid structure. The panels have been tested to measure their thermal and acoustic absorption, both in the laboratory and in real use conditions, demonstrating excellent performance, in line with the natural products currently on the market. In particular, the laboratory measurements showed a thermal conductivity of 0,041 W/mK for Cartonlana and 0,040 W/mK for Fitness. As for the sound absorption coefficient, Fitness panels have a better performance (aw=0,75 MH compared to aw=0,55 MH of Cartonlana).

Starting from that experiences, a further phase of experimentation of the production process of insulating materials is being implemented, in order to improve the degree of adaptability to the real availability of wasted natural fibers from local agri-food systems. The objective is to create and test an “open recipe” for insulation panels production, able to keep as low as possible the environmental impact, thanks to the adaptive use of natural fibers available in a specific context and time.

New panels, as those already tested by the research group, consist of two main components:
- a “matrix” based on sheep’s wool chemically treated according to a process patented by the research group capable of constituting the rigid keratin structure of the insulating panel;
- a “charge”, made up of waste materials and by-products of textile and agri-food chains; natural fibers that are not used on the market, but also artificial waste materials.

In the “open recipe” the binding matrix (sheep wool) is mixed with different quantities and proportions of the “charge”, fixing the appropriate rules and variables to keep the thermal and acoustic performances suitable for the use
in building sector as insulations.

**The “charge”, a selection based on “low environmental impact” requirements**

With the aim of keeping the environmental impact related to the production of the panels low and with a view to circular economy, it has been suggested the use, as “charge” selected with the intent to explore the possibility of obtaining panels with different performances.

The contribution presents the methodology adopted for the research in progress, the “open” Technology Assessment to be adopted for the production of the panels.

For the “charges” selections, to be tested in the new thermal-acoustic insulation panels, the research group defined some principles, in order to keep as low as possible the environmental impact of the insulation panel. The selection was oriented to:

- wasted materials, from already existing production chains in the reference territory, where sheep wool is available but currently discarded;
- materials without any others specific uses;
- materials available in sufficient quantities in the reference area, without any economic value for producers;
- natural materials, in order to facilitate the end-of-life disposal, assuming, ultimately, a thermo-valorization as biomass scenario;
- preferably fibrous materials, or however easily aggregable with wool fibers, in order to produce panels with an homogeneous composition.

Considering these requirements, the research group selected the following materials as possible alternatives: corn bracts, dried bean plant - referring to the Piedmont region territory - and almonds shells - referring to Puglia region. Therefore a production-chain study and an availability scenario, in parallel to the production of panel specimens, have been developed.

Corn bracts can be considered a by-product of corn cultivation harvesting and are single sheath leaves, protecting the corn female inflorescence, an ear that grows sideways to the stem, at the height of the 6-7th node below the male inflorescence (Università di Sassari, Dipartimento di Agraria). Corn plants generally present a single ear 10 – 20 long, but occasionally can reach 42 cm longness, and 3–5 cm large (Assomais), carrying about 1000 dry one-seeded fruit, the caryopsis, each. The female inflorescence is supported by a peduncle generating the bracts, generally in number of 5-6 each flower and representing about 7% by weight of a mature whole corn plant.

Corn is highly widespread in North Italy, while Piedmont is one of the four regions with the highest corn production in Italy, with a production area of about 148,855 ha (ISTAT 2016) and a 1,441.5 thousands tons of crop yield, despite suffering a sensible decrease of cultivation area of about 33%, after 2014. In Italy, corn harvesting happens in September-October, generally using a combine harvester machine. A square meter corn plantation area is likely to make about 6-8 corn ears, about 30 – 48 bracts, 40 – 65 t/ha of chopped plant, in north Italy. As a corn plantation by-product, bracts have quite no use, excepting, together with other corn residues, as biomass and boilers fuel. Moreover the large widespread on the regional area, its fibrous nature and low protein content, make it a potentially interesting product to be tested as a “charge” for the panels recipe.

Almond is a deciduous tree of medium height (from 5 to 7 metres in its adulthood) and slow rate of growth but very long-lived. It generally goes into production around the age of 5 and achieves maximum productivity no earlier than 20 years of age. It well tolerates drought and high temperatures in summer and adapts to dry and poor soils. Its fruit is an ovoid and elongated drupe, with a fleshy, light green coloured and hairy (sometimes also glabrous) exocarp (mallo), which detaches when ripe. The endocarp (shell) is woody, whose consistency can be hard or brittle.

Inside the shell are contained seeds (almonds) which are utilized mainly
by the confectionery industry and, partly, consumed as dried fruits. The harvesting period goes from the end of August to the end of September, depending on pedoclimatic conditions and cultivar, when the hull is completely open and almost detached from the shell. Currently, more than 93% of national production comes from two regions: Sicily (60%) and Puglia (33%). The total amount of the national production of shell fruits is about 79,600 tons (source Istat, year 2017). Given a yield of 25-30%, remain about 55,000-60,000 tons of non-edible parts that are merely used in cosmetic and soap industry or become fuel that could be employed, instead, as “charge” for making panels.

The opportunity of using the dried bean plant comes from the great availability of that material in the Piedmont region, where 23% of the beans cultivated area in Italy is concentrated (ISTAT 2010). In particular, the province of Cuneo can be considered the most suitable area for designing panels because both sheep wool and dried bean plants are widely available. In that territory the beans production is also identified by the IGP denomination “Fagiolo di Cuneo” (Protected Geographical Identification). Moreover, referring to the IGP denomination, another research group from Department of Architecture and Design has recently developed a production-chain and valorisation scenario, thanks to the project EN.FA.SI.2, funded by Piedmont Region.

The beans are harvested by hand or through threshing in different phases during the autumn season. In the threshing-harvest, the thresher collects the beans, leaving the rest of the plant (stem, leaves pods) in the field, where it completes its drying process. The plant is rarely harvested, more often it is turned in the field, with the risk of soil contamination by parasites. In few cases is used as cattle litter (with lower yield than straw) or burned as biomass to produce energy. The research group propose to use the entire dry plant for the production of the panels as aggregate charge from sheep’s wool. The production of the sheep wool and dried bean plant panel specimen gave a positive result, highlighting, however, some difficulties in separating the dried plant fibres.
Sustainable production and consumption is one of the seventeen Sustainable Development Goals (SDGs) (United Nations, 2015). The mobile phone is an important example of unsustainable production and consumption. There are widespread social and environmental impacts in its life cycle (van der Velden & Taylor, 2017) and the production and consumption of mobile phones continues to increase, also in countries with a highly saturated market. In 2017, 1.47 billion mobile phone units were shipped worldwide and that number is expected to reach 1.7 billion units in 2020 (Statista, 2018).

Repair is one of the activities that disrupt the unsustainable consumption of mobile phones. Repair extends the lifespan of a product, which slows down unsustainable product life cycles. Through stories of the repair of mobile phones, from Norway and Ghana, we are able to draw a global system of mobile phone production and consumption, which can offer insight for a more sustainable mobile phone life cycle.

The number of places where one can repair shoes, clothes, electronics, etc., after the warranty period has expired, has decreased dramatically in high-income countries such as Norway. Also when one brings a faulty item back during the warranty period, the item is most often not repaired, but replaced. As a result of increased awareness of the impact of unsustainable consumption, several community-based repair initiatives have sprung up in high-income countries, such as the Restart Project in the UK (The Restart Project, 2018) and Repair Café in the Netherlands (Repair Café, 2018), both with affiliates around the world. The Restart project focuses on the repair of electronics. Restarters Norway, which is one of their affiliates, organizes so-called repair parties for electronics (Restarters Norway, 2018). Repair Cafés offer all kinds of repairs, based on the availability of skills among their volunteers. Electronics, bicycles, and clothes are some of the most popular items.

Community repair is based on voluntary participation of repairers, who come together in a local setting, such as a community centre or library, to repair whatever people bring in. The meetings are organized by and for the local community. Community repair is often motivated by sustainable consumption or the unavailability or unaffordability of formal repair, but also the culture and joy of repair plays a central role.

In low-income countries, repair has always been an important household activity as well as economic activity. Our fieldwork on informal mobile phone repair in Ghana shows that repair is a collective activity; colleagues, master repairers, and apprentices work together, sharing tools and expertise.

Rather than comparing informal repair activities in Norway and Ghana, we propose to tell system stories of mobile phone repair in both countries. System stories have the capacity to shift the focus from parts of the system to the whole system (Stroh, 2015). They are part of what Ison calls a systemic inquiry, “a particular means of facilitating movement towards social learning (understood as concerted action by multiple stakeholders in situations of complexity and uncertainty)” (2010, p. 244).

We understand repair as a “doings of care” (de la Bélacasa, 2011). Our repair stories focus on the material aspects of the mobile phone. We follow the mobile phones and its spare parts to the places where they are repaired and we focus on the repair process itself, by looking at the tools and resources (manuals, spare parts) used for repair. Using system mapping (Stroh, 2015), we can draw global flows of materials as well as the structures that regulate these flows, such as national, EU, and international regulation, and consumer practices.
System stories and system mapping are important tools in addressing complex problems, such as those addressed by the SDGs. By focusing on repair, an activity disrupting the business as usual of unsustainable cycles of production and consumption, we are able to shift the focus towards the system as whole. By mapping global flows of materials, we are able to identify what is “systemically desirable” (P. B. Checkland, 1999; P. Checkland & Winter, 2006) in terms of possible actions that will strengthen repair as an intervention in unsustainable production and consumption. We identify product design for reparability, the free and affordable availability of quality spare parts, and zero value-added taxes on repair and spare parts as desirable actions for caring about mobile phones and other things.

REFERENCES


3 SOCIOTECHNICAL SYSTEMS IN THE DIGITAL AGE
Circular Economic Service System Design for Community Based Flood Resilience.

Designing a Collaborative Grain Storage and Service System for the Annually Flood Prone Communities of Assam, India

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The role of a designer is gradually being believed to be that of a social scientist and a leader who designs or facilitates innovation of newer ecosystems of products, services and systems; developing social capital along with resource effectiveness and economical benefits. The social and environmental imperatives have compelled designers to look beyond satisfying human desires, from merely creating problem-solving products towards focussing equally or more on generating overall well-being in the society — both individual and societal, and thus engender meaningful interactions of users with their surrounding environment through corresponding product-service-systems. As Professor MP Ranjan, a notable design educator blogs, “... (design offerings) are synthesized and developed in such a way that they vibe with the context and add value to the social, geographic and historical situation that is being addressed.”

In current times, emerging world issues like climatic aberration, exponential increase in population, heavy product consumption, it’s post-usage waste generation and poor resource management have been gradually leading to chronic problems of sustainability, such that the vision of a plausible tomorrow questions the mere existence of humans and the symbiotic relationships it share with its surroundings. With multiple causes and its complex interdependencies, these problems are deeply entwined within our lifestyle behaviours, aspirations, desires, social beliefs, and our response to the evolving environment. Shifting from the linear process of resource usage, consumption and disposal, circular economy believes in the core principle of re-circling material resource and preserve existing stock for a sustainable and resource abundant tomorrow. Enabling resource effective ecosystems today by ensuring collaborative usage, shift to renewable sources of energy and improved manufacturing processes and logistic cycles. Design-for-Circular-Economy (DfCE) is one of the first stepping stones towards creating future ecosystems of well-being living.

As a part of an academic applied design research project, this paper explores design of a circular economic service-system to facilitate community based resilience and enable a well-being ecosystem among the annually flood prone communities of the Brahmaputra Valley in the state of Assam, India. Threatening a sustainable lifestyle and scope for socio-economic development, the villages in the Brahmaputra Valley of Assam, India, experience massive floods annually, leading to basic need deprivation, impoverishment, weakness and extreme social, physiological and cognitive vulnerability. Primary ethnography and design research revealed that being exposed to an annual vulnerability to basic survival needs, accompanied by the absence of adequate and permanent flood resilience systems, these communities have been completely dependent on external aid for relief and rehabilitation.

This dependency, however, has reduced the overall desire and capacity for self-reliance and the community’s resilience to such situations of emergency.

Approaching through holistic design thinking and system oriented design intervention, this project attempts to collaboratively design a service system to facilitate an ecosystem of self-reliance, effective community interactions, resource effectiveness and participatory local innovations for flood-resilient village development.

**Understanding and mapping the process of systemic circular design intervention**

In order to understand and decipher the methodology and process of thin-
king and designing holistically, several social design methodologies, community well-being design frameworks, philosophies and narratives were studied to create a design artefact, 10-Q-2-d-i. The tool enabled to evaluate a generated design concept or idea from multi-stakeholder design development perspectives.

Analysing various case studies of circular economic design interventions, a set of circular economic design trends have also been compiled and segregated as idea trigger cards — ‘Design Intervention Cards for Design-for-Circular-Economy (DfCE)’ to engage into participatory design ideations. These cards, as initial design directions, focused on the design objective of enabling circular economy in a given context and aid designers and design students to channelize concepts generation process.

Exploring circular economic design opportunities for cultivating well-being among the flood prone communities of Assam, India

As primary research and end-user design inquiry, ethnographic research was carried out in three flood-prone areas of Assam to understand the current lifestyle scenarios, the severity of experienced problems, perceptions of well-being and prevalent behavioural biases of the primary stakeholders. Design dimensions for well-being and social sustainability ecosystem generation were mapped to the principles of circular economy in order to generate a system design approach framework. This framework was used to identify the leverage points for design intervention in the contextual system. Subsequently, a trans-disciplinary co-creation workshop was curated for idea generation, concept segregation and collaborative design development.

Contributing to flood-resilient village development: developing a collaborative grain storage and service system through social entrepreneurship

Using the system design framework, a social entrepreneurial model was conceptualized for the flood prone communities of Assam to facilitate and enhance self-reliance of food availability. Collaborative Grain Storage and Service (CGSS) System enables a user family to effectively plan their farm-produce consumption patterns, and have on-demand access of food grains during any emergency scenarios like floods. The different service touchpoint implementation strategy was further developed and validated with the users.

Effective implementation of circular economic behaviour today in terms of collaborative or shared services that generate higher numbers of livelihood opportunities, effective user experiences, and aids communities to adapt renewable energy sources that reflect visibly on their household expenditures will make communities and villages in India evolve to a more resource effective system.
Within the contextual constrains, service system design can be approached through stakeholder participation and systemic design methodologies. The paper/presentation highlights how system oriented design can work on complex social problems by creating product-service-systems that enables the stakeholders in their capability-building, addresses local sustainability issues and creates a global implication through its replicability.

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New strategies for the refrigerator in the transition towards a circular economy

In the last decade, the values of the traditional economy have been strongly challenged, considering the concept of development of the last century as the main cause of many environmental issues that we are facing today. Recently, new strategies have been introduced to provide a renewed concept of development, including the creation new business models in the context of the circular economy, a greater importance of intangible value, the merging of products and services (de Arruda Torresa, 2017) as successful strategies to oppose the classical economy. Nevertheless, both designers and companies still consider projects as ‘finished’ at some point. In the same way in which, before the introduction of waste regulation, manufacturers paid scant attention to their products’ end-of-life, today many companies seem no longer interested in their products after the sale once they have been sold and the warranty has been expired, i.e., while the product is in use. However, the usage phase impact more in products such as the refrigerator, which is characterised by a long lifespan (according to Bakker at al., 2014 the ‘optimal lifespan’ of new purchases is now estimated around 20 years) and a continuous use (400-1100 KWh/y according to the related energy class).

In this paper, instead, we take into consideration how products could continuously evolve after their implementation (Hansen et al., 2008) and how companies could benefit from them throughout their life cycle, delivering new services while changing their business model completely. This approach leaves room for addressing every step of the traditional life-cycle in a more circular way, shifting the focus on a more complex vision about the product. This scenario could radically change by introducing new business strategies such as reducing product ownership through sharing, remanufacturing activities and so forth, while extending the product lifespan, without the need to rely on outdated strategies such as planned obsolescence or the push on the purchase of more goods.

We adapted some of the strategies of the circular economy listed by Kirchherr et al. (2017) within the standard life cycle of the product, by facing the gap of a certain lack of circular strategies related to the use phase (Figure 1). Hence five strategies have emerged, three of which are suitable for exploring new scenarios based on the concept of flexibility and two strategies based on the idea of predictive maintenance.

![Figure 1: Introduction of circular economy strategies within the standard life cycle of the product](image)
Product flexibility

This section provides three non-inclusive examples of exploring new scenarios based on flexibility, empower the user to personalise the object and develop new behaviours of use and consumption.

- Reduce ownership: A first scenario could be the integration of a pay-per-use and sharing strategies that leads the user to reduce the ownership of goods, by paying for the actual product use, saving money when the product is used in a virtuous way. In this paper, an in-depth analysis of scenario is carried out, based on the literature which considers ownership and planned obsolescence as two obsolete strategies.

- Product evolution: Software update is just an example of a product that evolves over time, changing and adapting to technological changes. What if the same concept would be extended to every part of the product and every step of the lifecycle? In this scenario, the user purchases/rent a product and then he/she could transform and shape it according to his/her needs with components and functions that can be integrated.

- Product adaptability: What if the product would change its behaviour according to contextual factors, usage information and the habits of those who use it? In this scenario, the user purchases/rents a product, he/she starts using it and after a while his/her expectations will be delivered, because the product evolves to meet user’s requirements. Equipping products with intelligence makes them adapt and respond to change and remain fit-for-purpose over longer time periods (McAlone and Pigosso, 2017; Ellen MacArthur Foundation 2015). IoT data can be used to improve current products, but also for developing virtual services and sharing economy platforms to support the technical lifetime.

Predictive maintenance

The second part of the paper investigates how to combine IoT data with the design of new products, suitable for addressing other parts of the lifecycle. McAloone and Pigosso (2016) suggested that combining IoT data with participatory tools IoT could be one driver for the success of the circular economy, together with sustainable design/eco-design and Business model innovation. The circular economy can benefit from this intelligence for upcycling processes, monitoring the condition of individual components or whole product systems. Data about the real use of a product can be collected for a short time, with an object instrumented ad hoc for the experiment or alternatively on the marketable products.

Monitoring experimental products: in the first case, the product or its components can be monitored with experiments, to make their recovery suitable for a second valuable use. The R&D or design team, indeed, could study a prototype and then make projections over time of the expected use to determine when the object should be replaced or updated to obtain the maximum value from it. This could be the case of the following three examples, considering:

- Functional groups of components, i.e. a system of parts grouped by a specific function;
- Essential components, whose breakup will compromise the whole product functioning, eventually leading to replace it;
- Wearing parts, which can be easily replaced. Some relevant indicators should be defined and verified by measuring them through ad hoc experiments on these components, providing a more precise knowledge of the system.

Monitoring the final product: monitoring some parameters of the refrigerator as a form of predictive maintenance could also be performed on real products, to provide added value services throughout the lifecycle. It could
be done by introducing a few sensors on the final product that will be delivered to the user, to allow continuous data transmission of the most important indicators. Among the possible outcome, detect failures in advance, notify, inform, communicate are only a few possibilities and it raises the need for learning systems able to recognise patterns, together with a platform on which to share and communicate directly with the user.

These two scenarios have different purposes. The first deal with instrumented objects used for testing and monitoring objects to intercept the product to the suitable time in which it could be fully exploited, before it reaches its end of life, avoiding the product disassembly by preserving its integrity. The second aims to reconfigure the product to obtain real-time data and intervene promptly, shaping the object behaviour on the user habits and behaviour (i.e. by interacting with the user, facilitating the predictive maintenance, upgrading or replacing parts, improving the product or eventually allowing the product to adapt to changed conditions and learn from users’ usage).

Both scenarios would require analytics to measure and combine data inputs over time (Henne, 2015). The proposed strategies are suitable for both current product-centred economy and a future service-centred one, providing directions for future studies that want to address the extension of the product life cycle, while promoting an efficient use of products. IoT data open a variety of possibilities in monitoring, accessing more precise knowledge of goods and households, useful for design purposes.

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The paper illustrates a co-design research project performed with different stakeholders who represent a cleaning system consortium for the cleaning contract market sector, with the scope of social inclusion and creation of a sample of what Michael Albert defines as participatory economics [1]. Today, the cleaning market sector is very prosperous and competitive, considering the purpose of efficiency necessarily mindful, at the single company level. Industries involved in this innovation process, in many cases offers not only services related to cleaning tasks but logistic and furniture services also (i.e. management, security, and training). In particular, those industries work in the contract market sector for big environments (i.e. hospitals, schools, industries) where hygiene standards are very high, and the commitments demand a high degree of quality and innovation through very selective invitation to tenders.

Commonly, the companies belonged to this market sector work in four main directions:
1- research and development of innovative and sustainable hygiene solutions
2- integrated and computerised management of cleaning and logistics services
3- speed up and optimisation of cleaning operations
4- ergonomics of cleaning equipment.

To the operational teams on site, meaning the workers settled in the cleaning site, are given particular attention, both in economic terms because they are the principal source of costs for the company and in training terms, because of the lack of professional skills in some worker category. However, for the future, a paradigm shift is forecasted. It is thought that this significant market sector will be able to absorb, even temporarily, exodised workers also, namely that one expelled in the middle of their age from the employment market; surely with a high cultural level and familiarity with digital technologies.

Referring to this scenario, a famous Italian cleaning system group has started the research project described in the paper and based on the SMART PRODUCTION 4.0 industry model “... new production technologies shared by production-related actors that foster collaboration between people, machines and systems.” [2] In this first step of the experimentation, a SMART SERVICE is described. As reported by Consulting o McKinsey, SMART SERVICES consist in “a new generation of information and technical infrastructures that helps manage and monitor systems, exploiting the logic of maximum integration between all the actors of the production chain, including customers”. [3] The reference to the principles of Industry 4.0 is a requirement for our research because they are revolutionary towards the way of manufacturing products and organising work according to a systemic logic:
- Automated and interconnected production models;
- Intelligent and communicating products;
- Traceability of processes that fosters collective information;
- Shared and collaborative production model at the supply chain level;
- Cloud storage of a significant amount of collected data and their accessibility.

The cleaning system group, in particular, has requested to the University Design team, skilled in the development of ICT based services, HCD and Interaction Design, to direct the project by identifying the virtuous relationships among actors, processes and tools to implement them systematically.
in the supply chain of cleaning activities. Therefore, the project framework consists of two ambits of work, the first one consisting of the cleaning site in which people are living the spaces (users), cleaning operators and team coordinators collaborate, and the second one external to the cleaning site, consisting of service companies, distributors and manufacturers producer. The co-design chain created in this way involves all the different actors in one single process, each with its role, personal problems, needs and behaviour [4]. Employing UCD User-Centered Design techniques, the human being has been placed at the centre of the design process; the result is a new process system structured by new generation of APPs and Big Data Management platforms. Figure 1 describes the new process diagram highlighting how different actors can communicate each other, report malfunctions or issues, convey needs and provide data that the system collects and transforms into inputs, in order to make:

- the cleaning and maintenance process participated among final users, operators and cleaning system consortium;
- the control of cleaning services and the maintenance of spaces more effective and efficient, thanks to the real-time communication of issues between the user, operator and cleaning supervisor (coordinator);
- the cleaning company more aware of energy consumption, the effectiveness of the materials used (consumer products and equipment) and the efficiency of its workers;
- the production of products and equipment more sustainable developed for reducing the fatigue and increasing safeguarding the health of workers and the environment.

Figure 1: The actors involved in the cleaning system and the relationships that are created at the network level.
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Continuous Improvement: How systems design can benefit the data-driven design community

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Introduction

Currently, the learning science community is exploring the use of data-driven design to improve K12 educational systems. These “continuous-improvement systems” aim to align strategic goals, outcome metrics and human-computer system processes to support improved learning outcomes. However, the learning science community has only begun to apply systemic design to practical implementation of these systems.

In this paper, we present several examples of data-driven design in K12 educational systems in order to identify aspects that can benefit from systemic design. Through these case studies, we focus on three concepts: 1) systemic designers can ensure that the system is capable of measuring successful outcomes; 2) systemic designers can ensure that system optimization will improve intended outcomes while minimizing unintended consequences; and 3) systemic designers can portray what a future with these continuous improvement systems will be like to the educational community, before any resources are committed to building the technology.

Example #1: Ensure that the system is capable of measuring successful outcomes

Data can be used to inform system stakeholders about the success of designed systems; that is, how well outcome measures align with system intentions. For instance, after providing an instructional activity (lecture, small group, video, etc) in class, a teacher might assign their students an “exit ticket” quiz to assess whether the instructional activity was successful. These quizzes support data-driven decisions about how to spend time and effort in the classroom. Variations in student performance give teachers an understanding of the students who need greater attention and the learning objectives that need greater attention. Further, digital data from exit tickets or other formative assessments can be aggregated across teachers to provide school administrators with continuous insight into the areas of need, such as students or teachers who need additional help or learning objectives that are posing special challenges. Providers of digital instruction can then aggregate usage and performance across many schools in order to identify successful and unsuccessful usage patterns. Data-driven continuous improvement can occur at multiple levels (i.e., teacher, school & software provider) when systems are designed to generate valid outcome metrics of success (goal achievement).

Example #2: Ensure that system optimization will improve intended outcomes while minimizing unintended consequence

Success metrics can be used by human teams and AI systems to drive continuous improvement. However, the optimization of metrics can produce unintended consequences when chosen metrics are not fully aligned to intended outcomes and when feedback loops about metric suitability are impoverished. In this case study, an online educational game is designed with the goal of motivating students to practice math problems. After being deployed online, the game attracts several thousand students a day; these players are randomly assigned to different game design variations to observe how

the effects of different designs on key outcome metrics (e.g., duration of voluntary play). To investigate the role of AI in system design optimization, we implemented a UCB multi-armed bandit (a reinforcement learning AI/
ML algorithm) to automatically test variations in the existing game parameter space (e.g., time limits, etc). The algorithm is designed to optimally balance the exploration of potential game designs with exploitation of the most successful designs; sometimes it will randomly search the game design space for configurations that maximize metrics (duration of voluntary play time) and sometimes it will deploy the most successful variations. While the algorithm worked as intended, the system “spun out of control” and primarily deployed malformed game designs that were maximizing the outcome metric but were misaligned with the original educational intent: the game variations were likely played for long periods of time because they were absurdly easy. This shows the pitfalls of having AI systems engage in automatic optimization without humans in the loop as a governing feedback system. Systemic designers need to design feedback systems to monitor system AI to ensure that outputs are meaningfully aligned to system intentions.

Example #3: Portray what the future will be like

Artificial intelligence has the potential to facilitate the work of teachers by reducing the effort required to use data to inform personalized instruction. However, AI can be intimidating or off-putting to teachers who do not understand its operation or intentions. In this case study, we deployed a teacher-facing recommendation system that uses reinforcement learning to continuously improve recommendation usefulness to teachers. To design a reinforcement learning AI system, there must be data representations of the system state, the space of possible actions and a reward signal tied to a success metric. In our case, the system state is student digital performance on learning activities, the action possibilities are the different digital items that teachers can next assign to a student and the reward signal occurs when teachers act upon a recommendation (i.e., when they assign those digital activities recommended by the system).

This system embodies two key elements that diverge from most existing work in “adaptive learning” or “intelligent tutoring systems.” First, the system emphasizes human-technology teamwork, in contrast to human replacement, so that teachers are empowered by the assistance of the AI. Secondly, the artificial intelligence is deliberately constructed as an aggregation of human intelligence: the system learns from the activity-assignment decisions that are made by thousands of other human teachers and aggregates them into artificially intelligent recommendations. To promote adoption of this system, a key role for systemic design is making the intended future vision accessible and attractive to teachers and other stakeholders. Systemic designers can help to engage humans to participate in the decision making by presenting a glimpse of what a data-driven future might be like in the classroom.

Conclusion

Across these case studies, we show how systemic design can aid diverse participants in the implementation of data-driven design and optimization. Systemic design insight can contribute to the negotiation of meaningful and robust metrics of success, to the construction of human-in-the-loop governance of AI systems and to the representation of potential futures. We expect designers to play a crucial role in taming the complexity of practical AI-human systems and aligning system outcomes to sustainable, humanistic values.
Data, Fashion System and Systemic Design approach: an information flow strategy to enhance sustainability.

Nowadays, the role played by the fashion industry in contributing to the degradation of natural systems is increasingly acknowledged. The impacts on the environment are mainly linked to the use of non-renewable raw materials, water pollution and waste generated. In addition to these socio-cultural implications deriving from the use of cheap labour and undignified working conditions resulted from ‘fast’ fashion business model, where economies of scale deliver standardized fashion at high volume and low price. Overlaps to all this a significant lack of information and communication between stakeholders make the interpolations of the system difficult to be clear.

In this context therefore characterized by complexity, intricate interdependencies and flux, and a wide span, geographically, epistemologically and in term of disciplines and discourses it draws together since was first introduced to the realm of fashion (Fletcher, 2008) system and design thinking, has provided a helpful viewpoint on the area.

The ambition of this paper is to offer a perspective that faces this complexity and align fashion with sustainability values through insights gained from data.

Specifically using systemic design as a catalyst of change, this research looks through data generated inside fashion system in a holistic way, defining all the process, service and actor as a dynamic whole and not as a fragmented sum of its part.

Contrary to what happens with the sustainability strategies currently in use, which are focused on symptoms, and endorse methods that try to solve single problems not caring about existing relationships, systemic design approach can be an effective tool to restore the lack of information that concern the whole process and all actor.

This approach, which looks at the larger picture, focuses on the transition from a linear vision, where individual environmental issues are addressed, to a systemic approach, where an improvement of the individual components, if put in relation, corresponds to improvements for the whole industry (Bistagnino, 2011, 2016).

To planning the process linked to the paradigm shift, we chose to undertake information flows strategy, allowing the whole system components to be aware of their role and to make the flow of information functional to the objectives of environmental sustainability.

A preliminary literature review reveals in fact that acting in terms of information flow from a systemic perspective does not represent a parametric adjustment, nor a reinforcement or a weakening of an existing cycle. According to Meadows (2008), the structure of information flows can be an effective leverage point in the fashion system, if the information is delivered where it was not before, causing people to change behaviour. Adding or restoring information, in a fashion system where the information circulating is sometimes not linked to ethical and social value, can therefore, represent a powerful intervention, usually easier and cheaper than reconstructing physical infrastructures.

In the fashion industry, adding to or changing the flows of information between companies in a supply chain or between retailers, designers and consumers can create large changes for little effort (Fletcher, 2008). However, to trigger action, it is necessary to couple new information with resources and incentives to support the behaviour change.

To fill the information gaps, this research starts from the selection, the organization and matching of a set of data that represent a quantitative input and reveals the importance of a qualitative output graphically and appro-
Data matched with a Systemic Innovation Design Methodology becomes a useful tool to analyze, organize and understand visually all the complexity of process, behaviour and pattern related to fashion system. Mapping the entire lifecycle (fig. 1) highlights that some data are not effectively harvested and appears the need of generating new asset of data collection able to bring the intangibility of shopping and consumption experience to the tangibility of dress and people, spreading the awareness of the entire process inside the system.

Taking advantage of new technologies able to harvest personal data in almost any context we chose to undertake the collection from mapping body shape and consumer habits until the potentialities of open data. The Body shape set of data assisted with wearable technologies generates information not only useful for companies but able to increase consumer awareness about his purchasing and consuming habits.

In fact, a high empathic value is a key to clothing with a longer life cycle, according to Chapman (2005) work by cultivating an emotional and experiential connection between person and object, we can disrupt our dependency on consumption of new goods to construct meaning and our sense of self. In this research this operation is supported by the collection of personal data through Near Frequency Communication and IoT devices, concerning wardrobe data, to create personal narratives through customization, personalization, mapping thus the real attachment with specific garments in a particular context and collecting sustainable practices in real time (fig.1).

In conclusion including open data gathering with RFID technology allow to generate a global overview of warehouse movements and production system making the data collection even more transversal and inclusive.

While IOT, RFID, and Near Frequency Communication are powerful tools by themselves regarding data collection, when combined with distributed ledger systems such as blockchain, they enable an authentic traceability, increasing the potential to create a fashion system that is not only sustainable in terms of behavior and resources but also transparent in the processes and transactions.

The focus of the entire research is the use of a systemic design approach to navigating on a complex behavioural system and global supply chain networks. To underline the importance of collecting the interaction and the relationship in a significant dataset, highlighting how it is possible to generate a unitary and coherent understanding of the entire system capable of allowing and supporting sustainable development.

Since fashion is more than the materials that garments are made of, data give us the opportunities to go beyond discrepancies, help businesses make better-informed decisions about the production and distribution of goods.
and make the customer aware of socio-environmental problems related with their choices.

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The spread of technologies as Cloud and Distributed Computing, the Internet of Things (IoT) and Machine Learning techniques comes with a few paradigm changes with highly disruptive innovation potential and consequent design imperatives. Digital Abundance is a shorthand that introduces us to the economy of information as a non-depletable resource, as it can be continuously copied, while exponentially increased due to “cheap and small” sensor technology. High connectivity of devices and machines is shaping not only sensing and monitoring capabilities of different application fields, but also describing ever more ubiquitous and diffuse computing capabilities, affecting decision-making with a wide range of assisting tools and methods, like context-aware AI fuelled by a yet unmatched data flow.

On these premises, applied research at Polytechnic Interdepartmental Centre for Service Robotics in Turin, Italy, focuses on the development of a service robotics platform able to operate on the local scale and capable of adapting to evolving scenarios. Useful to this purpose is Robotics-as-a-Service (RaaS) framework, a cloud computing service model that allows to seamlessly integrate robots and embedded (IoT) devices into Web and cloud computing environment. As a service-oriented architecture (SOA) for robotic applications, a RaaS unit has the environmental potential of decoupling the production of economic value from energy and resources consumption. It includes services for performing functionalities, a service directory for discovery and publishing, and service clients for user’s direct access. This platform allows to manage robotics components both as an increasingly granular integration of control over automated tasks and as part of a largely aware whole emerging from their connectivity.

With the scaling potential of moving beyond its contemporary application such as industrial facilities monitoring, precision farming and agriculture, healthcare and risk management scenarios, RaaS is bound to involve an increasingly fluid and diverse range of users, shaping new socio-technical systems where practices, habits and relationships will evolve in respect to its adoption.

For this product-service system we propose a Socio-Technical Innovation framework to balance the efficiency of simple stable technological systems with the capacity for resilience and adaptability of more complex, unstable social systems that surround them. Complex systems high connectivity leads to difficulties in centralized control and predicting causes and effects, driving the need of localizing decision-making when possible. Chances of identifying a single ‘optimal’ solution for the whole system width are low; great part of current information and implementation happen on a local scale, necessitating a decentralized approach. While in simple and stable systems homogeneity of input is favoured over a more problematic diversity, in complex social systems heterogeneity is incredibly more valuable, both increasing the range of current information and of solutions generated.

A wider network of stakeholders, reaching out to growing community of users and producers, allows organizations to see more opportunities than those dependent on previous choices. Local decision-making made by a variety of actors with shared interests, is likely to be the most successful: though the larger system is complex and difficult to predict, its subunits are less so. Laying our foundations on Participatory Design (PD) research we propose the Actor-network social theory as a tool to analyse the intricate relationships that define the structure of groups where humans are not the are not the only participants, as artefacts concepts and design itself function as intermediary. Thinking of stakeholders in PD as a network of actors
is useful as it allows researchers or designers to understand cultural practices, power relationships and the roles of mediating artefacts or concepts, as recognizing the mechanisms through which power is exercised is vital.

In a User Experience Design context, a particularly useful term to describe possibilities of action emerging from the reciprocal relation between an actor and his environment, is affordance in its original definition proposed by psychologist J. J. Gibson in 1977. (Vardouli 2015). In his paper Vardouli argues that the notion of affordance could be analogized with the one of embedding, as they refer to possibilities for engagement of the subject with a context.

To support heterogeneity of solutions fitting diverse use cases and even different application fields we investigate service robotics case studies for modular design, to generate a product-service system of non-independent solutions.

A designed system of product components and services follows the purpose finding principle (Jones 2016). As Jones further explains in his paper on Systemic Design Principles, the purpose principle provides a whole-to-part view of problem space. The diversity of solutions provided by a modular configuration of functionalities, delivered in the form of services, guarantees a balance between fixed purposes and what Jones refers to as creative framing.

We will then explore the literature on PD solutions to usability issues. To answer interrogatives about the collection of end user requirements, about their involvement in a continuous development process and how to achieve a common understanding among the actors, we look for methods to explicitly model the interaction relationships between server and client, producer and consumer, designer and user in order to increase the learning capacity of a RaaS ecosystem through the integration of diverse experiences, while distributing means of production and innovation capacity.

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4 TERRITORIAL METABOLISM AND FLOURISHING ECONOMIES
The use of water for technical development or technical development for the use of water?

Nowadays in the global context, the use of water resources for daily activities is one of the main topics discussed by the international community. This paper presents a required reflection on paradigm shift toward an aware water management. As we know, in the past, especially during the 18th and 19th centuries, water power played a crucial role in early stages of industrialization. Waterwheels were applied in many industrial sectors, as in textile, iron and wood production, improving manufacturing processes and affecting economic, environmental, social and cultural structure of societies. Water power is one of the most known renewable energy and scientific and technological innovations lead toward the introduction of new machines. Many industrial sites and cities were developed near rivers, lakes and other watersheds and citizens improved technical solutions to manage water resources for producing hydroelectric power.

Considering the global goals of the Agenda 2030, especially the SDG 6, focused on providing sustainable management of water and on fighting water scarcity, and the SDG 7, focused on ensuring renewable and clean energy, we need to tackle some of main current issues to move toward sustainability. Many other examples suggest that we need to consider that the development of human communities depends by the availability of water resources and also to undertake considerable actions for a sustainable use.

Water power is considered one of the most ancient type of clean and sustainable energy and it provides many benefits for local citizens, as reducing water and air pollution and enhancing local resources. Hydroelectric power includes both large-scale hydroelectric dams and small run-of-the-river plants and the construction of hydroelectric power stations depends by the topography of the land. On the other hands the construction of new hydroelectric facilities might impact the environment in land use changing and also in preserve aquatic wildlife’s ecosystems. In some cases in large water reservoirs the amount of nutrients and sediments might increase, changing habitats and conditions for animal and plant life and increasing greenhouse gasses emissions. On one way some targets expressed by the SDG 6 (e.g. 6.6) regards the protection and the restoration of water-related ecosystems, as rivers and lakes, and on the other way some of them focus on the development of innovative technologies for wastewater treatment (e.g. 6.A). We need to look at these issues in a systemic view and to apply the systems thinking approach in water management practices to sustain local communities.

A systemic approach to hydroelectric power considers the impact in design practice of dams on natural ecosystems and urban contexts and it tries to reduce negative effects through the application of ecological principles. Ecological Engineering practice works to provide benefits for humans, to preserve natural ecosystems (Bergen, Bolton, Fridley, 2001) and it designs integrated systems (Mitsch & Jørgensen, 1989; Mitsch, 1996). In the ecological and systemic thinking, we shouldn’t consider water only like a resource for human benefits, but it is also habitat for other species of plants and animals. In this paper we would present benefits provided by small-scale hydroelectric facilities through a case study made in the urban context. It underlines how a natural and local resource, as water of urban river, can be used in order to “produce” systemic services for human being, in a sustainable way. Some of these benefits are the protection of biodiversity of riparian ecosystem and the reduction of environmental impact and noise and air pollution.

Mini-hydro power presents many advantages as the dependence by natu-
ral flow of watercourse, the low relative cost of the system and possible applications in remote areas. It creates new opportunities for rural and isolated communities but also reduce the environmental impact in urban and suburban areas. The use of this local and natural resource for micro hydroelectric power contributes to increase urban metabolism, producing clean energy that can be used in the local context.

The case study here presented is a low heat hydroelectric power plant that was developed in Turin urban city center, in Regio Parco district, an historical interest area. During the 20th century in this district were established one of the oldest Italian manufacture, Manifattura Tabacchi, and the main lighting company of Turin. The small scale hydroelectric power plant is located in the Dora Riparia river, known for its importance, in 20th century, in generating hydroelectric power for local manufactures in Vanchiglia and Dora districts. The aim of the project is to recover the existing weir intake structure, that in XIX century was used to deflect a part of water’s course into Regio Parco canal for energy supply of local manufactures. It was technically transformed in a inflatable weir used to produce hydroelectric power, placed in electric grid of the city, and to reduce the urban flood risk.

Considering the purpose to preserve river ecosystem, the project has planned to establish a fish ladder in vertical slot to facilitate fishes’ natural migration. It is also designed to reduce the environmental impact on landscape, local vegetation and urban noise. We need to apply systems thinking for providing benefits for humans and at the same time preserving ecosystems and enhancing historical pre-industrial heritage. Managing local resources and providing benefits for the whole context is important to promote sustainable urban metabolism, through the application of the holistic viewpoint. Urban context and natural river ecosystem are complex systems and design in-for-with them is a practice to undertake in a systemic view. Finally this paper’s purpose is to show how systems thinking and ecological principles can be applied to face one of the most important challenge of our time: produce clean and sustainable energy in site and reduce its ecological footprint.
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This research wants to demonstrate the need and the importance of the creation of an ecosystem to support the implementation of projects born from Systemic Design (SD) approach. The leading cause behind it is mainly related to difficult and complex implementation and the success of this type of projects in practical terms. However, they have specific characteristics that can tackle critical current challenges identified by many scholars as climate change, waste production, limitation of natural resources and pollution. For this reason, it is vital to sustain and foster their implementation.

To demonstrate this thesis, we firstly analysed previous SD projects applied to the manufacturing sectors developed in Politecnico di Torino to understand the principal barriers in their implementation. These projects are related to specific economic and productive realities (e.g. Barbero, 2016) or many realities in specific territories - intended as geographical areas - (e.g. Battistoni, 2016). This process was facilitated thanks to the direct involvement of authors in these projects. The result is that SD demonstrates to be able to connect the territory, design and environmental issue. The design discipline with its methodology and approaches has just confirmed to be a solution for the valorisation of the material culture and natural resources of a specific territory (De Giorgi, 2008; Catania, 2011). SD enlarges the borders of the traditional design discipline producing a step forward the eco-design. Indeed, SD approach applied to the single activities permits to change their core business, improving and increasing their incomes, considering waste as resources as in the Blue Economy (Pauli, 2010). Moreover, this approach permits the creation of new products that in some cases let the born of new economic realities, generating the autopoiesis typical of the natural systems as defined by Maturana and Varela (Capra, 1996) (see fig.1). All these opportunities can boost sustainable territorial development, creating a local circular economy.

Moreover, this analysis highlighted important characteristics of SD projects that are more than the five principal guidelines previously defined as Output-Input, Relationships, Act locally, Autopoiesis, Man at the centre of the project (Bistagnino, 2011). At the same time, they can represent the barriers to their success and implementation. The main reason is that they required, at the basis, a cultural paradigm shift (Barbero, 2016), from the linear to the systemic thinking, from competition to collaboration, identified just by Capra as a “the turning point” (Capra, 1982). In this framework, complexity results one of the SD projects fundamental characteristic as they focus on the relationships between components instead of the single entities and on the resources which go in and out of a production process. Talking about input/output and not resources/waste, the focus is more on qualitative aspects than on quantitative ones. Another consideration that is possible to make from this analysis is that SD projects are community-oriented, territorial-oriented and environment-oriented more than profit-oriented. Producing environmental sustainability, with implications on the economic and social one, they require the competences of different disciplines, multiple actors and stakeholders, both in the design phase than in their implementation, being multidisciplinary and interdisciplinairy projects. Last but not least, they require financial support, human resources and project management as all the projects. The current emphasis on the Circular Economy from the European Union is luckily helping to bridge this gap since 2015 (EU, 2015).

Once settled these characteristics, in a post-Anthropocene era becomes necessary the design of an ecosystem (ECO-SD) (see fig.2) able to stimulate and
foster the born and the implementation of innovative systemic projects. Indeed, the concept of the complex adaptive system that comes from biology is starting to be used by the business environment (Reeves, 2016).

Looking at the territory and its productive sectors with a systemic approach, shifting the attention from the single actors to the relationships that are possible to create among them, is possible to obtain different results. As the theory of system suggests “the whole is GREATER than the sum of its parts” (Aristotle), or better “the whole is OTHER than the sum of its parts” from Gestalt theory (Koffka). This shift can let emerge several new opportunities and potentialities linked to a development which is far away from the current economic evidence, centred exclusively to the increase of the GDP. Acting in this way is possible to answer to the real needs of a specific area, with the final goal to act on the cultural paradigm, obtaining a real sustainable development.

The core of this ecosystem cannot be identified in the current incubators of start-ups which are concentrated mainly on the economic sustainability of the projects and the training of the future entrepreneurs within linear economy benchmarks. Instead, it is a systemic incubator with the goal to foster the born and the reproduction of productive processes and act as an open system. In here, also the economists should think in another way as Raworth suggested (Raworth, 2017). In the ECO-SD, the attention is on the flow of information, matter and energy which create relationship both inside every single process and within them, and within the context of reference where it is placed.

The heart of ECO-SD is the research centre which acts as a guide: starting from the execution of the Holistic Diagnosis (Battistoni 2017, 2018), it can identify the current significant problems and the sectors where projects are needed. Opening the way to the innovation of process, products and services, that are therefore designed and implemented by multidisciplinary groups. In this case, the designers collaborate with other scholars and experts coming from the natural, social and economic science, acting as “mediator” (Celaschi, 2008), fostering the dialogue and the contamination. Working together for the implementation of the new projects, they should maintain the link with the local actors, not exclusively coming from the productive sector but also from the decision-making, to assure a local development in line with the policy design.

Figure 1 - Graphic representation on the SD applied to the manufacturing sector and the competences involved in this approach
Figure 2 - graphic representation of the ECO-SD ecosystem

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Creative communities are grassroots, bottom-up initiatives of people who through their diffuse design capacity propose new, desirable service futures that address the problems of their everyday life. The solutions designed by these communities provide a much-needed alternative to the breakdowns of the top-down sociotechnical support systems that were meant to address these needs. These creative communities exist within a transition from modernity towards sustainment, the next epoch of human development. The adversarial character of these systems causes them to embody alternative values such as conviviality, solidarity, openness and shift the focus from growth to flourishing (Ehrenfeld, 2008). Not only are the systems of values adopted by these communities more compatible with sustainability they also challenge a hierarchical order. Such action is collective rather than individual. It concerns a group of people who have been presupposed unequal by a particular hierarchical order, as well as those in solidarity with them, acting as though they were indeed equal to those above them in the order, and thus disrupting the social order itself.

What is disrupted are not only the power arrangements of the social order, but, and more deeply, the perceptual and epistemic underpinnings of that order. Such a disruption is what Rancière calls a “dissensus” (2010). A dissensus is not merely a disagreement about the justice of particular social arrangements, it is also the revelation of the contingency of the entire perceptual and conceptual order in which such arrangements are embedded, the contingency of what Rancière calls the partition or distribution of the sensible (le partage du sensible) (Rancière, 2010). Increasing the variety of these systems is a necessary perquisite to both overcome control from the hegemonic ideology (law of requisite variety) as well as to increase the resilience of these systems.

Resilience is defined as the capacity of a system to retain its organisational closure while absorbing external perturbations (Walker and Salt, 2012). The sociotechnical system that is a creative community creating social innovation faces constant threats due to the collapse of traditional support structures and their disruptive, adversarial character. Identifying strategies to increase the capacity of any system to resist external forces are necessary to ensure their survival in a time of unprecedented environmental and social pressures but in the context of the wider transitions towards sustainment and the necessary reconstitution of the domains of everyday life.

In order to create the strategies necessary, we turn to nature for inspiration and mentoring. Biomimisis is a framework that designs solutions inspired by biological systems. It opens up possibilities of seeing the way nature works, teaches and informs arts and sciences (Sanchez Ruano, 2016). It encourages deeper studies in order to arrive at technologies and strategies that may be achieved through interdisciplinary dialogues. Ecosystems display differing degrees of resilience. Understanding the strategies developed by nature to increase the resilience of eco-systems is a first step. Identifying and reframing these solutions can foster the resilience necessary for creative communities to flourish. The emerging fields of biomimetic design of services can support the evolution of service design (Ivanova, 2014). methods in the context of social innovation and shift the underlying assumptions behind the decisions made. Biomimisis has proven a robust methodology for the development of solutions in the fields of material engineering and product design, applying lessons from nature is a frontier for service design and the creation of resilient organisations.

We argue that permaculture, an agroecological systemic design tradition
(Cassel, 2015), provides an interesting direction for the development and research in the context of social innovation. In contrast to monoculture where only one type of value is the goal of the system, permaculture provides a systemic view that is focused in fostering virtuous cycles and cooperation between different symbiotic systems. Looking at creative communities as an interconnected ecosystem instead of discrete systems provides a different avenue for increasing their resilience and capability for flourishing by creating positive feedback within a wider ecosystem of bottom up initiatives on both a local and global level.

This paper aims to identify strategies from different permaculture systems to approaches that when applied in sociotechnical systems lead to increased resilience. Applying these through designs can provide a way to reconstitute the domains of everyday life (Kossoff, 2015) and transition towards sustainability in some grassroots, distributed way. At the same time these different ways of looking at provide a direction that seems to provide an answer to many emerging issues in the context of service design within a systems thinking framework.

In order to elaborate the strategies recognised the ‘Apano Meria’ Social enterprise will be analysed with respect to the relationships between different focus groups and how these can increase the overall resilience of the system. The object of this case study is a collection of different creative communities with various interests but connected by a common theme: enabling the flourishing of the island of Syros. In order to achieve this goal three main themes have been adopted: the environment, culture and people. Each of these themes is made up of different special interest groups that are interconnected both within the theme and in the wider scope of the community. For example, in the context of the environment different groups of people are working with the fauna and the flora while a different team looks at issues of marine ecology. Additionally, a different community studies the unique geological characteristics of the island. All of these teams are in an open dialogue amongst them and with the legal team that either informs them of legal framework or translates their wants and need to law proposals. Understanding the flows of information, the juxtaposition of people in different roles as well as increasing the overall diffuse design capacity of the participants in the social enterprise is the first step in creating a resilient organisation. Identifying relevant biological models that create virtuous cycles and translating these to design strategies will increase variety, resilience and the contingency between different people and communities.

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This article aims to present a research and design work that focuses on exploring new possible approaches to packaging design as applied to the field of reconditioning and reintroducing old household appliances to the market. The work developed by the research group from the Politecnico di Torino – Design, in particular, is part of a research agreement signed with Astelav, a Piedmontese company based in Nichelino (Turin) and a leading distributor of components and spare parts for household appliances, in partnership with Turin-based Sermig, a non-profit organisation that aims to provide people marginalised by unemployment, social and financial problems with hospitality and both social and job support.

The company recently launched the Ri-Generation project alongside Sermig. This involves reconditioning used white goods (washing machines, dishwashers, fridges, ovens, etc.) by intercepting the WEEE (Waste Electrical & Electronic Equipment) supply chain as well as encouraging socially marginalised people to gain new skills whilst assisting specialised technicians in reconditioning appliances. The work involves the replacement of damaged or broken parts, a cleaning process, followed by the product’s placement on the market. It is an example of a circular economy that helps prevent the accumulation of waste in landfills, offers old products a new lease of life and new added value and, at the same time, creates new economies and new employment and social rehabilitation opportunities for people in difficult socio-economic circumstances.

In such a scenario, the design work carried out attempts to develop new systems for the protection, transportation, presentation and sale of these used, salvaged and reconditioned products, so as to allow them to be distributed on the market, as well as to communicate their own particular image during the sales process. It is a very unusual packaging project because, apart from anything else, every product sold is different from the other, even if they share common characteristics.

The design challenge was tackled both in terms of its functional and marketing aspects, but also in line with a wider cultural paradigm that envisions the fine-tuning of a veritable system of activities and relationships that, in keeping with the characteristics of the Ri-Generation project, can generate innovation and sustainability at different levels: at a social level, by involving disadvantaged people and social cooperatives in packaging assembly;
at an environmental level, by salvaging old clothes to create the padding; at a production level, by specially training and organising personnel; and at a linguistic level, by applying new modes and registers of expression that stem from experimentation, particularly in the artistic field.

The new packaging design takes its cue from the use of the waste materials that Sermig receives on a daily basis through private donations, particularly second-hand clothes that are sorted, selected and then redistributed to people who are experiencing social and financial difficulties. The items of clothing that are damaged, ripped or worn out can be salvaged and, if properly processed, can be turned into efficient packaging systems. Garments are cut up and put together following clear procedural guidelines, and then positioned and sewn inside polyethylene tubes, creating a sort of “padded fabric” that is both waterproof and resistant and can wrap up and protect an appliance during the transport, storage and sales phases. The final product makes a strong impression: patches of clothing in different fabrics and colours surround the appliance, creating what looks like a cloth cube. Whilst it surprises and intrigues the viewer, it also expresses a narrative at different levels: an item of clothing that symbolises a product (a washing machine) declares its function at an emotive level whilst at the same time expressing the salvaging of a waste product, which is the principle that underpins the Ri-Generation project.

Since the most significant environmental problem for packaging systems is indeed related to the need to prevent waste before its production, the value of this salvaging process is further stressed by the reusability once it has finished transporting the appliance after sale. The information sheets included and the packaging’s own graphics suggest a “catalogue” of possible alternative uses (the protection of accessories and furnishings during house moves or for storing items in attics and warehouses, garage wall padding, informal poufs, pet cushions, picnic blanket undersheets, etc.).

The product’s fine-tuning has involved Sermig personnel (supervisors and guests) and Astelav employees and some social cooperatives during a number of workshops coordinated by the Polito research group, designed to test the production methods and skills of people both joining and leaving the packaging production process. The packaging is assembled by social cooperatives, who are suitably trained using the above-mentioned direct experimentation and partial co-designing phases.

To date – having completed the production development, prototype and trial phases – the project is now preparing a pre-series of dozens of items that will be tested during their transportation and sale to consumers. The resulting feedback from these activities will allow the project’s organisers to streamline packaging production methods and the entire sales supply chain.

Figure 2: The assembly phase and the final packaging
Among the possible outcomes foreseen, action designed to divulge this project in order to turn it into a repeatable or reinterpretable example of best practices is envisaged, as well as the promotion of the project’s cultural merits. Such action includes:

- The declinations of the semi-finished product: the defined packaging system, could be considered as a new semi-finished product which, when suitably reshaped, that means it could also be used as packaging in other product sectors;
- The curatorship and creation of an exhibition to be put on display: the design of possible display concepts that could be shown at exhibitions and sustainable packaging trade fairs or used for creating a tailor-made event dedicated to Ri-Generation’s case history;
- The creation of a special section on the Ri-Generation website: creating text, images, animation, etc. that can present the partnership with the Politecnico di Torino, the design process and the scientific and cultural value of the packaging design process;
- The creation of a narrative: a sustainable packaging case history could be the focus of a story told by a lively, abridged publication that could be distributed at particular events designed to promote the initiative and the Ri-Generation project’s work.
Our contribution is based on a case study of the systemic, human-centered and iterative approach employed by OvestLab, Modena, and reflects on relevant implications for the implementation of a circular economy in Italy. OvestLab is an ongoing experimentation that contributes to current debates within academia, local administrations and civil society on urban vacants, namely buildings and spaces that are no longer serving their purpose as places of production, market exchange and social interaction. It also shows how a circular approach to commerce, supported by interdisciplinary expertise, can ensure sustained revenues, reduce material consumption and address territorial changes due to complex variable forces, such as technological innovations and market volatility. Finally, OvestLab offers an example of how knowledge exchange with similar initiatives in other countries, enabled by an online platform, fosters interterritorial learning that is beneficial to all parties involved.

From a methodological point of view our analysis is informed by two main sources. Firstly, one of the authors has been involved with OvestLab from its inception, both as part of the executive board in one of the associations responsible for the project, and as a member of a local artist collective. Secondly, we integrated her description and reflection with documents written both as intermediary outputs for the project or by other actors not directly involved with OvestLab.

Located in the West part of Modena, OvestLab is part of the city’s Villaggio Artigiano (Artisans Village), which for many years represented a virtuous example of collaboration between the local administration and small private enterprises. Since the 2008 financial crisis, however, the Village experienced significant socio-economic decline, which was exacerbated by an increase in vacant buildings that served both residential and productive purposes. OvestLab is based in a former factory that, after closing ten years ago, has recently been requalified to become a hub for local open spaces and shared initiatives that address a number of multifaceted territorial issues, among which the lack of public spaces. The project is led by two associations, namely Amigdala and the Archivio Architetti Cesare Leonardi.

Conceptually, OvestLab wants to promote initiatives that are founded on the sense of community shared by local stakeholders (which is undoubtedly fragmented but still present); that reflect upon alternative imaginaries to guide actions addressing both ecological and economic issues; and that propose new symbolic and cultural meanings to spaces that can support the resilience of the territory and its community.

To analyze the collaborative actions currently ongoing as part of the Village’s regeneration process, we draw a number of theoretical guidelines from systemic design literature:

- An evaluation of the regeneration process not only through its final output but also the intermediate steps that led to it while at a meso level, defining the processes and circular design skills necessary to reverse the obsolescence of urban vacant and spaces.
- How new interactions that originate from a node within the urban fabric to create a network of new relations, can be more inclusive of previously unengaged citizens, and activate new social dynamics that are valuable for the local community.
- How processes of distributed governance among local stakeholders foster a sense of community while offering new spaces that local actors can adapt to their needs and characteristics.
- How allowing local communities to autonomously define and manage...
their relation to the space favors new forms of autopoiesis within organizations and transdisciplinary cultural projects managed in a decentralized fashion.

- How a spontaneous phenomenological structure that values action over planning can be employed to work iteratively and better adapt the reactions of the context while also promoting latent potential and resources, which may already be present in the territory or can be integrated with it.
- How working daily at the change of the local reality while also seeking dialogical opportunities with actors that operate at different territorial scales (regional, national and European) enables mutual learning and adds value both within the local community and the extraterritorial one.

Our aim is to contextualize these concepts through the analysis of the following actions:

- Supporting a number of initiatives - namely local gruppi di acquisto solidale (GAS, ethical purchasing groups), Genuino Clandestino and Alimentazione Ribelle - who aim at reducing food waste and promote distributed food production that revolves around local producers. This is an example of how local actors are adapting the space according to their specific necessity.
- Using furniture produced with recycled or reused materials during workshops that promote upcycling and artisanal practices and engage citizens of all ages.
- Creating, together with CivicWise and Ostello San Filippo Neri, a platform for distributed accommodation that capitalizes on the availability of vacant and underused buildings; thus applying the recycle and reuse ethos not only to product but also service design.
- Publishing a collaborative magazine to build a collective narration of the project and foster mutual learning among people of different ages, backgrounds and professions that include local actors as well as external collaborators.
- OvestLab is part of CivicFactories, an international network of territorial experimentations on urban regeneration, which includes initiatives in Paris, Valencia and Santa Cruz. This allows the local community to communicate and share best practices, which are informed by direct learning feedbacks and are enabled by CivicWise’s P2P online platform for glocal learning.

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Landscapes and systemic design: Po river Delta (Italy) case

Po Delta is World Heritage since 1999 and MaB Unesco Biosphere Reserve since 2015. In this area, regenerative coastal landscapes are proposed. Those landscapes are that restore the environment and encourage long-term sustainability, increased biodiversity, and enhanced resilience. A well-designed regenerative landscape can also complement property value, reduce water and maintenance costs, and create seamless, yet visually pleasing, harmony with surrounding natural open spaces.

In this area impacts of climate change can be easy predicted effects, it is clear that a more resilient landscape will be imperative if local society are to adapt and respond to the challenges of the future. Robust ecosystems underpin resilience in landscape function. To achieve these, healthy soils, dune recover, better use and conservation of available rainfall, pragmatic use of vegetation and groundcover, and increasing biodiversity are key.

The necessity of matching structural expressions of ecological integrity with cultural perceptions is particularly highlighted, by reference to the cultural bases for landscape perception and management (Nassauer, 1997), the landscape archetypes (Bell, 1999), and to the concepts of cultural and ecotone landscapes (Farina, 2006). These are examined for their potential role in creating a new synthesis of nature and culture.

Development of a realistic vision for Systemic Design in a regenerative landscape depends upon understanding the peculiar circumstances of its physical geography and biogeography linked to local history, culture and economic system (Bistagnino, 2011). The regeneration is based on scenarios of potential vegetation and hemerobiotic state of an area (the magnitude of the deviation from the potential natural vegetation caused by human activities, see Eurostat, 2017). The regeneration is also based on integration between Firms, Agricultural and wild habitats in order to reach a Blue Economy approach (Pauli, 2017).

The Blue economy concepts and the Circular economy agenda, as a set of strategic objectives, offer principles and guidance to identify blue economy potential for Po river Delta and its urban, landscape and coastal processes. Following systemic design approach, the local economy will be based on:

- coastal landscape regeneration;
- production of new materials (paper, textiles, clothing, biodegradable plastics, paint, insulation, biofuel, food, and animal feed);
- increasing resilience to climatic changes, sea level rise;
- design a new production environment with a Biofactory system integrating food, material and energy production. Proposed system (based on rice, hemp, wood, weeds, and shells) can be developed into a variety of commercial items including chemicals, paper, textiles, clothing, biodegradable plastics, paint, insulation, biofuel, food, and animal feed.

Analysis of the state-of-art and configuration of sustainable development scenarios have been performed by adopting the approach of Geographical Systemic Design: This allows local solutions to be addressed locally.

We have also built some project proposals in details: they go in the direction of re-generating agricultural lands. They can be considered as a sort of business model, that means that the benefits by migration from business-as-usual to new ecological based business models has been defined, by given the numbers of economical value outcomes.

These are long-term solutions as we wanted to contribute to improve the resilience of the studied area.

Project proposals are inspired by the Blue Economy and can be summarised as follows:
The beach dunes and beach areas can be rebuild using only a reshaping of areas and beach management. In the back-dune area the regenerate wetlands (dominated by Phragmites australis) will became a multifunctional ecotope, acting from water depuration to salt intrusion barrier. In this area a regenerative agriculture is also based in aquaculture waste recycling (Morris et al, 2018) is integrated into design of a new ecosystem mosaic: rice (Oryza sativa) - traditional in the Po river Delta agriculture landscape - and hemp cultivation (Cannabis sativa) can be integrated with phramites grooves and willow shrubs. A Quercus ilex forests and psammophyl vegetation in coastal areas can be redesigned in rural landscape. The dunes can be built as is mainly due to successional stages linked to it, herbaceous vegetation of grey dunes and mantles using mollusc aquaculture waste (production of calcareous shells from Mytilus galloprovincialis, Venerupis decussata, Tapes philippinarum). The rice and hemp will be integrated with grassland with Vicia faba var. Minor in order to regenerate agriculture and integrate it with pasture activities (Ovis aries). Pigs (Sus scrofa domesticus) will be growth in new woodlands (Quercus ilex forests).

Some of the benefits of proposed scenarios include:

- Reduction of flooding and sea storms risks.
- Effective erosion control.
- Reduced water consumption.
- Reduced maintenance costs and increasing local growth economy.
- Increased natural capital and ecosystem value.
- Elimination of chemical use.
- Reduced visual impact of development.
- Better soil conditions due to the use of native plants.

Soil health can be be built; depletion cannot be rectified by adding chemical elements to address identified symptoms. Carbon is a master variable within soil that controls many processes, such as development of soil structure, water storage and nutrient cycling. Every gram of soil organic carbon can hold up to 8 grams of water. Every regenerated are can increase from 3 to 5 tons of soil organic carbon per hectare.
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Contemporary worldwide economy has evolved into a global multidimensional process that manifests itself in cities through radical changes in human population densities and urban fabric. Such transformations are so rapid that cities are lag behind to cope with the demands of the market and population. Although this drastic shift has left many formerly manufacture/extractive cities with deprived and outdated urban fabric, this has resulted in the rise of post-industrial cities (ICLEI, 2018). Such accelerated changes have to lead the acknowledgment of these urban environments as challenging precincts to address sustainable development issues (Bulkeley et al., 2011). Parallel to this, focusing on the post-industrial legacy as ‘hubs’ for radical innovation towards more resilient cities (Ernstson et al., 2010a; Bulkeley and Broto, 2012).

On that view, the Sustainable Development Goal (SDG) trace an relevant roadmap for the post-industrial urban environment. Taking a deeper overview of the SDG 11 “Make cities and human settlements inclusive, safe, resilient and sustainable” and SDG 12 “Ensuring sustainable consumption and growth patterns”, cities will have to assemble for a long-term transition to a Circular Economy (CE) in order prevail over the systemic effects of deindustrialization. Taking into account that, “Cities are not actors; they are places where people and economic activities are concentrated; complex social, economic and physical systems” (Otto-Zimmermann, 2011), from a design point of view, it is very likely to undertake such areas with anticipatory approaches, such as design thinking, participatory and systemic perspectives (Buchanan, 1992). To prove how the combination of technology, design and social organization are generating new mechanisms to regenerate these deprived areas. These processes facing the local and global challenges on such precincts must enable a shift in the way they have been undertaken, it is important to introduce a profound holistic vision which can make more comprehensible the complexity of urban context (Grimm et al. 2000; Mehmood 2010; Newman 1999). “The more complex the network is, the more complex its pattern of interconnections, the more resilient it will be of our context” (Capra, 1996). On this critical urban fabric, how can these scenarios reach an inclusive, sustainable and cohesive urban transitions, that can decrease future economic, environmental and social costs, but at the same time strengthening economic competitiveness? How can territorial thinking in post-industrial areas foster frameworks to address the current environmental and economic challenges of society?

Such post-industrial areas regarded as living metabolism or “systems of systems” are on the need to search for resilience in order to tackle climate change and its economic impact. To empower urban transitions in those scenarios it requires design approaches on innovative strategies, services, and governance that support access to the regenerated areas while promoting social cohesion and flourishing local economies (Nevens, F, et al., 2013). Consequently, there is continuous support at the frontline of the cities agendas for a paradigm shift from the conventional linear to CE. As the aim of the CE is to regenerate the economy meaning to “keep products, components, and materials at their highest utility and value at all times, distinguishing between technical and biological cycles” (EMF, 2013). Given the current environmental and economic challenges of society, it is required innovative approaches to complexity on the urban environment, where the systemic one can be an efficient way to interpret and give solutions. On that view, cities will play an important role in a global transition to a CE (EMF, 2017).

Therefore, to pave the way to an efficient urban transition it’s needed new anticipatory approaches on sustainable development from a holistic and sy-
stemic point of view that create cohesive and smooth transition (Barbero, 2017). To enable this processes, the Systemic Design Approach (SDA) offers determined instruments for territorial thinking that allows to visualize and design the flow of material and energy from one element of the system to another, transforming outputs of one process into input for another one in order to obtain zero emissions and generating resilient territories (Bistagnino, 2011). This methodology generates new relations among the entities of a territory, enabling the visualization of the hidden assets which will promote a proactive synergy among local actors. Reactivating all source of territorial resources in order to anticipate a local development (Barbero, 2012). The creation of such relationship network promotes a general wellness improvement in the community, activating a cash flow between the various system participants: “the cultural and value systems are so spontaneously redefined, with direct environmental benefits” (Bistagnino, 2011). The SDA acknowledges territories to be understood in a holistic overview, encouraging proactive collaboration among local actors and simultaneously generating innovative decision-making strategies to conceive future productive activities sustainably.

Following that approach, the SDA is understood as one of the most effective expertise on enhance future CE strategies and to find innovative anticipative paths for urban transformation, economic restoration, and social cohesion. Achieving an effective CE vision which generates a wide range of services fostering local resources and therefore urban transitions (EMF, 2017). Such CE strategies are synthesized by the EMF on the ReSOLVE framework on six business actions: Regenerate, Share, Optimize, Loop, Virtualize and Exchange. Furthermore, translated by Prendeville et al., 2018 on a conceptual framework of a Circular City which delivers an overview from which to understand the ways CE could demonstrate in an urban environment.

Based on the previous, to allow an effective approach towards Circular City framework (CCF), the SDA through a Holistic Diagnosis (HD) tool delivers an anticipatory instrument for territorial development, that delivers new starting point for system mapping (Battistoni, Giraldo Nohra, 2017). Enabling an overview of such complex urban scenarios, in order to trigger a new economic model that arises from the appraisal of the resources offered by on post-industrial cities. Through a trans-disciplinary approach, it invites actors from different sectors such as governments, civil society, and industry to co-create CCF strategies undertaking bottom-up and top-down. Allowing all local stakeholders to pull different economic activities that coexist to deliver social and economic welfare, which are the impacts of the CE fostering urban transitions. On the quest of flourishing resilience in cities, How can territorial thinking in post-industrial areas foster CCF to address the current environmental and economic challenges of society?

This paper aims to delve into a better comprehension on the SDA tool HD to identify CE strategies which are economically self-sustaining and which supply flourishing livelihoods for the economic, ecological and social regeneration of deprived urban areas result of deindustrialization processes. To exemplify this, it is intended to examine the case study of the post-industrial area of Mirafiori sud in Turin, Italy. Focusing on the results of HD study approached in the area which was tailored to the characteristics of the precinct to deliver systemic approaches for urban transitions within CCF strategies that can be cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. As a result of this holistic overview, it is aimed to foster urban resilience by delivering innovative strategies addressing new economies shared between public authorities, civil societies, and industry/SMEs.

Moreover, this paper broadens the results of the HD analysis on Mirafiori area on the lens of CCF at multiple levels such as: (a) On the technical level based on the components of the urban metabolism networks through whi-
ch will result in the creation or redesign of local, circular supply chains (b) On the social level enabling citizen-based ownership of local resources on post-industrial areas. Through co-designing, co-creating, and co-implementing of the CCF in partnership with local stakeholders, who will participate in the development of new protocols for the integration of CE strategies. (c) On the economic level through systemic approaches

boosting circular business models for products and services, the output will be a framework with strategies for post-industrial areas highlighting market opportunities and public-private partnership models for circular productive activities (d) At Policymaking level these results will aim to change local policies on post-industrial areas and, fostering a better governance and disseminate innovative solutions towards a CE.

According to this, the need for territorial thinking on complex phenomena scenarios can be an efficient way to interpret and give solutions. In order overcome the systemic effects of de-industrialization and reactivate economic growth, post-industrial cities have had to reactivate their urban fabric through circular strategies, fostering a transition into a productive and stimulating place to live and work in that would restore residents’ sense of belonging and attract investment. Moreover, the SDA it is poised to be an instrument which benefits all stakeholders leading them to paths where all can reach an effective sustainable development creating new scenarios of economic profit and cooperation (Barbero, 2017). Eventually, this holistic approaches on post-industrial precincts such as Mirafiori shall foster urban transitions and evolve the current planning and policy environment, as a result, the design and implementation of city development strategies on CE. On that context, this expertise pretends to turn into a role model methodology for cities with industrial legacy. Fostering local actors towards sustainable development and better governance, disseminating innovative solutions to reinvent and shape more cohesive post-industrial cities.

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The proposed analysis is conducted in the framework of the theory of complex systems (Telfner, Casadio, 2003); following the paradigm of complexity, suggested by the systemic approach, means in fact making interact and analyzing the relationships between open systems, in this case the biological systems, from which the idea of circular production processes has also been borrowed (Stahel, 1982; Braungart, McDonough, 2003), and the economic-social ones (Georgescu-Roegen, 2003), since «never as today the link between ecological sustainability and economic-social sustainability has became clear” (Bonaiuti, 2003, p.42).

The first objective is therefore to create, starting from the data of the app Mercato Circolare, a photograph of the Italian economic-social system linked to the circular economy, highlighting its actors, roles and relationships. Photography becomes the basis of a comparison between the characteristics of this system and those of biological systems, verifying the plausibility of the anchoring of some principles of the economic-social system to the biological ones. To give just a few examples: presence of a plurality of ends and not maximization of a single variable; presence of a combination of competitive behaviors (in expansion contexts) and cooperative (in equilibrium contexts); impossibility of the part to control everything; endowment of a feedback system.

The second objective is to investigate whether it is possible to activate and sustain territorial synergies aimed at defining districts (Becattini, 2000) and network systems capable of transforming a series of problems typical of the national productive system into economic, environmental and social opportunities.

Assuming that the Italian circular economy system can have the characteristics of a complex system, since the complexity of a system is given by the architectural configuration that assumes the whole, it is inevitable to deal with the network category. In particular, the research intends to verify whether, as for complex systems, the Italian circular economy system also presents itself as a phenomenon endowed with a combination of multiplicity and autonomy (Telfner, Casadio, 2003). Autonomy is what makes such self-referential or autopoietic systems (Maturana, Varela, 1985) so that their primary functioning is moved towards self-renewal. In the same way, for the districts and circular socio-economic systems, one wonders whether it is possible, starting from what the territory offers, following a cascade model (Pauli, 2015) and exploiting the principles of physics, satisfying the primary needs locals.

The model of autopoiesis also becomes useful to describe the dynamics between node and network. In fact, an autopoietic system is not independent from the external environment: it speaks, rather, of an operational closure understood as the ability to select the inputs that arrive externally and therefore to fully control its internal organization, ie the invariant part, to protect its own identity.

Methodologically, the research develops through the elaboration of questionnaires, site visits, internet research and bibliography, identifying four sectors of analysis, starting from the app’s structure: businesses, products, civil society and cultural events. Mercato Circolare already records almost 400 activities (95% in Italy), of which 53% are businesses, 18% products, 14% cultural events and 15% institutions or experiences of active citizenship.

For all the sectors of analysis, except for cultural events, the same fields are investigated: the start year, the legal nature of the entity, the flow of the sup-
ply chain and traceability, the business model and the relative comparison with the reference markets, the value generated in environmental, social and cultural terms, and finally the motivation.

As regards the supply chain flow, for each company we intend to create a visualization of flows and production processes: design (materials and production); supply; logistics; sale; use; and end of life. In this way we intend to visualize the traceability of the process/product. The purpose of traceability is to offer an identity to the goods/service by making known the history and the subjects who participated in its transformation and realization. The design of the flow of the supply chain allows, subsequently, to identify the reality being analyzed with one or more types of economic models of circular economy (Lacy, Rutqvust, Lamonica, 2016): circular supply chain from the beginning; recovery, reuse and recycling of resources; lengthening of the product life; sharing platforms, and produced as a service.

For the evaluation of the value generated we intend to focus on environmental value, through the formulation of a multiple indicator of circularity, as suggested also by the Public Consultation Document prepared by the Ministry of the Environment in collaboration with the Ministry of Economic Development (July 2017). In this way it is possible to obtain a circularity balance related to an organization, a product, a service, or territory, which guarantees greater transparency, enhancing virtuous actions and unmasking “green washing” operations. With this in mind, it is important not only to highlight the real value generated in environmental terms, but also in social (inclusion) and cultural terms (promotion of the common good), thus deepening the theme of the motivation behind the start of an enterprise, product, service, or event inspired by the principles of circular economy.

The category of cultural events, on the other hand, is analyzed, also through the time and nature variables of the organizing body, and then through an analysis of the cultural offer proposed in terms of audience development and capacity building in relation to the circular economy issues.

In addition to the four sectors mentioned above, always taking advantage of the app data, it is considered interesting to explore a fifth category of analysis, consumers, made up of users of the app. Once a statistically significant number has been reached, it is intended to delve into three issues. The first two concern the way in which the app became known and the verification of previous knowledge of what the circular economy was. This is to verify the ability of the app to spread and expand in non-homologous contexts to its cultural reference domain. The third question is related to the effectiveness of the app: how much is actually perceived as useful by the user and how much it contributes to directing expenditure towards the circular economy.
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Working with Systemic Design during four years in Brazil we have been able to make some connections between different productive agents, having as a starting point the relationship among our academic activities and the movement of Community Gardens. Agriculture and nutrition are some of the society’s fundamental pillars, also considering the context of the Brazilian economy and, for that, these themes have been considered to be a good starting point to spread the Systemic Design principles.

Motivated by the Brazilian Law n. 9.795, from April 27th, 1999, that establishes the National Environmental Education Policy, the environmental education is considered “an essential and enduring component of national education and must be articulated at all levels and modalities of the educational process, both formal and non-formal”. For this, the graduate course in Visual Arts, offered at the Design School of the State University of Minas Gerais (ED-UEMG), that forms art teachers of basic education, has in its program the discipline “Special Topics in Environmental Education”. We also offer academic extension activities with short courses on vegetable and flower urban gardens in small spaces that create, within the university, a dialog on different aspects of Design, on products lifecycle, new Economies (such as the Distributed Economy and Sharing Economy), and to promote exchanges between the academic community and the society.

Considering the intertwined nature of the environmental issues to its social and economic aspects the main purpose of the discipline is fostering Systemic Networks of Integral Endeavours.

An Integral Endeavour is any productive activity (be it performed by an industry, a household, an individual or the nature) that operates considering its holistic relations and is grounded on integral sustainable values (that is, works aiming at having social, economic and environmental resources enough to provide indefinite duration of the activity). It defines goals and builds networks, based on Systemic Design principles: 1) generating zero waste, by using the output (waste) of a system as the input (resource) of another one, optimizing the use of resources, creating an increase of cash flow and also new job opportunities; 2) identifying and fostering relationships, since the components of the network have common values and interests, and due to the recognition of the importance of connections of multiple areas of knowledge and performance; 3) being self-productive, sustaining itself defining its own paths of action and the joint coevolution of the elements of the system, all of which with equivalent importance; 4) giving special value to the local context and resources (human, cultural and material), which contribute to solving local problems and create new opportunities; 5) place people in the centre of projects, that is, valuing people over products, being the contribution to the quality of life, with inclusion and accessibility, more important than the production of goods.

As the discipline is very interactive, with students also bringing their experience to the classroom, some very rich opportunities arise. A very interesting one is evolving as the connection among the communities of four slums in different areas of Belo Horizonte (the third most populated and developed city of Brazil), three universities and the urban planning institution from the local administration (URBEL). All four cases have in common the existence of a vacant area within the community, some residents that see it both as a threat if left unused and as an opportunity to make some action for the collectivity, and the opportunity of receiving the support of the academy and public administration, having cultural activities as a bond. In some cases, it is being built also opportunities of association with entrepreneurs.
The first community is in the area of “Morro das Pedras”. A student from the Visual Arts has invited us to give a workshop within the community to produce fertilizer from organic waste to enrich the soil of an area where there used to be some sheds that had been removed by local administration because it was beneath a high voltage powerline. In this area they have now a community vegetable garden, where 6 persons from the community make volunteer work donating 2 hours a day during working days and 5 hours on Saturdays. Organic waste, some seeds and seedlings are donated by 11 families that participate in the project in exchange for a weekly bag of vegetables distributed to the children of the local school that also participate in this movement. After about a year of development of the vegetable garden along with artistic and cultural activities, the community has won a contest for a financial support of the Brazil Foundation organization and one of the community leaders has won a photography contest with an image picturing the community. The values of Integral Endeavours have served as guidelines to define activities as well as style of leadership, community engagement, education and economic sustainability decisions.

The second community is in the area of “Santa Lucia”. It has also an area that, because of its geological risk has also been made vacant by local authorities, represented by a government organization called URBEL. Professors from a local private university (UNA) have been asked by locals to give support to make a community garden. From the partnership established among UNA, ED-UEMG and UFMG due to their common interests in research and extension projects, the group is working together with the community in this initiative, making collective actions (mutirões) and surveys to understand the culture of the community and their needs. It represents an interdisciplinary effort with the engagement of designers, architects, economists, sociologists, engineers, gastronomists, nutritionists, also with the support of URBEL, bringing together human and material resources.

Throughout this work, a spontaneous management group has arisen, establishing unprecedented interactions in the community, with the potential of increasing their social cohesion. From the principles of Integral Endeavors, Agroecology and Solidarity Economy, the group of residents, researchers and students have developed a series of collaborative actions, different from the capitalist market logic. At the same time, rich discussions about the principles of the vegetable gardens, its management and distribution of production are promoted, at the same time emphasizing the quality of what is being produced (healthy food, without pesticides) and the importance of the conscious consumption. It is noticed that some residents extended their autonomy and voice, because before they were shy and now, they can express themselves and realize interventions that are gradually transforming the space.

The third community is in the neighbourhood of Taquaril. In this case, URBEL has invited the academy (represented by UNA, UEMG and UFMG) to support some families to develop their urban gardens in a preservation area. There, the growth of dense bushes nearby the residences represented a danger to the families for hiding illicit activities as well as synanthropic animals that are a threat to human health. Since a retired resident had already expertise with agriculture, he should be the reference and inspiration for the neighbours. He is succeeding in creating a very productive space, although the neighbours are not quite engaged yet. Also, by practicing Integral Endeavors and Solidarity Economy values, we made a composting workshop with the families and are going to make activities to involve and foster collaboration within the community.

The fourth case is in the “Aglomerado da Serra”. There, there is a group that is rather independent, having already a practice of involving the community in the selective collect and organic compost making with and without worms. Some leaders of the community give workshops on this practice and sell boxes for vermiculture. We have participated as students in their workshop.
and afterwards have invited them to take part in a short extension course on vegetable and flower urban gardens that was offered by the ED-UEMG. Agroecological practices have been (are) the main focus of the group, as a way of life, along with healthy eating and income generation.

All these initiatives have as main objective the strengthening of social cohesion within the communities and of their autonomy to be reflected in self-management, broadening their collective identity and health promotion by food sovereignty, strengthening conscious agents, protagonists of relationships and of their living space. The theoretical foundations are the principles of Systemic Networks of Integral Endeavours, Agroecology for Food Sovereignty and Social and Solidarity Economy. Social inclusion, valorisation of diversity, exchange of academic and empirical knowledge are also cornerstones of our work.
This project was born from an earlier study exploring the bitcoin and blockchain community in Toronto. In that research, a sentiment kept coming up in the expert interviews; someone exploring these new blockchain-based monetary technologies would articulate something along the lines of "money is valuable because we agree it is valuable", as a quickly visited precursor to discussing their perspective on some aspect of Fintech or new finance.

This study delves deeper into the idea that the value of money is sourced from a collective agreement that it is valuable. The study begins by framing that collective agreement as a narrative, or more precisely, as an "effective story", defined by Yuval Noah Harari as "a story that many people believe." Using a hybrid model that combines Sohail Inayatullah’s 4-level, U-shaped Causal Layered Analysis (litany, system, worldview, myth) and a 4-level Computer Operating system model (user, application, OS, hardware) the project explores what that effective story/collective agreement is "about" towards an understanding of the values held by, or noticeably absent from, the most readily used monetary technology in the world; debt at interest, issued by a central authority, backed by the laws of a nation.

The combination of the CLA and a Computer Operating System model allowed for the leveraging of an idea from Douglas Rushkoff that compares the current debt-based financial system to a computer operating system with these attributes:

- Running in the background impacting everything in the system.
- In serious need of an upgrade. And;
- Its widespread use is perhaps concealing the possibility of other monetary technology solutions. Debt at interest is the monetary water we’re swimming in.

Connecting the worldview level in the CLA to the OS level in a computer operating system allowed, from the CLA perspective, a way to frame a worldview as a kind of technology or tool; a software or algorithm. From the computer operating system perspective, the hybrid combination allowed for a framing of software as a worldview or ideology; an effective story. Within the study’s wider provocation of “How might we get really rich?”, the study then asks, how is the story of money, (the shared agreement of its value) created in its telling? Who is authoring this story? Where and how does the “telling” of the story of money take place? This framing suggests the monetized financial transaction as the base from which the story of the common currency is authored, as well as where the manifested value of that story is realized. The transaction is addressed as a tangible site to design for specific experiences, the attributes of which may, over time and exchange, correlate to the more preferable values we’d like money to hold.

In search of a framework to explore which attributes might be designed towards within the financial transaction (any transaction where two parties are using debt-based currency), the study looked at the arena of self-esteem. A literary review on the subject yielded these ideas:

- It is an internal valuation based on the relative levels of specific attributes including honesty, responsibility, integrity, trust, and others. The coherence or synergy of those attributes, as they are internally evaluated, are the self-esteem of a person.
- It is at a level of the “deepest vision of competence and worth". It is a
truth, (perhaps concealed to the very person making the valuation), beneath any self-delusion.

- It is a human need, on the level of oxygen, and humans will attempt to fulfill the need. The evaluation is made one way or another and if not through true sources then through false sources.

- If self-esteem is attempted to be fulfilled through false sources it creates an addictive cycle where actual self-esteem deteriorates and addiction dynamics intensify. The study looks at outside validation as one of these false sources, and money’s part to play in this dynamic.

The project considers self-esteem as a kind of asset, the building and ownership of which is the bedrock upon which value can be created. In the context of design, Bruce Mau articulates a similar idea with his thoughts on the studio and refers to it as “the project where all the other projects are created.” How is this work a new way to communicate an economic system? The study brings up the question, how might the financial transaction be an engine for self-esteem? How might we consider the transaction itself as a venue to build self-esteem by increasing, by design, the propensity to experience and increase the components of the internal evaluation that is self-esteem. In this pursuit over time, the currency (or currencies) used to facilitate the financial transaction may come to hold alternative value(s).

Nathanial Branden frames the importance of self-esteem in this way: “We have reached a moment in history when self-esteem, which has always been a supremely important psychological need, has become an urgent economic need – the attribute imperative for adaptiveness to an increasingly complex, challenging, and competitive world.”

The solution model frames each of the individual experiences within the myriad of financial transactions as a piece of the source material in the story of money. This framing allows for a tangible place to design towards bringing more consciousness and alternative value(s) to the abstracted concept of value that connects to the common, debt-based currency. Over time and transactions, the hope is the iterative shifting of the monetary narrative from one of scarcity and insecurity to one more “about” an esteemed flourishing, one transactional incident at a time.

The possibility of a re-written story means a revised set of values held by the common currency. The widespread monoculture of money might then be a catalyst for change, as opposed to an entrenching tool for the status quo, as it spreads revised values, authored with increased intention and attention from more decentralized sources at the transaction level.
Figure 2 - Breakdown of hybrid CLA

**APPLICATIONS SYSTEM**

*THE APPLICATIONS LEVEL*

Describes the financial services within the global financial system. This level includes financial products and services, including currencies, mortgages, and other loans, stocks, bonds, insurance, as well as each and any of the credit products. The creation and exchange of these derivative products also occurs, in large part, at this level. This level also includes the institutions that are delivering these products and services, including banks, brokers, asset managers, markets, payment networks, issuers, and credit card companies (Kedrosky, 2015).

- This level associates to the SYSTEM or SOCIAL CAUSATION LEVEL of the CLA.

**HARDWARE MYTH**

*THE HARDWARE LEVEL*

Describes the foundational myth by which value and its pursuit is framed. It is at this level that the myth that precedes the story of money exists. The hardware level describes the hard limits of the system in a similar way that the technological resources a desktop computer are hard limits to what an operating system can allocate to application for the purposes of providing functionality to the user.

- This level also associates to the MYTH LEVEL of the CLA.

**DESCRIPTION OF THE HYBRID LEVELS**

**USER LITANY**

THE USER LEVEL

Describes the real economy level where people and institutions interact with real goods and services in exchange for financial products including currencies, mortgages, and loans.

- This level associates to the LITANY LEVEL of the CLA

**OS WORLDVIEW**

THE OPERATING SYSTEM LEVEL

Describes the interconnected network of national banks, licensed or charted banks connected to the central bank, national governments, corporations, and high wealth individuals that control and influence the issuance of currency and the management of large sums of money through monetary policy and financial regulation. The operating system describes the constellation of entities that are in relative degrees of proximity to the authority to issue currency. It is at this level that the real-world dynamics of the essence communicated in the new-evolved story of the goldensmith, as well as other worldviews on money and monetary systems.

- This level associates to the WORLDVIEW LEVEL of the CLA

It is at this level that the meaning from Kushnoff’s metaphor becomes a worldview in the CLA

Figure 3 – Hooked on heroics archetype

**HOOKED ON HEROICS**

*Virtue Signalling*

PUBLIC HEROICS

OUTSIDE VALIDATION

AS SELF ESTEEM

DEPENDENCE ON OUTSIDE VALIDATION FOR SHORT TERM FEELING OF TRUE SELF ESTEEM

AS RESOURCE

SELF ESTEEM CRISIS

ATTENTION TO SELF ESTEEM ATTRIBUTES

RISING LEVELS ON INTERNAL SOURCES OF SELF ESTEEM

Figure 24 – Hooked on heroics archetype – The hooked on heroics archetype describes how public heroics generate outside validation in the form of awards, monetary compensation, celebrity, etc. When outside validation is available, there is a choice in the intention of how to receive or use it. If used within the evaluation of self-esteem, it ultimately lowers self-esteem, increasing the frequency and intensity of self-esteem crises and driving behaviour towards more public heroics. Used as a resource (for example, an award can lead to collaboration with new partners, more money can lead to more time and space for internal reflection, etc.) more attention can be paid to the attributes of real self-esteem, lowering the intensity and frequency of self-esteem crises. This dynamic also describes the concept of virtue signalling: the conspicuous expression of moral values done primarily with the intent of enhancing standing within a social group (*Virtue signalling*, 2017).
Water is one of the most abundant resources on Earth and it is inextricably linked to life. In the Earth Complex System water can be considered as the matrix of life, water molecules are the 99% of molecules in human body and a water shell surrounds every ion and molecule in the biological system. The majority of natural phenomena involve water and our existence is dependent on this precious substance, or the lack of it. However water is limited and despite of its ability to self-cleaning along the water cycle, its quality is vulnerable and fragile. Hence, water scarcity and water pollution represent tremendous issues at global level that call for rapid solutions.

The here presented research refers to the Systemic Design (SD) approach applied to the design of the water treatment system at the MonViso Institute, a real-world mountain laboratory for research, education and entrepreneurship in sustainability transformations and Systemic Design located in the Italian Alps (Ostana - CN). The Alpine Region is a really unique environment very sensitive to climate changes and therefore it is an ideal place where setting a living lab for testing new approaches to the sustainable management of water resources.

The application of the SD methodology to the design of the water system entailed a focus on the understanding of the water behavior both at molecular and at macroscopic level. Therefore the SD methodology drove the research through an intense exploration of the complex properties of liquid water touching a variety of disciplines from physics to chemistry until bioengineering and medicine that has opened the frontiers to a more complete understanding of water.

Liquid water has been very well studied with a number of model structures having been proposed and refined (Wilhelm Roentgen, 1891; Bernal e Fowler, 1933; Franck e Wen, 1957; G. Nemethy e H. Sheraga, 1962; Martin Chaplin, 2000, Nilsson and Petterson, 2004; Del Giudice and Preparata, 1998; Stanley, 2013; etc.). However, extensively hydrogen-bonded liquid water is unique with a number of anomalous properties, and no single model is able to explain all of its properties, at least for now.

Theories and advanced models of liquid water are generally split among those that do not recognize a particular role in molecular water structure (Israelachvili, 2011), to those that provide an evidence of long-range ordering at room temperature (Pollack, 2013, et.al).

It has been shown that at a molecular level water does not have a homogeneous structure but rather is in dynamic equilibrium between the varying percentages of assemblies of different oligomers and polymers. The structure of these “clusters” or units themselves is dependent on temperature, pressure, and composition (Roy, 2005).

A previous PhD research project (Toso, 2015) has therefore focused on the investigation of these “emerging” properties with the aim of identifying innovative solutions for the treatment and use of water in accordance with the mechanisms through which it operates nature, valorizing water quality in a sustainable way. Part of the PhD research has investigated the water behavior at macroscopic level with a particular attention to the vortex technology.

The vortex is a classical dissipative system, a characteristic example of self-organization, which has been discussed by Prigogine (Prigogine, 1971). To trigger self-organization in a dissipative system we must create the right conditions. The stability of the vortices that can be observed manifests it-
self as a capacity for self-organization. These are turbulent fractal structures (Johansson, 2002).

To study the ability of vortex water to separate suspended solids a cylindrical device has been made in order to let water flow organizing itself into a vortex - a macroscopic structure has emerged spontaneously out of the flow. Lab testing proved a separation of Suspended Solids and Natural Organic Matter over the 95-98% in a single pass. (Toso, 2017)
Therefore, the research started from the exploration of the liquid water abilities in self-cleaning and self-organization at molecular level, and leaded to the design of a water system that drastically reconsidered the water usage at domestic level.

Thanks to a more holistic perspective on water it was possible to design a water system able to optimize water usage and to avoid harmful substances by taking advantage of the self-cleaning properties of water. The design concept here presented is based on the combination of the Vortex Water Technology and the Living Machine Technology.

The water system at the MVI has to supply 6 small buildings all over the year and eventually the watering of the plant growth area during Summer and Autumn. The water input comes from 3 spring water sources and also from meteoric water (both rain and snow). Seasonality is a huge variable in the water system that influences both input availability and water needs. Temperature also varies largely along the year: during winter time surficial water freezes, in spring time snow melting provides a large amount of water that needs to be collected and stored to sustain dry periods in the summer time.

The Water System at the MVI is designed to be self-sufficient and really connected to the territory. Therefore water has to be treated and used in a very efficient way and reused many times before letting it go to the Living Machine System that is the final waste water treatment stage of the MVI.

To properly design the water system the design phase is supported by a System dynamics model.

System dynamics (SDs) is a modelling tool which is used for discovering a system’s dynamic complexity. This modelling tool is used in several areas such as logistics (Gui Shouping et al., 2005) or urban economic growth in cities (Rusiawan et al. (2015), however, ecology is also the area where this method is often used (Mavrommati et al., 2014).

SD models can be built up with more development tools (Stella, Vensim), but here AnyLogic 7.3.6 is used.
Main elements of system dynamics are stocks and flows. In the case of a water system, we have built up the model around water tanks, that is the stocks are the water tanks (meteoric and spring water tank), and the flows are the inflow of meteoric water, the outflows are the use of meteoric water, such as washing, cleaning and toilet. The figure below shows this basic process. Spring water follows the same logic, where incoming waters (inflows) are the Fablab, Basecamp and Pond water, the outcoming waters (outflows) are cooking and drinking and personal care (e.g. shower). The grey water after shower goes to purification and will become as an inflow to the meteoric water. The final use of the used water is agriculture. The quantity of the water flow is calculated by the expected number of visitors.

This SD model can answer the following questions:

- The size of meteoric and spring water tanks for safe operation
- The effect of the expected number of visitors
- The possible shortage in meteoric and spring water
- The dynamics of the use of water
- The quantity of water, used for irrigation in agriculture.

The necessity of the use of dry toilets. The MVI water system is considered as a “living organism” where water is treated using chemical-free purification modules that take advantages of the biological based purification treatment from on hand and of the spontaneous solutes rejection in a free-vortex from the other.
The Systemic Design (SD) methodology here presented results as a supportive tool for helping the designer to look at the objective in its complexity and to organize all the actors of the project by giving them the ability to relate and evolve autonomously. As a consequence the individual parts of the system are intertwined, forming a virtuous network (autopoietic) of relations between the flows of matter, energy and information. In particular the SD methodology here adopted has been developed at Politecnico di Torino with the aim of implementing sustainable productive systems in which material and energy flows are designed so that waste from one productive process becomes input for other processes, avoiding being released into the environment. This model is inspired by the theoretical structure of generative science, according to which every modification in resources generates by-products, which represent an added value. Starting from the observation of natural phenomena, the SD approach aims to “learn from nature” not just for mimicking the natural technologies, but for designing a product system able to positively interact with a dynamic environment and an evolving society.

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Life conservation; A study into systemic design for wildlife

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Design; Systems; Wildlife; Nature; Ecology; Sustainability; India.

The foundation for any flourishing system is balance; something that has been lacking in the modern Anthropocene era. While designing our future, we largely forget the other 99.99997% of inhabitants on this Earth. The paper answers the question of what design can do for wildlife.

Wildlife is mostly thought of as the tigers and elephants in the forests to the fish and crustaceans in the sea; creatures living in their own worlds far, far away in their own worlds. If we really begin to define wildlife, we will realise it includes beings we live with; sparrows, bees, butterflies and a whole multitude of other species we see in our day to day lives; and even more that affect us directly and indirectly.

Wildlife are an undervalued element of a sustainable future. They are inevitably linked to everything; be it the tourism, the healthcare, or the food industry. However, the investment in our wildlife is only a minuscule fraction as compared to the benefits reaped from it. The paper talks about the link between economic and ecological systems, and how we can create a flourishing sustainable economy by taking into account all life on Earth. There is an understated interdependence between social and natural systems. While being a vital part of our economy, wildlife are also a vital part of several societies and cultures. There are also direct links between wildlife and human wellbeing and health, all of which are quantitatively and qualitatively proved in the paper.

Local context is as important as in any other system; with the huge diversity in habitats and natural ecosystems, there is also an equally large diversity in the socio-cultural and economic attitudes to wildlife. Geographies and man-made borders conflict with the natural ones. This makes the problem even more complex, and this complexity is further explored in this paper.

This project explores the roles of systemic design and research as a tool to create not only holistic solutions, but explore the right areas of intervention. The project’s main outcome included the creation of over 60 design briefs or opportunities for designers to get involved and fix the problems of wildlife. Work was also done to empower cooperation across different sectors that deal with wildlife; acts of co-creation and co-design between the government, non-government organisations, and the general society.

While this study is primarily focused in India, it has applications for wildlife and designers around the world. For a country that is developing at breakneck speed, it is vital that future policy design ensures a more sustainable future.

The involvement of the design industry can create fresh, new possibilities that benefit not only wildlife, but the humans that depend on them, directly and indirectly. It increases the scope of designers beyond aesthetic logos and functional chairs, to tackle larger, more systemic problems in the world we live in.
5 SOCIAL CARE AND HEALTH SYSTEMS FOR SUSTAINABLE LIVING
The paper discusses the topic of participatory design processes with systemic approach as a tool to negotiate, shape and prototype new inclusive models of citizenship and care to benefit marginal groups in society. The topic will be addressed via three case studies from the field experience of our action research through Design and Anthropology toward social inclusion (World Bank, 2013). The two disciplines shaped a collaborative and vibrant research environment challenging the issues of participation in design processes. Since 2009, the research operates in several Italian cities, entailing both methodological analysis and transformative actions that have tangible effects on social care systems: marginalized people, caregivers, services' management organizations.

The beneficiaries involved are asylum seekers, migrants, people affected by chronic diseases, and homeless people. They are usually intended as “fragile” people since they manifest urgent and highly impacting needs that require specific answers, usually provided by the care system, composed both by public and private sector. Usually, beneficiaries’ needs are multilevel (housing, health, income, work, social relationships, autonomy) and interconnected. The variety of actors that contribute to meet those needs is not part of a coordinated network. From the perspective of our research a care system shouldn’t be intended as a crystallized system but as an ever-changing system that constantly needs to be transformed to better answer to social change.

All the projects described move from the stakeholders’ desire of tangible transformations in order to improve the quality of service: development of new products, redesign of spaces and processes, innovation of the service itself. In order to support and facilitate this “desire of change”, on the basis of the complexity of the relations that shape the network of the system, it seems to be preferable to operate with a systemic design approach (Jones, 2014) and to develop projects based on participation and collaboration among all actors, in order to include the most of them in decision making processes.

**Method and Tools**

We developed a specific interdisciplinary method and a set of practical tools to operate into the social care system.

The fundamental elements that define our method are:

1. To observe and analyse the system in order to understand it in its complexity, focusing on the social relationships that occur among people and the stakeholders, and how they shape the system through the usage of spaces and objects. We use focus-group, in-depth interview, video-tour and participatory observation when the project has been undertaken.
2. To carry out co-design processes: all the actors are involved as expert users. We build shared decision making processes designing together a shared vision of change, and tools and procedures to achieve this change.
3. To encourage co-production of the intervention with every stakeholders. They are invited to make available resources in order to produce and manage the interventions.
4. To lead co-creation processes of the most tangible and practical stage of the project set out during the co-design process. We invite the actors to take part to the process sharing knowledge, skills, and competences.

The participatory workshop is the practical tool we adopt to materially sha-
The desired change. It consists of on-site interventions through creative and collaborative processes, working from within the context. The workshop is an opportunity to stimulate synergies among the actors in an informal and dialogic environment. During the workshop new connections between all the actors are found out, tried out and tightened. The workshop is also a way to prototype solutions that can be tested, discussed and implemented with all participants. Moreover, the workshop offers the opportunity to connect the social care system services, so often marginalized, with the society. We do so by inviting in the “outside” to take part to the processes: university students, volunteers, citizens.

**CASE 1. Design for Each one**  Co-design of personalised devices for people suffering from multiple sclerosis and muscular dystrophy

The co-design process involves users, care givers, design students and researchers, promoting collaboration between Politecnico di Torino, Associazione Italiana Sclerosi Multipla and Animazione Valdocco, the social cooperative managing the care service. In the framework of collaborative workshops, everyday life problems of sufferers are investigated by a group of designers and caregivers, through participant observation. The group investigates on those gestures that users cannot do and they prototype small tools. Within a one-week long workshop, the product is developed and prototyped by a continuous collaborative process with the user. Than, with the same method, the product is implemented and tested for a long time until it is ready to be released.

**CASE 2. Cantiere Mambretti**  Participatory renovation of shelters for migrants and homeless people in Milan

The project relies on the collaboration of homeless people and migrants in the role of expert users, workers belonging the organization managing the reception service, designers from Politecnico di Torino, young volunteers as high school students and citizens in general. The design action places emphasis on ideal of “co-created beauty” as trigger to reshape reception services and spaces. The co-design process is stimulated by preliminary focus groups with hosts and workers, in order to understand the needs and to define together solutions that all the actors can agree on. Than, the group of participants is engaged in the tangible transformations initiatives: furniture building, wall painting, wayfinding set up. The project generates a sort of temporary “creative revolution” in the shelter: everybody is welcomed to participate and help with the design interventions. The vibrant environment of the workshop challenges the reception service’s routines and fixed roles and create a positive impact, also because it involves operators and users in the actions, giving value to people’s skills and aspirations (Campagnaro, 2018). The effects of this process are diverse in relation to each category of participant: for migrants people, participation acts as a trigger for a sense of protagonism and gratification, while, for the organization’s workers, the project offers the chance to rethink to the way the service is provided and to imagine how the spaces could contribute to improve it.

**CASE 3. Costruire Bellezza**  Design Anthropology led lab based in Turin aiming at social inclusion

The group of participants of Costruire Bellezza is heterogeneous: homeless people, care givers, social workers, students and researchers in design and social sciences and creative talents. The process is rooted in the collaboration between the Municipality services for homeless people, the social cooperative managing these services and our universities (Politecnico di Torino and Università di Torino).
The lab functioning is based on regularly held creative workshops leading to the production of co-design and co-created artifacts for the participants of the project and for the neighborhood communities. The main outcome of the project can be traced on what the collaboration of the participants generates in terms of empowerment of the homeless people (Sen, 1992) putting in value their capabilities, development of new skills in the students (Margolin and Margolin, 2002), and in the offer of an innovative and informal occasion during which the relationships between social operators, educators and homeless people are tightened.

**Design domains**

The specificity of the case studies presented can be traced in the extensive use of the co-design method in order to develop all the (tangible-intangible) artifacts together with the users: either the output is a tool, a space or a new social service. However, if we analyse those processes by the “design domains” (Jones, Van Patter, 2009) a scale of incremental impact can be observed between the projects.

The ‘Design for each one’ objects represent an unseen ground for the design of innovative products based on specific needs usually unspoken by the users or not answered by the traditional market because of their specificity. Moreover the project produces an empowerment effect on the organization, fostering the participatory approach also in the educational work.

The ‘Cantiere Mambretti’ projects have an effect on a systemic dimension. They impact on how the reception service is provided in terms of both quality and functionality of spaces. Assuming the co-design model as “a new way to do things”, the stakeholders are connected systemically as agents of change. This environment activates all the participants and design enhances not only physical changes but also the strategy that lies behind the service (Campagnaro, Di Prima, 2018).

Lastly, it is possible to read ‘Costruire Bellezza’ as an example of a project operating on the highest level of the scale of the design domains. Started as an experiment (Binder, Redström, 2006) in 2014 and now recognized by the public administration as a new public service for homeless people and the development of initiative of social cohesion, Costruire Bellezza provides an example of how initiatives of co-design of objects and services can encourage new policy models that rely on the alliances fostered by the participatory design processes.

**Final remarks**

According to our experience, the systemic vision, thanks to a participative approach, enhances the relationships among all the stakeholders developing new visions of the services, making everybody a “beneficiary”. In order to facilitate and foster an horizontal environment of mutual exchange and collaboration, the researches need to stay within the processes. Doing so, they understand attitudes, behaviors, unspoken needs and outcomes and they can reorient the process on the basis of what the field and the people respond. Places of care can become places of innovation if the project’s system is open, flexible and sensitive to context and individuals. This fosters the cohesion and the inclusiveness of the care systems and it generates the opportunity for all those involved to flourish.

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SUSTAINABLE HEALTHCARE: OUR DEFINITION

Introduction

Medical care in the Western world accounts for between 8% and 17% of GDP (according to the WHO), depending on the country. In Western Europe, the average is about 10% of GDP. A sector of this size inevitably has a significant impact on the environment. Healthcare activities, due to their specific nature, affect the environment in different ways (waste production, use of chemicals, increasing use of disposable materials etc.). These impacts often are almost exclusively due to healthcare (pharmaceuticals in the environment, infectious waste, different sources of radiation, antibacterial materials etc.).

Over the past 10 years, interest in Sustainable Healthcare has grown globally. Sweden is considered one of the world leaders in terms of Sustainable Healthcare. One of the reasons is that since the 60s, Sweden has been a forerunner in the introduction and implementation of environmental legislation as well as the concern in sustainability issues, that has also been reflected in the healthcare sector.

Sustainable Healthcare has an untapped export potential. Sweden has made great efforts in the sustainability area and is in most cases among the top players in the world, but this has not been exploited to its full potential as a lever for increased export. In this Innovation Agenda we elaborate the issue of the unrealized potential of Sustainable Healthcare.

Definition of sustainable healthcare

The concept of Sustainable Healthcare includes several aspects and spans over various disciplines and areas.

The focus of the Innovation Agenda is on the environmental impacts of healthcare buildings and on the activities that take place in them. In this Agenda, we distinguish Sustainable Healthcare from Sustainable Health which relates to prevention and public health. Disease prevention activities help reduce healthcare impacts, however they are not considered in the Agenda. A further distinction should be made between Sustainable Healthcare and Environmental Health which focuses on the effects of environmental impacts on human health.

“Sustainable healthcare concerns the care of a patient with as little negative impact on the environment.”

The model below illustrates the concept of Sustainable Healthcare and the
Healthcare innovation involves a wide range of stakeholders from different sectors and scientific fields. Even though they develop innovation in different ways, relatively few address sustainable development, which highlights the importance of a more comprehensive understanding of sustainability in healthcare innovation. Outside the well-established technological innovation systems, almost every Swedish hospital, county and region has been involved in national/EU projects and other activities related to environmental that aim at improving sustainability in healthcare.

Sustainable healthcare innovation

Sustainable Healthcare is an interdisciplinary cross-sectoral area. Many different stakeholders, both from public and private sectors, are interested in or affected by Sustainable Healthcare.

- Public stakeholders: research centers, municipalities, regions, counties, healthcare administrations, universities, national boards etc.
- Industrial stakeholders: companies working in the healthcare sector or other sectors with potential applications in healthcare. Industrial stakeholders include private healthcare, Life Science companies, Med Tech and other companies with sustainable solutions applicable to hospitals (e.g. Cleantech companies).
- Networks, professional organizations and Science Parks: organizations in the healthcare sector which contribute directly or indirectly to Sustainable Healthcare innovation.
- International organizations: organizations that bring together different stakeholders of Sustainable Healthcare at an international level. NGOs frequently drive forward sustainability issues in healthcare.
As the model below illustrates, Sustainable Healthcare is a horizontal framework as compared to the sector-specific approach used in industry classification. There is no Sustainable Healthcare industrial sector: different solutions, products and innovations span over a wide range of sectors.

<table>
<thead>
<tr>
<th>Sustainable hospitals</th>
<th>Good environmental performance</th>
<th>Good environmental performance</th>
<th>Applications for healthcare</th>
<th>Good sustainability performance and applications for healthcare</th>
<th>Smart locally produced organic food</th>
<th>Support/boost sustainability performance</th>
<th>Management system, reporting, training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction industry</td>
<td>Life Science</td>
<td>Med Tech</td>
<td>Clean Tech</td>
<td>&quot;Regular&quot; Companies</td>
<td>Food Industry</td>
<td>ICT</td>
<td>Management</td>
</tr>
</tbody>
</table>

**EXPORT POTENTIAL: A SWOT ANALYSIS OF SWEDISH SUSTAINABLE HEALTHCARE**

Each of the many organizations involved in the work on the Innovation Agenda provided its own view of the challenges and opportunities that Sweden has in the field of Sustainable Healthcare. The SWOT analysis presented below is partly based on the experience from Sustainable Healthcare of the project management and the report authors, partly on the interviews and meetings with various stakeholders conducted within the work on the Innovation Agenda.

### Strengths
- **Good conditions in Sweden:**
  - established environmental organization;
  - innovative sectors;
  - investments in the area
- **Good conditions globally:**
  - one of the world leading countries;
  - good reputation worldwide

### Weaknesses
- **Structural and organizational:**
  - fragmented area with a weak academic context;
  - no national platform;
  - no proper marketing
- **Swedish legislation/healthcare system:**
  - internal competition, procurement

### Opportunities
- **Economy and market:**
  - boost export, revenues, employment rates while reducing costs;
  - good domestic market;
  - marketing strategies
- **Research & innovation opportunities**

### Threats
- **Swedish market lags behind**
- **Delays in Swedish regulations,** also in respect of export
- **Public sector sets up obstacles rather than being a major catalyst**

**Swedish best practices in Sustainable healthcare**

There are many ongoing long-standing projects in the area of Sustainable Healthcare that bring together universities, businesses, counties and span across borders for better efficiency. Sustainability aspects that these projects focus upon differ: energy efficiency, resource optimization, biomaterials, sustainable transportation etc.

The following three examples show the depth and width of Swedish research:
• MistraPharma: the project aimed at identifying pharmaceuticals that can affect aquatic ecosystems and managing the risk for growing antibiotic resistance in the environment (www.mistrapharma.se)
• PVCfreeBloodBags: the purpose of this cooperation of public healthcare institutions and plastic manufacturers is to produce a PVC-free blood bag that follows the required specification and contains no hazardous substances (www.pvcfreebloodbag.eu)
• CLIRE - Climate Friendly Health and Care: the project includes six sub-projects that aim to demonstrate how healthcare can work with climate change in different ways, from energy efficiency in hospital buildings, to greenhouse gas reduction in supply chain. (www.clire.se)

CONCLUSIONS AND FUTURE OBJECTIVES

Structural conclusions

• The sector-specific approach which is a most widely used approach is not suitable for a cross-sectoral area such as Sustainable Healthcare. In most cases, the focus on a specific sector is an obstacle to interdisciplinary collaborations and projects.
• There is a high demand for an independent platform for Sustainable Healthcare with the capacity to bring together all stakeholders, to facilitate meetings, events or other activities where companies, researchers and healthcare institutions can meet to discuss challenges and opportunities for cooperation.
• Stakeholders lack coordination and often are unaware of their role in Sustainable Healthcare. Companies lack knowledge about the work and needs of the healthcare sector. The academia lacks understanding of the challenges within the area of Sustainable Healthcare. It is necessary to give all stakeholders a broader view of Sustainable Healthcare and help them identify their own roles in the area.
• Cleantech companies do not have the same opportunities to test, validate and commercialize their products/services for healthcare, as the Life Science industry. However, Cleantech industry has a significant potential for further development.
• Purchasing organizations lack information on sustainability requirements that are applicable to procurement processes, as well as innovations that are available on the market.

Export-related conclusions

• Sweden is well-known abroad as an expert in Sustainable Healthcare. However the export potential of the Swedish expert knowledge is not fully realized. This concerns not only Swedish environmental technology, but above all the systematic approach, management, know-how etc.
• Swedish companies with innovative solutions for Sustainable Healthcare target foreign customers rather than the domestic market. The Swedish market is considered to be much more complex and difficult to access, and therefore less profitable.
• Sweden has been at the forefront of promoting sustainability in healthcare for many years, but today Norway and Denmark are investing heavily in environmental technologies and green innovations in the healthcare sector. Consequently, Sweden could eventually lose its leading position.

Communication-related conclusions

• Many companies do not consider healthcare as a potential customer due to lack of knowledge about how the sector operates. Therefore, better communication and simple activities (e.g. study visits and meetings with healthcare procurement) can make a significant difference.
• Many domestic stakeholders are unaware of Sweden’s leading position in Sustainable Healthcare. As a result, national export policies often neglect the area that could provide high export revenues due to lack of knowledge.
• According to a number of companies involved in the work with the Agenda, the healthcare sector is often sceptical about new solutions that business offers. Business needs more opportunities to communicate and test its solutions while hospitals need risk-minimizing warrants for testing an innovation.
• Healthcare, industry, academia and other sectors seek meeting places at local, regional, national and international level where all Sustainable Healthcare stakeholders can meet, discuss current and future challenges and share knowledge.

RESULTS: THE NORDIC CENTER FOR SUSTAINABLE HEALTHCARE

The work with the Agenda highlighted the high need for an independent platform that would bring together all stakeholders in the field of Sustainable Healthcare. Following this conclusion, Vinnova extended the project and provided additional funding to start an interdisciplinary center focused on Sustainable Healthcare.

Purpose and tasks

The Nordic Center for Sustainable Healthcare (NCSH) is an intersectoral arena for stakeholders, organizations, projects and expert knowledge in the sector of Sustainable Healthcare. NCSH is an umbrella organization for existing companies, projects and competence. Our ambition is that the NCSH shall generate collaboration and ideas, and gather actors from the healthcare sector.

The NCSH shall help the healthcare sector and its suppliers of products and services to reduce their environmental impacts, while increasing export and employment in healthcare in Scandinavia. Moreover, the reputation of Scandinavia as the world’s leading region in terms of Sustainable Healthcare will be further strengthened.

A growing network

The kick-off meeting for the NCSH was held on May 28th, 2015 at Medeon in Malmö, combined with the final conference for the Innovation Agenda. Over 60 participants from business, public sector, universities and municipalities arriving from Italy, Belgium, Sweden, Norway and Denmark attended the meeting.

The interest in the NCSH is vast, and the number of members is rapidly increasing: in early September 2015, the NCSH already had over 20 members, and many national and international companies, as well as counties, regions and hospitals have expressed a strong intention to join the center.
CONTRIBUTORS TO THE INNOVATION AGENDA

"More than 200 organizations have contributed to the Innovation Agenda."

The working group for the Innovation Agenda was led by TEM Foundation in collaboration with Swecare, Lund University and a number of other partners. The work that included many activities (interviews, workshops, meetings, conferences etc) was carried out in synergy with other initiatives and projects related to Sustainable Healthcare.

Focus areas

The work on the Innovation Agenda included three principal focus areas:

Focus Area 1: UNDERSTANDING THE MARKET
- What innovations does healthcare need?
- What areas are overlooked?

Focus Area 2: MARKET COMMUNICATION
- How do hospitals/regions, companies, and universities communicate their needs and offers?
- How can expertise of the healthcare sector (the customer) be coupled with expertise of companies (the supplier) in terms of Sustainable Healthcare?
- What is needed to improve collaboration between healthcare institutions with universities and companies?

Focus Area 3: ACCESS TO HEALTHCARE MARKET
- How can companies get access to hospital environments for product testing and development?
- What kind of support do SMEs need to scale up and reach out to foreign markets?
- What needs to be done to boost export of Swedish Sustainable Healthcare solutions?

Participants

The contents of this report is a result of the work with the Innovation Agenda that involved more than 200 organizations from business, hospitals, municipalities, counties, regions, cluster organizations, NGOs and academia. In order to make a balanced and comprehensive analysis of the state of the art in Sustainable Healthcare, these organizations participated in a series of activities where they gave answers and suggestions within the 3 focus areas of Sustainable Healthcare. The feedback from the participants provided the basis for the analytical part of the Innovation Agenda.

Different enquiry channels

- 8 national meetings with more than 100 organizations involved;
- 4 international meetings held in Norway, the United Kingdom, Germany and Sweden (with participation of foreign ambassadors);
- workshops with more than 50 participants;
- 16 interviews with key stakeholders in the area of Sustainable Healthcare;
- 600 contacts in the NCSH mailing list;
- more than 3000 contacts through TEM and Swecare mailing lists.
@HOME in transition
Encouraging asylum seekers towards more self-driven approaches to navigate the unknown they are surrounded with.

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KEYWORDS
Action design research;
Co-design;
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Systems Oriented Design;
Participatory Design;
Transition;
Home;
Asylum seekers;
Refugees;
Refugee camps;
Reception centers;
Humanitarian; Actions;
Discussion Facilitation;
Self-efficacy.

Introduction

Welcome and feel yourself @ Home in transition. This project is the story of tackling a common affliction today which brought 2 migrant girls from Iran to each other. They shared their backgrounds, hopes, pains and skills together, forming the project which was not only a master diploma, but a real life concern for them both.

This diploma project is meant to be the first pilot of a co-development concept in transition (elaborated inside report) which happened in Norway at the Refstad Transit reception center in Oslo, during winter-spring, 2018. Despite the differences among reception centers around the world, they carry some similarities (Mouzourakis & Taylor, 2016) which enabled the project to extend its horizons beyond a contextualized student diploma. Consequently, the outcomes of this first pilot in Norway are both specifically designed for Refstad and also for the general context of transition around the world. The designed actions and tools are generalizable and carry general values which can be extracted as core materials to adapt to any other asylum and refugee centers around the world.

The project is following the concept of Co-designing Actions and Facilitating Discussions In Transition (Peter Checkland & John Poulter, 2006) which affords the possibility to learn through changing the system with its own footprint. It is not about a singular or multiple problem-solving project, but about working with a situation rather than defining problems to solve. (Denis Loveridge, 2008)

The project aims to create a different state of mind within the context of transition and influencing the social system with participatory approaches as a fundamental element of dignified reception. By capacity building and raising self-awareness (NORCAP, 2016), the project is meant to motivate the asylum seekers to recall their competences and wishes towards self-efficacy which affect every area of human endeavor by determining the beliefs a person holds regarding his or her power to affect situations. Consequently, the process of recalling, planning and taking collective actions based on available resources inside the reception center, builds dignity, self-esteem and self-reliance among people. Such approaches could lift mitigating tensions and conflict in the reception facility and build bridges between different groups.

In addition, the inhabitants of each center would co-develop towards a self-initiated future based on their abilities and hopes. This achievement will also remove the false hope of necessarily ending up in the host country and enrich their abilities to bring them broader horizons regardless of the answer they will get from the authorities.

Fields of the project

With a cross-disciplinary approach, this design diploma project is being held within different design disciplines simultaneously to bring a combination of their values to the humanitarian context.

Among the involved design fields:

- Systems Oriented Design: The emergence and development of a designerly approach to address complexity. (Sevaldson 2013 - www.systemsorienteddesign.net, 2009)
- Participatory Design and Co-design: as an approach attempting to actively involve all stakeholders (e.g. employees, partners, customers, citizens, end users) in the design process to help ensure the result meets
their needs and is usable (Simonsen & Robertson, 2013).

- **Service Design**: as a design approach to improve the quality of different actors' interaction and involvement by planning and organizing people, infrastructure, communication and material components of a service. (Brown & Wyatt, 2010)

- **Transition Design**: an area of design research, practice and study which looks toward design-led societal transition toward more sustainable futures. (“Transition Design 2015,” n.d.)

Therefore, in this project, tools of Systems oriented design will provide a holistic view over the complexity of the field. “Service Design” tools and approaches help the designer to go in details and design actions based on the target groups’ needs. Co-design tools will facilitate discussions and collaborations among the designers and target groups. Together, these components benefit from the ideations within transition design field.

**Theme of the project**

Today, 80 million people are displaced and yet 28,300 people a day are forced to flee their home due to conflict and persecution. On the other hand, the world population is growing and this growth will not be among white and rich people. Therefore, the pressure on the borders will raise and continue over the next years. (“UNHCR - Figures at a Glance,” n.d.) However, 2018 is considered as the down period with less arrival for most of the countries including Norway. Consequently, less resource dedication to emergency responses could lead to saving time and prioritizing development approaches/programs, enabling proper preparation for upcoming challenges. Projects with engaging development capacity management in this period could bring up different scaled local solutions which would empower self-driven approaches towards the problematics. Among them, frustration due to long waiting periods, pacification of the asylum seekers, self-loss and psychosocial health issues could be mentioned.

Followed by the context specific local solutions in countries with less emergency status, approaches and extracted materials/outcomes could be patterned and implemented as several ensuring pilots in other countries as well. For humanitarian authorities who are engaged with providing services and resources for vulnerable people, there is the priority of encouraging solutions towards promoting self-efficacy within the reception centers to enable courses of action required to deal with prospective situations. Consequently, an individual will be empowered to exhibit coping behavior and sustained efforts in the face of obstacles. This also leads to better integration and active engagement towards the living specifications of the context of resettlement.

**Context of the project**

In particular, this project is focusing on the context of Transition, such as reception centers where it is even more important for refugees and asylum seekers to consider integration measures intertwined with reception, even in the early stages and with (despite of) the notion that not everybody will be granted asylum. (Bergtora Sandvik, Fladvad Nielsen, Brita Fladvad Nielsen, & Gabrielsen Jumbert, 2016)

Due to the constrains in the transit reception centers and their “military protection atmosphere”, (Balasubramaniam Venkatasamy - Refstad camp manager), as well as asylum regulations, inhabitants’ life style is limited to daily basic needs and long frustrating waiting period which provides lots of issues with psychosocial health and tension. (Based on our field studies & resources)
Design for the taste-makers: System oriented social innovation for improving the living condition of salt pan labourers

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KEYWORDS
Social Innovation; Migration; Empowerment; Community based Design; Wicked problems; Co-Creation; Unorganized Sector.

Context:
Imagine food without salt, the taste buds falling into deep unconsciousness due to the split subconscious confusion created to identify the taste of the food we consumed. The term tastemakers fit perfectly to the labourers who work in the salt pans to produce what gives taste to our food, Salt. The project aims to understand the ecosystem in and around the production of salt, use design thinking to flourish the living condition of the labourers working in these salt field, improve their working condition to care about their physical parts in the self-involved work culture of producing salt, understanding the socio-economic and cultural condition prevailing in it and build a self-sustainable model for the people involved in the ecosystem enabling a well-deserved return on their efforts. Using Co-design approach and participatory design approach as tools, NGO’s working in the area, the community leaders and the labourers working in the salt fields were involved in bringing design interventions.

The target of this project is to not only make the profession of salt pan labour a respectful one but also to make this profession recognisable. This would ensure cultural sustainability and justifiable remuneration pertaining to the physical and mental efforts invested in the process of producing salt looking at the psycho-social, economic and work environment conditions. The idea was:

• To expose the family of the labourers to the multidimensional possibilities to identify and solve a problem
• To associate with them, to improve their work and living conditions
• To motivate the children of salt pan labourers to explore diverse professions for their means of livelihood
• To build a co-operative self-sustainable system that would bring the community together and work towards their social inclusion in and around the community.

Figure 1: Father and son resting in the Salt Pan Fields
Methodology

The entire ecosystem was understood by doing many field visits, Shadowing method and primary and secondary interviews of the academic experts working in this field, the Non-profit organisation associates working in these areas, labourers, labourer’s family members, landowners and the retailers as part of this applied design research project. 15 case studies which included literature, documentaries and blogs were explored to build a strong understanding.

The location of visit was restricted to Morbi salt production areas in Gujarat, India. Co-Design and participatory design workshops were done with the available members of the community and NGO workers working for them to understand the hierarchy of the problems and the social outlook of the residents. Exchange tools and methodologies with the NGO workers helping them to build a social to Interactive workshops were done with the kids trying to understand their mental development and interest areas. Design tools like Affinity Mapping, Break the Paradigm, Method Cards were used to synthesize the findings to get insights to bring about design interventions.

Observations & understandings

Repeated visiting of the salt pan areas, shadowing their daily routine activities and living a few days of their life at their home, gave a clear understanding of the different layers of the conditions prevailing in the area. The caste and religious system coupled with the age-old stereotypes contributed a major role in the present condition of the labourers. The down trodden living condition was due to a combination of socio economic and political reasons. A design intervention encompassing these factors would be necessary for bringing about a social change. Intense interview sessions with experts from social science background, socialites, faculties from labour institutes, social innovators, designers, social reformers, policy makers were done. This helped in building the topic case study as viewed by different perspectives and understanding the interlinks between the different factors that caused the prevailing condition.

The problems that the designers figured out initially were as per the paradigm build due to their upbringing in a different context all together and be very much possible that the problems that they figured out might not be the real problems that the labourers are facing. The participatory workshop with the labour family and other stakeholders helped us to understand the true problems that were concerning to them. A clear hierarchy of the intensity of the problem could be mapped. During the Co-Design workshops the participants facilitated by the designers could themselves bring out creative solutions to the problems faced by them, thereby bringing a positive outlook towards their life. The involvement of stakeholders and users in the design process helps in in-time validation of designs and to understand the satisfaction and influence of the new design user.

The interactive workshop with the kids living in 2 different contexts, one with the children who took formal education and other with ones who did not receive formal education, showed the difference in the perspectives of the outlook of children and gave a clear picture of the need for formal education for the children in the area, thereby facilitating us to bring about design interventions to build a sustainable future for next generations.

Design interventions

Looking at the scenario with a systemic approach helps to break the boundary of possibilities for bringing about intervention. It was understood that a single solution cannot bring a reformatory change in the condition of the salt pan labourer which was an outcome of socio-political and economical
aspects with a historic background. Different levels and kinds of intervention would be required to bring about an upliftment in the condition of the salt pan labourers.

- Create a new business model: Avsar, a sustainable collaborative start-up between social reformers and the salt pan labour community. Looking at the contribution of small scale salt manufacturers against the large-scale manufacturers in the total quantity of salt production, it is necessary to look at the present scenario not from a profit-making lens but from a sustainable livelihood opportunity lens. Avsar is a business model built on these lines that would manage the systemic complexity and present a sustainable future scenario.

- Redesigning the playgroup: Gamification of the learning process created an interactive learning experience for the children helping them to learn healthy living habits and acquire basic knowledge. A playgroup which would infuse motivation in children of different age groups would help build an active individual with a positive and responsible outlook towards community and society.

- Designing co-creation workshop models for organisations working independently in the social sectors: Co-design and participatory workshops give rich and meaningful insights into the condition and problems faced by the end-users. Methodising the process of organising a workshop and its activities would help the organisations working at grassroots levels to improve the efficiency of their efforts.

- Policy design for the governing authorities: Suggesting policies that would cater to different needs of the salt pan labour community and which would align to their economic condition to sustain for a longer run.

These would contribute in the complex system to improve the living condition of the labourers working in the salt pan industry, the tastemakers, to align to Nelson Mandela’s dream in true sense “Let there be work, bread, water and salt for all”.

Figure 2: Salt Pan Labour’s children playing in the fields.
Ethos Design for a Good Quality Life: Building an innovation framework for individuals and organizations towards resilience and cognitive flexibility

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The whole world is driving towards a utopia for a “faster, better, more” future. But ironically the more we have, the more discontent we’re becoming. The current epoch is probably the most complex and ambiguous time humanity has had to deal with. While we’re all designing for a better life, society, nation and world; we haven’t stopped to design and define the attributes that constitute a better quality life.

If we look at what the experts have to say about benchmarks of a utopian life: psychologists have one frame of reference to answer this question from, economists have another, spirituality yet another. The world right now is chasing quality of life through quantifiable parameters like better health, education, employment, GDP etc. and has been benchmarking nations on these parameters. But there is enough evidence to prove that these parameters have fallen short of their promise. Life in countries with the highest GDPs have problems of depression, suicides and obesity. Similarly there are poor countries with little resources resiliently fighting issues like child mortality rate and unemployment.

It’s evident that we experience life as human beings through parameters that are far more qualitative than economic indexes. Our experiences of happiness, flow, love and contentment come not from outside but from somewhere within us. So to improve quality of life of mankind, we need to re-assess what Quality of Life universally means. Paraphrasing the Nobel Laureate Joseph Stiglitz: “What we measure informs what we do. And if we’re measuring the wrong thing, we’re going to do the wrong thing.”

With these dichotomies and questions about the current global narrative of a good life, we set out on a journey to define and quantify a “Good Quality Life” using the tools and methods of Systems Design.

Our research for this project started with extensive study of all global models and indexes (World Happiness Report, 2018) that define a good quality life, and identifying the gaps in them. We researched theories of multiple paradigms and reached out to various domain experts ranging from psychologists, economists, sociologists, environmentalists to philosophers, spiritual gurus, historians and fiction authors. We discovered a plethora of theories, some contextual and some more relevant, some old school and some contemporary. There was a lot of wisdom about man’s experience of good quality life that we got a chance to dig into.

We then started a more firsthand primary research of looking at places where no one was looking for a good quality life. As true designers, we started looking for deviant behaviors in the system, because that’s where the most relevant insights emerge. Doing this project sitting in India, we used the diversity and complexity of our nation as an advantage for the project. We went to all sorts of places and people to understand people’s perception of life.

We went to the central jail and spoke with murderers and rapists. We went to old age homes and heard stories of unwanted grandmothers. We went to remote villages and immersed in their daily lifestyles. We travelled with migrant workers to understand their daily routine and aspirations.

We spent time with experimental educationists teaching children without any curriculum; all of this to understand deviant behaviors. And at each stage, having a culturally diverse team from Indian and Germany was a big boon. It helped us to be pragmatic and unbiased with the way we engaged with our research.

A month long process of synthesis and sense making of all these primary
and secondary case studies brought us down to a list of universal insights. With numerous connections and patterns between the insights, we narrowed them down to three fundamental attributes that we believe account for a good quality life. These attributes are the lowest common denominators of what we as human beings are inherently wired to be, attributes that are at the core of who we are. These attributes are fundamental to building a life of resilience and cognitive flexibility, and hence they are fundamental to evolution.

The three attributes of “Quality of Life” are:

- **Attitude** | Childlike Creative explorers, who find engagement and pleasure irrespective of what their surroundings are. Explore, learn and move ahead is the way of being. They neither hide their feelings nor hold on to them for very long.
- **State of being** | Love Love is a state of being where you accept yourself for who you are, accept everyone like you accept yourself, you live and care for others like you care for yourself, without expectations. You start feeling that you and others are alike. Eventually creating a feeling that we are all ONE.
- **Ability to act** | Creativity An ability to look at things and situations in varied perspectives, challenging rigidly formed assumptions and coming up with spontaneous acts or solutions.

These attributes are simple, holistic and universal. To make them more understandable and actionable we constructed a framework around them, which has been benchmarked and standardized using the Humantific Method by GK VanPatter (VanPatter, Pastor, 2016).

The framework is intentionally designed to be simple, free of overbearing jargons or complexity and its open enough for interpretation and evolution. Our idea is to keep the framework in a state of perpetual beta, where it’s ever evolving as a model. We want to keep it dynamic enough so it can adapt as per the needs of an individuals or a culture it gets used in.

Being designers ourselves, we’re already on a journey to test and refine this framework by embedding it in our work of designing products, services and strategies.

We started with the design of an “Assumption busting toolkit” that allows people and organizations to use our framework and reassess their assumptions/hard wired beliefs that are holding them back from being more childlike-loving-creative. This toolkit has been successfully tested through a range “Designing your life” workshops with people of various ages and backgrounds. We used our learnings from the workshop to design a mobile application called Unblock, that gamifies this experience of assumption busting.
sting for people. Our application was shortlisted to be a finalist at the Global Hackathon by Aegon.

This framework played a key role in a project we took up with the national science center, to design workshops on creative leadership for school children. We've also used the fundamentals of the framework to reassess the current linear narrative of design thinking. Our modified approach of designing thinking 2.0 was shared in the form of a workshop at India's biggest entrepreneurship summit. The workshop saw an overwhelming participation of 280 attendees.

It’s been quite a journey for us so far, but it’s far from complete. One project at a time, we’re on a slow but steady journey to test and refine this framework and our approach for Quality of Life. We wish to reach a stage where we can design a world with its development paradigm aligned to childlikeness-love-creativity.

We want to use design to make this world a better place, but not through traditional prescriptive methods. Cultures are an open, adaptable and non-prescriptive tool that build societies and their value through habits and rituals. Thus, we’re now working on expanding our purview as designers from creating objects and services to creating ethos. We’re working on using our design skills of interpreting systems, of influence behaviors; to create cultures of the future that define the spirit with which people live.

We’re a team Ethos Designers, well-armed with our framework, and all set to realign the paradigms of Quality of Life.

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Long-term conditions represent a healthcare crisis that requires a holistic and sustainable intervention. Systems thinking is fast becoming a vital and suitable approach to face the complexity of chronic care design and development. Systems thinking is considered a reasonable approach to cope with value conflicts between stakeholders and to generate consensus through the negotiation of the different healthcare systems elements. Although there are models that support the implementation of the system approach, there is still little understanding about how to assist the tension of conflict of values and purposes across the different stakeholders.

For example, even if the overarching goal of healthcare such as “achieving people’s health” seems a well-established consensus among the healthcare stakeholders, the broad interpretation of the different stakeholders could generate diverse proposals of how to address it. These discrepancies can cause processes of change towards sustainable healthcare systems to be hindered and fail in their implementation. Therefore, to negotiate the purpose of the system is a critical action that should occur in the early stages of the project and it should be carried by participatory encounters.

However, the participatory encounters in healthcare face challenges such as the lack of a common language, busy schedules, lack of empathy for the needs of others and low understanding of complex systems. Thus, strategies to trigger understanding and help to deal with value conflicts among communities of practice towards the definition of system purpose needs to be explored. Among promising strategies there are visualisations. Historically, visualisations have helped to address the discussion of complex topics and to generate models to interpret the interaction of complex systems.

Although a system visualisation facilitation method can be used to facilitate the collaboration to make sense and to co-create a common understanding of the system among different stakeholders, this technique requires support elements that guide participants during the process. A holistic outcome-based approach has been proposed in an attempt to carry out the process to facilitate a system visualisation method.

Outcomes are commonly present in healthcare systems and normally are linked with the aim and objectives of the stakeholders. However, outcomes have been barely explored as the main element to represent systems. Then, outcomes are an opportunity to negotiate the system purpose through participatory encounters; but, at the same time, outcomes will offer elements to guide and to link the stakeholders with a broader perspective of the system. This outcome negotiation process should be a participatory method able to facilitate the systemic thinking, the empathy toward the relevance of other stakeholder needs and outcomes and, finally, to allow the identification of a potential strategy to align the actions of the stakeholders towards the system purpose in a sustainable manner.

The first proposal of an outcome-based system visualisation technique was generated following a literature review. The most relevant healthcare outcomes included were traditional outcomes such as biometrics, health-related behaviours, safety and quality of care. In addition, novel meaningful outcomes such as subjective wellbeing and happiness were identified as potential leverage across the system and therefore included to complete the holistic outcome.

This paper attempts to explore how to visualise complex systems interactions using a holistic outcome-based approach. A three-hour workshop was carried at a major design conference to gene-
rate system visualisations. The workshop was firstly adapted following recommendations from Sevaldson and Jones and Bowes. However, there were adjustments made after the pilot; the corrections were mostly to clarify the instructions of each task, adjust the time of each phase, and to remove the evaluation of an author visualisation.

Participants of the final workshop were recruited by invitation of the conference organisers. They had access to a description of the workshop prior to signing in. Although previous experience in healthcare systems was not mandatory at least 80 per cent of the participants expressed to have some type of experience in the design of healthcare services.

23 participants worked in 5 teams facing three main tasks. First, to generate an individual visualisation; second, to propose a team visualisation using outcomes, and finally, the teams produced narratives to orally explain their visualisation.

Overall, the data consist of twenty-three individual visualisations and five group visualisations with their narratives. The visualisations were analysed and compared to find relevant patterns across the teams. The results of the visualisations suggest that there is not a clear visual pattern to make sense of systems through outcomes. Although, some outcomes, such as the psychosocial were more present in the visualisation as a link to the patient, the clinical outcomes were mostly associated with the healthcare system.

However, one of the main remarkable situations is how the visualisation technique and the use of outcomes triggered and encouraged open and meaningful discussions among the participants. Outcomes were an element to work around that guide and help participants to deal with a smaller subsystem.

These findings can suggest that outcome-based systems visualisation is a promising method to trigger meaningful discussions, increase the awareness of the systems elements through a holistic vision of what is relevant for the different stakeholders. Nevertheless, these conclusions may be somewhat limited by the inclusion only of participants with a design knowledge. However, these findings gathered important feedback for developing further systems visualisation methods that pretend to include patients, family, and the wider interested community. A further study with a focus on the use of an outcome-based visualisation as a participatory approach that includes patients and providers is therefore suggested.

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Human-centered approach for flourishing: discovering the value of service ecosystem design in psychosocial career counselling service

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University students are becoming more and more fragile under the new circumstances of socio-economic climate, subjective factors, increasingly diverse student population and the strong presence of their parents. It is much more difficult for them to manage their campus life, containing academic performance, social support, psychological well-being, or financial pressures, in a new environment. The problem of adapting the way of university life and directing their future in a positive way is raising. The latest report from National College Health Assessment indicated that over half of students have these fragile feelings, such as hopeless (53.1%), overwhelming by all you had to do (86.9%), Exhausted (not from physical activity, 83.4%), very lonely (64.4%), very sad (68.1%), overwhelming anxiety (61.4%) and so on (ACHA, 2017). Besides, Career-related Issue (24.2%) is the one of the main difficulties for undergraduates to handle within the last 12 months. These negative emotions and issues effect the students' flourishing in life.

In this scenario, the Psychosocial Career Counselling Service (PCCS) is a corresponding solution for students to reach flourishing in the campus ecology and social ecology. The aim of this service is to improve students’ decision-making skills, communicating skills, the self-concept, and other coping strategies (Naicker, 1994). It supports individuals to understand and discover themselves so as to become self-directing (Shertzer & Stone, 1981). The career trajectory has a serious impact on human flourishing, and it affects people’s every single day into varying extents, such as social circles, a marriage partner, holiday plans, retirement possibilities (Krumboltz, 1993). However, the critical weakness in career-related services at university is in the absence of perception from students. The study from Engelland, Workman, & Singh (2000), was conducted in three universities and analyzed the both perspectives from undergraduate clients and career service staffs. It showed that the three of the five service quality gaps in campus were derived from the lack of understanding student expectations.

The objective of this study is to explore what are the improvements of PCCS from student perspective and how service design can contribute to this service in a cross-cultural context. It is a collaborative research and conducts with a psychologist who is in charge of PCCS at university. Therefore, it combines the knowledge from design discipline and psychology field. The methodology strategy of this research is Case Study to understand what are the service improvements from human-centered approaches, and build service maps from institution documents. Two national universities, that one is in China and another is in Italy, has been chosen and the unit of analysis is the PCCS center for each case. The research target is first-year undergraduate student from different disciplines. The reason of studying on freshmen is that they experience the transition time from high school to campus life. In this period, they suffer a stressful and anxious time while they build new psychological identities (Skahill, 2002), and the common “freshman blues” can escalate into fragility, when students start their adulthood and live on their own (Rui, 2017). The methods are in-depth interview, open-ended questionnaire, and documentation.

In China, this exploratory study collected 32 interviews that last around 40 mins to 60 mins. Besides, open-ended questionnaire elicitation resulted in 553 responses in total and 549 for the valid responses. The method of data analysis was in-depth interview, open-ended questionnaire, and documentation.
is thematic analysis- 6 steps (Braun & Clarke, 2006). The findings from the two countries emerged a connection between service improvements and the service ecosystem, since the institution system, education policy, culture, and social environment are different. It entails five nested social systems—microsystem, mesosystem, exosystem, macrosystem and ecosystem (Jones, 2017) to improve the service quality in a holistic vision.

With both theoretical and empirical explorations, an inter-disciplinary approach for service ecosystem design of the campus PCCS for first-year students are emerged. In addition, it puts forward a robust conceptual service design output, which demonstrates its high potential to benefit human flourishing. It discloses for the academia and practitioners both in design and health field an opportunity to see the service ecosystem design for people’s wellbeing in intercultural background, which based on human-centered design logic in order to consider PCCS improvements from new insights, which involves students in an active role for creating the service in an initial step, which is a new collaborative way in PCCS to make a common ground for service design from both design and psychology, which provides an integrated outcome for the general situation and the particular cultural diversities.

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Pre-fuzzy front end alignment of multiple stakeholders in healthcare service innovation - unpacking complexity through service and systems oriented design in Strategy Sandboxes

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Introduction

Contemporary health systems are deeply complex, organisationally and temporally. Recently, focus has increasingly been given to patient experiences and needs (LaVela & Gallan, 2014) and to developing services that accommodate a diversity of needs within formal institutions and their extensions into society. With patient-centred recovery and well-being as a focus, the challenge arises as to how innovative and sustainable services can be developed in contexts of such systems. While Service Design (SD) has emerged as a domain of design-based inquiry and professional practice, early studies have often centred on commercial partners, service delivery, customer experience and satisfaction views. However, such approaches ought to be coupled with Systemic Design efforts, due to the socio-technological complexity and interlinked nature of healthcare service development and change management (Jones, 2013). This is crucial in the front-end of related design.

In the Nordic countries, the public healthcare sector is seeking to increase partnerships with private actors in order to reach policy goals and offer healthcare services to a wider demographic in a time of resource shortage. Ensuring a fruitful collaboration between public and private sectors becomes central as a matter of design and innovation. Such collaborations also amount to complex social systems, where actors need to understand patient journeys and medical procedures, co-create innovative solutions and distribute ownership, assignments and risks. Establishing collaborative partnerships between healthcare actors and private commercial actors can be challenging due to the deeply institutionalised ways of working and siloed expertise of the medical sector.

This calls for processes and tools that support communication and alignment of diverse actors’ views embedded in such complex social systems to be further developed and better understood systemically. This is especially crucial in the front end of related design, often referred to as the ‘fuzzy front end’. The authors have tackled these challenges facing innovative partnerships through the development and proposal of a Strategy Sandbox workshop pilot.

Developing a Strategy Sandbox for healthcare service innovation

Innovation processes are often divided in three areas: the fuzzy-front end (FFE), new product development (NPD) and commercialisation (Koen et al., 2002). The FFE determines what is to be developed on a conceptual level, but does not develop the details for a specific solution, hence the term ‘fuzzy’. In healthcare cross-sector collaborations, all actors need to gain an understanding of patient journeys and medical procedures early on, to be able to co-create innovative concepts and make a planning for the distribution of ownership, assignments and risks. This paper therefore proposes the introduction of a preliminary phase of the FFE, termed the ‘pre-fuzzy front end’ (PFEE), supporting an alignment of relationships between participating actors and the co-creation of a shared understanding of the object of development before entering the FFE.

Through defining the PFEE, the authors have questioned: How may service design support multiple actors (public and private) in aligning their expectations, needs and goals to co-envision new directions for patient-centric healthcare service innovation in the pre-fuzzy front end of a development process?
Rooted in qualitative inquiry and practice based research, the authors have made use of a blend of methods to approach this question: research by design, reflection on action and analysis of data such as sketches photographs and contextually designed facilitation tools that unpack the fuzzy front end site in wider reflexive and iterative innovation processes.

Understanding the complexity of service-system relations

The sandbox metaphor is borrowed from innovation processes and product R&D and is perceived as a conceptual workspace encouraging exploration, experimentation and interaction between diverse actors. It is informed by the Centre for Connected Care (C3) research investigating innovation labs (Carstensen & Bason, 2012) and co-design communication tools (Sanders & Stappers, 2008) that are used within the context of healthcare service design. The research draws parallels to design oriented innovation venues in health, e.g. the 100-days challenge of Nesta Health lab (UK), Experio lab (Sweden) and Mindlab (Denmark).

One of the features of complex systems is layering, meaning that different phenomena and unpredictable qualities can appear at different levels of aggregation and spatial scale (Liljenstrom & Svedin, 2005). The Strategy Sandbox has therefore set out to unpack the complexity of healthcare service development on three levels: Macro (mapping stakeholders needs), micro (mapping user needs and experiences) and meso (co-envisioning and co-developing possibility areas). Sandboxes have also been described as having four key features: connectors, framing, space and speed (Clarke, 2017). The workshops explored early phase formation of innovative partnerships within the C3 stroke project. With 47 participants in total, the concept has been run as an innovation partnership and public procurement between public sector actors and commercial vendors to innovate products and services to address unmet needs.

Workshop 1

Working on a macro level, the first workshop aimed at aligning the participating actors by creating a shared overview of their needs and perspectives, allowing them to express their opinions and views. Tailored communication tools mediated discussions between workshop participants, facilitating the sharing of perspectives on the service situation and proposals of possible public-private partnerships. (Figure 1).

![Figure 1: Actor Mapping Flags, tangible communication tool developed by Rygh, adapted to the facilitation design developed by the Strategy Sandbox team.](image)

Actor needs were filtered via criteria derived from medical health professio-

1 C3 is a collaboration between the Norwegian public healthcare system, the medical industry and academia aiming to accelerate adoption and diffusion of patient-centric innovations and increase growth in that industry.

2 The C3 stroke project consists of three main organizations: The Centre for Connected Care, Sunnaas Rehabilitation Hospital and the City of Oslo. In addition, representatives from Oslo University Hospital, Akershus University Hospital and the National Patient Association for Cardiovascular Disorders also participate.
nals, designers and participants where a visual relational mapping clarified available resources in the actor network. By using physical tools, concepts were re-evaluated and adapted leading to concept shifts (Buur, 2012) where a proposal was presented regarding what a med-tech company might offer in developing innovative purchases following defined needs. This, we see as a systems oriented design mode of exploring service networks.

Workshop 2

On a micro level, the second workshop facilitated a detailed mapping of users’ needs and experiences and an exploration of different public-private partnerships. Here, we sought to unpack systemic complexity in two ways: 1) mapping patient needs and experiences, and 2) exploring partnership possibilities for technology, users and health service professionals. The workshop made apparent patient views through their participative engagement in patient journey experience mapping, specifically in transitional parts of the service trajectory.

Between workshops, project team meetings were held to reflect on and analyse the previously generated data, leading to plans and strategies for the next workshop. Ten possible areas of development were identified and used as a basis for workshop number three.

Workshop 3

The third workshop of the Strategy Sandbox was dedicated to co-assessment and co-development of the identified possibility areas on a meso level. Evaluations of previous mappings and explorations to develop ten possibility areas for new systemically situated service development, were evaluated and revised to: 1) strengthen patient cognitive assessment, 2) secure further and consistent treatment practices, 3) empower the patient, family and carer givers, and 4) implement distance monitoring and digital touchpoints. To facilitate the evaluation and selection of focus areas for the wider project, a holistically oriented health technology co-assessment tool was developed by the authors (Figure 2).

Future pathways

Through utilising a service systems design process and taking a ‘pre-fuzzy front end’ approach to strategy sandboxes, the stroke project managed to leverage proposals of strategies for matching the aims of technology partners with the service directions of the public healthcare actors. The workshop process facilitated an alignment of expectations and goals amongst participating actors, an identification of needs both for participating actors and end users, and co-envisioned directions for service innovation within the topic of stroke.

Service systems relations are layered and entangled and take time to be understood by a wide network of diverse actors. Our inquiry this far indicates

Figure 2: Technology co-assessment tool developed by Almqvist, Støren Berg, Romm and Rygh.
that in order to accommodate the time needed to develop an understanding of the complex relations involved in healthcare collaborations, there is a need for a pre-fuzzy front end alignment phase within service innovation processes. Furthermore, to support the development of more sustainable and accessible healthcare services, this pre-fuzzy front end phase can greatly benefit from more systems oriented design approaches being incorporated into strategic workshop facilitation design.

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The Impact of Food Production on Public Health: Systemic Strategies for a Diffused and Transversal Prevention Plan

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Nowadays talking about industrial agro-food production also means referring to different environmental, economic and social repercussions. Although attention given to the way in which the food is produced has grown, the social costs linked to food production have been investigated with a more superficial approach. In many cases the most common mistake is to separate the quality of production processes of our food from our health, forgetting that social costs also translate into health costs if they become burdensome and prolonged over time for the majority of people. An insufficient and fragmented level of information about the strong link between food’s undeclared contaminants and chronic diseases reduces the consumer’s capability of choice in the purchase of food, further diminished by food primary selection executed by the large-scale retail trade.

While smoking is a choice, today getting sick through unreported contaminants contained in our food is not. Smoking is a bad habit, food is a necessity and as such it should not “poison” humans. In fact, diabetes and obesity are not the only disorders related to the quality of food production processes, where production processes refer to all the activities carried out along the entire production cycle, from seed to sale. In this complex scenario, the systemic approach acts as a tool for reading and analysing linear agri-food supply chains, characterized by chemical inputs such as antibiotics, hormones and pesticides (Bistagnino, 2011). However today the range of such contaminants is widening, especially if we consider all the chemical additives used during the extensive phases of food processing and all those substances released from polymeric packaging in the industrial or domestic conservation phase. In the human body they act as endocrine disruptors, interacting with other contaminants assimilated during the years (Maga, 1995).

This systemic phenomenon is deeply connected to two concepts, Chemical Body Burden, that represents the accumulation and interaction of chemical contaminants in the body and Acceptable Daily Intake (ADI), that is the quantity of pollutant legitimated to be swallowed daily without any apparent risk to health (Robin, 2012). The effects and the mutual interaction of these substances not chosen by the consumer are responsible for what the World Health Organization defines as an “epidemic” capable of perturbing
the health of future generations. The list of diseases related to industrial food production is destined to lengthen especially considering the current system of reproductive dysfunctions, neurodegenerative diseases and cases of teratogenesis in the fetus. In fact, most future pathologies will be of fetal origin: the transgenerational effects will gradually increase. For this reason, it is necessary to translate the concept of sustainable development and the same sense of environmental responsibility also in the field of public health. It is indispensable to start from the prevention of current generations to defend the health of future generations.

On the basis of this assumption, systemic design can lead to a behavioral change in people and in the actors involved in the health and agri-food field. In order to allow the future population to enjoy an optimal state of health a paradigm shift needs to take place within the management of public health, involving a focused and widespread prevention system, starting from the control of the pollutants included in the agri-food production system.

Since the ’30s industry has controlled and influenced research on the toxicity of products, counterfeiting the veracity of scientific results (Robin, 2012): this fast growing phenomenon has allowed higher thresholds of ADI and the legitimization of new hazardous substances. This is the reason why a multidisciplinary figure like that of the designer is essential to lead an improvement that starts from the bottom and works simultaneously on two different fronts through a shared change. This means firstly collaborating with professional figures closely linked to the epidemiological and nutritional fields and with public and private health facilities; and secondly by interacting with the patients and less aware individuals, so that a system of prevention and precaution can be put in place, extending also to those who are not affected by any diseases but who seek a balanced state of health. The systemic designer has a responsibility in this sense, not only as an activator of relationships, but above all as a processor of a sustainable action strategy that necessarily includes a reversal of the approach to chronic diseases and the consumption/production of food.

On one hand, the doctor should keep his mentorship rebuilding it with greater awareness about the link between diseases and food production, investigating the food chemical exposure suffered by the patient, evaluating his eating habits and pursuing a systemic analysis of his disorders, interpreting the human organism as a set of strictly related organs (Capra, 1997). On the other hand, it is also necessary a direct involvement of those who have not yet revealed any disturbance, so that a possibility of protection can be realized through the dissemination of information.

However, it is important that this system also involves food producers, so that they can move towards a production free from chemical contaminants.

Figure 2: Interaction between the acceptable daily doses of several toxic substances (by authors)
which follows the season and favors the local varieties. It is also essential to adopt recognized certifications and labels to reassure, inform and guide the user towards conscious consumption.

In this double context the systemic designer draws a dense network of relationships among different actors, within which the patient and the healthy individual to be protected represent the center, active part of the system, directly involved in the treatment and prevention process, where prevention means knowledge, conscious purchase, even self-production.

It is legitimate to ask why the designer represents the fulcrum of this network of relationships. The first answer is represented by the fact that he is simultaneously planner and user of food/health systems, consumer and health seeker (Jones, 2013). The real motivation lies instead in his transdisciplinary education, which supports him in comparison with other branches of knowledge.

Working in the perspective of sustainability and territoriality, it responds to global challenges with ethics and great intellectual honesty, always taking into consideration the peculiarities of the places and the communities in which it operates, which become an integral part of a sustainable, functional, efficient project. Nevertheless, there is another aspect that is not negligible: the systemic designer stands above all conflicts of interest, moving away from the will of the big agro-industrial and pharmaceutical corporations, planning for a sustainable well-being shared by all the collectivity involved, that does not allow tampering and disinformation. Therefore he plans a path that can become a guide towards a behavioral change, through educational projects that stimulate daily qualitative actions and choices (Wendel, 2014). Products, services and territorial strategies change their focus, moving from the profit to the health of individuals and the environment in which they live. However, in order for the connections designed between users, producers, food and health institutions to be constructive and lasting, the designer undertakes to create a dialogue between disciplines, languages and distant professions, minimizing conceptual and communicative obstacles, reconciling different cultural backgrounds. Thus its mediator role becomes fundamental for the achievement of sustainable compromises between different visions, through the objectification of critical points and possibilities. He, therefore, stands as a designer and observer of the system, avoiding imbalances in terms of costs and benefits.

Today there are many case studies developed to bring people closer to the theme of well-being achieved through food, however, most of them rarely collaborate with a team of specialized figures. The largest number of cases helps the users find local and seasonal products and meet direct producers. Some platforms aim to guide users towards a more conscious purchase through complete descriptions in terms of nutritional values, composition, etc. Almost all use tools such as apps and sites to facilitate online purchase, but the downside is the absence of a reliable source of this information and that of specialized support figures.

Moreover, there are some very interesting isolated cases, which although they do not consider the involvement of the designer profession, they assist the interaction among patients, medical figures, food-producers and chefs for the prevention of the diseases. (an example is Diana 5 Project, conducted by the Dr. Franco Berrino and the "National Cancer Institute, based in Milan). Through this type of projects the level of awareness achieved is higher, thanks to the direct involvement of the patient in the production process of the daily meal. In addition, they represent an excellent example of design application, because it takes strength from relationships, experience and direct comparison. The aims of this research are intended to be part of the Health System for Sustainable Living sector and are not far from the approach pursued by the Medical Design frontier, but with an additional variable: the consideration of the constant chemical exposures to which man is subjected.

Nowadays a real revolution of public health is urgently necessary and this
can happen only by starting from education, training and interaction, so that knowledge can become an instrument of power, while food an instrument of prevention rather than a cause of a global system of growing diseases.

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Measuring Sophistication in Systemic Design and Computing

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Systemic Design;
Education;
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Recursive Design.

Introduction

Over the past decade there has been a growing recognition among educators that systems, design, and computing, are the three disciplines that best encompass the skills and knowledge workers need to successfully contribute in the 21st century workforce (AAAS, 2009; Uri Wilensky and Mitchel Resnick, 1999). Yet, in addition to the many complexities that arise in education, developing curricula that successfully mesh these disciplines introduces new and understudied complexities; particularly, when it comes to integrating those curricula into schools and matching them to current educational standards and metrics. In this presentation, we describe the theoretical underpinnings and practical benefits and challenges of our curriculum in Systemic Design and Computing (SDC) based on three iterations of a pilot course.

Our SDC curriculum treats systems thinking as a worldview that can be used to organize knowledge, formulate problems, and evaluate solutions, design as a set of methods for synthesizing and communicating solutions, and computing as a medium for implementing, testing, and deploying those solutions. It is rooted in the idea that teaching students a small set of cross-cutting concepts and skills while training them to apply those skills in new contexts can provide a firm but flexible foundation to build on over the course of their lifetimes.

We evaluate our pilot course and evolving curriculum in the context of Learning Progressions (LPs) (Alicia & Alonzo, 2011; Black & Simon, 1992; Rogat, Corcoran and Mosher, 2010), extending that research by defining a quantifiable notion of sophistication in SDC concepts and skills. Using spider-graphs to chart student progress along multiple dimensions and developing quantitative measures based on the emergent properties of these graphs we have developed a flexible but consistent framework that captures and communicates the complexity of interdisciplinary learning without sacrificing our ability to track and compare student and cohort progress. Our hope is that by systematically investigating how students progress in their learning of SDC concepts and practices, we can understand the most effective ways to create the coherent, multi-dimensional, and engaging curricular experiences that students need to mature into effective and adaptable lifelong learners.

SDC Progress Variables

Typically, sophistication, the core metric of LPs, is defined by grade-level expectations or disciplinary knowledge, but measuring it has proved difficult and at times controversial. Progress maps (Hess, 2012; Hess, 2008; Wilson and Draney, 2004) in which student performance is ranked graphically on a continuum, have been praised as consistent, reliable, and practical measures of student performance, with the added benefit of easily communicating results. They have proven useful in providing timely feedback to students and teachers as part of formative assessment, and can be combined with an underlying statistical model for longitudinal and group comparison, something education researchers value highly.

For our pilot course, we used six progress variables that embody a few key concepts in SDC. These are one example and are not intended to be doctrine or all-encompassing. Three of these progress variables, system mapping, visualization, and algorithms represent collections of essential skills and knowledge in each SDC discipline. However, the SDC curriculum and LP also aim to teach students how to integrate disciplinary concepts. So, in addition,
we defined three progress variables that embody the knowledge and skills for the intersections of each of the disciplines (a similar approach was used by Rowland (Rowland, 1999). The three intersections are Systems+Design, Design+Computing, and Computing+Systems (the “+” indicates deep integration, not simply adding one discipline onto the other) and the associated progress variables are iteration, interactivity, and modeling, respectively. The resulting structure allows us to map student progress across six interconnected axes: the three “core” fields of systems, design, and computing plus the three intersections that connect these fields.

Measuring Sophistication

The measurement model we have developed is both a basis for evaluating progress in student understanding and a way of communicating that progress back to students. Our approach uses a multidimensional variation of a progress map employing spider graphs (also called radar charts). The result of connecting individual numerical values on a radar chart is a polygon whose shape gives a holistic picture of the learner at glance (Figure 1). However, another important characteristic of these charts, which has been completely overlooked in the literature, stems from the fact that the polygon has emergent properties (area, center of mass, eccentricity) that are readily apparent in the visualization but difficult to dig out of the data, despite being straightforward calculations. These emergent attributes of the polygon provide quantitative metrics for measuring sophistication in SDC.

The area of the polygon in Figure 1 denotes the overall level of the learner’s sophistication, providing a single collective variable that measures student learning along all SDC dimensions, this is a replacement for a course grade or GPA in this system. This value can be used to verify quantitatively that learning is taking place, or combined with the additional variables to reveal a wealth of insights, described below, that are typically hidden by traditional grading systems.

Another emergent property of these graphs, the center of mass (or centroid) of the polygon, shows where a student’s focus and core-competency lies. Calculating the centroid, and using it alongside the origin (center) of the radar chart as foci in an ellipse (see Figure 1) allows us to calculate a third value, the eccentricity. Eccentricity provides a measure of the depth of a student’s specialization (a “well-rounded” student with equal skill in all areas will have a circle with 0 eccentricity). Students may choose to become more eccentric by specializing in one discipline, or try to balance out by becoming more circular. The point is to provide clear and digestible information for students to make the choice which best suits their goals, while maintaining the ability to compare students and cohorts. Students of equal sophistication (area) can have very different shapes, eccentricities, and centers of mass.
As we deployed the above methodology and measurement model in parallel with our traditional grading scheme, we noted many benefits and some drawbacks. Benefits include: tailoring a curriculum, comparing across different subject matter, measuring integrated learning, and overall flexibility. While drawbacks include difficulty standardizing across courses, time required for mentoring, and students’ desire to “optimize.” These will be discussed in depth in our presentation.

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As a discipline that deals mostly with complex, intangible components, service designers have developed a broad toolkit to visualise and interact with the elements that can be difficult to perceive otherwise.

Examining service design tools closely one can see a strong link between them and tools used in systems thinking to visualize behaviours and structures. In fact (eco)system mapping is one of the main tools for service designers, service blueprint adopts swim-lane charts to understand layering of the various channels and actors while providing a service, and user-journey can be seen as a detailed view of the system interactions and dynamics.

However despite the highly systemized nature of service design approach and tools, not all applications lead to a positive systemic impact. And as services (and especially digital services and platforms) play more and more important role in the general economy and the distribution of capital, resources and human flows, we clearly need to think on the larger scale and understand how to augment our tools to comprehend the large-scale and long-term impacts.

Approaching systems thinking from within the service design practice we would like to examine in detail some emerging needs that we should consider when thinking of tools and processes that support our practice:

- the need of observing systems in dynamics to better understand their behaviour and how they can evolve over time;
- the importance of understanding the interconnectedness of a given system, its subsystems and other external systems, mapping out all the relationships involved;
- the need to focus on the long-term consequences of our actions and of the externalities that were not taken care off in the previous solutions, in order to achieve a more positive impact.

In our contribution we would like to show how augmented service design tools can help designers better including system thinking in their everyday practice.

**From Personas to Dynamic Personas**

Personas are a fictional narrative used to describe the needs, expectations and desires of specific types of users, and come up with ideas and solutions that meet those needs. Dynamic personas extend this concept by looking at how the user behaviour could evolve over time. This means defining a target for them to reach, or multiple targets, and flash out the possible scenarios in which that persona would or wouldn’t be able to achieve those goals.

We will show how we have applied this tool in a project with Mozilla, to better understand the enabling and blocking factors affecting the way people relate to Internet Health issues.

**From System Map to System Loops**

System maps are synthetic representations that describe how a system is structured, by displaying all the actors and showing their connections. System loops enrich system maps by always showing the relationship among two actors as an exchange in which they are both giving and receiving something. This means analysing more in depth the dynamics that sustain the
system, mapping out tangible and intangible exchanged values and imme-
diately visualising critical issues, gaps and redundancies.

We will show how we used system loops to better understand the relation-
ship between citizens and Public Institutions, to identify all the data, money
and document exchanges and how they could be optimized.

From Roadmap to Impact Roadmap

A project roadmap is a very functional tool that allows a company or orga-
nization to define all the steps needed to bring a certain service or product
to life. An impact roadmap expands the project phases and milestones with
additional layers, enlightening possibilities to generate value while moving
along the process, as direct or indirect consequence of the main activities
and actions. This means reflecting on all the actors surrounding the deve-
lopment of a solution and identifying strategies to generate positive enga-
gements.

We will show how designers can generate value along the execution of a
service design process, by sharing a story from a project with American Red
Cross in Kenya and South Africa.

These three examples are just the beginning of possible augmentation of
service design tools for more sustainable and impactful practice. We started
to apply them on our projects, tested them with other practitioners during
the recent ArchitectaDay in Torino, and we hope to have the opportunity
to further extend this conversation, and expand the systemic service design
toolkit.
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The Visual Representation of Complexity: Sixteen Key Characteristics of Complex Systems

Sustainability practitioners have long relied on images to communicate complexity. Visual communication plays an important role in facilitating learning and collaboration on social, environmental and economic issues that are characterised as complex systems. The Visual Representation of Complexity was a short research project conducted for CECAN (Centre for the Evaluation of Complexity Across the Nexus) at the University of Surrey (UK) and completed at the Loughborough University. The research addresses the need for imagery capturing key characteristics of complex systems that will be widely understood across different fields and sectors. The work facilitates learning by helping researchers, policy makers, designers and evaluators with varying degrees of familiarity with the complexity sciences develop a shared understanding of systemic processes. The research identifies, defines and illustrates sixteen key characteristics of complex systems and contributes to an evolving visual language of complexity. The research process involved collaboration between myself and the CECAN research group: Alex Penn, Pete Barbrook-Johnson, Martha Bicket and Dione Hills. This paper describes the research process and reflects on its contribution.

The project started with a research proposal I submitted to CECAN in an open call for proposals in July 2017. My research project was funded as a small project (16 days) to visually represent key aspects of complexity. I started conversations with CECAN project mentors in September 2017. As I worked with the CECAN team exploring potential research processes and outcomes, I modified my initial proposal to accommodate newly articulated concerns and newly identified project goals. A new research process was designed to identify, define and illustrate key characteristics of complexity with surveys, participatory design research and the design of new illustrations. The first step was to identify the specific features to be illustrated. During early meetings and two participatory workshops a total of sixteen characteristics were identified. The key characteristics of complex systems were identified as: feedback, emergence, self-organization, levers / hubs, non-linearity, domains of stability, adaptation, path dependency, tipping points, change over time, unpredictability, unknowns, distributed control, nested systems and multiple scales. Once this initial stage was completed, I sought to gather information from communities within the CECAN network and beyond.

In order to collect ideas from academics, sustainability practitioners and designers with expertise in the visualisation of complexity, systems mapping and design, I brought the research project to the Relating Systems Thinking and Design RSD6 The Environment, Economy, Democracy: Flourishing Together conference (at the Oslo School of Architecture and Design, Oslo, Norway, October 18-20, 2017). At RSD6 I was offered a last-minute opportunity to run a participatory session at the plenary with approximately one hundred people. After a brief introduction, I distributed 50 surveys with twelve key characteristics of complexity (four more were added later). I asked the group to work in pairs to visualise each concept. I collected 47 surveys with visualisations for each characteristic. These activities (including pictures of multiple surveys) are documented on the #RSD6 hashtag on Twitter.

I organised the images by collecting all examples for each characteristic on separate sheets. These were organised by type on two axes based on similarities in visual devices, visual strategies and visual metaphors. Arranging the images in this way enabled the identification of patterns. Most concepts were commonly understood with some similar visual conventions – although there were often other random, unique and provocative outlier interpretations.
These characteristics sheets were then used as a basis for two participatory design workshops in London with the CECAN research group (November 17 & December 15, 2017). I facilitated group crits to discuss the images in detail with an emphasis on encouraging particular interpretations for each characteristic. We did not rely on popularity as the basis on which a final graphic would be designed. In some cases the group wanted an entirely new image. The group sought images that captured the essential characteristics of each concept according to group discussions. Along with facilitating the identification and development of definitions, new examples and learning points with the CECAN research group, I designed new visual outcomes for each of the characteristics (according to instructions from the group over four months). The CECAN research was completed in April 2018 with the outcome of an A1 poster (figure 1).

The research project created space to collect ideas and visualisations, to critically assess visual strategies and to design new visual representations of sixteen key features of complexity. Within this interdisciplinary and participatory design research process, we used visual methods to explore visual proposals and come to enough of a shared understanding of the sixteen key concepts to create a new visual representations of each characteristic. The participatory design process resulted in scope creep as the work expanded with the involvement of people pulling in different directions. The initial brief for this research and my original research proposal were different from the ideas that were developed for the outcomes half way through the project. The name of the project changed from “A Typology of Visual Codes for Systemic Relations” to “The Visual Representation of Complexity: Sixteen Key Characteristics of Complex Systems.” Newly articulated directions emerged as the CECAN research group experimented with images to capture particular interpretations of complexity.

With financial assistance from Loughborough University, I bought the project to RSD7 in Torino, Italy in October 2018 and made the slideshow and collection of images from the RSD6 surveys publicly available. The Visual Representation of Complexity project supports informed decision-making at CECAN and other communities engaged with the analysis of complex problems. The poster with the sixteen key characteristics with definitions, learning points, examples and illustrations can be used as a learning resource for practitioners, academics and students alike. The visual methods facilitated both knowledge production and dissemination. The artwork has circulated widely in the CECAN network, within the Systemic Design Research Network’s (SDRN) Relating Systems Thinking and Design annual conferences (RSD6 and RSD7) and in the wider complexity community on Twitter. The images will be used in an upcoming CECAN publication: the Magenta Book Annex on dealing with complexity in evaluation. The visualisations will continue to support relational ways of understanding complex phenomenon.
THE VISUAL REPRESENTATION OF COMPLEXITY

*Definitions, Examples & Learning Points*

A research process was designed to identify key characteristics of complexity and to inform the development of accompanying descriptors. In order to gather ideas from academics, sustainability practitioners and designers with expertise in the complexity sciences, systems mapping and design, I collected 50 surveys at The Environment, Economy, Democracy, and Resilience Knowledge Lab 2013 (in November and December 2013). The images, definitions, and examples used in the research process were drawn from the knowledge and experience of the participants.

1. Feedback

Where a result or output of a process influences the input to the system, directly or indirectly. These can be the point of a system...

2. Emergence

New, unexpected higher-level properties can arise from the interaction of components. To be truly emergent, the system must not be predictable if the components cannot simply be described, isolated, or predicted from the properties of the lower level components.

3. Self-organisation

Regulations or higher-level patterns can arise from the local interaction of autonomous lower-level components.

4. Levers and hubs

There may be components of a system that have a disproportionate influence on the system due to their concentration of power or connectivity. While these hubs can help to stabilise change, their behaviour may also introduce vulnerability to disruption.

5. Non-linearity

A system is non-linear when the effect of inputs on outcomes are not proportional. With non-linear systems, small differences in inputs can lead to large and unexpected changes, or changes in direction (e.g. increases in some measure becomingdecritical, despite small or consistent changes in inputs).

6. Domains of stability

Complex systems may have multiple stable states which can change as the context evolves. Systems gravitate towards such states, remaining there unless significantly perturbed. If change in a system passes a threshold it may slide rapidly into another stable state, making change very difficult.

7. Adaptation

Components or actors within the system are capable of learning or evolving, changing how the system behaves in response to interventions as new actors, in social systems play, or resources increase or decrease. Adaptation is the property of systems in response to change.

8. Path dependency

Current and past experiences, actions, or decisions depend on the sequence of states, actions, or decisions that preceded them – namely their path dependency.

9. Tipping points

The point beyond which a system continues to change dramatically. Change may take place slowly, suddenly, but suddenly increase in pace. A threshold is the point beyond which system behaviour suddenly changes.

10. Change over time

Complex systems inevitably develop and change their behaviour over time. They are not in a static equilibrium, but also the fact that these changes are often not out of equilibria and are continuously changing.

11. Open system

An open system in which interactions occur. These can take the form of information, energy, or material transfers into or out of the system boundary. In the initial balance an open system is a closed system which exchanges materials, energy, people, capital and information with its environment.

12. Unpredictability

A complex system is fundamentally unpredictable. The number and interaction of agents, inputs and feedback loops and how these inputs interact is impossible to accurately forecast with precision. Randomness can have a large effect on complex systems and fundamentally determines at any point in time – i.e. it is impossible to predict chaos and all the interactions that create the state of a complex system.

13. Unknowns

Because of their complex causal structure and openness, there are many inputs which influence the system. In many cases there are unknowns. The influence of such unknown inputs means we often see unexpected and indirect effects of our interventions.

14. Distributed control

Control of a system is distributed among many actors. No one actor has total control. Each actor may have access to local information.

15. Nested systems

Complex systems are often made up of nested hierarchies of complex systems (so-called ‘systems of systems’).

16. Multiple scales and levels

Actions and interactions in complex systems can operate across scales and levels. For this reason systems must be studied from multiple perspectives and levels.
Re-defining journalism education: using systems thinking and design to revolutionize the future of storytelling

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KEYWORDS
Systems Thinking; Design Thinking; Journalism; Media; Education; Democracy; Sustainability; Wicked Problems; Complexity; Future of Journalism.

The problem

Journalism education has not kept pace with the growing complexity of the professional practice.

The first crisis in journalism had to do with transitioning to a vastly more complex digital environment. Now, journalism is struggling to sustain itself amidst outdated business models, fractured audiences, declining trust, and a White House bent on undermining the whole operation. At stake is a vital part of the checks and balances system of a functioning democracy.

Journalism + Design is a forward-looking, iterative education program preparing students and professionals alike to function in the complex ecosystem of contemporary journalism. We use systems thinking and design practices to help journalists better understand the interconnected nature of the problems they face, both as journalists having to operate within a complex adaptive system as well as practitioners and future practitioners expected to report on and explain the most important stories of our times – climate change, the effects of unfettered global capitalism, income inequality, racism, crumbling democracies. These are all stories of complex adaptive systems, or what Rittel and Webber called, wicked problems – impossible to even name, let alone solve, and with boundaries that blur into other wicked problems (Rittel and Webber, 1973).

Design and systems journalism initiative

This abstract seeks to outline the theory and practice behind our efforts to bring design practices and systems thinking into journalism education for both students and professionals. As mentioned above, the problem for journalists is two-fold:

First, how do we build a sustainable system by which news is gathered, verified, synthesized, and distributed in a way that is independent from powerful interests? Many people talk about “saving the newspapers” or in other ways propping up existing entities. French economist, Julia Cagé, in her book, Saving the Media, argues that what will fix the news is a new, not-for-profit business model (Cagé, 2016). There’s Victor Pickard who, in his piece for The Guardian, recognizes that traditional ways of thinking about the news is not helping the industry, but still recommends a new, non-commercial business model (Pickard, 2009). Our analysis is that what is at stake is not so much the longevity of existing manifestations, but rather ensuring that some system for doing the above-mentioned work itself exists in the future – whatever that might look like.

Second, how do we prepare journalists to tell the most important stories of our times – those of complex adaptive systems, or, wicked problems? This does not require merely digital skills, which is the strategy of most news organizations. Rather, it requires the ability to understand the forces behind events in the news, the interconnections between those forces, the non-linear natures of how events occur and multiply, and how to identify feedback loops and leverage points.

A systems approach to redesigning journalism education and professional development is necessary to address these problems. The Journalism + Design initiative involves identifying leverage points for interventions in the education and professional spheres as well as opportunities for inspiring pu-
Public discourse, such as publishing papers and popular articles, launching a podcast, and convening open workshops with community partners. The additional challenge is how to foster a change in attitude among the future of journalism community from one of trying to solve the problem of the crisis in journalism to one seeking to sustain a healthy system of journalism.

**Re-designing journalism education and professional development**

A significant part of the work of this initiative has been the development of an undergraduate journalism major at The New School in New York that marries fundamental journalistic practices and ethics with a systems and design practice. Our definition of design is a set of flexible processes for navigating unknown environments. We define systems thinking as the practice of studying wholes rather than parts in isolation, studying patterns of change overtime and identifying driving forces.

This work has been primarily done through the Journalism + Design program at The New School. The program started four years ago with seven classes and 30 majors. Today, we offer 27 classes, have nearly 100 majors and see 406 students taking our classes. It has already become the second biggest major in the school.

The excitement generated by the program among professionals led to the development of workshops and events outside the college, such as systems thinking for beat reporters, basic design process workshops, and systems and design support for projects around complex topics like homelessness, gentrification, and gerrymandering. In addition, the initiative has also begun work fostering systems and design approaches to journalism among community leaders in underserved urban neighborhoods in order to help build informal information networks to serve needs unmet by professional news organizations or the closing of local professional news outlets.

The aim is to equip journalists with the ability to surface and diversify story ideas and sources, explore complex relationships, be more resilient in the face of uncertainty, identify how the structure of complex systems dictate outputs and consequences, and develop and maintain participatory and collaborative partnerships with non-media organizations and community members.

**Presenting**

In this presentation, we will provide an overview of the theories and intellectual work behind this initiative as well as surface learning to be gleaned from the work itself. This presentation will provide the audience with years of innovative research, curriculum, and insights, and, since playful experimentation is a key tenant of how our program was designed, our presentation will incorporate how our initiative actually operates in the field. More specifically, it will look at how systems thinking and design cooperate, how our program has integrated them into fast-paced, overworked newsrooms, and what this initiative means for sustainable journalism and democracy at large.

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As design educators at Zayed University, Dubai, in the UAE we believe in the educational capacities of social innovation and in the exploration of new models and processes of systemic design. Particularly in the field of education, continuous innovation is both necessary and possible if we are to imagine new ways for young people to realize their full potential.

The current higher education system in the Middle East and South Asian regions often represents a socially narrow and dated curriculum that is especially limited in its ability to cultivate empathetic, driven and holistic young leaders and changemakers. Our education system in the UAE has not evolved yet to be imaginative, integrated, or reflective of the complex realities youth experience. Social innovation in education allows for re-imagining how we may create spaces for creative youth engagement and develop models that enable young people to realize their potential as changemakers. The question we explored was ‘How might we co-design an immersive, transformative, and sustainable changemaker pathway for social innovation?’ To do this, we leveraged community initiative and institutional support from Zayed University to build a platform to social innovation named INNOCO (Innovation and Co-design). Simply put, INNOCO actively supports young people interested in building their capacities as changemakers. Hence, it strives to disrupt a linear educational approaches and builds on the need for a paradigm shift in education in the region.

In three (3) years INNOCO has developed a research framework that has been successfully implemented and has already been modeled for a partner project at Zayed University; has facilitated a youth engagement program with participants in UAE and Nepal; and, has chronicled the changemaker journeys of program participants through quantitative and qualitative narratives. Through these cumulative processes, youth explored ways in which they could connect, collaborate and contribute to their larger communities.

The proposed paper will detail the following critical aspects of our work with the hope that an engaged audience of educators and systems thinkers may learn from our shared experiences and enrich our collective knowledge.

**Values of Co-design and Commitment to Social Innovation**

Co-design was and continues to be a guiding principle in our work. We understand it to be an approach that fosters inclusivity, participation and celebration of collective ownership and achievement. Our efforts to implement
principles of co-design into all aspects of vertical learning took shape in brainstorming and feedback sessions, open communication with participants through accessible platforms, and in regular meeting sessions to reflect on program activities and identify strength and improvement opportunities. Although the processes for co-design can be slow, complex and highly iterative, we believe it to be a promising pathway to social change allowing community participation. From 2015-2018 our co-design process involved approximately 116 experts, facilitators and organizations from diverse backgrounds and sectors. When done right, co-design can yield lasting, meaningful impacts that permeate through individual, community and systemic levels.

The value we assigned to co-design was also instrumental in deepening our understanding of social innovation. The term ‘social innovation’ has become increasingly popular and can mean different things to different people. We brought diverse voices and perspectives together following the principles of co-design and appreciative inquiry to clarify collective vision and to support individuals for their capacity development. We are committed to social innovation as initiatives that ‘are not only good for society but also enhance society’s capacity to act.’ (Hubert et.al., 2010).

Research framework

Our research model is a human-centered and evidence-informed one titled ‘ME=WE’ that resonates with the Panarchy Theory1 to understand the systemic and symbiotic relationships between self (ME) and society (WE). The framework focuses on ‘action and reflection’ contributing to social change that one can affect at an individual, community and systemic level (Lampel 2003).

Wise and diverse communities across our world adopt this simple philosophy. In Indonesia the Balinese principle of ‘tattwa masi’ translates to ‘you are we and we are you’. Similarly, the South African philosophy of “Ubuntu” teaches that our humanity is reflected in the achievements and humanity of others, intrinsically connecting the ‘self’ with the collective. This framework also manifests in the Mobius strip, a mathematical phenomena that demonstrates infinite and continuous movement and sprouting growth.

The ME=WE framework acts as a pathway that begins with the individual as a changemaker who engages with their community and systemic change through a continuous cycle of growth, action and reflection. The individual journey mirrors the expansive and moving structure of this framework as they engage in activities grounded in empathy, trust, creative confidence and communication. Through this work, the individual experiences growth points between action and reflection allowing for enriching their knowledge and capacities and deepening appreciative inquiry mode as continuously leaping from ME to WE and WE to ME.

Program Tools

A flexible and imaginative program as a series of independent workshops or an intensive 9-day bootcamp was developed to facilitate socially minded youth engagement. The program objective is to build collective capacity in planning and developing entrepreneurial and/or community-driven service projects. Workshop sessions introduced youth to hands-on and experiential learning through empathy driven tools, storytelling techniques, value proposition canvas, design thinking practices and more.

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1 Panarchy is a conceptual framework to account for the dual, and seemingly contradictory, characteristics of all complex systems – stability and change. It is the study of how economic growth and human development depend on ecosystems and institutions, and how they interact.
The INNOCO program was piloted with youth in UAE and in Nepal in varying forms. In UAE (2016-2017) a six month workshop series was implemented where 20 youth experienced learning and collaboration however, participants were not ready to move forward with social enterprise projects. In Nepal (2016 – 2018), the program was initially piloted with select youth and evolved into a 9-day innovation bootcamp with 18 youth. The innovation bootcamp was well-received by youth who continue to be engaged with social change for their communities. The program also included a mentorship component where seven mentors were identified and recruited from Nepal and internationally, matched with youth mentees to foster intimate relationships of learning and expansion. At the end of the Nepal bootcamp, (9) ideas were pitched to a panel of community judges, out of which (7) have emerged as viable projects in development.

Impact Stories

The impacts of our work are illustrated through quantitative and qualitative data collected at different stages of the Nepal run program. While our impact assessment data is primarily qualitative gathered through transcribed one-on-one in-depth interviews, quantitative data was also collected through post program surveys.

Analysis of the quantitative narratives shows that the program was highly rated by participants especially in the areas of bootcamp environment and cultivating culture. These were critical areas for us as we attempted to create an unconventional learning environment and culture that valued co-design where youth could contribute to the process in fulsome ways. On a scale of 1-5 (5 is very satisfied; 1 is unsatisfied) participants rated key areas of their experience, below is a snapshot of average rating scores: Workshop Quality: 4.1 / 5; Content Relevance: 4 / 5; Culture & Space: 4.6 / 5; Expectations Met: 4 / 5; Interaction: 4.2 / 5; Creative confidence: 4 / 5.

The qualitative data collected through in-depth interviews was used to develop a set of illustrated changemaker stories to further our Knowledge Translation and Exchange (KTE) efforts. The stories follow youth participants who completed the INNOCO program and demonstrate the transformative change they experienced that led to actions on individual, community and systemic levels.

The seven viable projects that emerged from the Nepal bootcamp, are in their initial developmental or operational phases. This includes a literacy and reading program in a rural community; a homestay for women facing domestic violence; a hydroponic farm; and a kiwi farm and waste management system. The Nepal youth group also realized their vision by registering as the Nepal Youth Innovators (NYI), a space for young people to connect to like minded changemakers and cultivate meaningful connections and collaborations to better contribute to social change.

In summary, the key areas of co-design as an overarching value enabled redefining the ME=WE framework that was then translated into a comprehensive and flexible set of program tools for youth engagement. The impacts of this social innovation model in its entirety is both powerful and promising for future work. The ME=WE framework has already been used as the foundation for another project based at Zayed University that aims to innovate food systems, and at Impact Hub at Georgian University in the USA. The program tools will soon be shared on an online platform for youth, educators and/or academics to easily access and adapt for their local communities. We believe that INNOCO is a strong example of a social innovation pathway that cultivates young changemakers and a study in co-designing alternative forms of learning that disrupt linear models. As one of the Nepal youth participants so aptly states “What we learn in schools is not everything. I want kids and young adults to learn life skills that will bring out the best person that they can be.”
Perspectives on Systemic Design: examining heterogeneous relevant literature to provide a historical and ‘systemically inspired’ review.

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KEYWORDS
Review; Review methodology; Research agenda.

Review Methodology

As the ideas of systemic thinking become more familiar and found in many disciplinary discourses, so there is an increase in work reviewing systemic thought. Existing literature reviews are often conducted from a particular disciplinary standpoint, for instance, management (Mele et al, 2010); engineering (Monat, 2015). It is as yet too early to carry out a literature review on systemic design. Therefore, although this paper is in the tradition of a literature review, it differs in two respects. The first difference is in the emphasis on giving a sense of a historical perspective (Peruccio, 2017). This allows us to move from the type of literature review whose primary purpose is to draw out key concepts. Rather, we wish to add to the ‘key concepts’ review, a narrative that builds on timelines and contemporary reactions to relevant discourse in the period under study. The second difference, is to use a review methodology based on a systems-inspired literature review (Sylvester et al, 2013). This encourages drawing in a range of literature, and lends support to narrative inferences by making explicit the interrelationships between ideas, timelines and contemporary discourse.

The rationale for making these departures from traditional review methodologies is that, since systemic design is relatively new, grounding it within a historical perspective is an important contribution to establishing a background. Also, systemic design’s ‘newness’ means that resources are not discoverable using traditional literature review search techniques which rely on pre-defining search terms. However, we believe that a review based on ‘sweeping in’ (Nelson, 2003) heterogeneous relevant research literature will offer a richer set of materials. In short, this review would seeks to map the trajectory of ideas that have been influential in systemic design and related themes ‘entangled’ with systemic design, and by doing this, generate fresh insights into the philosophy, theory and praxis of systemic design.

Entanglement

Since both systems thinking and design have highly inter-disciplinary traditions, it is natural that both should be bound up with many types of work, and that sometimes valuable pieces of research are located in publication outlets that would not normally be directly associated with design or systems, such as with a collection of resources about sustainability (Systemic Learning for Sustainability, 2019) or healthcare (Clarkson et al 2017). Moreover, it may be that the perspective, which may be for example, the collection in which the resource is located conceals viewpoints relevant to systemic design. For instance, we know that participatory approaches are a bedrock of systemic design, yet foundational research on the notion of co-design as collective creativity, leading possible “transformation toward more sustainable ways of living in the future” (Sanders and Stappers, 2008) does not mention systems, although it might be argued that it appears to have absorbed it. Another example is when systems thinking is applied to an area contingent to design, such as creativity: Csikszentmihalyi, a psychologist, claims systemic implications on creativity (Csikszentmihalyi, 1999).

Therefore, following relevant themes and topics and also research groups [e.g.,1] is important. This is not done with a primary aim of discovering search terms, - although this can be useful at a later stage for seeking out more

1 Entangled in the sense of “when information about one improves our knowledge of the other” https://www.quantamagazine.org/entanglement-made-simple-20160428/
resources, - rather, it is mapping themes to an overall emerging picture, so that interrelationships can be reflected upon. This, in turn, leads to more discoveries until a 'saturation' point is reached, sufficient for a well-grounded narrative accounting for how certain themes are related and how developments have emerged. This narrative can then give some basis to make assumptions about how they might continue to develop.

As an example..

The trajectory of systems thinking and systems oriented design offered by (Peruccio, 2017) shows how a historical perspective can be illuminating. Between the 1972 publication of the Limits to Growth (Meadows D. el al, (1972) and the Buchanan's 1992 paper noting an area of design ‘concerned with complex systems or environments’(p.10) (Buchanan, 1992) there is a gap of two decades. Previous to this, we know that systems thinking was taught in the now famous design educational establishment that was the Ulm school, (1953-68). Also, we know that in this period Design was pre-occupied with self-reflection on the nature of design e.g. ‘designing designing’ (Jones, 2014); with debates about intuition versus positivism, with ‘designer-ly ways of knowing’ (Cross, 1982). It is strange that systems thinking does not seem to have infiltrated to produce ‘systemic design’ earlier.

We might speculate, that perhaps it was because of an association between positivism and system dynamics (Coyne and Snodgrass, 1991; Cross, 1993)? In a different discipline, Collopy notes that systems thinking did not implant itself in management (Collopy, 2009) although he attributes this to need to acquire literacy in systems. The question of systems literacy is also part of other discourses around systems thinking, with claims that systems literacy is essential to all research endeavours (Bosch et al, 2007; Dubberly, 2014).

Design History and Literature Reviews

Design historians are the acknowledged experts in answering these kinds of questions posed above (Formia, 2017). However, we maintain that literature reviews, especially those framed as we have described, could also be helpful. For instance, within design oriented academic journals, there is an emergence of concern with incorporating wider issues into design. Examples are papers on ‘whole system design’ integrating social, economic and environmental phenomena (Blizzard and Klotz, 2012; Charnley et al, 2011) and the linking of ‘design for sustainability’ (DfS) as design for ‘system innovations and transitions’ (Ceschin and Gaziulusoy, 2016). Many of these papers evolve their systems thinking discourse from exposure to interests in sustainability (stewardship of the planet), or to ‘bumping up against’ complexity in their design work. This correlates the claim that, “design studies today tend to follow an ambiguous version of complexity theory, rendered without citations or methodological influence’ (p123) (Jones, 2014). If this is the case, is design simply responding to the pervasiveness of calls for the need for systems thinking, apparent in all kinds of settings (Bland and Bell, 2007; Vexler, 2017)?

Current work and future directions

The plan for our work, is to continue to map out themes and timelines, with the aim of also creating a set of resources that can be added to, interpreted (and re-interpreted) to explore the interrelationships of timelines with themes that are found both in and around systemic design. A number of such themes have already presented themselves in our work so far, such as the relationships between service design and systemic design which call for more exploration (Darzentas J. and Darzentas J.S., 2014; Darzentas J. and Darzentas J.S., 2017). Another theme is to examine the antecedents of recent work on systems thinking as a psychological construct (Davis et al, 2018; Randle and Stroink, 2018) and speculate what this might mean for designing with neurodiversity. More immediately, the suggested synthesis of Design Thinking and Systems Thinking (Ryan, 2014; Pourdehnad et al, 2011) is a
fertile ground for more nuanced investigations as evidenced by (Jones, 2014; Sevaldson, 2017).
It is our hope that we can also engage with the emerging systemic design community, via the new Systemic Design Association, to create a special interest group of like-minded researchers, in order to, for instance, bring in impactful literature from sources that are unknown to the wider community, because of not being published outside of national boundaries, or inaccessible due to language barriers, or being published in non-indexed resources. In this way, we hope our review work will not only lead to publications, but the establishment of a background prompting fresh research questions.

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Systemic Learning for Sustainability http://learningforsustainability.net/systemic-design/

Based on several research by design cases, the paper aims to conclude the mix of diverse media in reference to diverse generative agency in Systemic Approach to Architectural Performance design field. In this field, the design processes and design's performances are seen as the 'resulting design objects'. Therefore, the agency involved in both is merged and proceeds parallel within one co-performative eco-system in its fight for Post-Anthropocene. SAAP is a fusion of several process based fields and their media, involving namely:

- ‘Systems Oriented Design’
- ‘Performance Oriented Architecture’
- ‘Prototypical Urban Interventions’
- ‘Time-Based Design’
- ‘Service Design’
- ‘Co-Design, Co-Creation and DIY’

The direction of media mix and time-based design in creative digital design techniques was suggested by Sevaldson already in 2005 (Sevaldson, 2005). However, this new approach contributes to the field by assigning the diverse media to particular biotic and abiotic agency, including trans-disciplinary human co-design participation. This involves: a) the complexity diagramming - a manual analogue and digital tool from Systems Oriented Design (SOD) called GIGA-Mapping, the most designerly way to deal with systems (Sevaldson, 2013), b) digital modelling and c) its full scale prototyping and namely, d) all the performances of all the above mentioned, generated in time. The last ones appear through i.e. airflow, relative humidity, temperature; species such as algae, lichen, butterflies or bumblebees; material properties; or through human trans-disciplinary co-designers, such as general public, landscape ecologists, coders, architects and so on. Therefore, there is a shift from what architectural profession used to be perceived. As a designer, you can only interact with the system, not designing it. Through this interaction, you can co-design and therefore re-design the (eco)system.

Through the properties of the active agency within the co-design are also defined their creative design tools. Therefore, the performances take multiple layers, such as synergy of natural, social and cultural defined in Performance Oriented Architecture by Hensel (Hensel, 2010). Here it involves namely creative trans-disciplinary and trans-social, biological, material, climatic, mechanical or digital performances.

For example, within human speculative co-design some disciplines or public relate better to drawing or image relations’ connections, the others to physical modelling or prototyping or combinations of all. This needs to be at first point grounded by physical GIGA-Mapping to find the relations of the natural, social and cultural data, thoughts, understandings and speculations. The physical maps can be further on translated to digital maps and digital modelling simulations and afterwards printed and fabricated to meet physical interaction again. This feedback looping interaction is however simultaneously co-designed with the other kinds of agency. The prototype’s performance is co-generated by i.e. relative humidity, temperature, their material properties and organisms that appear in its adjacent environment or directly settles on prototypes. Therefore, the design processes appear to be multi-layered in relation with multiple agency and mixing digital with analogue, biotic with abiotic. The paper exemplifies these processes on several different cases of ‘responsive wood’ (Hensel & Menges, 2006) projects.

The projects focus on trans-disciplinary multi-layered, analogue and digital, collaborative design processes grounded in GIGA-Mapping for prototypes.
Some of the prototyping and mapping projects focus more on detailed, other than human, environmental interaction development and its prototypical observation. This is followed by architectural application speculations and its referential studies on traditional architectures (see Figure 1). While the development of the first and very early research stage prototype is followed by GIGA-Mapping of its environmental interactions speculations supported by sampling, the prototyping research takes four feedback-looping paths that are however interconnected with the other two projects:

a) long term first prototype observations when exposed to environmental settings;
b) observations of related traditional architectures;
c) the new prototype development based on condemned weaknesses of the first prototype
d) observations of related traditional architectures and both of the prototypes for planned practice application.

Through the long-term prototypical observation, the development of climate-material interaction and related biotic agency is taking place in time when it is co-designed by the mentioned. In the same time, the new prototype that is trying to answer firstly observed weaknesses is built and observed again. This is within the same time confronted with related historical references of possible applications (see Figure 1) to lead to the planned use in practice. This ‘bottom up approach’ of prototyping is followed by ‘top down’ practice applications speculations and traditional architecture references from extreme climates observations in reference to ‘adaptation to climate change in our location’ (Czech Republic Ministry of the Environment & Czech Hydrometeorological Institute, 2015).
The studies led to focus on eco-systemic service design through performative eco-systemic ‘prototypical urban interventions’ (Doherty, 2005). Such approach is gaining from collective trans-disciplinary knowledge gathered through multiple stakeholders with co-design GIGA-Mapping. One of the key intervention is responsive wood insect hotel TreeHugger, parasitting on a tree trunk in the middle of a central urban eco-top. TreeHugger is a small object. However, it is applying detailed climate moderation solution through responsive wood concept for variety of insect species’ needs to create their liveable and/or preferred environment. These, in reference to the larger eco-systemic chain are to generate ‘edible landscape’ (Creasy, 2004) for i.e. bats and birds, while another fast food of blossoming plants seed bombs is generated for these insects to become a food. All this is integrated through the multi-genre festival EnviroCity, representing the synergy of natural, social and cultural environment with its generative agendas of recipes for DIY. Therefore, the project on architectural sustainable solution has transformed to the sustainable solution for eco-systems. It is not only bringing solutions through habitation but also through sustainable eco-system of co-living with nutrients resources, the environment of ‘flourishing for all’ (Ehrenfeld & Hoffman, 2013).

The full scale prototyping in reference to co-design process was largely discussed by Capjon (Capjon, 2005). However here, these processes are perceived as a ‘results’ that are co-designed with overall eco-system in time. The field calls for the shift from ‘Cities for People’ (Gehl, 2010) towards the participation of both, biotic and abiotic agency into one co-performative eco-system, the ‘Real Life Laboratory’ (Davidová, Pánek, & Pánková, 2018). This is supported through using the key concept SOD tools such as ‘Rich Design Research Space’, discussing the social and spatial parameters (Sevaldson, 2008) and GIGA-Mapping, that in this case, serves as a co-design communication and complexity relations mapping tool that is indivisible from prototypical performance and ‘resulting’ observations, reflections and co-design.

The paper concludes with that there is a necessity of mixing analogue and digital processes based on the involved agency and its position in time and these need to be multi-layered. This is mainly achieved through hands on reflective Research by Design, investigating the ‘eco-systemic prototypical urban interventions’ (Davidová & Prokop, 2018), their related historical prototypes studies and their DIY iterations. Therefore, within the field of ‘Systemic Approach to Architectural Performance’ (Davidová, 2017), the design management, the methodology, the collaborative design processes, the design’s physical results and their collaborative performances are fused in one

Figure 2: The TreeHugger Responsive Insect Hotel Prototype after its Biotic and Abiotic Interaction over Winter Time: The prototype applies Ray 4 panelling adjusted to double curved surfaces and is a result of transdisciplinary co-design – the Trans-Co-Design. (Photo: Davidová 2018)
Time Based Eco-systemic Trans-Co-Design. These processes therefore generate the concept of ‘ecological urbanism’ defined by Mostafavi and Doherty (Mostafavi & Doherty, 2016).

REFERENCES


Some of the most significant challenges of sustainability can be traced back to the complexity of social and ecological phenomena and the difficulty to connect these with design decisions made at the level of products and business models. Such complex systems are especially difficult to assess and influence as they do not lend themselves to simple causality relations and prediction (Boulton et al., 2015; Jones et al., 2014).

A few schools of thought in design are explicitly embracing complexity, such as systemic design (Jones et al., 2014) and transition design (Irwin, 2018). Building upon insights from complexity science, they encompass a wide range of design methodologies, such as giga-mapping (Sevaldson, 2011), system maps (Irwin, 2018), or co-creation (e.g. Sanders and Stappers, 2008).

The vast majority of methods described in systemic and transition design literature are qualitative in nature. This is in stark contrast with the methods used in complexity science – or complex systems science. This interdisciplinary field of science has been built predominantly upon the use of quantitative, computational models, a number of which have been applied to social phenomena, e.g.

- Network theory enables the modelling of a set of elements interacting with each other, such as people in a social group, employees in a company, or companies in a supply chain (Newman, 2010). This type of approach has delivered numerous insights, e.g. on the structure of social networks (Scott, 2017), the organisational needs of engineering projects (Sosa et al., 2004), and the robustness of the internet and the web (Réka et al., 2000), as well as to sustainability questions (e.g. Bodin and Tengö, 2012).

- System dynamics can be used to model a system of interconnected stocks and flows and their evolution over time. This method has been used to assess scenarios of global ecological challenges (Meadows et al., 1972), as well as to inform business model design (Cosenz, 2017), conservation initiatives (Johnson et al., 2012) and pathways towards sustainable development (Hjorth and Bagheri, 2006).

- Agent-based models provide a way to simulate the dynamics of social systems by placing explicit emphasis on how they emerge from the behaviours of individuals (the ‘agents’) (Van Dam et al., 2012). Their applications include the dynamics of segregation (Schelling, 1978, Wilensky, 1997), policy analysis (Lempert, 2002, Nikolic and Dijkema, 2010), and industrial ecology (Axtell et al., 2001).

- Systems of differential equations can be used to represent certain phenomena at aggregated levels, e.g. to give a mathematical representation of the response of societies to societal problems (Scheffer et al., 2003).

Such computational models could provide key insights for design for complex systems. Table 1 lists examples of computational models from literature that can be easily connected to a design activity.
If computational models have such a potential for design, why haven’t such methods been promoted in the literature on systemic and transition design? We explore the potential causes of this reluctance through three key questions, and deduct lessons for the development of computational methods in design for complex systems, and therefore design for sustainability.

1. Can humans be modelled?

It is fair to ask whether mathematics can usefully describe social phenomena. Supporting this concern, the field of economics has in the past heavily underplayed the complexity of human behaviours, using drastically simplified assumptions to enable mathematical description (Arthur 1999).

The response to this concern is 2-fold. First, models of human behaviours have greatly improved over the past decades, e.g. through behavioural economics. These improved hypotheses however still need to be made explicit in research, as they often reflect certain values and worldviews.

Second, today’s online tools have given rise to unprecedented data about human behaviours, through the field of computational social science (Conte et al. 2012). The applications to design are worth considering (Lettieri 2016).

Recent research (Moat et al. 2014) demonstrates the growing ability of modern techniques to predict social behaviors and, if this weren’t enough warning, recent news headlines highlight the implied risk that this be used to manipulate people. The ethical considerations of modelling humans should thus always be considered carefully.

2. Are design and modelling practices compatible?

Developing a computational model requires strong critical thinking and rigour. It can thus be more conducive to removing ideas than to creating new ones. Could it stifle the generative, creative thinking that is central to design? Two approaches to avoiding this shortcoming are to carefully think of the phase in which to integrate the use of a model and to leverage intuition and ideas from the designers and stakeholders as inputs into the model.

Data analysis and modelling can be time consuming and require specialised skills, so they can be cost intensive. Budget or planning may therefore motivate their exclusion. What may address this issue is the development of

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For example, the Guardian’s coverage of the Cambridge Analytics case (accessed on 29/11/2018).

Table 1: Examples of computational models with potential applications to design.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Function of model</th>
<th>Methods used for modelling and data</th>
<th>Related design activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Templon et al. 2017</td>
<td>Maps the organisations and individuals connected to Donald Trump.</td>
<td>• Network</td>
<td>Prioritising stakeholder engagement</td>
</tr>
<tr>
<td>Schmitt Olabisi et al. 2010</td>
<td>Describes possible scenarios of conservation in Minesotta.</td>
<td>• System dynamics</td>
<td>Prioritising interventions</td>
</tr>
<tr>
<td>Cosenz and Noto 2018</td>
<td>Simulates effects of different decisions (e.g. investment) in a business.</td>
<td>• System dynamics</td>
<td>Simulating sustainable business models</td>
</tr>
<tr>
<td>Sircova 2015</td>
<td>Simulates the effect of irrational behavior on resource depletion.</td>
<td>• Agent-based model</td>
<td>Simulating stakeholder / user behaviour</td>
</tr>
<tr>
<td>Schelling 1978, Wilensky 1997</td>
<td>Simulates the dynamics of segregation for different citizen preferences.</td>
<td>• Agent-based model</td>
<td></td>
</tr>
<tr>
<td>Nuss et al 2016</td>
<td>Maps supply chain risk within product platforms</td>
<td>• Network</td>
<td></td>
</tr>
</tbody>
</table>

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interfaces and platforms enabling the adaptation of existing models to new situations. As an illustration of such solutions, the platform Kumu offers a user-friendly interface for network analysis².

Finally, designers often question whether such models would support the engagement of stakeholders, as they can come across as dry and complicated. Participatory modelling experiments demonstrate that stakeholder engagement can be an integral part of the modelling process (Schmitt Olabisi et al. 2010), as long as the process is developed with this intent from the start.

3. Can you model with limited data?

Finally, some powerful computational models rely on very large datasets from online use, such as Facebook or Twitter data (Conte et al. 2012). A design problem however does not start with a dataset, but with a problem to solve. As a result, not every systemic problem will possess such a dataset. Design by definition takes place at an early stage of intervention, before the project itself has delivered data. Are computational models still relevant in these contexts? Here are a few responses to this concern.

First, many designers may underestimate the amount of data available today, when leveraging online media and advanced data analysis techniques (e.g. natural language processing), which can turn large volumes of unstructured documents into structured datasets (Conte et al. 2012).

Second, much can already be learnt from models based on limited data, complemented with plausible assumptions. Uncertain data can also be treated as the source of multiple scenarios (Kwakkel 2013).

Finally, there is an opportunity to approach models in a lean, iterative manner: a first model is built based on theory and hypotheses, which can already help to explore and refine the assumptions of the stakeholders and designers; such a model will in turn inform which data to gather throughout the project, so that more and more refined versions can be developed iteratively.

As the discussion above suggests, there is an opportunity in expanding current design methods with computational models, provided the following considerations:

• Making assumptions explicit and addressing ethics questions,
• Leveraging data from online tools and big data analysis methods,
• Developing simulation interfaces for designers and stakeholders,
• Leveraging designers and stakeholders’ intuition as input into the model,
• Adopting an iterative approach to model building.

The next steps in demonstrating this potential is to build case studies of design projects leveraging computational models. Adequate cases would concern issues affected by social complexity, which means that the interactions between individuals play a key a role in outcomes. Ideally, data sets should be available, either from the start of the project or through its development. Finally, such projects will require stakeholders that are curious and willing to experiment with new approaches.

This paper showed that despite the fact that much of complexity science is based on quantitative, computational models, the literature on design concerned with complex systems refers nearly exclusively to qualitative approaches. It explored some of the key questions that may be motivating this reluctance to leverage computational models of social systems, deducted a set of guiding principles for their introduction in design for sustainability, and proposed next steps to this endeavour.

Given the urgency to address some of today’s societal questions, no stone should be left unturned. Computational models have repeatedly proved

² kumu.io/markets/network-mapping (accessed on 29/11/2018)
their power to shed light on complex social dynamics of importance to sustainability. It is time to explore their application to the field of a design to enable the transition towards sustainable societies.

REFERENCES


Several recent studies have published well-developed practices of co-creation, design facilitation, and stakeholder convening for advanced design collaboration. There may be many systemic design methodologies that prove effective in their consultative or engagement settings. Yet in any design process requiring consensus in participant decision making, non-parametric design contexts I refer to as Design 3.0 and 4.0 (Van Patter and Jones, 2013), we face a practical and systemic problem with stakeholder representation. Unlike product or service design (Design 2.0) we cannot merely sample from a user base to inform design decisions targeting future product releases.

In Design 3.0 and 4.0, the “users” are the system. Real stakeholders are not merely representatives of a social system in which they hold membership, they are committed co-producers of the existence of the system of concern. As in a wicked problem, each selection of stakeholder matters, and they co-create a framing and context that remains path-dependent, that cannot be undone. Vision, context and direction setting are extremely sensitive to initial conditions, and – especially when performed well - may create a lock-in effect with confirmation of beliefs among actors that their choices represent desirable preferences for future system participants.

In systemic design we face the wicked problem dynamic of a changing problem frame with each selection of participants. We can see shifts between each stage of a progressive design process, sustaining an essentially artificial co-creation engagement. These methodologies initiate design co-creation from visioning and problem framing, through system concept formulation, and toward consensus on collective action. All of these activities require stakeholder insight and validation, and much less design guidance and content (as necessary in D2.0 product/service contexts).

Any design process may be irrelevant if stakeholder selection fails to represent the requisite exogenous variety in their social system AND fails to enroll authentic commitment from those selected stakeholders. Because design disciplines are predicated on a tradition of creative problem solving, these functions are often underdeveloped. We do not select and enroll sufficiently well enough to guarantee an effective result.

Western culture now exists in what we might call a late-modernist knowledge society, and we have centred users and stakeholders as the source of knowledge and validation. Human-centering is itself presented as evidence of ethical practice, or at least, a necessary sensitivity to multivocalism in design process. However, the situated placement of (usually) self-selecting participants as representative “voices of the system” can slip into an efficient, unreflective process that escapes responsibility of future consequences of design decisions. We clearly would not decide a consensus for real social system participants. Yet how are we disclosing ourselves as lifeworld-sensitive designers, when we, perhaps even worse, decide who will be the system participants?

Design problematics in the many domains we now touch involve social complexity and the complex multiplicity of stakeholders. If we recognize that stakeholder co-creation is a context for design facilitation, we bring forth skills for different roles than product or service designers. We (systemic designers) are neither authentically domain experts or visionaries in the highly complex fields in which we serve, such as urban planning, healthcare, education, ecological community design, even AI and technology. The search for an authentic commitment, our stake in the game, must be negotiated in our experience and contributions to domains in which design is demon-
strated through care, not just performance.

The proposal presents an iterative stakeholder sampling process developed for Dialogic Design (Christakis & Bausch, 2006) and other foresight methodologies, where the undersampling of variety leads to insufficient knowledge and gaps within critical areas of social representation. Based on two design action research cases performed with a large US research lab and Canadian foresight studies, we advance a sampling model that integrates four dimensions:

- **Worldview perspectives**, based on Latour’s (2013) Modes of Existence ontological typology as a social theory of orthogonal perspectives,
- **Diversity and demographic characteristics** (including temporal preference),
- **Foresight temporality and trend categories**, and
- **The SDD reference stakeholder model** (Christakis and Bausch, 2006).

A model for Requisite Stakeholder Variety enables robust sampling for ontological representation, variety, biases and diversity of knowledge, and exogenous representation commitment (e.g. skin in the game, Taleb & Sandis, 2015). A canonical stakeholder selection model maps selected foresight categories (e.g., STEEP) to worldview ontological domains, and further diversifies by variety attributes including age, culture, gender, and proposed horizon preference. This mapping identifies significant relationships of knowledge and trends across domains and disciplines. At minimum the stakeholder sampling model provides a checklist that exposes possible risks and blind spots in the available composition of stakeholders or experts. The model further provides a schema for identifying values conflicts between worldviews and other attributes associated with known stakeholder interests (such as strategic preferences that planners wish to include).

The requisite stakeholder variety model for stakeholder discovery was designed to address the necessary variety in high-stakes foresight for long-term R&D strategies and as a reference model for anticipatory policy research. We have proposed an approach called evolutionary sampling, that iteratively samples stakeholders from across sets of covarying dimensions identified within the social system being designed. This method also effectively enables planners and sponsors to reveal biases and risks and to trade-off potential leaders, dominant voices, and under-represented minority views within the social system of concern.

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Bringing systemic thinking into design education—and practice—takes many forms. Work described at previous RSD conferences (e.g. Sevaldson 2017), and in the wider community around systemic design, cybernetics, and related fields such as transition design, has emphasized the value and importance of particular systems concepts and approaches, from the leverage points and stocks, flows, and buffers of Donella Meadows (2008), to the conversation models of Dubberly and Pangaro (e.g. 2015), the materials mapping of Aguirre Ulloa and Paulsen (2017), and the visual approaches of Boehnert (2018). There is, taking a systemic perspective, probably no ‘right’ set of concepts to teach or learn, only a repertoire or vocabulary (Lockton & Candy, 2018)—a requisite variety—of methods, tools, or lenses for examining and exploring systems at different levels of resolution and with different purposes and goals in mind; “All models are wrong, but some are useful” (Box & Draper, 1987).

Among other useful concepts, one pair of ideas from the systems and psychiatry milieu of the 1960s and 70s has proved applicable in provoking design students to consider systemic effects in relation to aspects of interaction with digital technology in everyday life, and enabling new kinds of analyses: R.D. Laing’s concept of knots (1970) and Gregory Bateson’s notion of the double bind (1972). Although originally developed and presented in very different circumstances, the two concepts have certain synergies that make them valuable ‘tools for thinking’ about systems, and can be applied practically to people’s role in contemporary technological examples including issues of data protection, social media, ‘smart’ homes, behavioural targeting, and design for behaviour change, as well as other topics within design practice such as contextual research with participants, and participatory design.

To summarise the concepts briefly in this abstract: Laing’s Knots is a curious 1970 publication, a slim book formatted in the form of a volume of poetry, which contains a collection of patterns of human thinking, metacognition, and theory of mind that Laing had noticed in his work as a psychiatrist, and turned into abstracted (but still often poignant) examples. Many of them involve one person reasoning about how another person thinks, or trying to unravel the complexity of, or causalities within, a situation, and there is a good deal of ‘second-order’ thinking present. These knots are essentially about people trying to understand what someone else understands about them, or in our terms, how someone understands their relationship with a system. But that understanding changes how they relate to the system, and the system in turn then changes the relationship, and a tangle or knot emerges.

For instance, the book starts with:

“They are playing a game. They are playing at not playing a game. If I show them I see they are, I shall break the rules and they will punish me. I must play their game, of not seeing I see the game.” (Laing, 1970)

Some later patterns verge into forms of concrete poetry which are essentially systems diagrams (e.g. Figure 1), and it is this way into using the concept of ‘knots’ which proved especially useful in an exploratory Master’s level class called Experimenting with Design, taught at Carnegie Mellon for the first time in 2017. Students were introduced to knots through extracts from the book, and challenged to find (and construct) examples of analogous situations in people’s everyday interactions with technology.
For example, in Figure 2, a ‘new knot’ around data sharing and personalization in smart homes is presented (building on ideas from Fantini van Ditmar & Lockton, 2015). Figure 3 shows a knot approach to a common issue in design for behaviour change—a perceived collective action problem.

Students applied the ‘knot’ principle in conjunction with Bateson’s concept of the double bind. In this context, it refers to dilemmas, situations where someone feels—or experiences—being pulled or pushed (metaphorically) in two contradictory directions at once (causing stress, unhappiness, or decision paralysis).
More precisely, it describes situations where the ‘rules’ of how to act within a system seem to be mutually self-contradictory and any action taken in one direction causes more problems in the other (paralleling aspects of wicked problems, particularly Conklin’s (2006) interpretation). To use an example that students raised, they know they ‘should’ eat more healthily (taking time to prepare), but they also know they ‘should’ spend as much time as possible working. Often the contradiction occurs because each framing of ‘the problem’ is operating at different level of the system, and so uncovering double binds as experienced by people living ‘within the system’ can be a route into understanding how to intervene, or at the very least to map the system from the perspectives of the participants.

In the conference presentation and subsequent paper, I will develop both the theory behind these concepts and how they fit with systemic design, and also discuss practical examples of how students applied the ideas to explore systems perspectives on topics including Facebook targeting advertising, culture around food and fashion, and design for sustainable behaviour. I will also offer some tentative methods for how knots and double binds can be used within participatory design processes and user research with a systemic design focus.

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What if we were better and faster in finding and implementing solutions supporting the transition towards a more sustainable society and planet? What if engineers and designers were habitually looking into nature’s design solutions when confronted with complex problems? What if transdisciplinary teams were designing from cradle-to-cradle, generating circular opportunities but no waste? What if our educational system were equipped to train systemic design thinking and doing for sustainability to everyone?

Systemic Design Labs (SDL): Incubating systemic design skills through experiential didactics and nature-based creativity

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KEYWORDS
Systemic design teaching and learning;
Engineering design;
Master program;
Educational toolkits;
Bio-inspired design.

Systemic Design Labs empower engineering and interdisciplinary Master students to become change agents for sustainability. Outdoor experiences, biomimicry, fabrication and transdisciplinary partnerships help to develop skills in sustainability, critical systems thinking, bio-inspired creativity, circular design and service understanding, embedding technical work within social-ecological systems.

Engineering design education is facing growing responsibility for contributing to the global societal goal of sustainability in a world of increasing complexity. Students have to be empowered to proactively design products from a systemic perspective, where ecological life cycle design is integrated with traditional engineering design skillsets, also in relation to social factors and user needs. The Systemic Design Labs (SDL) initiative at ETH Zurich builds on established teaching in engineering design and introduces systemic design thinking and doing in an innovative format based on experiential didactics and outdoor creativity. We developed a new, integrated modular block course for MSc and PhD engineering students, where ecological design skills and service understanding are combined to better cope with the increasing complexity of current and future sustainability design challenges. We use bio-inspired design, fabrication with sustainable materials and product systems mapping as innovative but proven didactics to spur creativity, holistic and critical thinking within a sustainability context. We prototype an educational fabrication toolset for teaching systemic design and sustainability in schools, while engaging in transdisciplinary partnerships for societal impact and gaining realworld experience.

The SDL is an initiative at ETH Zurich to develop, experiment and implement innovative educational offerings in sustainability and engineering design. Starting from engineering design, SDL integrates the natural sciences and the humanities, eventually reaching out with flexible learning modules to teaching creative, systemic design for sustainability to everyone.

We showcase a set of new SD courses at ETH Zurich where we built skis, kiteboards, skateboards, educational snowshoe kits and knives in the academic years 2016-2018. The courses were setup to one part as more of a classic lecture and seminar-based courses on sustainability science and systemic design theory; the second part consisted of fabrication parts, experimenting with practical tools to design and prototype. Students showed and expressed high interest and engagement in and beyond the course, with multiple requests for further project opportunities.

The SDL aims to integrate systemic thinking and doing for sustainability in current engineering design education and practice. SDL crosscuts traditional engineering disciplines to address critical human needs and foster inter-departmental cooperation. We achieve these aims in seven fundamental ways: First, we sensitize students for the potential to developing sustainable solutions for pressing societal problems. Second, we engage students in systems thinking by mapping an engineering design challenge within its greater societal and service context, working interdisciplinary. Third, we
spur ecological design thinking and creativity by experiencing nature’s de-
sign solutions outdoors, practicing the art and science of bioinspired design.
Fourth, we teach life cycle analysis and circular design by working with na-
tural materials, expanding from the current engineering focus on high tech
materials and metals. Fifth, we advocate critical thinking for sustainability
by letting students design and fabricate an educational snowshoe building
toolkit for schools, as an initial example, based on established systemic de-
sign principles. Sixth, we transfer the practically derived skills to a complex
real-world application of a transdisciplinary (TD) partnership, and seventh,
we maximise outreach by spreading the educational toolkits, by offering
modular course concepts to partners, and by publishing course movie.

During one of the new SDL courses and as a main output to increase outre-
ach, students systemically designed and prototyped an educational toolkit.
The educational toolkit has three main didactic functions and one general
goal: First, students apply their acquired skills and material knowledge on
something concrete; second, students prototype and fabricate with a func-
tional and user purpose; third, students not only fabricate, but design the
kit with the aim that others can use it to teach systemic design to their stu-
dents – this requires a self-reflective process; and fourth, the toolkit signifi-
cantly increases public outreach of the SDL since it is distributed to schools
and the broader public.

The guiding narrative behind the toolkit idea is that of a modular, multifun-
cional and systemic designed backpack, something practical that most pe-
ople can connect with. The backpack is useful in daily life and for exploring
the outdoors, it aims to take people out in nature as the best teacher in sustai-
nability and systemic design. It can be equipped with a variety of practical
tools and things for an exploration, such as snowshoes, a stove, hiking poles,
a flask, a wind-powered phone charger, a hand or solar-powered torch, and
similar tools. The SDL tools can all be carried in the backpack and are of help
in outdoor activities yet designed with careful attention to environmental
resources and impact. The backpack and each tool are designed according to
systemic sustainability guidelines and thus of value as such. Even more so,
for each tool there is an educational kit, so others can use the kit to practice
systemic design while at the same equipping their backpack, preparing to
explore the outdoors and getting inspired by nature’s creativity. The design
of the backpack and its tools is interdisciplinary, having an industrial des-
gn component, a material and engineering part, include the consumer/user
perspective, and trigger the connection with nature and natural sciences.
It motivates people to go outdoors, while the design inspirations are drawn
from nature.
Introduction

Organizations are struggling to find ways how to deal with the complexity and uncertainty of the (societal) challenges in the current dynamic environment. Linear approaches are considered insufficient to deal with current dynamic, complex challenges (Conklin, 2005; Snowden, 2002). In order to deal with this, organizations need to improve their adaptivity: to become sensitive to what is happening outside their boundaries, and to act upon external signals in flexible ways. Adaptivity requires a delicate balance between efficiency and innovation (Schwartz, Bransford & Sears, 2005). Organizations that enable an adaptive response open up adaptive space by engaging networks and emergence (Uhl-Bien, 2017).

In the last decades, a more strategic role for design and designers has been found to help organizations to deal with complexity and uncertainty in a dynamic world (e.g. Nelson & Stolterman, 2012), especially because of the constructive approach of creating future artefacts that help experiencing possible futures, by means of for instance prototypes, visualizations, or video.

In this paper we present our approach to open up adaptive space in an organization in a designerly way, and our first learnings when applying this approach in a real-life case example.

Prodaptivity

The presupposition is that a designerly feedforward learning approach, which we refer to as ‘future probing’, will help organizations to become prodaptive, as in being able to anticipate changes and act in preparation of these. The core mechanism in adaptivity relates to feedback. However, in volatile situations mere reacting on changes in the environment is insufficient. A proactive attitude is required and a sense of ownership to actively seek for weak signals of change. To anticipate the changes requires some understanding of the situation and the capacity to ‘read’ future signals that indicate what is about to happen. Like a toddler’s mother, who embraces herself because she picks up the signal that her child is going to jump into her arms (as toddlers do), and because she knows the toddler expects to be caught (as mothers are supposed to do, according to child logic). It helps to have experienced a similar situation before to make sense of the emerging future situation and to be able to make better decisions in the present.

The exploration of possible futures allows a cross-disciplinary group to gain insights and build understanding on future (societal) challenges. Future probing opens up adaptive space by inviting people to step out of operational flow and link up with other disciplines for exploration.

Approach: Combining Future Visions and Pressure on the System

Our two-tier approach consists of first exploring possible future visions by means of concrete manifestations of possible futures (e.g. Gardien, 2006), followed by niche experiments intended to put pressure on a system (e.g. Schot & Geels, 2008), in order to provoke regime change. Chris Ryan (2011) refers to such an approach as ‘eco-acupuncture’: identifying where energy is stuck in the system, then putting pressure at those points in order to allow for the release of that energy.

The process starts with mapping the current situation, stakeholders, trends and drivers. From a combination of trends and weak signals a range of futu-
re visions is explored by making tangible future probes. These are products or services, that represent the projected future in a provocative way, and enable people to experience and discuss how they would deal with such a future and what are underlying values and motives. The narratives and insights are used to develop so called future enriched experiments, to poke the current system to evoke movement.

In this approach learning takes place on three levels:
...about the phenomenon under investigation (knowledge development)
...how to bring about movement in the organization (systemic change)
...about the way that a designerly approach can help the group to take a pro-daptive role in this process (professional development)

Case Example: Surfing the Data Wave

Together, the research group Co-design and a provider of ICT infrastructure to Dutch research and education institutes explored futures where data are abundant, along three lines: autonomy, educational big data and data ownership (knowledge development). The intention of the project was to design, lead and communicate a process, that would activate employees to deal with future changes (professional development), and that would start a cultural change in the organization toward a learning, pro-adaptive organization (systemic change). The details of the approach were developed during the project by a core team of both frontrunners from the organization and codesign researchers. This development was guided by these design values: pushing boundaries, discovery by serendipity, enabling to act and make, cross-disciplinary collaboration, learning from the future. The frontrunners acted as ambassadors of the three themes and reached out to other employees to take part in thematic embassies, based on curiosity and expertise. Furthermore, students were involved for their youthful energy and to look from fresh perspectives.

Step 1: by mapping the current system a dialogue about trends and drivers, like data accessibility (open, closed), automatization and robotization, instigated the discovery of new frames. Powerful ‘what-if’ questions started alternative world views regarding control and autonomy: “What if technology takes all decisions for and about us?”
Step 2: experiential far-future probes (visionary prototypes) were developed as entry point to this new world. People were asked how they would deal with such a situation. E.g. students were offered a study contract by their university, that lowered their tuition in exchange for controlling all their personal data. 

Students appeared open to some kind of fair trade, but demanded that use by commercial third parties would be prevented at any time.

Step 3: although in this case we did not yet conduct near-future probing experiments, it would be valuable to investigate how students could have more control over and insight in the personal data, that are now kept by educational institutions, for instance in a personal education ID. Currently an employee is researching this in a PhD-trajectory.

**Project learnings**

When putting the future probing approach to practice, it appeared difficult to let go of current frames and thinking patterns in favor of more radical innovation. Even more cumbersome was to connect activities and insight from the far-future explorations to the present, without complying to the organization’s pull to order and stability. Bootcamps and workshops generate energy among diverse groups of people and this opens up adaptive space (Uhl-Bien & Arena, 2017) to share and develop knowledge. However, we encountered difficulties in trying to hold this adaptive space to facilitate more continuous innovation. We found both enablers and obstacles:

- Generative tools and visualizations to support the process increased confidence among the participants who were unfamiliar to the process of future probing.
• Alignment of the innovation process with operational processes of both the organization and education (when involving students) can become a huge bottleneck. Making adequate use of the flexible hours in agenda’s, like lunchtime and early breakfast helps.
• Keeping momentum throughout the whole process is challenging. Bootcamps and co-design sessions ignited a lot of energy and enthusiasm but were considered extra time and put pressure on operational deadlines.
• Both the thematic content (data-revolution) and the novelty of the process (future probing) appeared attractors to engage employees in activities. However, because the approach was new to them, the desire to prototype new solutions to put on market next week often prevailed over learning from ‘visionary prototypes’.

Preliminary conclusion

The future-probing-approach is promising in opening up adaptive space within an organization, because it provides the tension dynamics needed to learn from conflicting perspectives and to create novelty by linking up with people (Uhl-Bien & Arena, 2017). Both operational and innovation managers need to develop commitment and agree on time spent on innovation. To quote the chief innovation in this case: “It should be voluntarily, but not open-ended”.
To actually enable people and organizations to be prodaptive, we need to expand the future probing practice. Therefore, it is necessary to understand its working mechanism, especially in connecting far- future explorations to near-future experiments.

The future probing practice at least needs to support participants:

... to recognise and let go of own patterns, dynamics & paradigms (probes as scaffolds)
... to change their daily practice: from focus on outcome to focus on learning (probes as boundary negotiating artefacts)
... to proactively become more adaptive to make the connection (probing experiments)

1 This will be the subject of a PhD trajectory of the first author.

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This paper aims to develop a conceptual and methodological framework to facilitate the understanding of cross-disciplinary interactions among heterogeneous working groups that work together with creative purposes to approach to complex problems. This approach requires a self-organization process among actants that regularly originates conflicts in terms of ideology, language, terminology, techniques and methods, —mostly because of epistemological contrasts among fields of knowledge—. These conflicts have direct impact in the coordination of agencies and the formulation or strategies (their variation, selection and adaptation), which enables or obstructs the interactions flow and its productive results.

To achieve the understanding of this phenomena, this paper is based on the following principles:

- Complex problems solving requires the formulation of systems-oriented approaches that need to be developed collaboratively, so the necessity of applying systemic and strategic design to facilitate cross-disciplinary processes is essential if we are looking to create innovative theoretical and methodological frameworks.

- Actants’ profiles are not determined by their disciplinary backgrounds, but by their capacity of flowing across institutionalized systems of knowledge, oriented by their interests of agency, and regulated by diverse exchange processes that enable their organization and linkage with other agents through the consumption, production, and application of information and knowledge. This is will be understood as “disciplinary mobility”.

- GIGA-mapping and other systemic design techniques are useful to represent complex processes that involve a multiplicity of agents, systems and interactions. Using systemic design and visualization as a tool for group-thinking facilitation can help to understand the disciplinary interaction stages and the diversity of actants’ attitudinal profiles that enable or hinder their workflow. (iv) There is a possibility of utilizing spatial metaphors to understand and communicate complex concepts like “disciplinary profiles” and “disciplinary mobility” that essentially represent the flexibility among multiple ways of understanding, being and acting while facing a problem. This paper uses the four dimensions of Neri Oxman’s Krebs Cycle of Creativity (Science, Engineering, Art and Design), to set-up a framework to map interactions across disciplinary territories.

Throughout the paper I will explain how these principles have been applied to create a methodological framework that brings theory and practice into a set of tools that can be implemented within a workshop format called “Knowmap”. The workshop is based on the following insights:

- Arnold van Gennep’s “rites of passage” model is useful to understand the disciplinary interaction process as a journey/experience where the individual experiments an identity transformation while moving from monodisciplinary understanding to a cross-disciplinary way of working. This approach identifies 3 different stages: separation, margin and aggregation.

- Exploring the relationships among the concepts of space, knowledge and power as understood by Michel Foucault, helps to reflect on the way academic disciplines have been historically and culturally constructed, in the same way that nations were created to regulate agents with the distribution and classification of space and identity. This happens as well with human knowledge and the way institutions create
frontiers to separate and reproduce modes of knowledge production. This phenomenon has direct impact in the way human agents assimilate these modes as a way of being and doing.

- Finding patterns and creating personas can help our understanding of the different ways of acting while experiencing disciplinary interaction processes. With this purpose, the research illustrates 3 attitudinal profiles: “The local”, an expert on a single discipline; “The tourist”, and interdisciplinary curious with mixed expertise; and “The Knowmad”, a multidisciplinary strategist.

- Visual thinking and systemic design tools can facilitate the understanding of disciplinary interactions as complex experiences constituted by different layers of metaphorical spaces (territories of knowledge, actants’ mindsets, exchange processes, and systemic interactions), though a rhetoric process to visualize strategic flows, interests, barriers and leverage points.
Design for emergence – enabling stakeholder liminal transitions and innovation value pivoting through complex systemic transformations

How might we emerge sustainable innovation value within complex systemic transformations?

Researchers observe that “innovation occurs through the combination and recombination of information and knowledge that are old and new” where “innovation is thus an emergent process” (Cooke, 2013). However, emerging innovation in a sustainable manner – whether within markets, communities or organizations – is increasingly viewed as being related to the processes of learning (Harkema, 2003) within complex–adaptive systems (Carlisle & McMillan, 2006), collaboration within multi–stakeholder environments (Sørensen & Torfing, 2011), and value co–creation (Romero & Molina, 2011).

And yet, the innovation initiatives entrusted with emerging sustainable innovation value frequently experience challenges in cross–industry settings – including lack of adoption by the key stakeholders in the natural resource management practices (Shiferaw, Okello, & Reddy, 2009), healthcare organizations (Cresswell & Sheikh, 2013), and policy environments (Douthwaite, Keatinge, & Park, 2001). Innovation is posited to be further complexified by the team climate and performance (González-Romá, Fortes-Ferreira, & Peiró, 2009), and the multi– dimensional aspects of enabling adoption (Pichlak, 2016).

To respond to the outlined concerns around the feasibility of emerging new value through innovation processes, we introduce Design for Emergence – a practical, applied design methodology intended for multidisciplinary teams and practitioners – to enable flourishing futures and increased resilience across systemic scales (Bergström & Dekker, 2014), human psychosocial contexts (Matin & Taylor, 2015) and social support systems (Sippel et al., 2015; Almedom, 2015). We introduce tools and methods for building social coherence (Antonovsky, 1987; Keyes 1998) across systemic scales and levels of analysis (Marr, 1982), with the goal of easing the stressors within ‘liminal spaces’ (Van Gennep, 1906; Turner, 1987) to impact desirable future outcomes and enable individual and organizational transformational journeys.

The Design for Emergence is positioned as a meta–design modality comprised of three core components: 1) Design for Adoption, 2) Design for Resilience, and 3) Design for Transience. Each component is a general purpose meta–design modality with specific canvasses, intended to simplify practical use of theoretical concepts within diverse, complex innovation environments requiring multi–stakeholder collaboration and delivery of broad cross–scale impacts.

Recognizing that the intrinsic and continued participation of key stakeholders is essential for the success of innovation initiatives, as exemplified in co–innovation (Lee, Olson, & Trimi, 2012), the Design for Adoption eases this process by leveraging motivational theory to support both initial and on–going stakeholder engagements (Pink, 2009).

To maintain energy throughout the implementation phase of an innovation initiative, the Design for Resilience leverages methods for managing liminal journeys (Van Gennep, 1906; Turner, 1987), and uses the ‘Sense of Coherence’ (SoC) mechanism (Antonovsky, 1987; Keyes 1998) to enhance resilience of the communities, organizations and stakeholders involved.

As an innovation initiative nears completion, researchers observe that a change in the underlying value perceptions acts as a stressor (Cullen, Edwards, Casper, & Gue, 2014). To re–imagine the value propositions within
the enclosing ecosystem and re-orient stakeholder value-perceptions, the Design for Transience maps how value perceptions change through the levels of analysis (Marr & Poggio, 1982), and leverages the ‘three horizons’ foresight method (Curry & Hodgson, 2008) for exploring the evolution of value perceptions from the experienced present to a perceived future.

A key objective is to be able to leverage practical tools to pivot value perceptions within market changes and complex ecosystemic transformations - to articulate value-propositions that enhance collaborative potential and create alignment with the key stakeholders, customers and communities in a way capable of enabling emergent innovation.

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Finding the emic in systemic design: Towards systemic ethnography

An under-emphasized but crucial variable of success in systemic design is the perspective through which a problem system is understood and from which interventions are conceptualized and implemented. While rooted in design (a consciously empathetic discipline; cf. Kimbell, 2011), it is easy for systemic designers to use research practices that may fail to capture and use the perspectives of their stakeholders. These approaches risk misrepresenting the stakeholders who contribute to projects and, in turn, they are a danger to the potential impact of these mis-researched problem systems. In this research, I propose an assessment framework to check whether a project effectively deploys research tools and processes that strengthen stakeholders’ perspectives, and I provide a proof of concept of this framework in use through hermeneutic case study analysis.

Systemic design processes that are not executed with the direct and explicit engagement of stakeholders—to the extent of achieving an emic (from within) understanding of the system—may be flawed at their foundation. By fostering recognition of the importance of an emic perspective, and by providing a framework of principles, practices, and processes to accomplish systemic design with this perspective, I hope to ensure that systemic design processes are as accurate and valid as possible with respect to the stakeholders of the system.

It is not to suggest that systemic design practice is “too etic” (from outside). In fact, with roots in design, systemic design is often deliberately emic. Systemic designers make use of designerly tools that help the researcher to build empathy with system stakeholders (e.g., soft systems methodology, critical systems heuristics, appreciative inquiry; Jones, 2014). They often seek to engage stakeholders in the systemic design process and include reflective analysis of what has been learned in order to assess where deeper engagement with the system is required (Ryan, 2014). That said, with the advent of crowdsourcing (the facilitated involvement of the general public in problem solving, usually using online tools; Lukyanenko & Parsons, 2012) and data science (the use of computational tools to analyze and understand large quantities of data; Šćepanović, 2018), data-driven methods may increasingly influence systemic design practice. One recent example sought input from hundreds of people to identify opportunities for change in Canadian post-secondary systems through an iterative online survey (Second Muse, Intel, & Vibrant Data, 2016). This data-driven direction is a powerful opportunity, of course, but it underscores the need to develop principles and best practices for assessing and supporting emic understanding as we gain more data from these tools.

In the first phase of this research, I look to the principles and theorists of ethnography to develop a framework for assessing the emic/etic perspective of a given research project. Namely, Geertz’ “Tick Description: Toward an Interpretive Theory of Culture” (found in The Interpretation of Cultures, 1973, chapter 1) provides a foundation for the process of emic research in the form of four iterative steps: (1) acknowledge initial impressions; (2) capture speech, behaviours, events, and artifacts; (3) construct meaning; and (4) self-appraise sufficiency of capture and construction of meaning. Meanwhile, Creswell and Miller (2000) provide a set of five procedural principles for emic validity: (1) triangulation; (2) disconfirming evidence; (3) prolonged engagement; (4) member checking and collaboration; and (5) researcher reflexivity. Taken together, I generate a critical research framework which can be used to assess a given research project’s emic/etic perspective.

In the second phase, I provide a proof-of-concept of this framework (and its
theoretical underpinnings) via a case-based assessment of three systemic design projects. Case studies provide an effective venue for learning about the context-dependent manifestations of the phenomena being studied (Flyvbjerg, 2006). One of these case studies is one I have developed through my experience in participating and contributing to the development of the Canadian National Youth Leadership and Innovation Strategy framework, which convened hundreds of youth and youth-serving organizations in order to understand the youth leadership and innovation system in Canada (MaRS Studio Y, 2017). The second and third case studies are those profiled by Ryan and Leung (2014). In each case, I use identify phenomena representing the practice of emic (or etic) understanding in the research orientation of the work, as acknowledged by the above framework. I examine the step-by-step procedure and any associated notes about the experience of the researchers and participants involved. In each step or experience, I look for evidence of the four steps of emic understanding or the six techniques of emic validation reported above.

In order to interpret and analyze the chosen case studies, I turn to the methodology of phenomenological hermeneutics (Eberle, 2014, p. 196; cf. Wernet, 2014). Phenomenological hermeneutics are appropriate as I have access to the described phenomena of the systemic design projects captured by the chosen cases, but these phenomena are not explicitly captured with reference to emic or etic perspectives—thus some construction of the inherent emic or etic data is necessary in order to make judgments about the perspectives found in the projects.

This hermeneutical analysis provides comparative evidence for the emic and etic perspectives used by the researchers in each case. It becomes possible to contrast and critique the principles, practices, and processes employed in each project in order to make a judgment about the project’s resulting emic/etic orientation. From these analyses, a metaphor emerges. Systemic design projects with etic orientations adopt an intensivist approach. Akin to intensive care in medicine, the systemic designers attempt to artificially suspend a system in a room. (Consider board room systems mapping as a trivial example of this practice.) Attempts are made to “get the whole system in the room”, but the system is therefore removed from its context. The status of inaccessible elements of the system are guessed at and assumed, while other elements are placed in stasis and augmented by facilitation and technology. The resulting interventions are spun up in this artificial space, but implemented in the system’s context—the systemic design team simply hopes that their assumptions hold and that the artificial suspension didn’t cause too much damage. System design projects with an emic orientation adopt an extensivist approach. The designers themselves extend into the system. They sit with it for a while in order to acclimatize to its culture and learn its patterns. They interact with stakeholders and phenomena in context and capture these interactions as they are, as an ethnographer would. The interventions they develop are (co-) created in place, built into the system’s real networks and activities.

Of course, the challenge with these dueling approaches is that there are important trade-offs. The extensivist approach takes time and personal investment. What’s more, the intensivist approach can have other valuable outputs: stakeholders of a system see one another and the parts of the system they interact with as a cohesive whole. The result of this analysis, then, is not an obvious set of best practices. Instead, the emic/etic assessment framework can be used to judge how a research project effectively captures the perspectives of its stakeholders. It breaks down a project into components, each of which provides an intervention point for enhanced emic understanding. Finally, it provokes a reflective conversation, forcing us to ask ourselves where we can do better.
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A key component of many systemic design processes is the development and analysis of systems models that represent the issue(s) at hand. A system is a collection of interdependent social, technological, and environmental phenomena. Models of systems often take the form of Causal Loop Diagrams (CLDs—sometimes referred to as influence diagrams) in which phenomena are graphed as nodes with connections between them indicating an influencing relationship. These visual modelling techniques provide systemic designers with a mechanism for stakeholder collaboration, problem finding, and generative insight (i.e., sticky note ideation makes everyone feel heard, appears democratic, and often results in emergent themes and ideas). These functions are valorized in design thinking, and they provide real value in garnering momentum and achieving common mental models in complex problems. They give systemic designers powerful resources for use in visual argument.

However, while we believe these tools are useful, we also believe their true potential is unfulfilled. The properties of complex systems (and of how people engage with them) present a number of issues that introduce bias and chance into this process (Norman & Stappers, 2015). Given a model, systemic designers work through what they observe and interpret, engage in dialogue about what is important, and look for patterns (one category of which is archetypes, in which phenomena following certain patterns tend to produce similar emergent behaviours; Braun, 2002). While some principles and processes exist (see Jones, 2014), identifying leverage points and designing solutions tends to happen by “muddling through” a problem. This means solutions are developed and implemented in opportunistic form, through satisficing rather than optimizing (Norman & Stappers, 2015; see also Simon, 2008, chapter 2). Thus, we find a critical value gap: models are used in visual argument, but they could be used to augment those very arguments founded on evidence and logical relationship analysis.

We propose the application of semi-quantitative analytics to systemic design models to go beyond visual argument, offering a powerful toolkit for: Comprehensive system mapping for complex sociotechnical systems (including the development of reference models that can inform synthesis/Giga-maps, or that can be used as their own arguments); Network-based analysis to uncover key structures, relationships, and latent leverage positions of modelled phenomena; Analytical mapping of problem systems and sorting out multicausality; A toolkit for cross-impact analysis between problematics; and A “reality check” on strategic foresight proposals (by mapping temporal changes in networks and problematiques, we can better predict signal -> trend outcomes).

With these analytics, models may be rethought in terms of the logics of leverage to reconcile this value gap. We introduce (or at least renew emphasis) on centrality analysis (metrics derived from social network analysis, evaluating the relative importance of mapped phenomena through measuring the structure of the directed graph made by the phenomena) and decomposition heuristics (algorithms derived from systems dynamics that analyze the directed graph structure to reveal the causal and loop hierarchy of modelled systems) in systemic design.

To demonstrate the application of centrality analysis, we map the interconnectivity of the Sustainable Development Goals (SDGs) and their targets based on the work of Le Blanc (2015). By using metrics adopted from social network analysis, we are able to differentiate between goals and targets.
of differing levels of importance based on the structure of the map. Phenomena closeness (how proximate a given element is to the rest of the map) provides a ranked list of key indicators of change in the mapped system. Eigenvector (how well-connected an element is to other well-connected elements) analysis provide a ranked list of highly connective forces in the system; potential leverage points. These metrics therefore help identify which goals and targets to watch and which to intervene on the process of creating systemic change in the SDGs.

To demonstrate the application of decomposition heuristics, we create a level partition (a hierarchy of causal structure of a map) and a loop inclusion graph (a hierarchy of feedback loop subsystems nested within one another) from feedback loops modelled in previous work on education systems change (Murphy, 2016). The level partition only decomposes the system into two levels, showing the strongly connected nature of the modelled phenomena in the system at hand. The loop inclusion graph, however, shows that certain feedback loops dominate the feedback loops they are contained within. Understanding—and intervening upon—these dominant loops should take precedence over their subsidiaries.

The potential value in combining these tools should be clear. Decomposition heuristics can be used to break down the structure of modelled systems, making clear hierarchies and isolated systems within systems that sometimes disappear in the hairball complexity of these models. Likewise, centrality analytics can indicate key indicators, leverage points, bottlenecks, and other useful phenomena in the system. Taken together, isolated, dominant subsystems with high rankings on centrality measures tell systemic designers exactly where to stand in order to move their systems.

The resolution of this value gap is particularly important as we see growth in the use of systemic design—and the technologies that support its practice. In order to develop models of systems that accurately represent the many stakeholders involved in the system, systemic designers must draw on diverse sources to collect and organize as much data as possible (Jones, 2014; Stroh, 2015). Fortunately, thanks to the development of recent technologies and practices such as crowdsourcing (the development of participatory systems that involve publics in a collaborative project, usually directed by a project owner; Lukyanenko & Parsons, 2012) and data science (a set of techniques and theories that help distill insight from data; Šćepanović, 2018), the collection and organization of large amounts of data will become ever easier.

This brings us to an important paradox. Larger, more complex, data-driven models are likely more representative, as they capture more perspectives and nuances than simpler models. At the same time, larger, more complex models are harder to learn and understand (Rossi & Brinkkemper, 1996), and therefore they are also harder to use in the development of solutions. Thus, the tools we propose come at a crucial moment for leverage analysis in systemic design. Their advancement and provisioning could elevate the potential of the tools at the core of the discipline. With this careful rethinking of the logics of leverage, we might make better arguments for change, finding the place to stand from which to move the world.1

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1 The title of this paper is a reference to Archimedes, who famously said the following as a way of demonstrating the physical principles of the simple lever: “Give me a place to stand, and with a lever I shall move the whole world” (“Archimedes,” 2018; cf. Tzetzes & Kiessling, 1826, for an earlier Greek version). In truth, the place he would have needed to stand is about 3.8 trillion light years away (or 40x the size of the observable universe), but his statement was nonetheless moving.
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Introduction

While the continuous flow of events - within the complexity and dynamic systems theory - seems to be a given, we still cannot tell the exact nature of future events, prior to their emergence. This research aims to establish a code for the city as a semantic system that models cities and monitors their sociospatial metabolism. In setting the general schema for its ontology, the research disregards the difference between the observable and the nonobservable as well as the anthropocentrism this distinction implies (DeLanda 2013). In this context the city is composed of both the actual and the virtual, the "city as is" and the "city as it could be", respectively. As they both inform and enhance the city's identity, its production is to be explained through a process ontology format without the need for a designing author.

Such an autopoietic system Humberto Matura and Fransisco Varela classified as a 'machine' which is 'organized as a network of processes of production of components, continuously realizing the network of processes that produced them' (Maturana and Varela 1980) thus able to process information over time. As this information is both actual and virtual, the concept of a code is introduced as a mediator mechanism. The material agency of this productive process, key to Deleuzian ontology, is described as a bifold process which constantly informs itself, including a "convergent phase of selection" and a "divergent phase of design" (Spuybroek 2008: 189).

For the convergence phase - one to inhabit the virtual domain - a code of Design Patterns (Passia, 2016) is organized by gathering information that is relevant and providing its topological structure, one that concentrates on the relations instead of the components. A movement towards quality, order and organization. In the divergent phase - one to inhabit the actual domain - an affective mechanisms' index (Roupas, 2016) is organized to guide the actualization as the code germinates and transforms into actual spatial structures with geometric and qualitative properties. (Spuybroek 2008: 189) A movement towards quantity, matter and structure.

Convergent phase: the code's organization

To propose a framework for the code's organization, we introduce Christopher Alexander's (Alexander et all. 1977) 253 Design Patterns as the code's elementary units. Each Design Pattern is a diagram that describes form through a set of rules or criteria, expressing a relation amongst a particular context, a particular system of forces that is repeated within the context, and a spatial configuration that allows these forces to balance. Design Patterns' internal structure, already quite fluid and dynamic, is essential for the code to simulate two important processes: the process of representation - that is to gather and store information about the city - and the process of self-organization - that is to develop organized structure and adapt it to cope with the changing fields of information (Cilliers 1998).

In that respect, Design Patterns are introduced onto a surface in space as assemblages pointing to modes of information transmission (Wilden 2011: 220). On that surface they are free to assemble and reassemble anew, as they use their ability to communicate at different spaces, levels and scales. Through a two part population-thinking process their regularities and tendencies are documented and protocols of interconnected networks of communication are established. (image 01) These two parts of the populationthinking process agree with Henri Bergson's distinction between difference in kind and difference in degree (Bergson 2014: 23). Mapping their difference in...
kind describes the city’s dimensions as Design Patterns’ assemblages while mapping their difference in degree defines its dimensional gradients as degrees of Design Patterns.

As Design Patterns start populating this autonomous surface, the manifold gets activated and energized. At the end of the first part of the process, the manifold will have four spaces of possibilities pointing them as the city’s four dimensions, each inhabited by specific Design Patterns:

- interiority vs. exteriority
- integration vs. separation
- concentration vs. decentralization
- similarity vs. heterogeneity

After the second part, each dimensional space will be organized according to four varying degrees of intensity called dimensional types, where the same Design Patterns will be employed to produce the full array of all degrees. (image 02)

Through this bifold process, we have defined a number of attractors for the city’s code: its four dimensions as the genera of exteriority, cohesion, integration and differentiation, and also the intensive boundaries of their internal variation. Through the attractors, it is possible to explain the city’s identity in relation to networked patterns of communication between its elementary units, themselves consisting of degrees of intensity (Passia, 2016).

**Divergent phase: the code’s structure**

Entering the divergent phase and while the code maintains in full its topological organization, it transforms its structure to become formative by replacing its elementary units. To allow for the material structures to remain open and thus able to create variations of oneself, an affective mechanisms’ index is created, a map of the affective capacity of spatial objects at different scales, from design objects to buildings and urban configurations. Those spatial structures are theorized as assemblages, that is systems composed of interacting parts. And since all assemblages are parts of larger assemblages, their components’ ability to engage is contingent. (Meillassoux 2012:10)

In order to analyze and produce spatial assemblages of that kind, we point to their more stable characteristic: which is their ability to affect and to be affected. (Deleuze & Guattari 1987:xvi) In mapping the assemblages’ affective ability, spatial objects are analyzed in two axes. (Delanda 2006: 13) The first axis focuses on the relations that the assemblage’s material and expressive components develop in order to enter the assemblages. The second axis records the processes known as A-signifying signs or A-signs, (Guattari 1995:54) which are the triggering mechanisms able to stabilize or destabilize the assemblage and thus allow its parts to assemble anew. These mechanisms are introduced as intensities that transform the object beyond meaning, beyond fixed or known cognitive procedures. They belong to a molecular level which is populated by modulations, movements, speeds, rhythms and spasms. (Lazzarato & Melitopoulos 2012: 240) As a-signs cannot be isolated from matter, we thus point to affects as the result of the a-signs’ capacity to trigger the selection of one action possibility - affordance - among many.

To that end, approximately 100 a-signs have been mapped via the analysis of numerous contemporary spatial objects of various scales, including works of art and installations. In that respect an affective mechanisms’ index is created (image 03), one where all the a-signs are listed as an index of techniques that could enhance the affective capacity of the final design object. Each a-sign is now connected with the list of affects it triggers and which thoroughly defines it. And vice versa, as the same affect can be triggered by different a-signs, the design object is allowed to lie in a perpetual state of becoming. Through the affective mechanisms index we are now able to analyze and direct the design object’s final form while at the same time
establishing the mechanism to measure its continuous transformation.

To define spatial objects, A-signs are categorized in terms of their aesthetic power to affect and to be affected and are placed onto the respective dimensional areas of exteriority, cohesion, integration and differentiation. On the basis of the general categories of form, structure and surface, different part’s degree of contingency are evaluated and measured. (image 03) By replacing Design Patterns with A-signs we introduce affects as material information that is immanent in the spatial object while at the same time they confer no meaning; they only convey some information without semantic content. The affects’ ability to merge with the material world without mediation allows them to avoid the realm of representation. With this codification we are able to control the final form of the design object while at the same time establishing the mechanism to measure its continuous transformation.

Conclusions

Having the same code with different components - Design Patterns and A-signs - we are able to construct a machine that connects the convergent phase of selection with the divergent phase of design. Through this bifold process, we have defined a number of attractors for the city: its four dimensions as the genera of exteriority, cohesion, integration and differentiation, and also the intensive boundaries of their internal variation. Through the attractors, it is possible to explain the city’s identity in relation to networked patterns of communication between its elements, themselves consisting of degrees of factors. At the same time, through the a-signs we have actively connected the convergent and divergent phase. In the code we organize for the city, the elements and the relationships exist in the same continuum thus effectively bridging the gap between the actual and the virtual city. The code we have organized for the city resembles Deleuze’s abstract machine: ‘a map of relations between forces, a map of destiny, or intensity, which proceeds by primary non-localizable relations and at every moment passes through every point, or rather in every relation from one point to another.’ (Deleuze 2016: 36).

Appendix of images

1. Work in progress: Map of Communication 03_12 criteria list
2. Work in progress: Map of Communication 04_the city’s 4 dimensions
3. Work in progress: Extract of Affective Mechanism Index
4. Work in progress: Code table with A-signs
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“Wicked problems” as defined by Horst Rittel in his pivotal text Dilemmas in a general theory of planning (1973), to this date provides a significant mode of rethinking questions of complexity in architecture. Recent interest in alternative instruments to frame complexity due to various forms of crisis (environmental, economic, refugee, etc.) and the resulting discussions on new instrumentalities or more specifically what John Law (2004) identifies as after method (ways of dealing with mess) opens the need to rethink the discourse on research methods and their relation to wicked problems in architecture. Although Rittel’s original paper has led to research projects in many fields such as sociology, organizational learning, information theory, software design, product design etc., apart from a small number of researchers such as Champory Rith and Hugh Dubberly (2007) there is very little direct discussion on wicked problems in architecture. In addition, while most people identify Rittel’s work in the context of information theory, information systems, conversation theory they pay less attention to the broader systemic component and humanities related aspects of his work. In this paper I will discuss a studio experiment with a device called “Fun machines” as a method of rethinking wicked problems in relation to architecture.

Systems which are identified in the context of the studio as fun machines are in fact carefully constructed timely architectural devices as a reaction to cultural agitants in forms of multiple crisis in the spheres of labor, migration flows, housing, environmental, educational. Whilst Rittel’s discussion on the nature of wicked problems is at the crux of the theoretical framework, in addition it engages with two other types of discourses to formulate a theoretical framework. Firstly it engages with the “non-trivial machine” as identified broadly by the second generation of systems theorists (Heinz von Foerster, Gordon Pask) and the systemic notions of “information” and “heuristics” that the second-order systems framework engenders. The studio also draws on 1960/70s appropriations of these concepts within architecture by systems practitioners such as Archigram and Cedric Price. Secondly, it engages with the philosophical discourse on humor as identified in the work of Sigmund Freud (humor and the unconscious), Henri Bergson (humor and the social), Gilles Deleuze (the connection between sense and nonsense), and Arthur Koestler (bis-association and the techniques of humor in problem framing).

Drawing on the aforementioned theoretical framework the pilot studio focused on wicked problems in the context of East Germany more specifically Dessau and the surrounding socio-political and environmental contexts. The wicked problems chosen by the students were transferable across other East German cities. The problems of migration, Germany’s efforts to balance these migration trends with the push of refugees towards the East, the lack of proper jobs and social infrastructural systems in, the disconnection between educational sites such as the University of Applied sciences in the former Bauhaus compound and the wider context of the city, the attitude towards outsiders or migrants, media and education systems in the GDR period and their contemporary effects, were chosen as starting points to their investigations. The resulting heuristics of the fun machines and their representations in the form of a comic strip has four specific features themes in relation to some of the core concerns laid out in Rittel’s 1971 paper.

1. The fun machine as a device facilitates the non-taming of the wicked problems. It exposes the multiple feedback loops of complexity in these problems and allows the architect to reframe these processes in a recursive
manner. For Rittel wicked problems were another way of rethinking the
discussion on the significance of instrumental knowledge in architecture.
Particularly instrumental knowledge as something that does not deal with
“what is” (science) and “what it means” (humanities) but rather as something
that relates to “what matters” (pragmatics). Fun machines create mattering
maps.

2. Paradox or contradictions are significant components of wicked problems.
When converted to a tame problem, these contradictions are reduced to
simple problem statements. Using Koestler’s notion of “bis-association” the
fun machine utilizes paradoxes as a productive factor in the generation
of the machine. Discordant codes, hidden incongruities are made explicit. Ac-
ccording to Rittel design emerges through conflict and controversy. The fun
machine is a conflict/controversy map.

3. The fun machine plays with language. According to Rittel wicked pro-
blems need to be reframed constantly. The fun machine utilizes word play
in its many forms (pun, witticism, perversions of rhythm and rhyme to en-
gage in re-languaging of the identified problem.

4. The fun machine allows for a Clowning of the self and the construction
of alter egos. It operates as a tool for designers to rethink their own subject
position and agency. This idea of clowning allows one architect to assume
multiple voices at the same time and voice the contradictory positions wi-
thin the designing self. This method of not taking yourself seriously allows
for other voices and criticisms that are part of the design framework to be-
come apparent.

More specifically the project is part of a broader research and education
experiment on rethinking the encounters between architecture, systems
theory and wicked problems. It is an attempt to reframe ways of teaching
Rittel’s concept of wicked problem and its relevance to contemporary di-
cussions on research methods in architecture. The fun machine is not only
a device to rethink how wicked problems are framed through humor but
also remain as a way of introducing the concept and discourses of systemics
to graduate students of architecture as a core discourse in there academic
program or design studio education. In the presentation I will flesh out the
discussion developed in 3 earlier paragraphs as 3 sections with special re-
ference to the pilot studio project (including the drawbacks). It is hope that
this will generate a broader conversation on ways of developing the project
further. In a complex world where wicked problems become an inevitable
part of the everyday life of an architect it is hoped that the fun machines
will provide young architects with a tool for thought, action, activism, and if
nothing else a method of survival in times of frustration.
Several French authors have contributed to enlarge the knowledge on a soft and constructivist view of systemic thinking in the last decades.

The theory of complexity by Edgar Morin (2005) persisted to be the more complete and exhaustive critic of positivist approaches, underlying the need for embracing complexity, giving up on the necessity for absolute objectivism while opening a path exists between idealism and realism postures.

Morin, (1999) specially described the Complex thinking as a building with three different floors: Information, as well as cybernetics theories would be on the first floor. Second floor would be occupied by auto-organization and dissipative structure theories. The third floor would lodge three principles developed Edgar Morin: (1) The dialogic principle means that two contradictory principles are united not to overcome the contradiction but to consider the complexity of the tension that this contradiction provokes. (2) The recursion principle is based on a procreative loop, meaning that the subject is a product of the system and at the same time the system is created by subjects’ actions. Subjects do not only receive information from the system, they build a representation and creatively transform the system. (3) Finally, according to the hologrammatic principle, “the part is in the whole, but the whole is in the part”. For instance, society is composed by human beings but the society as a cultural construct is represented in each human being.

Based on this theory, Le Moigne (1994) and the cognitive science authors of enaction theories went beyond the bounded rationality (Simon, 1982), and introduced a new vision of thinking about systems warning designers that systems are interpretations (or cognitive construction) depending on the observer(s). For them, information and knowledge are not identical, as well as knowledge and action are not interdependent. “Knowledge” is an enaction of a system and a mind (Maturana et al., 1970) (not an accumulation of information) and an action that comes into new phenomenon (not a prerequisite for action) (Benasayag, 2006). Knowledge is about modifying cognitive constructions to create clearness in experimentations and practices. A system cannot be known without acting and transforming it (Piaget, 1998) therefore design research and practices can be seen as means to operate research for action (Avenier et al., 2007).

In systemic design, soft-systemic approaches have been developed (Checkland, 2000) within a constructivist epistemology, considering models not as hard copies of the reality or representations that allow a prediction, but as intermediary objects (Jeantet, 1988) that will support design processes for building effective actions.

Numerous sociologists and designers also participated in the observation of complex processes of innovation and have been defending the importance of social dimension in such processes. For Alter (2002), innovation processes involve the co-evolution of systems, mental representations and relationships between stakeholders. With the Actor Network Theories, Akrich et al., (1988) proposed not only a frame to observe the co-evolution of processes of technical artifacts and social structures but also defined the notion of “translation” referring to the complexity of creating relationships when building innovating networks: stakeholders are constantly creating narratives that could create convergence or divergence between the diverse interests, enrol and disengage new actors.
Complexity, Constructivism, Enaction, Translation are key notions that constitute the pillars of systemic thinking. Efforts are still needed to diffuse and embed them into actual organizational and design practices.

The French Bask author, Jean Michel Larrasquet (1950; 2018) was amongst the action-researchers applying complexity and systemic theories in his practices of activist, manager, prospective researcher and professor.

- He was co-founder and president of the “Projectics” society for 20 years. Projectics is a community that question the complexity of human action within organizations through an annual conference and a revue that promote new and original angle on the topic, publishing articles in English, Spanish and French.

- He also co-initiated a master of systemics from 2012 to 2015 proposed to managers. The training was composed by a 320 hours program, mixing plenary sessions and tutoring, based on 5 different modules introducing complex system management, systemic modelling, agile methodology, creativity and business model tools, inter-culturalism and soft systems approaches, open and sustainable management.

- He was the president and an active member of the Bask Study Society "Eusko Ikaskuntza3". This institution was created in 1918 to take up in a comprehensive and integrated way the social challenges of the Basque Country, considering its territorial specificities and going beyond the administrative, ideological and social obstacles. He was managing recent prospective works using design thinking tools to imagine and encourage reflections on strategic societal challenges like resource depletion, tradition and language preservation, health in different rural or semi-rural territories.

- He co-created an original program of incubation for social innovative projects named ETICOOP4 in partnership with a major cooperative bank of the region, so project holders did not have to pay any fee for training and coaching. The program is supporting projects based on cooperative values, innovation and territory through common courses reaching 120 hours and 2 years of individual tutoring. Participants particularly enjoyed being challenging by external experts as well as their peers on key entrepreneurship themes like business modelling, financing plan, communication...

- Through this contribution, authors would like to outline the contribution of French systemic thinkers that have not been systematically translated in English and therefore are rarely referred by the actual Systemic Design community. More especially, we want to give a special tribute to the legacy of Jean-Michel Larrasquet that has highly participated in supporting processes enhancing the adoption of a complexity and systemic thinking into design practices, for people, organizations or territories (Larrasquet, 2006; Larrasquet and Lizarralde, 2010; Larrasquet, 2012; Larrasquet et al., 2016; Lizarraide et al., 2011; Real et al., 2017). Specific highlights will be provided in the paper to disseminate the wisdom he acquires and transmits through his interrelated academic and practical works:

"Complex organizations are networks of people embedded in territories and cognitive's processes constructing transitions with sense-making, ethics, care and emotions".

1 https://www.cairn.info/revue-projectique.htm
2 http://www.estia.fr/masters-ou-masteres/
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Beyond user centric design

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KEYWORDS
User Centric Design;
User Oriented Design;
Design Thinking;
Agency;
Systems Oriented Design;
Anthropocentric design.

This presentation will bring forward a criticism against the dominating attention to user centric design and discuss it from a perspective of systemic design.

User centred design has gained an important position and attention in the design world and beyond. The spread of design thinking into management and engineering as well as the public sector has contributed to this. It has been useful and appropriate to bring these fields to a better understanding of user needs and their experiences.

This development has largely been beneficial for the consumers, the users of systems and operators of machines. The development has been driven by its obvious congruent market orientation. Being user oriented is also good for sales. It can be coupled to branding and experience design easily. The current focus in service design on user experiences has driven this further.

User oriented or user centric design has hence become a leading beacon for many. In design practice as well as in schools user orientation is, a priori, taken for ethical good. Also other professions like engineering and management have adopted user orientation within the concept of Design Thinking (Boland & Collop, 2004) (Brown & Katz, 2009). The concept of user centric design has been discussed and questioned by Restrom (Redstrom, 2008) clarifying the difficulties in the concept, proposing that the user is a fiction, designed during the design process. Baumer who points to the blurred division of users and non-users (Baumer, 2015) and Wagenknecht defines the role of the unwantedly affected non users, the affected bystanding that comes with marginalization and passivity (Wagenknecht, 2017). This paper intends not to add to this discussion and refinement of the understanding of user centric design. Rather I want to take a step back, to a bird’s eye view, and raise the criticality towards the design methodologies and theories that put the idea of the user at the centre on the costs of other concerns. The frame of the abstract does not allow to elaborate on the nuances of this critique. The intention is to develop and refine this in the next steps towards a full paper.

The critique against a user centric design approach might contain several points addressed below. For each of them one could point to practice cases that would demonstrate e.g. sustainability etc. and more advanced approaches. However, the dominating user oriented approach in design is structurally not including these issues. It puts one aspect in the centre and this has unavoidably come at the expense of others.

Anthropocentric

User centric perspective applied in design are by their nature anthropocentric. This means that it is centred on the needs, perspectives and approaches setting humans individually and humankind in the centre. In times when our planet is threatened by human activity, continuing to propagate a human centric worldview is no longer adequate.

Not sustainable

From the anthropocentric worldview unavoidably follows unsustainable development and a further build down of our fundament to sustain life on earth. Action for sustainability is not a naturally integrated result from the worldview but is an addition to the human centric worldview.
Not agent based

A human centric approach is weak when it comes to agency. The notion of agency in design is used with great confusion. I use the term exclusively for a person acting on behalf of another person, or other entities, non-humans and environments. Agency in design becomes ever more important, to include secondary users, affected bystanders or non-users, or non-human beings that are affected by the design intervention often in unintended ways.

Does not care for the people in the production process

Amongst the secondary users, most often forgotten, are the people involved in the production process. Seen from a systems perspective, the purpose of a company is manifold even if it is not expressed so. Creating jobs is an important aspect that also contributes to distribution of wealth. One could claim, depending on the analyses, that from a systemic perspective the root purpose of companies is to create jobs.

Highly commercial

A user / consumer centric approach tends to be highly commercial. It comes at the cost of other perspectives, e.g. community dominated perspectives or other societal perspectives. It does not cater for unintended consequences
A user centric perspective is inherently un-systemic and thereby is not able to cater for the unintended effects of our interventions.

Beyond user centric design

The idea of user and use reduces the potential complex relationship between object and actor (Latour, 2005) to a question of the object serving the user. The roles seem to be fixed: The providers of objects (and services) to the ones that receive them (the users). The users role in such a scenario is relatively passive. Though this notion of division of roles is challenged by service design theory, where the user is allegedly co-designing the service in the moment of consumption, and the notion of participation and co-design inherent in user oriented design methodology, still the user is normally perceived as congruent with the consumer.

Hence while inherently portrayed as an approach that reinforces a democratic design, by listening and involving the user it is not what it seems. User oriented or user centric design tends to reinforce the power divide in the liberalistic market economy and is politically not on the side of the disempowered but reinforces the means of the empowerment to increase their profit.

Susan Gasson implies a critical approach to user centric design and suggests “human centered design” as a .... dialectic between organizational problem inquiry and the implementation of business process change and technical solutions. (Gasson, 2003) This indicates a design strategy that still keeps the human in the center but that has multiple perspectives.

A multiple perspective approach in design is needed and needs to be developed further as a systemic design strategy. A fragmented and distributed approach, where, in the outset, everything is equal, is probably not the way to go. We need rather to have multiple centric design approaches where user centric design is one of several lenses. Others would be human centric and citizen centric design, design ethics, social systems, sustainability, technology politics and organizational design, economic issues and more. Most important we need to investigate possible side effects and unwanted outputs from the systems we design.
In a multi-centric design approach, some issues need particular attention:

1) How the perspectives are related and how they might be strategized and orchestrated. For that we need a systemic design approach. We provide such a framework in SOD (Sevaldson, 2009, 2011) and tools to cope with it in e.g. gigamapping

2) The notion of agency comes in the forefront.

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Systemic design focuses on issues of greater "scale, social complexity and integration" than service or experience design (Systemic Design Association accessed 2018). Given the rapid emergence of the systemic design field, attention has focused on theoretical and methodological development (Jones and Bowes 2017). In this paper, we contribute to this development by formalizing a method, grounded in complexity/resilience theory, for mapping social system identity.

From complexity/resilience theory, we adopt the "landscape" and "attractor" metaphors for conceptualizing stability and change in social systems (Sheffer 2009, Byrne and Callaghan 2014). In this approach, existing or potential social systems can be characterized as "regimes," with dominant regimes described as business-as-usual and alternatives as niche or innovation regimes (Westley et al. 2011). To further develop this approach, we characterize social systems in terms of identity (Vickers 1980), and then relationally analyze social regime identities in terms of their underlying social factors or logics (Thornton et al. 2012). In these terms, a social attractor can be characterized as a constellation of logics, the "attraction" to which, among social actors, individually and collectively, serves to stabilize the regime (Silverman and Hill 2018).

Based on this model, we describe a method (and suite of techniques) for mapping analogies and distinctions in selected and bounded social systems and scenarios, as constructed by design strategists and/or by group-process participants. While this method is itself quite straightforward, its application encourages systemicity both in the models that can be developed and in the dialogs and deliberations that can be facilitated. In order to situate this method within a systemic design toolkit, we compare it with the methods described and illustrated by, for example, Sevaldson (2012/2017) and Jones and Bowes (2017), as well as with the wider literature on analogy making and comparative analysis (e.g., Hesse 1966, Hofstadter and Sander 2013).

In 2017, seeking to standardize and accelerate adoption of one mapping technique, we developed a "regime shift canvas" (Silverman et al. accessed 2018). This canvas is based on a bricolage of the landscape model with the design "bridge model" (Dubberly et al. 2008). In this bricolage, the "model of what is" in the bridge model represents a business-as-usual social regime and, by analogy and/or distinction, the "model of what might be" represents an alternative social regime or scenario. This canvas can be used in a variety of ways: as a prompt to individual creativity, as a basis for group facilitation, and as a heuristic device that informs the use of other analytical, group process, and/or foresight techniques.

This standardization also highlights the limitations of a singular technique and artifact (i.e., "canvas"). We discuss these limitations, and then describe additional techniques for mapping social system identity. Each of these techniques is illustrated herein, with examples drawn from the referenced literature and from student mappings developed in masters degree-level design programs at Pacific Northwest College of Art. In effect, these techniques represent variations on the bridge model, and we diagram each of them as such.
Regime Shift Canvas
—a tool for imagining by analogy—

What is This?
The regime shift canvas is a strategic design tool for developing descriptive models of transformative futures. Describe what is. Then imagine by analogy what could be.

Bridge Model
existing reality

model of what is

imagine by analogy

model of what might be

Focal system:

Example Canvas
Focal system: Global Food System(s)

model of what is
(the dominant regime)

model of what might be
(an alternative regime)

logics (describe what is, imagine by analogy what might be)

food production
narrative

food security & sovereignty

feed the world
goal

access to healthy & culturally appropriate food

efficiency, comparative advantage, technological progress, plenty
value

ecological health, social equity, resilience, sufficiency

concentration of ownership, specialization of production
governance & practices

small and medium-scale agroecology

carbon intensive
physical inputs

labour intensive

How to Fill Out the Canvas
Start by asking
What is a situation that you see as problematic? Identify a set of systemic social relationships in this situation. This is your focal system.

Regimes are functioning instances of the focal system — ways that the system is manifested, experienced, and described.

Name the logics stabilizing the dominant regime — and then imagine how such logics might stabilize an alternative.

How does the dominant regime maintain its legitimacy? How and why do individuals and organizations participate in the regime's ongoing development? Take these relational characteristics of the regime as its logics.

Fill out the canvas by considering how these logics are expressed in the dominant regime — and then how they might be differently expressed in your preferred alternative.

For example:
- narratives: How is the meaning or function of the regime described or understood? Through what story do participants identify with the regime or see it as legitimate?
- goals: What spoken or unspoken goals are assumed for or attributed to the regime?
- values: What values are affirmed through participation in and/or identification with the regime?
- norms, practices, habits: How do the activities of participants shape the regime — and how are these activities shaped in turn?
- governing institutions: How does institutional design shape participation? How are legal, administrative or regulatory lock-ins established or enforced? Are some excluded from participation?
- materials: How do physical materials or material artifacts shape and stabilize participation?
- finance: How do investments shape and stabilize participation?
- indicators: How do indicators of success affirm the legitimacy of the regime?
- power: Who benefits from the regime's persistence?
- emotions: How does the regime's persistence afford a sense of security or otherwise satisfy the emotional needs of participants?

For discussion
After filling out the canvas, consider how the logics of the dominant regime reinforce each other. Does each coherently support the regime's narrative? By analogy, how might such reinforcements and coherence be engendered in your preferred alternative regime?

Fill Out Your Own Canvas

model of what is
(the dominant regime)

logics (describe what is, imagine by analogy what might be)

model of what might be
(an alternative regime)

Based on the model of stability and change described in:

Bridge model adapted from

Sign up to download and test out the canvas:
regimeshiftcanvas.org
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INTRODUCTION

Value Shifting

The word ‘value’ is derived from the Latin valere, which means ‘to be strong or worthy.’ Since this origin, ‘value’ has developed new connotations:

- [Value] “The regard that something is held to deserve; the importance, worth, or usefulness of something.
  - The material or monetary worth of something.
  - The worth of something compared to the price paid or asked for it.

- (Values) Principles of standards of behaviour; one’s judgement of what is important in life.”

The emphasis, in economics, on moral values, and economic scientific value, has evolved from an initial focus mainly on values in early societies, as social interactions dominated, to a greater focus on value in modern societies, as economic interactions have come to dominate (p19 Heilbroner et al., 2012). According to Heilbroner (1985 p107-118), in the early nineteenth century with the rise of Utilitarian philosophy, values became null and void as Utilitarianism asserted that:

“...whatever served the individual served society. By logical analogy, whatever created a profit (and thereby served the individual capitalist) also served society, so that a blanket moral exemption was, so to speak, extended over the entire range of activity that passed the profit-and-loss test of the marketplace.”

Heilbroner (1985)

Up until the mid-nineteenth century, economists believed that a clear objective theory of value was a prerequisite to having a clear appreciation of the prices of services and goods in the economy.

However, after the mid-nineteenth century, the understanding of economic value shifted towards one of ‘subjectivity;’ where the price which is paid by the consumer (who has subjective ‘preferences’) in the ‘market,’ determines the value of the goods or service, which are now regularly conceptualised as being ‘scarce’ (p7 Mazzucato, 2018).

Modern economics has, according to Mazzucato (p8, 2018), all but left the study of value behind (in all its forms). What resides, such as theories of ‘share-holder value,’ ‘adding value,’ and ‘value chains’ (Porter, 1998) are often found in greater presence in modern business schools, than in the study of economics.

The business strategist, academic, and writer Michael E. Porter defines value as the following:

“In competitive terms, value is the amount buyers are willing to pay for what a firm provides them. Value is measured by total revenue, a reflection of the price a firm’s product commands and the units it can sell. A firm is profitable if the value it commands exceeds the costs involved in creating the product.” Porter (1998) p38

1 Oxford Dictionary
2 “Economics is the study of how societies use scarce resources to produce valuable goods and services and distribute them among different individuals.” (p4 Samuelson et al, 2010)
Arguably, one of the most famous studies and visual models of a ‘business view’ of value, was developed by Michael E. Porter, which he explains in his book ‘Competitive Advantage.’

Porter (1998) describes a model, that has two main levels of abstraction, the ‘macro view,’ is called ‘The Value System’ (Figure 2); and the ‘micro view,’ which Porter (1998) calls ‘The Generic Value Chain’ (Figure 3). Porter (1998) states that, it is here, at the level of the ‘Generic Value Chain,’ that the most effective form of analysis can be made:

“The relevant level for constructing a value chain is a firm’s activities in a particular industry (the business unit). An industry- or sector-wide value chain is too broad, because it may obscure important sources of competitive advantage.” Porter (1998) p36

Therefore, Porter (1998) therefore, that it is within ‘The Generic Value Chain,’ a form of minimal unit or cell, where internal production processes can be disaggregated (isolated and separated) into a sequence of discrete tasks (divis- sional ‘silos’ of labour and or mechanical processes), where they can then be analysed for improvements (relative to competitiveness). Porter does not suggest that these distinct internal ‘building blocks’ are in-
dependent of one-another; acknowledging instead, that they are interdependent activities - with specific forms of ‘linkages’ and ‘interrelationships’, shown in Figure 4 and 5.

**Figure 4: Illustrative Interrelationships Between Value Chains in Paper Products. By Porter (1998)**

**Figure 5: Tangible Interrelationships in a Diversified Firm. By Porter (1998)**

**Need for more Systemic Models**

Due to planetary wide issues such as climate change, and the destruction and pollution of eco-systems, for example; there is an amplified imperative for production firms (i.e., industry, agriculture, forestry and fisheries) to evolve how they do business.

And so, the reductionist emphasis on the Business Unit by Porter (1998), with its linear, disaggregated representation (at least in the visual models), combined with a predominant focus on competition and subjective value, without any explicit or implicit inclusion of moral values, may not be so relevant (or at least, sufficient) for this transition. And so, this is arguably the reason why there has been a plethora of systemic/holistic models over the

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3 The 17 UN Sustainability Development Goals (SDGs): (accessed 18th October 2018) URL: https://www.un.org/sustainabledevelopment/sustainable-development-goals

4 The IPCC (Intergovernmental Panel on Climate Change) Reports: (accessed 18th October 2018) URL https://www.ipcc.ch
Possibly the most internationally recognised model in this ‘systemic’ field to date, is the ‘circular economy system diagram,’ (Figure 6) developed by the Ellen MacArthur Foundation. The model builds on a central linear value chain a more expansive system of material feedback flows.

Prior to the CE diagram, there has been other ‘circular’ models, such as the ‘Cradle to Cradle’ model by Walter Stahel (Figure 7), or the ‘Comet Circle TM,’ developed by Ricoh, Ltd (Figure 8).

Figure 6: The Circular Economy (CE) system diagram by the Ellen MacArthur Foundation

Figure 7: Cradle-to-Cradle Model by Walter Stahel

Figure 8: Concept of a Sustainable Society: The Comet circle TM Copyright © 1999-2011 Ricoh Co., Ltd All Rights Reserved
Also, there are input-output diagrams, promoted by the ZERI\(^8\) (and others, including the Systemic Approach Foundation\(^9\) for instance (Figure 9). ‘Input-output’ can also be used as a tool for designing new material flows through integrated production systems.

These models mentioned thus far, focus on material flows and transformations, however, there are also models within this theme that are based around embedded capitals/systems (which often also include material flows).

For example, ‘The Five Capitals’ (Figure 10\(^10\)), the ‘Vision - Pursuing the Ideal Society (Three Ps Balance TM)’, shown in Figure 11\(^11\), and the ‘Embedded Economy’ diagram (Figure 12\(^12\)). There has also been a model developed by Alexandre Lemille, within his ‘Circular Humansphere’\(^13\) (Figure 14), that also integrates some social priorities within the ‘circular economy system diagram.’ And Kate Raworth has also developed another model, known as ‘The Doughnut,’ (Figure 13) which brings fundamental human needs and planetary boundaries together into one vision\(^14\).

The overall purpose of many of these visual models, is to illustrate some of the key elements (and the relationships) and, sometimes, the potential strategies which are available. These models can also describe different visions of the economy’s place and role in our societies, and their relative (perceived) importance.

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8 ZERI (Zero Emissions Research & Initiatives); URL (accessed on the 18th October 2018); accessed on the 18th of October 2018; URL: https://en.wikipedia.org/wiki/Zero_waste_agriculture;

9 The Systemic Approach Foundation (Accessed 18th October 2018); URL: http://www.systemicfoundation.org


2 The Developed Regenerative Value Systems Model

2.1 Resources Renewal - All land and ocean regenerative practices used when producing resources (e.g. bio-chemicals, fibres, and foods). Practices that also build healthy soil, ocean ecosystems, or regenerate local water and mineral cycles, bio-diversity and resilience for instance.

2.2 Systems Renewal - All regenerative practices that are used to develop natural, cultural, and economic systems within a region. Large scale land regeneration projects, social networks and festive activities, social financing and policy work for instance.

2.3 Resources Conservation - All product eco-design, production machines, and the structures in which production and transformation takes place. These structures are interdependent ‘Holon’s.’

2.4 Systems Conservation - This includes product-life-extension processes, product-service-systems, and the integration of related goods and services. These systems keep materials flowing for longer and reduce asset redundancy, whilst increasing overall efficiency of the system.

2.5 Resources Cascading - All systems that use residuals for further production activities, creating new income streams. This includes biological materials, gases or liquids, heat, or minerals for instance.

2.6 Systems Cascading - The outputs of one firm becoming the inputs of others – across industries and across firms. This includes biological materials, gases or liquids, heat, or minerals for instance.

2.7 Holistic Principles - This is the central node, the place where the context can be understood, shared, and transmitted. Where decision making can be viewed from, when actors are in the other nodes.

**Figure 10**: The five capitals by Forum for the Future

**Figure 11**: Vision - Pursuing the Ideal Society (Three Ps Balance™). Image 5 of 5 © 2002 Ricoh

**Figure 12**: Embedded Economy diagram by Kate Raworth

**Figure 13**: The Doughnut of social and planetary boundaries (2017) by Kate Raworth

**Figure 14**: The Circular Humansphere by Alexandre Lemille
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Place—what it means to be somewhere, or to be from somewhere, and how we then construct this as an idea and in built form—is a common thread running through the many systemic crises of our time. It is both a value under threat from globalisation, networked technologies, gentrification, and ecological and humanitarian disasters, and at the same time a contributing factor to political and social tensions that are intertwined with these issues, becoming visible in the reinforcement of borders and in current tendencies towards ever more specific units of political identity and nationhood.

As an emerging theme in recent RSD conferences and related publications (e.g. Ellefsen, 2017; Ruttonsha, 2016, 2018), place is an issue where systemic design and architectural theory can fruitfully contribute to each other. This is, however, not as straightforward as it might appear.

One of the most influential works on place within architectural theory is Christian Norberg-Schulz’s (1980) Genius Loci. In this and related works, Norberg-Schulz turned towards phenomenology and in particular Heidegger’s later philosophy. This enabled him to move from the abstraction that is characteristic of his earlier writing to understanding architecture in more concrete and qualitative terms. Phenomenological approaches such as that taken by Norberg-Schulz have been in retreat in architectural theory in recent decades. This has followed significant criticisms that are especially pertinent to contemporary discussions of place (e.g. Leach, 1998, 2005):

- the theoretical underpinnings of phenomenological approaches to architecture are entangled with the nativism that is currently resurgent in our politics;
- the regionalist approach that phenomenology has motivated has been co-opted by the global capitalism that it had sought to counter;
- the tendency of phenomenological accounts of architecture to downplay the spatial consequences of social and economic factors is not tenable from a contemporary standpoint. Thus, while the phenomenological approach to place that has been pursued in architectural theory may have much to contribute, it is bound up with some of the very issues that are in need of being addressed.

In this paper I explore an alternative theoretical basis for understanding place. Although Norberg-Schulz is perhaps best known for introducing Heidegger into architectural theory, he also makes use of a diverse range of other references. While this is especially the case in his earlier work, many of these sources are still prominent in his thinking even after his turn towards phenomenology. These include Jean Piaget, who I focus on here. Piaget’s ideas have, in parallel, been a significant influence on the development of the epistemological position known as radical constructivism (and the overlapping field of second-order cybernetics) through Ernst von Glasersfeld (1974) and Ranulph Glanville (2006/2014) amongst others. In this working paper, I reformulate Norberg-Schulz’s discussion of spatial experience in radically constructivist rather than phenomenological terms, building on the role that Piaget’s ideas have in his thinking and the connections that these ideas make possible.

This shift allows for a significantly different understanding of place, emphasising the personal and interactive qualities of spatial experience rather than the properties of spaces in themselves. This avoids some of the complications that arise with phenomenological approaches and may be used to initiate new connections to fields where constructivism has been influential, such as cybernetics, systems thinking, and design research. This, in turn, allows for some of the less tangible issues that are bound up with
contemporary conflicts over place—such as the design of technologies and services—to be understood in similar terms to place itself.

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Design, as a practice that operates within artificial systems, draws upon a multiplicity of knowledge domains situated within entangled technical, economic and social systems. As a result of operating within the high level of complexity of entangled systems, the object of design expands as it shifts from nodes in the system to lines and to meshes. According to Latour (2008), design has moved from being a superficial layer added to objects to be interwoven in the processes that constitute ‘things’, which are assemblages of human and non-human agents in a system. Design has grown in comprehension, so that it became so it became integral to the inner meaning of things and extended to include larger assemblages so that “cities, nations, cultures, bodies, genes and the nature itself” can all be designed. New capabilities that are enabled by radical technological changes allow not only deciphering the complexity of ‘living things’ across scales -from genes to the nature- but also designing them. This paper proposes that new models and frameworks, which draw on evolutionary models, can facilitate navigating emergent design spaces.

Biotechnology, deemed as the dominant technology of our century (Dyson, 2007) is the convergence of life, physical and engineering sciences. Biotechnology ecosystem is an example of an open innovation system that is comprised of heterogeneous networks that weave small, science-based biotechnology companies, investors, and nonprofit research organizations into a community which operates based on the principles of aggregation, self-organization, and soft-assembly (Powell and Owen-Smith, 2004). The convergence of separate knowledge domains not only increases the number of application areas but also changes how research is being conducted. Because of the blurring disciplinary and institutional boundaries, the distinction between pure and applied research is becoming obsolete while knowledge domains are reconfigured towards supporting added value applications through use-inspired basic research and vision-inspired basic research (Roco et al. 2013).

Figure 1: Biotechnology ecosystem
Design attributes affordances to a product for known and unknown use in order to create value. However, Akrich argues that the actual uses of technologies are much more complex than what is inscribed in technical objects as ‘a framework of action together with the actors and the space in which they are supposed to act’ (1992). According to Heskett, design is an interface between the context of production and the context of use in which the value is created (2017). In the context of production design establishes the connections between technological opportunity, social institutions and economic value. In the context of use, the design product is put into context by its users. Hence, utility and meaning are constructed, whose relationships are mediated by the product. The structures that constitute the context of production and the context of use are not fixed but highly adaptive and contingent as these contexts co-evolve. In the development of emerging technologies, these structures start adapting once the technologies are put in the context of use. For example, the inclusion of the wider group of users often propels the formation of new networks and in turn new application areas.

Since the potential application areas of emerging technologies are not always obvious, evolutionary models could give insights into how value could be created through design. Fitness landscape model enables visualizing the attributes that contribute to fitness and the distribution of fitness across the topography. Thus, the model can also inform how the agents will move across the landscape to increase fitness, in other words, to adapt. Evolution is a process of search over fitness landscapes in which the topography determines the likelihood of success (Kauffman, 1992) which is determined by the agent’s ability to adapt to the landscape and it is dependent on both the attributes of the agent and its interdependencies to other agents in the ecosystem. Fitness landscape model could give insights into understanding the development and evolution of emerging biotechnologies.

This paper proposes a model for value creation which builds on complex adaptive systems and fitness landscapes theories to navigate the unfamiliar design space. Drawing on Heskett, proposed three-dimensional fitness landscape (Fig. 2) is defined by “economic value”, “technological opportunity” and “social institutions”. In unfamiliar design spaces, such as those defined by changes in biotechnology, fitness cannot be achieved purely by hill-climbing. As Norman and Verganti (2013) state hill-climbing could be an effective strategy in finding local peaks, but there is the risk of becoming trapped in a valley or on a local peak. Radical changes in the landscape create higher peaks, however, it is difficult to locate the peaks in unfamiliar design spaces. Thus, to reach the highest peak a combination of hill-climbing and other ‘adaptive walks’ has to be employed.

Figure 2: Fitness landscape of context of production
The are several approaches to designing the adaptation. First Levinthal and Warglien (1999) propose that by "designing the surface on which adaptation processes take place", the quality of the adaptive process could be altered rather than directing the behaviors and actions of each individual. Because the major determinant of a fitness landscape is the density of interdependencies of interacting agents within a system, the primary landscape design activities would involve the manipulation of these interdependencies. Thus, the ecosystem would be influenced to change without having to manipulate individual agents.

A second approach would involve increasing the adaptation capacity of individual agents through design. Design could be employed as a generative process to increase the diversity of efforts in innovative search, which would help to generate more recombination possibilities of technologies for application and reconfiguring internal structures to adapt to environmental changes. In the case of biotechnology, successful adaptation will require a combination of both approaches since most of the innovation capacity relies on both distributed networks of production and the unique set of capabilities of the individual agent while the ecosystem in which innovative search takes place is influenced by social institutions and economic value.

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In the spirit of honoring Bateson’s metaphor of binocular vision (1979), this proposal brings together two design scenes for comparison in the mind of the reader as a way of generating new connections relating design and systems thinking as they played out (and are playing out at the time of this writing) in practice together with stakeholders and others in international and intercultural design contexts. The two comparative design scenes we explore are the Generation of Peace Project in the state of Ceará, Brazil, where more than 10,000 co-researchers sought to foster cultures of peace statewide, and the design of a Design Thinking course in the Honors College at the University of South Florida in Tampa, Florida. Connecting these two distinct scenes are not only shared practices rooted in design and systems thinking but also the World Café (Brown and Isaacs, 2005; Steier, Brown, & Mesquita da Silva, 2015), a group communication process facilitated in each scene that later also emerged as a conversational bridge connecting the scenes.

As a first scene for binocular vision, the setting is Brazil’s Generation of Peace Project, a cooperation between the State Department of Education of Ceará (SEDUC), Brazil, and United Nations Educational, Scientific, and Cultural Organization (UNESCO), aimed at building networks of a culture of peace between 700 high schools and their communities. The focus on peace in a broad sense, promoting inclusion and respect for diversity, directly and indirectly involved almost 500,000 youth and their families as well as over 16,000 teachers and school administrators, in creating and maintaining a culture of peace. The voices of most societal segments brought in conversation facilitated by the World Café across the whole process of inception and development of the project made it possible to reach more than 200 high schools in less than a year. On the fourth year, in 2014, the project certified 509 schools that presented evidence of building peace on a daily basis, accounting for almost 75% of the entire school system explicitly engaged in the movement. The syncretization of the concepts, tools, and methodologies of systems thinking and the vision, values, and philosophy of ecological thought, elegantly organized in Stephen Sterling’s (2003) thesis, gave rise to the conditions that allowed for the schools to contribute to the project’s evolution according to their local characteristics, sharing the same framework with the other schools while providing unique experiences. Hence, “Generation of Peace” is a result of a whole systems design approach (Mesquita da Silva, 2017).

As a second scene for binocular vision, the setting is in the United States, in the Honors College at the University of South Florida (USF) in Tampa, Florida, where college leadership sought to bring about change together with their students across a number of different dimensions of student life, ranging from the design of a new, dedicated Honors College building to the redesign of students’ curricular processes. To begin that work, students were invited as co-designers together with college leadership and faculty in bringing about change in the College and the larger campus environment through recursively designing their (our) Design Thinking course. These student co-designers were also invited to consider their observing frames (Steier and Jorgenson, 2003) in relation to their learning together with others, and have engaged so far in diverse design projects ranging from enhancing support of refugees moving to the Tampa Bay area to designing green spaces in USF’s Marshall Student Center, and they are regularly engaged in redesigning the course - ranging from reflection-in-action during group activities in a single class setting to inviting redesign of the course as a whole at the end of the term.
By looking at these two scenes in "double vision," a number of key principles and patterns emerged for us that both connect these local contexts and offer opportunities for further inquiry as more general design principles. Most notably, in this proposal we highlight the recursive connections among design and communication, including how communication emerged as a key focus of design along with the other "objects" of design (Thompson, Steier, & Ostrenko, 2014) in both scenes, and also highlight an emergent need across both scenes for focus on cultivating learning from a whole systems perspective.

In attending to communication as a designable aspect of the larger design efforts for both scenes, we extended Glanville's observation (2012) that design is a conversational process among designers by opening conversations through World Cafés and other group processes with stakeholders and designers together as a way of bridging multiple levels of communication - similar in spirit to Bateson's development of the "orders of learning" frame (1972) - affording focus on both communication process and content such that a new, “third language” might be cogenerated by designers and stakeholders together, leading to new opportunities for learning and shared understanding about local design contexts.

Building on this attention to communication process as a designable aspect for design teams and stakeholders together, we also brought forward the integration of action and inquiry from both second-order cybernetics and action research (Greenwood and Levin, 2007) as a frame of colearning- suggesting that the learners in a design scene include both the designers AND the stakeholders, as well as the larger whole of designers and stakeholders together, as they jointly work toward whole systems design. Through this mutual learning and languaging together, new frames and metaphors emerged cogeneratively with new perspectives on shared possibilities for action.

In bringing these systems and design thinking principles into practice through hundreds of meetings we co-facilitated across both of these scenes, ranging from hosting World Cafés for cultivation of peace in Brazil to facilitating students’ learning related to design research in a Design Thinking course, this proposal highlights the importance of transitioning design “meetings” from a frame that primarily foregrounds products over processes and roles over activities to a frame that affords a focus on relationships through joint attention to communication process and on mutual learning toward whole systems design.

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Systemic Design and Its Discontents: Designing for Emergence and Accountability

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Design; Emergence; Ethics; Governance; Influence; Innovation; Persuasion; Politics; Psychology; Responsibility; Systems.

“Any machine constructed for the purpose of making decisions, if it does not possess the power of learning, will be completely literal-minded. Woe to us if we let it decide our conduct, unless we have previously examined the laws of its action, and know fully that its conduct will be carried out on principles acceptable to us! (Wiener, 1950)”

In this paper we seek to advance the discourse and prospective impact of systemic design through challenges and opportunities centred in perspectives from psychology and ethics. We argue that systemic design is adolescent. It has a growing sense of its power and potential, yet it is prone to clumsiness and yawning lapses. To advance its role in fostering inclusion and flourishing, how might we lead systemic design to greater maturity, responsibility, self-awareness, in a word, to accountability?

We assess that systemic design is on track to fulfill its potential as a holistic practice and discourse, akin to an advanced form of service design. Yet for this to happen the community must undertake more careful processes of development. Systemic design needs to balance its ambition and confidence with humility and ethical commitment. Toward this end we propose that systemic design covet skills, insights and awareness from its ‘aunts and uncles’. We indicate that greater use of psychology is needed to inform descriptive work, and more ethics is needed to uphold normative purposes.

We advocate developing systemic design theory and practice through the further introduction of concepts from social and group psychology, as well as ethical governance. This groundwork is timely and needs-based, as it sheds light on potentially manipulative techniques at the intersection of choice, persuasion, influence, politics, and other nonlinear, societal forces. Our proactive goal is to better equip systemic design to address complex problems at the level of UN Sustainable Development Goals (SDGs), including equity, diversity and inclusion. We examine developments at the intersection of democracy, social media and automation that are highly unsettling, including the use of Facebook users’ data by Cambridge Analytica in the context of the Brexit campaign and the 2016 US election. In this light we articulate an urgent and remedial call for the systemic design community to develop and uphold a code of professional ethics and conduct, not unlike those adopted by engineers, doctors, management consultants and planners.

Pathways

We ask, has psychology successfully lent its wisdom to other disciplines? Indeed, behavioural economics is one pathway that has found significant value and traction. This project, which synthesizes demonstrably irrational human motivations and biases into the brittle, positivist models of classical economics, has begat a more resilient and mature hybrid. We take encouragement from experiment and exploration in arenas that hold strong interest for systemic design: policy, governance, community development, economic cooperation, innovation.

To better understand inherent systemic design’s risks, and establish historical and critical context, we ground this study with reference to early twentieth century work, including Norbert Wiener, considered “father of cybernetics,” and Freud’s American nephew, Edward L. Bernays, portrayed as “father of public relations.” More than any single figure Bernays understood and anticipated spaces and practices of persuasion including marketing, public relations, and consumer psychology. In the early twentieth century
Bernays pioneered forms of ‘advertising without advertising’, that is to say product placement.

His works provide considerable architecture for modern mass culture. From their titles alone we may glimpse both the power and pitfalls of industrial, design-fueled techniques of persuasion: Propaganda, 1928; Public relations, 1952; The Engineering of Consent, 1955. Our brief critical review reveals that Bernays ideas are unsettling in their relevance to contemporary concerns and its frank assertion that democracy requires guidance and constraint by a shadowy elite. Bernays’s work has never been well known to the public. This is all the more surprising considering his long and influential shadow. We argue that his work is critical to understanding the use and misuse of persuasion for social purposes. Bernays describes ‘engineering consent’ as follows:

“Use of an engineering approach—that is, action based only on thorough knowledge of the situation and on the application of scientific principles and tried practices to the task of getting people to support ideas and programs. (Bernays, 1955)”

Purposes

We lay out tactical scaffolding for the psychological maturation of systemic design through a discussion of projects led by the authors. Here the values, design principles and choices demonstrate alternatives to the twentieth-century manipulation model and to other inherited, status quo approaches. Skelton outlines the open software platform Betaville, a massively participatory, editable, urban mirror world project elaborated by an international network of partners and collaborators. Van Alstyne presents Strategic Innovation Lab, a large, decade-old Toronto-based social lab dedicated to envisioning possible and preferable futures through participatory foresight. Our strategic goal is to better prepare the systemic design community for two purposes. We want to address complex problems at the level of UN SDGs, including reduction of poverty, hunger, inequality, consumption, and GHG emissions, while boosting wellbeing, sanitation, social justice, innovation, and strong institutions. More troublingly we want to stem and mitigate consequences arising from broad design and deployment of automated and augmented systems in which emergent dynamics lead to unsettling social and political effects.

This work extends and deepens the theoretical framework “Designing for Emergence” (Van Alstyne & Logan, 2007), presented in RSD5 Toronto (Van Alstyne & Logan, 2016). Understanding innovation and knowing how we might give rise to desirable, emergent processes within systems requires us to understand emergence -- bottom-up forces of morphogenesis. As one exchange at RSD6 pointed out: We don’t design systems, we design pathways through systems. In summary, the purpose and process we are advocating for the systemic design community is to advance our maturity and thereby our positive impact for the many, not the few. In other words, we want to learn to act more responsively and responsibly, to do both risk-taking and risk-management. Is this enterprise deeply intertwined with psychology and ethics? Clearly. Does this describe the primary opportunity and challenge facing Systemic Design as a community? We think it does.

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**Socionas: Bringing the systemic view into the design for health and sustainability**

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**KEYWORDS**
Co-design; Co-creation sessions; Personas, socionas; Systemic design; Systemic phenomenological Approach; Design for healthcare.

**Introduction**

One of the key ingredients of a designerly approach is to stay connected to the real life, human perspective, even if the design process calls for high levels of abstraction and modelling. Designers design well with pictures/stories of real people in their heads, rather than with statistics (Sleeswijk Visser et al., 2005). Persona’s (e.g. Cooper, 1999; Pruitt & Adlin, 2006) have become a commonly used method across the fields of design: using rich narratives of constructed people, based on real user data as a compass in the design process.

Even though this is a valuable approach, the human-centeredness can also be a pitfall in designing within complex situations, as the focus on the individual experience of people can lead to underconceptualizing the problem and, in-turn sub-optimal ‘quick-fix’ solutions (Jones, 2013).

Within design for health, a lot of attention has been given to behaviour change, and behavioural design (e.g. Fogg, 2009, Lockton, 2010, Cialdini, 2015, Hermens et al., 2016), which focus on the individual (oftentimes the patient). Dynamics within the care network around the patient are referred to as social context. However, these dynamics between people strongly influence behaviours of people within healthcare, and designerly interventions directed to break these patterns could be much more effective than bombarding individuals with persuasive interventions.

Besides an awareness of processes and dynamics involved in a healthcare, and awareness of the larger system at hand, we noticed that both designers and healthcare workers could benefit from a sensitivity towards systemic patterns and dynamics in the small, to enable them to sense, interpret and act based on this. This led to the following research question: In what ways can designers get insight in the hidden dynamics in care systems and how can they maintain and include these insights throughout the co-design process?

**Socionas**

In this paper we present socionas as a tool to aid designers to incorporate the systemic view into the design process. Postma (2012) first coined the term socionas in her search for a method that allows for designing for person-person-product interaction, as she found that tools for user-product interaction did not attend sufficiently to the social consequences of interacting with products. Her approach is based on Activity Theory (Engeström, 1987) and Stanislavsky’s System (1961) as anchoring theories in order to develop a method for designers to empathize with their users and the social context in which they operate.

We adopt the term socionas, but use them in a slightly different way, referring to a way to capture variations in prototypical dynamics in social systems (such as care networks) and enable designers to work with the systemic level, while not losing sight of the individual. Basically, a sociona consists of a visual description of the dynamics in a system of people/functions (a family, a care network around a patient on a micro level and stakeholder setups on a macro level), anchored by brief personas as actors in the dynamic (see fig. 1, bottom right for an example).

In identifying the dominant patterns, we adapt a systemic phenomenological approach (Hellinger et al, 1998; Stam, 2012), using constellations to identify and manifest hidden dynamics. For more information on constellations...
Figure 1: From research to personas, to sketching and playing out socionas in a cocreation session by healthcare professionals, to visualizing the interaction of the socionas and make them usable for the design process.

and its use in systemic design see our contribution to RDS6 (Van der Lugt, 2017).

Case example in healthcare: active after stroke

We applied socionas as a guiding principle in a project on stimulating stroke patients to stay active after suffering a stroke.

Research indicated that self-reporting of amounts of movement does not provide enough and accurate feedback. A very sensitive motion sensor can give this feedback to both patient and therapist. Technically pretty straightforward, but in what ways could this product-service system be designed in such a way that it will stimulate movement over a long period of time (3-6 months)? A team of healthcare (stroke) researchers, physical therapists, engineers, behavioural scientists and product- and interaction designers engaged in a co-design project in order to develop the product-service system (see fig. 2).

Figure 2: The ACTS product-service system, consisting of a charging station, a feedback screen for both patient and therapist, and, developed based on insights in the project, a generative toolkit to be used for physical therapists, their patients and caregivers, in order to identify values and insights in the week of the patient.

Because the dynamics between patient, physio therapist and primary care giver(s) appeared to dominate the recovery trajectory, we developed first a variety of personas of these three roles and then combined these into recurrent pattern dynamics. This led to a series of 5 socionas that were used throughout the design process.
A case example in sustainability: creative producers

A second case in which we used socionas concerns energy transition: The Creative Producers project.

In order to obtain information about the ambitions of residents regarding energy transition and their knowledge, needs and willingness to invest in their home it is important to know them and their social networks. By mapping this for a number of representative networks in the neighborhood, you gain more insight into the situation and you can determine strategies to start energy transition at a micro level.

At a macro level it is even a challenge to start a project in a municipality. Determine the necessary stakeholders whom all in their own expertise may or may not be involved, while struggling to manage interest, needs and everyone’s role in the project. The sociona can also be used in these situations to map the network system of representative stakeholders. Again, a person is not exchangeable; due to someone’s role, interests or character, other relationships and interactions may arise that may or may not benefit the project. A few citations from a participant can clarify this:

“It has to do with personalities. A person from a residents’ collective was very open and who welcomed us immediately. This influenced the success of the project”.

“There was a very involved alderman who could talk to the residents in a human way and was very confident at the same time”.

“At Alliander a person had lost the urgency and drive within the project, this caused difficulties. Only when a new person was put on the job, is resolved.”

In the Creative Producers project we used the socionas tool in a session with social designers who were responsible for the human side of energy transition. The designers were able to visualize dynamics with simple persona cards (see figure 3).

Fig 3: Socionas as a tool for designers in combination with the theory of the behavioral lenses.

STAKEHOLDER-SYSTEEM en/of SOCIONA’S
Interesting was that each designer used it differently (see figure 4). One more at micro level, the other more at macro level. Both immediately led to insights of system dynamics and generated inspiration for intervention strategies.

Visualize dynamics

To support the designers in focusing on the dynamics rather than the individual it can be helpful to visualize the socionas. On the basis of the example below it becomes clear how dynamics in a sociona can be made visual.

"Patient Alex (78 years old) had suffered from a stroke a few years ago. He has been very confused since then. He regularly visits the physiotherapist (Charlie, 38) who gives him all sorts of instructions that he needs to be more active. His wife Eva (71 years old) is a caregiver, Alex likes that. Eva is very protective; at home she takes on all the tasks. “You just sit down, I’ll make you a cup of tea”. When Alex comes back, therapist Charlie can see immediately, Alex didn’t do well at home. “Yes, of course you did not do all those exercises, I can see that right away.” Charlie tries to push Alex, but also tries to help by informing him simple tasks that make him more active, such as taking the mail out of the mailbox, climbing stairs or do some grocery shopping. Alex nods in agreement. At home, however, a completely different situation arises. Eva takes over all tasks right away. When Alex starts about what the physio said, Eva says: “But that does not work at all, what if you fall ... I will not be able to catch you.” Alex does not even start talking about it anymore, it is not worth the hassle. Besides that, he also likes to be cared for.”

Figure 5 shows the current group more or less “static” dynamics. Working towards a more dynamic attitude or introducing a fourth actor (the latter can be a person, but also an intervention), as can be seen in figure 6.

Discussion of the results

Constructing the socionas together in the ACTS case functioned as a boun-
dary event (Stompff, 2012) in which collective sensemaking lead to socionas, which then functioned as boundary objects throughout the design and development process. Both designers and healthcare professionals were able to keep referring to these dynamics as a reference point whilst designing and developing prototypes.

The approach fit both the task at hand and the way both designers and healthcare workers approached the challenge. Play-acting enabled them to share their experience, to empathize and ideate. The socionas connected these experiences with literature research and stories of patients. Within the co-design process, being aware of the dynamics between patient, therapist and caregiver and making this tangible was a very helpful tool for the development of the intervention.

In the Creative Producers project, there was limited time, the tool was only used with the designers themselves. Involving the persons in question in the development could be very valuable. However, at these complex situations, a large number of personas leads to a vast number of socionas, which becomes too complex to grasp. Also, in the level of socionas it is important to stay aware of the prototypical nature, being fully aware that you will not be able to represent all dynamics. How to describe the most striking or persistent ones? A final question is how to keep the socionas even more ‘alive’ and work with them structurally throughout the design process. How to sense variations in system dynamics and how to allow socionas more ‘stage presence’ in the co-design process.

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Integration of methodologies through an academic toolkit for the design of products services systems for sustainability –SPSS- in colombian contexts

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The design for sustainability in colombia

Colombia, one of the countries in the world with the greatest wealth in natural resources (Arbeláez-Cortés, 2013; Sánchez, 2002), it has presented an unprecedented deterioration in the last two decades of multiple factors, of which, for the purposes of this research project will expose the lack of strategies to train professionals that respond to complex socio-environmental problems. (Márquez, 2001; Posada, 2007; Sánchez, 2002).

To attack this problem, Colombia has implemented the National Policy of Environmental Education (PNEA) and “Bases for a quality policy of higher education in Colombia”, both strategies are committed to environmental research from different disciplines and their close relationship with the training processes, seeking in this way that the proposals respond to problems of the real context. (Molano Niño & Herrera Romero, 2011).

Regarding the program of industrial design, its history at the national level begins with courses taught in 1966 and formalized between 1973 and 1977 (Camacho-lotero, 2014; Fernández, 2008), subsequently and hand in hand with the trend of environmentalization of the disciplines (Andrade Vicente, Frazão, & Moreira da Silva, 2012; Ceschin & Gaziulusoy, 2016; Fuad-Luke, 2009; Luffiego García, 2000). Design of the SiNaDi is a national program created, seeking to “generate the necessary conditions to advance towards an inclusive and sustainable society culturally, environmentally and economically” (Torres, 2015,p.45). This new vision of the program has demanded changes of pedagogical paradigms (De Miguel, 2005) and consequently academic courses of eco-design began to appear in the different curriculum of the design programs supported in the experiences of the exterior (Tukker, Haag, & Eder, 2000), in all cases, there have been valuable contributions but lacking an articulation with the national reality”. For this reason, the research question is posed: IS IT POSSIBLE TO DEVELOP A TOOLKIT THAT SUPPORTS TRAINING PROCESSES IN DESIGN FOR SUSTAINABILITY, RECOGNIZING THE PARTICULARITIES OF THE COLOMBIAN CONTEXT? Based on this premise, the process discussed below is addressed.

About the dsxc toolkit

According to Geli de Ciurana (2005) “The environmentalization of curriculum university should consider” complex thinking, flexibilization, and curricular permeability, contextualization (time and space), constructivism, consideration of cognitive, affective and action aspects of people, integration of theory and practice, critical and projective thinking, didactic development and better spaces for participation”. Starting from this premise, the DSxC is designed as a toolkit that supports academic processes of the sustainable design by grouping, organizing and presenting 10 different methodological frameworks, under the premise that the participants build their own process.

Therefore, to group and organize the methodological frameworks, a review of 10 of the methodologies is carried out (Shedroff, 2009) around Design for Sustainability considering first of all those that address the problems in a systemic way (Aguayo, Estela, Lama, & Soltero, 2011; Bovea & Pérez-Belis, 2012; Ceschin & Gaziulusoy, 2016; Crul, Diehl, & Delft University of Technology, 2007a; de Pauw, 2015; Jones, 2014; Navarro, Rizo, Ceca, & Ruiz, 2005; Pigosso, McAloone, & Rozenfeld, 2015): PRODUCT SYSTEM SERVICE DESIGN FOR SUSTAINABILITY -SPSSDE-, SYSTEM DESIGN, BIOMIMICRY, CRADLE -TO-
Regarding the Colombian context, the COLOMBIAN ATLAS FOR SUSTAINABILITY is developed in which is presented all the collected information -government platforms, studies, statistics, reports, big data- that allow a first approach to understanding the context according to the tool and the methodologies exposed.

On the second hand, to present the DSxC toolkit, researching and analysis of similar tools has been carried out (Crul, Diehl, & Delft University of Technology, 2007b, Guild, 2011, IDEO.org, 2008, Starkey, 2016, Vezzoli et al., 2014) in the search for the best possibilities for the presentation of information to the university academic community; This analysis shows the need to propose a physical document that presents the generalities of the process supported in a virtual platform that delves into detail the information of interest.

About the methodological frameworks and their contributions

After reviewing the methodologies, the following assessments are briefly concluded: THE SYSTEMIC DESIGN (Luigi & Bistagnino, 2009) provides principles and strategies to understand complex situations with a strong focus from visual communication; the SSPSDE (Vezzoli et al., 2014) is a rigorous and systemic exercise that presents a large number of strategies focused on the design of products associated with services; the CRADLE TO CRADLE -C2C- (McDonough & Braungart, 2002) implements a vision from closed production cycles and corporate responsibility; BIOMIMICRY (Benyus, 2002) provides a conceptual framework based on natural principles; HUMAN CENTERED DESIGN -HCD- (IDEO.org, 2008) Its main focus is the collaborative work, specifically in the methods to identify and characterize the actors as well as how to relate and make them participants in the project; DFX -DESIGN FOR EXCELLENCE- (Watson, Radcliffe, & Dale, 1996) is a compendium of functional strategies designed for the different phases of the life cycle of the product that can be used during the conceptualization and verification stage; LIFE CYCLE ASSESSMENT (Orrego, 2012) it is a widely used methodology with multiple approaches whose main objective is the analysis of negative impacts; CIRCULAR DESIGN (Moreno, De los Rios, Rowe, & Charnley, 2016) focuses on the development of proposals under the criteria of the circular economy; the BACKCASTING (Mendoza, Sharmina, Gallego-Schmid, Heyes, & Azapagic, 2017) allows us to plan a future scenario based on desirable variables including the prospective planning to achieve it, and finally the PERMACULTURE (Mollison et al., 1991) with its deep vision about sustainability provides an ideological course.

In total, 264 methods belonging to the 10 methodologies have been reviewed and categorized, of which 69 are concentrated in the research stage, 68 in the concept stage, 60 in the detail stage and 21 for the delivery stage, adding 46 design principles for the SSP approach. These are cataloged to facilitate the decision of the applicator in different criteria such as presence of online format, degree of complexity, degree of intervention, execution time, qualitative/quantitative approach and use according to CVP; it is also grouped into sub phases of the DSxC; in RESEARCH, it focuses on context, actors, problems/needs, case studies, and results; in CONCEPT, systems concept, systems design, SSP concept and results; in DETAIL, SSP design, evaluation, detail design and results; and finally in DELIVERY, planning, media strategy, iterations and results.

Dsxc, a kit “step by step”

In practice, the kit has 2 complementary versions: printed and online, the printed version is a quick guide and infographic with presentation of basic concepts about methodologies and their processes, list of methods, advice and warnings of use, and the online version which presents a detailed ex-
Participants in the process receive a step-by-step explanation on their first approach with the kit, then they begin to acquire the basic knowledge needed to develop a sustainable design process, once they obtain these pre-knowledge, they must choose the criteria for the development of the process - see Table 1-; then start the “process construction” selecting the methods according to the design phases. Throughout the process, the kit will accompany the participants by providing context data, advice, warnings, links, etc.

**Conclusions**

Education for sustainability from the academic processes typical of industrial design should be oriented to work on real processes -this criterion would imply a knowledge of the local realities in which it develops-, a limited time -defined by academic times-, a constructivist vision -allow the student to be part of the construction and supported in didactic processes that facilitate the implementation of scientific theory- this, together with the appropriation of the community in the territory, the university social responsibility and the capacity of the students in the generation of SPS that stimulate the sustainable growth of society.

Table 1: Classification of methodologies, methods and criteria. DSxC.

Table 2: DSxC. Information architecture.
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One major issue attached to the transition towards a sustainable society is that of improving social equity and cohesion in low and middle-income contexts, for an environmentally sustainable re-globalisation process characterised by a democratisation of access to resources, goods and services (Assembly, UN General, 2014). Regarding such transition, Sustainable Product-Service System (S.PSS) has been studied since the end of the 90th (Mont, 2002; Goedkoop et al, 1999; Tischner, Rayan and Vezzoli, 2009; UNEP, 2002; Vezzoli et al, 2014) as one of the most promising offer/business models. S.PSS has been recently defined as: “an offer model providing an integrated mix of products and services that are together able to fulfil a particular customer demand (to deliver a “unit of satisfaction”), based on innovative interactions between the stakeholders of the value production system (satisfaction system), where the ownership of the product/s and/or its life cycle responsibilities remain by the provider/s, so that the economic interest of the providers continuously seeks environmentally and/or socioethically beneficial new solutions.” (Vezzoli, 2018)

Distributed Economies (DE) is another model studied since 2005 (Johansson, Kisch and Mirata, 2005; IIIEE, 2009) as an alternative economic structure to the dominant Centralised one promising for locally-based sustainability (Johansson, Kisch and Mirata, 2005); DE has been recently defined as “Small-scale production units, located by or nearby the end-users, whether individuals, entrepreneurs and/or organisations/institutions, i.e. the producers are the same end-users or nearby them. If the small-scale production units are connected with each other to share various forms of resources and/or goods (physical and knowledge-based ones), they become a Locally Distributed Economy Network, which may in turn be connected with nearby similar networks. If properly designed they are promising to promote locally-based sustainability, i.e. Sustainable Distributed Economies (S.DE).” (LeNSin Polimi team, 2018)

The paper discusses an innovative system approach to sustainability, i.e. the win-win potential of coupling S.PSS and DE for a sustainable society for all, which is the Research Hypothesis of the LeNSin (the international Learning Network of networks on Sustainability) project, funded by the EU Erasmus+ programme involving 36 universities from Italy, Finland, Netherlands, United Kingdom, China, India, Brazil, Mexico and South Africa. The Research Hypothesis runs as follow: (Polimi, 2015)

A S.PSS applied to DE is a promising approach to diffuse sustainability in low/middle-income (all) contexts, because it reduces/cuts both the initial (capital) cost of DE hardware purchasing (that may be unaffordable) and the running cost for maintenance, repair, upgrade, etc. of such a DE hardware (that may cause the interruption of use), while increasing local employment and related skills, as well as fostering for economic interest of the producer/provider to design low environmentally impacting DE products, i.e. resulting in a key leverage for a sustainable development process aiming at democratizing the access to resources, goods and services.

Shifting the concern of the design role, the following Research Hypothesis (Polimi, 2015) has been studied by envisioning a new system design role to design for S.PSS applied to DE.

Within the LeNSin project, different types of DE have been classified as (LeNSin Polimi team, 2018): Distributed energy Generation (DG), Distributed Manufacturing (DM), Distributed production of Food (DF), Distributed Water management (DW), Distributed production of Software (DS), Distributed...
Both Research Hypotheses have been explored and characterised within the LeNSin project with the following process: each of the 36 partner institutions carried out literature review on the topic, followed by a coordinated case study analysis; the results of those activities were shared between all partners in a meeting and through the project web platform. These activities were followed by 5 seminars held in Brazil, South Africa, Mexico, China and India, where the partners gathered academics, companies, NGOs, governmental institutions, etc. This led to a refinement and characterisation of the Research Hypotheses. All produced that far were the bases for the design and implementation of the first round of 5 pilot courses held in the non-European partner countries, where local and European teachers were involved in the teaching and evaluating boards. All of the learning resources (syllabus, videos of the lectures, slides, case studies, tools, etc.) have been shared with other partners right after the end of each course. A second round of pilot courses was then carried out with the same logic in different universities and with different guest EU teachers and observers. At the end, a total of 10 pilot courses were carried out, each of them evaluated by a questionnaire given to both students and professors. A method with a set of design tools for System Design for Sustainability for all (SD4SA) is now available.

The paper gives a particular attention to the description of a Sustainability Design-Orienting Scenario for S.PSS applied to DE, as introduced by the polarity diagram below.

Finally, the following new role of designer is presented (Polimi, 2015)

SD4SA:

“design of S.PSS applied to DE, i.e. the design of the Systems of Products and Services that are together able to fulfil a particular customer demand (deliver a “unit of satisfaction”), within the DE paradigm, based on the design of innovative interactions among locally-based stakeholders, where the ownership of the product/s and/or its life cycle responsibilities remain by the provider/s, so that economic interests of the provider/s continuously seek both environmentally and socio-ethically beneficial new solutions, i.e. solutions accessible to all”.

The paper contents are innovative as both the understanding (and the description) of the win-win potentials of S.PSS applied to DE, and the related system design approaches, skills and tools are new. Those outcomes resulted
from a process where their validity and characterisation have been carried out by a well-integrated groups of worldwide researchers. Finally, all the learning resources on the knowledge-base and know-how developed in the project are uploaded on the LeNS web platform, where they could be downloaded free of charge, with an open and copy-left ethos. The outcomes achieved are already innovative and relevant, but at the same time, it is clear that new research activities are needed to better identify the win-win characteristics of S.PSS applied to DE as well as the approaches and the skills for a new generation of designer adopting a system approach to effectively address the sustainability challenge.

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The early stage analysis of a systemic innovation lab

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KEYWORDS
Systemic design;
Systemic innovation Lab;
Complex;
Wicked problems.

PURPOSE
This paper documents the early stage development of a South Australian systemic innovation lab that is using Wicked Lab’s FEMLAS process as its lab methodology. Systemic innovation labs are a lab type that has been purposefully designed to address wicked problems. While systemic innovation labs and the FEMLAS process incorporate the core set of principles that have been proposed for systemic design, they differ from traditional systemic design in two ways: instead of taking a systems thinking approach they take a complex systems approach and instead of their design component being centred on solving problems it focuses on the development of initiatives that assist system transitions.

BACKGROUND
Systemic Innovation Labs

The complex wicked problems that the world faces need to be addressed through self-organising governance networks (Meuleman, 2011, p. 104). These networks require enabling conditions to be established in order to maintain the coordination required for emergent self-organisation, adaptive capability (McKelvey and Lichtenstein, 2007), systemic innovation (Davies et al., 2012) and transitions to new improved states (Goldstein et al., 2010, p. 104).

Systemic innovation labs are an ideal mechanism to strengthen self-organising governance networks. They are a hybrid lab model that incorporates and synthesises key features from other lab approaches that are recommended for addressing wicked problems: they focus on addressing complex problems, take a place-based transition approach, enable coherent action by diverse actors, involve users as co-creators, support a networked governance approach and recognise government as an enabler of change (Zivkovic, 2018).

A range of principles have been embedded into the systemic innovation lab model including the core set of principles that have been proposed for systemic design and principles from solution ecosystem and systemic innovation approaches (Zivkovic, 2018). The core principles proposed for systemic design are: idealization, appreciating complexity, purpose finding, boundary framing, feedback coordination, system ordering, generative emergence, continuous adaptation, self-organizing and requisite variety (Jones, 2014, p. 106). Solution ecosystems consist of all the initiatives in a geographical area that are addressing any of the interdependent causal factors that underpin a wicked problem (Eggers and Muoio, 2015) and systemic innovations are ‘a set of interconnected innovations, where each is dependent on the other, with innovation both in the parts of the system and in the ways that they interact’ (Davies et al., 2012, p. 4).

While systemic innovation labs incorporate the proposed principles for systemic design, they differ from traditional systemic design in that they take a complex systems instead of a systems thinking approach. Systems thinking and complex systems approaches are based on different intellectual traditions (Castellani, 2018) and have different ontologies (Snowden and Stanbridge, 2004). Systemic innovation labs also differ from traditional systemic design in that the focus of design is not on designing interventions to solve problems but rather on designing initiatives that have the required
characteristics to enable system transitions (Zivkovic, 2018).

Development of the Lab Methodology

The need for Wicked Lab to develop a lab methodology was identified during the evaluation of Wicked Lab's Complex Systems Leadership Program. Wicked Lab's program incorporates an online Tool for Systemic Change, and both the program and tool support systemic design that is informed by complex systems theory, and solution ecosystem and systemic innovation approaches. The evaluation highlighted that Wicked Lab's program and tool would have a greater impact if they were components of a systemic innovation lab methodology (Zivkovic, 2017).

Concepts and techniques from four complex systems leadership theories are embedded into Wicked Lab's program and tool. Complex systems leadership theories are leadership approaches that are based on complexity sciences (Hazy et al., 2007, p. 2). As a problem solving approach, they do not focus on finding the one way to solve a complex problem. Instead, their focus is on providing a framework within which stakeholders can learn, interact and adapt to maximise their effectiveness in solving complex problems (Geyer, 2003, p. 254).

The Complex Systems Leadership Program consists of three units of study which are undertaken online during a six-month period. Unit 1 focuses on participants understanding the characteristics of wicked problems and why a complex systems approach is required to address them. In Unit 2 participants gain an understanding of initiative characteristics that assist communities to strengthen their adaptive dynamics and undertake transitions, and in Unit 3 they gain an understanding of initiative characteristics that assist governments to support transition approaches.

During each of the program's units, participants use Wicked Lab's online Tool for Systemic Change to address a wicked problem of their choice in a geographical community of their choice. In Unit 1, participants define the boundary of their solution ecosystem: the geographical boundary and the wicked problem, and enter into the software all of the initiatives within that geographical boundary that are addressing any of the underpinning causal factors of their targeted wicked problem. In Unit 2, for each of the initiatives that were entered into the software in Unit 1, participants identify if the initiative has any of the initiative characteristics that assist communities to transition to a new state that has increased coherence and performance. During Unit 3 participants identify if any of the initiatives have initiative characteristics that strengthen the interface between community and government systems.

To progress the need for a lab methodology that was identified during the program's evaluation, Wicked Lab has developed the FEMLAS Lab Methodology which incorporates the capability building of its Complex Systems Leadership Program and the mapping, analysis and reporting functions of its online tool. FEMLAS is an acronym that stands for the six stages of the FEMLAS Systemic Innovation Lab methodology: Form, Explore, Map, Learn, Address and Share. At the Share stage of the process there is an iterative loop: after completing the Share stage, the four stages from Map to Share are repeated periodically.

Case Study

The South Australian Systemic Innovation Lab case study that is described in this paper focuses on climate adaptation and is a partnership between the Natural Resource Adelaide and Mount Lofty Ranges agency of the South Australian Department for Environment and Water and the City of Marion. Wicked Lab's FEMLAS process is being used as the lab's methodology.
**METHODOLOGY**

Schuurman’s (2015) three levels of lab analysis: macro, meso and micro are used to analyse the case study. The macro level is the lab’s core team which consists of a diverse range of stakeholders to ensure that the complexity and interconnectedness of the wicked problem is represented. The lab’s meso level consists of the solution ecosystem of initiatives and the organisations that are collaborating on these initiatives. At the micro level the focus is the specific lab methodology: Wicked Lab’s FEMLAS process. Semi-structured interviews are undertaken with key stakeholders involved in the lab’s establishment to undertake this analysis.

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