Chair:
Prof. Francesco Trabucco

DOCTORAL PROGRAM IN DESIGN

Field of study

Held at Politecnico di Milano university, the Doctorate in Design Research is created and managed by the Industrial Design, Arts, Communication and Fashion Department, INDACO, in cooperation with the Department of Mechanics and the Department of Chemistry, Materials and Chemical Engineering. Politecnico di Milano research doctorate courses aim to build the skills needed to perform highly qualified research jobs in manufacturing and service enterprises, the public sector, and the university.
The scientific field to which this course belongs is industrial design. Its interdisciplinary relationships include the philosophy and theory of language, art history, design, science of materials and technology, industrial engineering, decision making, and computer science.

Industrial design, following the meaning adopted within this doctorate, is intended as a discipline acting within the industrial culture and accompanying its transformations. Among its main tasks is to deal with processes and products configuration. In this sense, this school specific meaning goes to use, function, social and individual consumption of the products (the functional, symbolical and cultural factors) as to manufacturing (techno-economical, techno-systemically, techno-productive and techno-distributive factors). All these themes are expected to be faced with the support of the conceptual tools of research in its theoretical, critical, historical and methodological articulations.
The complex of the issues investing the theme of innovation will represent the conceptual trajectory of the whole program.
The attention to innovation-related phenomena are due to various factors, partly internal to the dynamics of the discipline of industrial design, partly motivated by the perception of the growing complexity of the innovative process, thus fostering in-depth analysis and new approaches which can legitimately be faced within the doctoral programme. Whatever the motivations for the analysis of technological change and innovation, this trajectory of enquiry highlights the factors and fundamental ingredients of the process of development, transition and transformation of industrial products, services and systems. As a starting point a broad view of innovation is assumed, being a dynamic process involving the development or improvement of new products, services, technologies, processes, institutions, systems, strategies. Such an extended view of innovation includes the range of economic and social activities - in areas such as communications, corporate strategies, market dynamics, education, public institutions - so relevant for design action as product design in its strict sense.

Professional qualifications

The Doctorate in Design aims to train a designer/researcher with malleable qualifications. For the professionals produced by this programme are both designers who know how to do research and researchers skilled in using design tools. At the same time they are experts in managing awareness, in constructive interaction among various players, and in the communication of ideas and concrete proposals.
This skill set finds application in a variety of work environments. It is particularly in demand in organizations explicitly devoted to developing design research, such as universities and research centres, design agencies, and companies that are attuned to social and technological innovation. It is also sought out by public-sector organizations, by service enterprises, and by local development organizations, which are increasingly faced with complex planning problems that the designer/researcher can effectively deal with, analyze, and find solutions for.

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THE USE OF HAPTIC DEVICES TO CONVEY DIRECTIONAL INFORMATION

Michele Antolini

The vast majority of the activities we perform during the day, while working or during our free time, is multimodal. This means that several senses are involved in such activity, usually with a different effort. Vision is usually a very important sense for humans, and for this reason it is often overloaded in respect to the other senses.
Information overload is a common issue in multimodal activities, and it has been investigated within several contexts, such as for the human-system interfaces in industrial and nuclear plants, for fighter jet pilot's cockpit or car drivers. Acoustic alarms are a common example of a way to remove part of workload from the sight, since the supervisor can be informed about the danger even if he/she is not continuously looking at the warning light. Vibrations are another example of non- visual signaling, commonly used to raise driver's attention if he/she is crossing a lane, approaching a speed bump or zebra crossing. Common mobile phones use vibrations to signal an incoming call, text, or email using the sense of touch instead of vision or hearing.
In this thesis, the use of haptic information to balance sensory workload has been examined. As case study, the wayfinding activity for pedestrian resulted to be a good scenario for experiments, since it can be considered as one of the most common multimodal activities performed by people. In fact, as discussed and documented in detail in this thesis, during pedestrian wayfinding, sight is the main sense involved, but hearing, touch and, to some extent, smell are extensively used during such activity as well.
In addition, it has been developed a novel haptic device, using a torque produced through the gyroscopic effect to inform the user about the direction to follow. The large majority of haptic devices able to guide the user to a destination are tactile (in general, vibro-tactile). Despite some kinesthetic haptic guidance device has been developed, the device, which is the result of this research work, is novel because it is the first one developed by using the gyroscopic effect to produce a torque able to guide the user. This technique permits the miniaturization of the device, thus allowing the integration with modern mobile phones and, in general, small-scale handheld devices.
A perceptual test and a navigation task have been performed during the research documented in this thesis.
The perceptual test has been performed to validate the effectiveness of the kinesthetic stimulation provided by the device. The navigation task had the aim to prove the effect of haptic, kinesthetic information on the distribution of mental workload, and in particular on the partial discharge of the vision. This second test has been performed using a small indoor maze (4.20x3.60 m) built in one of the labs available for our research group.
From the tests, it resulted that, despite the users provided with a visual map found the way out from the maze faster than the users guided by the haptic device (this also because of technical reasons), the latter performed better in the individuation of visual distractors, i.e. some visual signs which represented potential threats or however useful information.
At the time of writing, haptic information for wayfinding is a growing field of study, and several research groups are active on this topic. This research work covers part of this topic, making a step beyond in the knowledge of the impact of haptic information on the distribution of mental workload among the senses, during wayfinding activities. In addition, the working principle of the device designed and developed for the tests has been put through patenting process.
Of course, further developments are possible, from a broad investigation about mental workload in wayfinding involving more senses (such as hearing and smell) and different scenarios (escape from dangerous situations, or guidance underwater) to the design of a smaller, more effective and efficient device using the gyroscopic effect to convey directional information.

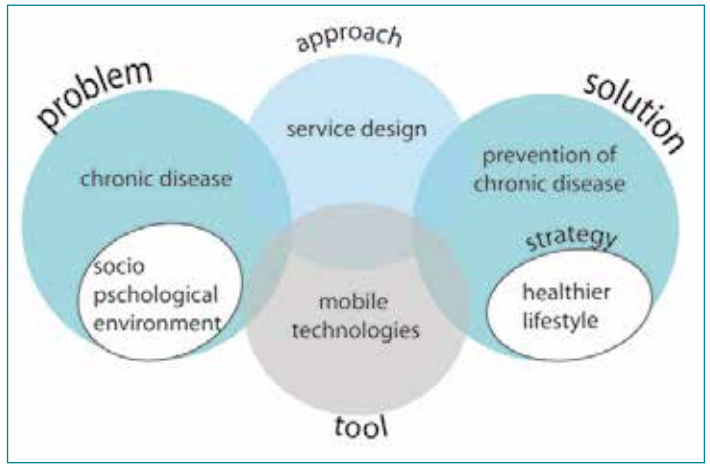
SERVICE DESIGN FOR SOCIAL INTERACTION
Applying mobile Technologies for a Healthier Lifestyle

Pelin Arslan

The PhD research explores the relations between service design, health and today's social media specifically through mobile technologies. Due to economic, social, and environmental changes, new forms of well-being emerge. On the other hand, mobile technologies offer new opportunities for a more user centered, socially connected, and economically sustainable healthcare system. With the improvement of social media technologies, designing services opens more opportunities to create future scenarios around healthcare. A major focus of research is understand and contribute the service design through effective use of mobile technologies to incite social interaction in promoting healthier lifestyles.

Healthcare is one of the most important issues in human beings life. There are various problems in today's healthcare regarding cost, accessibility to services, lack of healthcare providers and illness oriented approach of actual system. Since the complexity of the problem involves more stakeholders within the healthcare system to provide solutions from different perspectives, it becomes crucial to design participative services.

As it is described in the (Figure 1) chronic disease is a problem area and an alternative solution is the prevention of chronic disease. One of the strategy to prevent chronic disease is to sustain a healthy lifestyle. Service Design is an approach to propose solutions through tools like mobile technologies. Chronic diseases are long duration illnesses and generally slowing progression such as heart disease, stroke, cancer, diabetes, obesity etc. Health damaging behaviors - particularly tobacco use, lack of physical activity, and poor eating habits – together with environmental problems are major contributors to chronic diseases. However, these diseases are preventable and controllable by daily activities and changing "unhealthy lifestyle choices."



1. Interrelations between Problem Area, Solution Area, Tools and Strategies.

Prevention requires a long-term management of everyday behaviors towards healthier habits such as eating nutritious foods, becoming more physically active and avoiding tobacco consumption. These self-manageable activities could prevent chronic diseases and therefore also prevent some of the important problems of the healthcare system. Self-managing an activity requires awareness of what you are doing and the mindset of whether what you are doing is right. Being conscious of the situation, anticipates an active participation in the prevention. Sub-problem of coping with a chronic disease is that patients are not regarded as a relevant factor within the cure. The patient is a network of physical and psychological functions and interacts with physical, biological, social, and symbolic factors. As Helman [1995] and Manderson [2000] notice traditionally, clinicians focus on the physical and biological aspects. Social and symbolic environments in which patients live and the meanings that patients derive from illness experiences often are not taken into account by contemporary medicine.
Involving patient into the process could be a way to obtain socio-psychological data from a patient. As Goodare and Lockwood [1999] state "Only the patient knows about his or her experience of illness, social circumstances, habits and behavior, attitudes to risk, values and preferences." Obtaining this type of information from patients themselves rather then observing their actions could be another way to active participation of patient in their everyday health routines. Both clinical research and 'experiential knowledge' as defined by Caron et al. [2005] are needed to manage illness successfully."
The use of mobile technologies and social media, can help patients manage chronic disease conditions or changing their behavior in order to follow a healthier lifestyle in many ways as tracking and storing health data, sharing these data with friends and families, and consulting their health data with their healthcare providers.
The research is based on Frayling's "research through design" model [1993] and explores the practices and processes of design through the participation in three action projects. The purpose is (i) to explore how to design a service application in the context of healthcare taking advantage of mobile technologies, (ii) to understand the designer's role in designing service for a healthier lifestyle and (iii) to investigate the use of participatory and service design tools for the engagement of users in their long-term healthcare management.
The research begins with a summary of research background, motivations and methodology concerning how service design through mobile technologies for social interaction could provide an approach for healthier lifestyles. This section provides a guideline to the overall dissertation giving an introduction of research problem, explaining the objectives of the research and how these objectives will be achieved by selected methods.
The thesis book is composed of four parts. The book gives an introduction explaining the context, the problem area, the aim and the methodology used in the research. The first part, which includes three chapters, explores theoretical background including literature review, field research and case study collection strategies. The state of art gives an overview of previous work done in the field regarding key conceptual themes; 'design thinking towards service design', 'mobile technologies and participatory tools for social interaction in the context of healthcare', 'research strategies for designing health services'.
The second part structured in four chapters, in which three of them focuses on action projects regarding healthier life service scenarios. The third part concludes research results and analysis of the three practiced led projects. This chapter proposes a conceptual framework for designing services for healthier life, and designer's role in designing services providing also discussion of existing barriers to embracing participatory approach. It investigates together with the results, the effects of methods used as a data obtained. The conclusion part gives an closing outline if the research problem has been solved, to what extend objectives has been achieved, how this knowledge can be used in different areas of research.
This PhD research gives specific contribution to service design field and the role of service designer in healthcare is, (i) the creation of relation between actors through of their creativity and intuitive competences, (ii) the capacity of translating and transforming ideas, desires, and the need of actors in visual representation forms, and (iii) developing new tools to help users to develop behavior, and problem addressed; for experts to help them structure, synthesize and communicate user behavior.

EXPERIENCES FROM CONTEMPORARY ANIMATION FOR AUDIOVISUAL DESIGN

Practices, process, productions

Elisa Bertolotti (Industrial Design and Multimedia Communication)

Animation is almost everywhere in all contemporary audiovisual productions. Nevertheless craftsmen animators, who are working in a dedicated way, establishing an intimate relation with their instruments, making conscious technical and aesthetical choices, often work isolated. An important heritage from animators is therefore not given enough exposure: their high quality researches and inventions not only from the technical, methodological, process, but also narrative and linguistic point of view are known just by an élite of enthusiasts and professionals who attends specialized conferences and festivals. Design has always used the moving images for their communicative effectiveness, which is primarily expressed when harmonized with the narrative. Often images are used in design in an intrumental manner, in order to propose scenarios, stories of existing realities, to communicate and promote changes and identities, until, in some cases, they become the center of its theoretical and practical research. If design works with moving images and *animation is everywhere*, inevitably design meets animation. In this sense, the study of animation becomes then vital for design, especially in the very heart of craftsman practices which carry a rich technical and procedural toolbox that might otherwise be disregarded.

What audiovisual communication design can learn from these experiences? Is it possible to imagine criteria, ideas, methods for communication relevant for designers' practice when they have to construct (and then keep) an audiovisual project? This research explores animation from a communication design point of view. It focuses on the craftmen animators work, characterized by a long process of research and reflection. Its objective is to understand what audiovisual communication design can take from contemporary animated film production, seen as situated projects, in terms of methodology and workflow in order to relate it to the productive and distributive conditions of its own environment.

A limited number of animation projects currently in production have been taken into consuderation: *Via Curiel 8* by Mara Cerri and Magda Guidi, in Pesaro, Italy: a short film animation hand drawn and colored frame by frame, co-produced by *arte* France; *About Love* by MagicMindCorporation from Berceto, Italy: a TV series project made in stop motion with magnets; *Wandernd Haus voll Vogelwasser* by Veronika Samarsteva, a short in cutout multiplan produced by Hochschule für Film und Fernsehen (HFF) in Postdam, Germany; PFFUIT PFFUIT PFFUIT by Florent Lazare, produced by *Kawanimation*, Paris: a project for a TV series about ecology made mixing many animation techniques with live action; three animation projects by Ursula Ferrara for three documentaries (*L'amore e basta*, *Sulle strade di Nanda*, *La passione di Laura*). Afer 25 years on self founded animation projects between Lucca and Pisa (Tuscany, Italy), Ursula Ferrara is here working on commission.

The animators' daily work was observed closely, using ethnographic qualitative research techniques: qualitative interviews and participant observation. The work's process, the contribution of others and the time management of each project have been reconstructed to highlight relations between the technical and procedural choices and the production limits (time, resources, people involved). The research result is a reflection on contemporary visual practices through the stories of some animators' practice. These experiences are told to the designers' community, especially to audiovisual communication designers, as source of inspiration from both the aesthetic and the project point of view (design choices on techniques, on process, production and distribution).

IDEAS SHARING LAB
Community Centred Design for Multifunctional and Collaborative Food Services

Daria Cantù

In recent years Design has taken an active role in projects for 'place' development, where a 'place' is defined as the result of the interactions among the anthropic, environmental and built territorial components. From the service design perspective this means dealing with relations between people and local resources, and facilitating the creation of actor/ service networks within a defined territorial area.
The context where this doctoral research moves is the relation between cities and periurban countryside, where two main problematic areas emerge: firstly, growing urban sprawl overwhelms the surrounding agricultural land, which loses its function; secondly, small and medium farms in these urban green belts face major economic problems. However, in this framework many opportunities connected to social innovation are emerging. There are groups of people that have found new ways of obtaining fresh food locally, creating real services based on collaborative relations between city dwellers and small and medium organic farms. It emerges from literature that the enhancement of these connections is the main strategy to be pursued for a sustainable development of periurban areas. According to European directives, supporting actions should strengthen the role of farmers by promoting agricultural multifunctionality, meaning the ability of a farm to offer a multiplicity of services while keeping food production as the main activity. Strategic and service design work in this context by activating small, locally based projects, in order to support the existing best practices, to activate resources not yet valorized and to create new services. In order to understand the practicality of carrying on such supportive intervention, this doctoral research adopted case studies and participatory action research with a "learning by doing" approach. Moving from the collection and analysis of existing cases of social innovation, the thesis furthers knowledge of de- mediated food services, highlighting their offering and connections between the actors involved, and the relations and experiences characterizing such solutions. From this preliminary analysis it then defines a new typology of services, called 'multifunctional services'. Due to their relational nature, these enhance connections and collaborations in the territory, pushing its development. These mid-way results reshaped the initial research question into: how can we take advantage of already existing multifunctional systems to design a local food service network?

Starting from the hypothesis of working with local communities from the beginning of the process to achieve sustainable service solutions, multifunctional farmers' markets were detected as suitable places to start a testing phase aimed at co-designing new service ideas with the communities of producers and consumers. This approach, defined as Community Centred Design (CCD), adopts the methods and tools of User-Centred Design (UCD), scaling them up to community size. It calls for work within the local context, right from the beginning including people in the design process who will be directly affected by the future services. The action-research was carried out for more than one year, in the Earth Market in Milan, in the framework of the Feeding Milan. Energies for change project, and in the Greenmarket in Union Square in New York City. It led to the outlining of a new format for service design intervention for sustainable territorial development, redefining the role of designers in such contexts. They become facilitators and triggers of participatory projects involving localcommunities, developing step-by-step tools to support strategic conversations with the actors involved, and acquiring new knowledge and competencies on field. The result of this research is the definition of a format for design intervention in projects for 'place' development: the "Ideas Sharing LAB". This is a temporary Living Lab, set up in the market place, which functions as an engine to activate new services and synergies in the process going from the scenario building to the service implementation. The main contributions of the research are:

- specific knowledge of de-mediated and multifunctional services
- the framework and opportunities for CCD
- an analysis of the peculiar features of CCD
- design tools and strategies when applying its skills and competences in this context.

THE INTRODUCTION AND SCALING UP OF SUSTAINABLE PRODUCT-SERVICE SYSTEMS

A new role for strategic design for sustainability

Fabrizio Ceschin

It is now commonly accepted that the dominant socio-economic development models in industrialised contexts are unsustainable. A concept that theoretically and practically represents a promising model to steer our production and consumption systems towards sustainability is the **Product-Service System (PSS)** one. A PSS is a specific type of value proposition that shifts the business focus from selling products to offering a combination of products and services jointly capable to achieve final user satisfaction. If properly conceived, it can offer an economic and competitive incentive for stakeholders involved to continuously foster improvements in resource productivity. Thus it represents a promising economic model to decouple economic value from material and energy consumption. A wide number of research projects in the field of PSS and sustainability have been recently supported by EU funding, and several design methods and tools have been developed in the last years to orient and support the development of sustainable PSS. However it has to be underlined that the application of this concept is still very limited. The reason is that sustainable PSSs can be considered, in most of the cases, **radical innovations**, because they challenge existing customer habits, organisational structures and regulative frameworks. Therefore the challenge is not only to conceive sustainable PSS concepts (several methods and tools can in fact be used to support this task), but also to understand which strategies and development pathways are the most appropriate to favour their introduction and scaling up. There is in fact *a knowledge gap regarding the dynamics, mechanism and factors driving the implementation and diffusion of this kind of innovations* and, consequently, there is a lack of strategies, approaches and tools to enable *strategic designers, project managers* and *management consultants* in designing, managing and orienting this process. This study focused on this unexplored research area. In particular the following **research questions** were formulated:

RQ1] How do sustainable Product-Service System innovations take place?

- a. What are the dynamics and factors that facilitate and hinder the process of introduction and scaling-up?
- b. Is it possible to manage and orient this process? And if yes, how?

RQ2] Can strategic design have a role in supporting and orienting this process?

- a. If yes, what kind of knowledge base and capabilities are needed by a strategic designer?
- b. From an operational point of view, what is the design approach, methods and tools that can be used in practice?

In order to answer above mentioned research questions, a three-stage **design-based research approach** was applied:

- A *preliminary research stage (I stage)*, aimed at exploring and describing how sustainable PSS innovations take place: what are the mechanisms, dynamics and factors influencing the implementation and scaling up process. This stage was based on a literature review and case study research, and sought to provide an answer to RQ1;
- A *prototyping and assessment stage (II stage)*, aimed at developing a design approach (and related method and tools) to enable strategic designers in designing and facilitating the process of implementing and scaling up sustainable PSSs, as well as building up the design knowledge base necessary to support design practice. This stage was based on an iterative process characterised by a continuous implementation, assessment and refinement of the design approach (and related method and tools) in practical design experiences (2 projects and a design workshop with graduate students). This stage focused on answering to RQ2.
- A *reflection stage (III stage)*, aimed at undertaking a retrospective analysis of the whole study, to specify original contributions, generalise the research results, and identify promising directions for further researches.

The **I stage** of the research provided significant insights and the understanding on how the introduction and scaling up of sustainable PSSs takes place:

- **1]** A ***framework describing and explaining how sustainable PSS innovations take place*** was developed. It reduces the complexity of the process and provides a comprehensive overview of the main influencing factors. The framework describes the process of introduction and scaling-up as a transition path, characterised by an incubation phase, a socio-technical experimentation phase and a scaling-up phase. It also brings all the influencing factors together, grouping them in four main clusters (factors related to the societal embedding process, the actor network, the project vision and actor's expectations, and the learning process).
- **2]** The research contributed to clarify how ***socio-technical experiments*** can trigger the process of introduction and diffusion of sustainable PSS innovations. Building upon insight from transition studies and the result of the first part of the research, a definition of socio-technical experiment was developed. It identifies the key issues to be addressed when designing and managing this kind of experiments.
- **3]** The research conceptualised the functions that ***socio-technical experiments*** can play in transition processes: experiments can act as ***Labs*** (to test, learn and improve the PSS innovation on multiple dimensions), ***Windows*** (to raise interest on the innovation project and the related actors, disseminate results, build-up synergies with existing similar projects/initiatives, and attract and enrol new actors) and ***Agents of change*** (to influence contextual conditions in order to favour and speed-up the societal embedding process).

The **II stage** of the research aimed at understanding the potential role that strategic design could play in designing and facilitating the introduction and scaling up of sustainable PSSs. It can be concluded that:

- **1]** ***A new role can be played by strategic design for sustainability***: not only in generating sustainable PSS concepts, but also in designing and facilitating transition strategies to support and speed up their introduction and scaling up. In other words, it is a strategic design capable of guiding and supporting a company, an institution or a network of actors, in the process of ideating sustainable PSS innovations, as well as in the process of designing and facilitating its introduction and gradual embedding of these innovations in society.
- **2]** On the basis of this new role, the research contributed to clarify the new ***design attitude and capabilities*** needed by PSS designers to operate at such strategic level. It also identified the ***design knowledge base*** that strategic designers need to be equipped with.
- **3]** Furthermore, on a more operational point of view, the research developed a practical ***design process, and associated guidelines and tools***, to support *strategic designers, project managers,* and *consultants* in designing and managing the societal embedding process of sustainable PSS innovations. The whole process consists of *3 phases* (incubation; socio-technical experimentation; and scaling up.) and *5 activity clusters* (vision building and expectation shaping; action plan development; actors network establishment & development; action plan implementation; monitoring, evaluation and learning).
- **4]** the research translated all these results in a **tentative handbook** that seeks to provide the necessary theoretical knowledge and the practical how-to-do-it competence to support practitioners in introducing and scaling-up sustainable PSS concepts. It merges three different levels: *theoretical, practical* and *illustrative* ones. The handbook was evaluated by 7 practitioners and 14 academic experts and the assessment results were used to improve and refine the handbook.

The **III stage** of the research provided a retrospective analysis of the study and specified the main research finding, as well as limitations, generalisations based on results and recommendation for further research.

THE IMAGE OF THE CITY: JERUSALEM AND THE STRATIFICATION OF SENSE

Luigi Farrauto

Throughout the centuries cities have been constantly changing, together with their image, their *imageability*, therefore their graphic representation is being constantly adapted to those changes too.
The evolution of digital technologies enables now new forms for visualizing the city: from the location-based representations of data to dynamic cartographies, that describe cities displaying in real-time flows of data, information, things and people. The tools that once allowed the cartographer to make maps have radically changed: the empirical analysis of the environment has been transformed into a true work of digitalization, in a data flow, led by the evolutions of technologies and tools, such as GPS and GIS; inks and prints on traditional media are now visual representations obtained through computers and software.
The rapid success of digital cartography has made the world's knowledge an everyday real-time experience. Nowadays, cities, territories and activities no longer have secrets. However, statistics reveal that more and more people have very little knowledge of the world. Maps are losing the *symbolic power* they used to have in the past: although extremely accurate, they seem to fail in visualizing meaning; *'sense'*. Geography, as a discipline, is facing a big crisis, due to the sudden changes in the way we experience the world. Atlases are disappearing from school shelves, and geography classes are being deleted from school programs. The world knowledge seems to be nowadays confined to a *Google* search. According to a recent Huffington Post article, traditional maps are listed to be one of the 20 things that became obsolete this decade, therefore their fate might be to disappear: digital cartography is about to be the only tool for discovering the world.
Throughout the history maps have played an important role in the society, by being not only a way to depict the territory, but also a mirror of humanity's dreams, fears, ambitions or passions. In ancient times, cartographers left a trace behind their maps, their *personal* trace, which can be considered as a sort of cartographic memory, made of calculations errors, annotations, advice: human traces which made maps a hyper symbolic artifact. Centuries ago, it took travelers several years to report their trips: ancient cities were described through long tales, diaries, novels. The *surveyor* was both the person in charge of the journey and the map designer; that is the reason why every map was the result of years of navigation.
Nowadays, modern travelers, or the *smart city users*, can easily track their journeys in real time, through simple and almost-ubiquitous objects, such as *smart phones* or tablets. The modern city can be constantly monitored through several location based and crowd-sourcing tools; so can its services can be very well improved by information-sharing processes. If centuries ago news about cities and people needed months to travel from person to person, now every single city is exposed to a non-stop flow of data, providing the entire world with a huge amount of information. Every day, on-line news tell us many stories about the city, through articles and dossier; thousands of data, thousands of "fingerprints" which emerge from the digital world. Those 'fingerprints' are data generated by GPS users, or by journalists while mentioning the city in their articles. They define a city-image, a memory, a cartography of places made of what has appeared somewhere in the digital world.
So how to record these geographic fingerprints? How to keep trace of the virtual traces left on a city? How to visualize the city digital memory? Can this kind of visualization help us in better understanding the city's dynamics?

This PhD thesis aims at visualizing the city's images which are obtained by analyzing its *'digital fingerprints'*: human traces left in the web by people experiencing the city. The first, theoretical part of this research explores the history of cartography, by analyzing the relationship among the subject (people looking at the map), the object (the map itself), and the 'object of the representation' (themapped place). Several ways of city-visualizations have been analyzed, in order to set a diagram in which to define a research focus. For this sake, methods and technics of map-making have been explored, in particular those concerning emotional cartography and subjective maps.
The focus of this research are the "*divided cities*" and their cartographic visualization. Jerusalem, the Holy City, the center of every maps for centuries, has been chosen for the project-part of this thesis, since it's one of the most disputed cities in the current geo-political situation, and maps have often been the topic of the discussions themselves. Beyond controversies and *cartoversies*, this thesis aims at analyzing Jerusalem from its digital image, in order to build new thoughts about the place, new ideas, giving it a meaning and a sense.

Project

In order to achieve this goal, we first selected a list of on-line news, choosing from both local and international newspapers. Than we created a list of geo-tags, containing Jerusalem's places and landmarks' names. Through the software *Processing*, we then operated an automatic on-line search of each geo-tags, on each of the newspapers' databases. We ended obtaining a list of places in Jerusalem, with the number of mentions from each source, on a particular time-span. After the data analysis, we started visualizing them on a series of choropleth maps, in which Jerusalem has been depicted through the "newspapers' mention lens": if a city-neighbor has never been mentioned, thus, it's not going to appear in the map, becoming a 'white space', or 'silence'. We collected thousands of geo-data, searching from 15 newspapers' databases any geographic text, appearing on an every article written between 2001 and 2011. This amount of data made several city images possible: one tailor-made city map is designed according to each newspaper and each time-span. We could eventually design a city atlas, **NextArcheology**, made of the full stratification of map. *NextArcheology* can be considered as the visual memory of the digital city, of Jerusalem's *digital fingerprints*. The atlas can be used as a city-image database, useful for researchers willing to deepen some geopolitical issues, or to understand how the image of a certain part of the city is changing through the years. The atlas itself becomes a source of stories about the city, the ground where further research could be digging for getting new discoveries, new knowledge. Through the atlas we can build new thoughts about the city, discover untold stories or understand its past. That's why we decided to mention the archeological process, with which we share the idea and the necessity of exploring and understanding the past in order to better understand the present.

A TRANSDISCIPLINARY INVESTIGATION OF THE ROLE OF SPATIAL DESIGN FOR THE UNDERSTANDING OF *IN-BETWEEN* URBAN SPACES

Elisa Lega

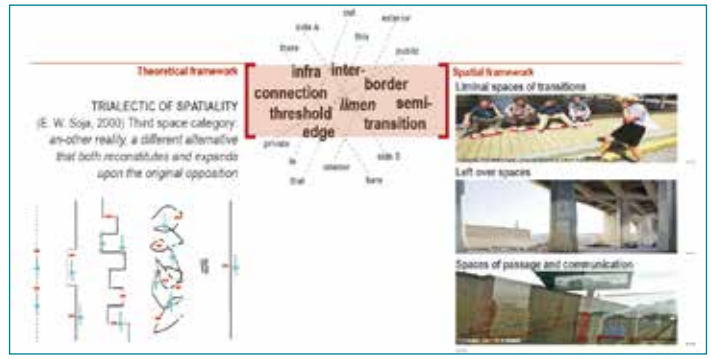
The starting point of the research comes from observing what contemporary mobility is now creating within the urban scenarios, continuous spaces of exchange, shifting the philosophical and built-environment discourses from the fixed spaces of staying to a new perspective regarding the *spaces of transition* - the spaces of change, reuse, interpretation.
The theoretical and critical background of the research focuses on the one hand on the analysis of the trans-disciplinal identity of Interior Design as a discipline able to cover the different fields of the project for spaces, with specific attention to the approach of Space / Spatial Design.
And, on the other hand, on the gradual emergence of new categories of spaces, referring in particular on those uncertain and intermediate spaces generated by taking pert or not to the contemporary urban system, the *in-between* urban spaces.
Two aspects supporting each other and highlighting the ability to define different contexts in which to act according to new logics taking into account the rapid change of places and the complexity of values that constitute them.
Starting from Interior Design values the research builds an exploratory / interpretive path that wants to propose Spatial Design logics for *in-between* urban spaces.
SPACE/SPATIAL DESIGN: *design activity for the design of spaces*

1. Re-phasing urban density - in-between urban spaces.

(interior/exterior) and its related tools/equipments system, for the widespread inhabited urban realities of the third millennium, through innovative environmental relational and logical configuration strategies - progressive and regressive, even systemic. (Piccinno, 2008)

- ***IN-BETWEEN* urban spaces:** *intermediate and uncertain spaces with strong physical or relational or temporal values of connection/ disconnection with the nearby, in which there is potential to activate new dynamics/relations capable to generate spatial quality with the surroundings.*

The contemporary urban field underlines the existence of a new typology of public domain, different form the past agora of public life, where strong dynamics and event-like experience take place together with new interpretations and meanings of spaces. This involves a departure from the notion of technical functionality of spaces to that of a dynamic semantic system of liminal places, getting closer to the concept of *cultural geography of travel* (Hajer, Reijndorp, 2001) by which there is potential for the *in-between urban* spaces to become new meaningful places and hence new types of public domain. This interpretation of spaces leans on a notion of performative environment focusing on what a building or a place actually does rather what is said to be.
The research wants to investigate how Spatial Design, in relation with theoretical and practical inputs generated by bordering disciplines, could find in that type of domain a new ground where to operate in terms of relational innovation within the urban spaces, by using it's non invasive skill to affect the context, it's adaptability and reversibility to the ever-changing needs as a key point feature to keep the pace with the modern urban metabolism.
By means of Spatial Design, together with inputs coming from other fields



2. In-between urban spaces - theoretical and spatial framework-01.

3. Open interpretative analytical deisgn model for the Spatial Design of in-between urban spaces.

4. Open model applications - In-between as site specific or generic.

of knowledge (Architecture, Cultural Geography, Philosophy, Sociology, Psychology, Anthropology, Literature and Art), the idea of polarities which usually characterize our social and spatial organization (for example in the contrast between the private and public, physical and virtual reality, etc..) can be placed in discussion in favour of identify a category of third space, a trialectic of spatiality, another space in which occurs in the presence of the two opposites.
The *in-between* spaces are carriers of complex urban qualities and are *not simply spaces suitable for dynamics and realignments, but are the only place - the place around identities, between identity - where the question of becoming, openness to the future, goes beyond the conservative impulse to maintain the cohesion and unity* (Grosz, 2001).

Challenge of the research is to build an *open* and complex interpretative/ analytical/design model to organize the multiple aspects for the understanding an design of *in-between* urban spaces.
To obtain that results along the research have been developed different models to understand the theoretical values (interpretative model) and spatial/relational/ temporal qualities (analytical model) of *in-between* urban spaces together with a selection of methods, parameters and tools used, in the broad academic scenario, to investigate heterotopic spaces with a trans-disciplinarity approach.
The application of the *open* model suggests a process to develop design proposal for *in-between* urban spaces that follows three main phases built upon various parameters: analysis and collection parameters (Exploratory phase), proposal parameters for the enhancement of the experiential, spatial, functional, temporal qualities/dimensions (Design phase) followed by the proposal outcome in itself (Design outcome).
Aim of the open model is to provide ad-hoc tactical responses to the wide variety of *in-between* urban spaces by selecting/connecting the different elements that constitute it through a high degree of freedom in order to develop a broad number of application options oriented to the enhancement not only of the place but of the identity, image and perceived values of this type of relational spaces.

COLOURFUL CITY: COLOUR, URBAN SPACE, IDENTITY OF THE CITY DURING EVENTS

Xia Liu

The relationship between city identity and colour has been discussed from different viewpoints, colour as the emotion elements, colour as a decoration elements, and colour as a historical element to protect and restore the ancient city colour landscape, and the Colour Geography of Lenclos. All of them described the colour important to city identity and image.
With the globalization trend, the fierce competition among cities and the coming of communication age, some scholars emphasis that colour is a symptomatic and symbolic element in the transformation process of modern city from the tangible to the immaterial image, while facing up this chromatic complexity of contemporary city, need to use colour to create more harmonious relation between urban space and human being multi experience, and in the process of design, communication, perception and aesthetics are the basement of the possible colour interpretation.
From another aspect, the events become the important opportunity to display the city character and image because of his role of revitalizing the degrading inner city with a brand new image, But the study about events mainly focuses on four fields of communication and media, mass culture, public relation and recreation and tourism. The contents touch upon the event definition, the concept system and category, the research about tourists who participating the events, policy adaption in event places, the strategy, planning and management of events and results, assessment and effects of events etc.
But there exists a lack of research to overlap and connect three of them, colour, city identity and events, and how to use colour to improve city identity during events.
Therefore, our hypothesis is that the convergence among three branches of colour, the building of city identity and event can generate a very different future. Actually, the signals of this convergence already can be watched in recently hold mega events, especially with the development of new technologies like multimedia and smart light and their creative applications, it was found that there exists a strong need to close the gap among different event designers, such as urban planners, architects, designers and light designers etc to build the harmonious and vivid event environment because they work in different "spaces", levels and fields, there lacks a dialogue platform and a series of cooperation method to create better design model and process.
Around these concerns, employs three groups of case studies and one sort of empirical research and action research through mixed approaches between phenomenological and action research: First literature research and three groups of case studies will provide some methods, tools and principles for following action research. There are no complete and absolute answers to it; they will provide a possible open design strategy and toolkits to observe the conclusion by participation of the designers with the different background in order to contribute knowledge by the questions for further practices and research.
The first group of case studies is a slight case study by desk research mainly to discuss colour application about if and how colour to revitalize and shape city identity and activate urban space in various contexts and levels, these cases are divided into different classifications according to their functions. Finally, summarizes those cases and their possible roles in building city image and identity.
Second group of case studies includes Beijing, Berlin, Venice, three cities based on two different situations are collected to make a contrast from the viewpoint of human being's perception during event. As a visitor, I took the chance of visiting La Biennale di Venezia to do a deeper field investigation, finally make a detail contrast between two different city situations.
Case studies (Group3) based on the Mega-events following the timeline (Olympic Games) to understand what already happened in the past, these deeper case studies will bring an important reference for next step to develop the colour design strategy and toolkits.
Based on the results of literature research and three groups of case studies, here has a proposal: the acupuncture-type colour design strategy, which seeking to achieve both integration and a systematic method to build up contemporary city identity during events and post events. Due to the integration of multidisciplinary and interdisciplinary, some design methods will be employed such as card sorting for sharing inspiration and improving communication, mood board for forming unify colour image and colour theme. And all the process includes the qualitative analysis method of urban by perceptual, graphic, photographic, colour mood board and Kabayashi's colour image and some colour experience storyboard will be employed to help the process of analysis and design.
And in order to illustrate and test the method's potential, here "Colourful city: colour, urban space and city identity during events" workshop is organized, architects, designers, planners, other experts and some students are invited to participate this workshop to test the colour strategy and toolkit, two events have been chosen as practical cases.
It is verified that acupuncture-type colour design strategy is an effective approach to explore the potential solutions, but the abundant design language in different design fields also increase the complex of process, next colour design and application process should be an open and free approach to be deeper discussed.
In the next process, the proposal strategy should be deeper developed in the process of design and completed based on the local and real contexts, because they haven't become working prototypes, neither have they been applied. Therefore the related arguments in the future should be considered based on the application of this colour design strategy.

DESIGN, INNOVATION AND COMPETITIVENESS IN THE TEXTILE INDUSTRY

Upstream Design Driven Innovation

Anna Lottersberger

The Italian textile industry is facing increasingly more difficulties, as a result of the growing competition in the global market. Industrial enterprises which produce textiles for the apparel sector are by tradition labour intensive, but, but also deeply rooted into Italian production environment, renowned for the top-end intrinsic quality, but now obliged to adjust to the influx of imported textile products from the newly-developed countries, particularly those in South-East Asia, mainly from recent-developed countries in South-Eastern Asia. During the last ten years, the Italian textile industry has suffered a strong downturn in terms of the number of companies, employees and revenues; simultaneously the supply of places in higher education institutes for studies in textile majors has been drastically reduced in Italy.
This doctoral research was undertaken in order to study the dynamics of textiles invention processes, in order to outline promising trajectories of relevance to the creation of new textile products. The first assumption was that customers have always paid significant attention to the aesthetic, symbolic, and emotional value of 'Made in Italy' hard break - apparel and design above all. The thesis proposed to move selected practices and theories, which were validated into these traditional design-led consumers' markets such as furniture and electronics, upstream to related B2B market, such as the textile materials' one.
The literature review focused on two major fields of study: the first was the world of textiles, involving the definition of 'textile', 'textile design' and the role of 'textile designer', and specifically the field of research and product development in the industrial context, followed by a wider analysis of recent changes in the global textiles scenario. The second was the theories connecting Innovation, competitiveness and design - specifically, design thinking, open innovation concept design, strategic design and design-driven innovation. The Design-Driven Innovation model and tools, firstly theorized starting from 'Made in Italy' furniture best-practices seemed the most challenging for inventing new textiles, due to the innovation of technology, meaning and language of products.
The lack of references on textile innovation, textile product-development, textile design and textile design education was the cue to develop two empirical activities. The first was the exploration of the field through 40 preliminary interviews with key professionals from the textile academic world and the industrial one, and through the case study on the innovation processes in three Italian leading textile companies. Among these three firms, the second activity was based on the practice- centred approach of research through design.

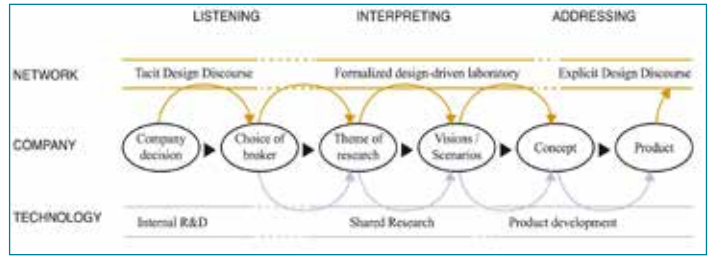
TEXTILE INDUSTRY IN ITALY	2001	2005	2008
ENTERPRISES (NUMBER)	19.215	16.869	14.719
WORKFORCE (NUMBER)	227.000	183.900	168.004
EXPORT TRADE (MIL. €)	18.359	13.942	10.184

1. Elaboration of the data from 'TAC Ricerca per il settore Tessile e Abbigliamento', published by the Italian Ministry of Labour and Public Policies in 2009, which included the evolution of the Italian textile sector.

Starting from the Design-Driven Innovation agenda, an action-research method was specifically drawn up with one textile company, in order to test a design-driven research paradigm and to develop new concepts for a new textile material.
The first phase included direct participative observation of the ordinary activity of research and product development of the company, in order to gain the trust of both the executives and the other team members, to deepen the knowledge of the company and gain insights into the competences within the textiles chain.
A second phase consisted of the formalization of the Design-Discourse network of the company into a Design-Driven Laboratory, involving 5 players external to the company: 3 artists, a new- technology advisor for a Venture Capital new-tech exploration and a textile material Engineer working as technology-transfer manager.
Only the third phase was a faithful reinterpretation of a Design-Driven Innovation model for the development of new concepts for textile materials. In this case, the researcher played the brokering role of the Designer. This step involved the launch and management of the research activity with the artists and the international exploration of new technologies and studies for textiles. At the end of the third phase a presentation of all the outcomes, both from the artistic and technological research, was made to the company staff, and the two shared concepts were elaborated upon.
The main results of the research are the novel model of textile design, specifically for the Italian industry, and the adoption of an explicit Design-led Practice by a B2B textile company.
The original contribution of knowledge of this research is the refined definition of textile design practice and a proposal for the role and competencies for textile designers. Thus, a partial validation that a design-driven approach is desirable for the invention of textile concepts and innovation of textile products was achieved. Although one fully developed project may not be sufficient to confirm the reliability of the Design-driven Innovation model within the textile industry, the elaboration of the theories also derived from this case opens new trajectories for future development in textile design and research in textiles.

	MICRO	SMALL	MEDIUM	LARGE
360° PRODUCTION			*	**
CONVERTER	**	**	*	
NICHE	*	**	**	*
GLOBAL		*	**	**
LOVE-MARK			**	**
CONTACT WITH THE TOP MANAGEMENT	**	**	*	*
INTERNAL R&D			*	**
BUDGET			*	**
NETWORK	**	**	**	*
VARIOUS PORTFOLIO		*	**	**

2. Necessary requirements for a Design Driven Innovation process matched with companies' dimensions: '*' medium presence of the criterion, '' for high presence of the criterion.**



3. Elaboration of the Scheme of DDI (Verganti 2009).

THE PHYSICAL COMPUTING AT ENVIRONMENTAL SCALE, AIMED TO THE OFFER OF SERVICES AND THE CREATION OF A SYSTEM OF RELATIONS BETWEEN PUBLIC SPACES, TRADE AND RESIDENTS

Innocenzo Rifino

The study here summarized, examines a historical intersection between the ubiquitous computing discipline and the design of specific urban artifacts commonly known as totems or kiosks. This intersection is performed on two levels:

- in functional terms to the offer of services and the creation of a system of relations between public, business and residents
- from the point of view of the interface in order to integrate the potential of "ambient intelligence" and "physical computing" to an interactive artifact placed in a urban environment.

Ubiquitous computing, or ubicomp, is an emerging field of computer science that seeks to increase the potential of everyday objects and physical environments by introducing invisible computational capabilities, interconnected, sometimes camouflaged into the usual behavior of users.
Sometimes a change of technology has implications that are so epochal that everyone must deal with it, adapt, or prepare to them. The revolution in information technology known as ubiquitous computing is the most recent change, and is starting to make an impact in the practice of designing digital artifacts, and also in the business of the same.
The term "ubiquitous computing" was coined by the mourned Mark Weiser, in the work at Xerox PARC, and dates back to late 1980. He saw ubicomp as the logical consequence in our relationship with the digital tools we use. This effect is intrinsic in the historic reversal of the ratio between users and digital devices available: from many users sharing a device to many devices at the service of each user. This multiplication is now becoming so high and pervasive that now tends to overlap two (sometimes three) to one with artifacts, at least in common use. As described Weiser, ubiquitous computing consist in the ability to process information that has left behind the desktop, and was distributed throughout the built environment: "Invisible, but everywhere."
Weiser was not the only one with ideas in this regard. Similar efforts have been launched from a wide variety of think tanks, corporate "visioning centers" and academic research facilities. At the same time has created a global language slang as reference to this discipline, in which the terms ranged from "pervasive computing" to "ambient intelligence" to "tangible medium" to "physical computing".
So far, most of the projects "ubiquitous" who have seen the light consist in tailored pieces made so impromptu, prototypes designed by engineers with in mind the needs and preferences of other engineers. Examples include the first implementation of the PARC "tabs", "pad" and "boards", a transactional "Smart Floor" by Georgia Tech University in the late 90's or most recent "Red Tacton, body-area networking" NTT's system that uses the body's own electrical field to transmit information wirelessly. These are, mostly, some of the many proofs of concept, not nearly enough stable and refined to address the congestion that would be endlessly subjected to an artifact daily use.
In any event, there is a steady flow of applications that migrate outside the laboratories. In 1997, residents of Hong Kong have begun to use a single smart card, equipped with a Radio Frequency Identification (RFID) chip, called "Octopus" useful for many purposes: to buy a ticket while on a bus, or a snack at the store corner, or even to open the front door of the house.
A startup company, based in Pittsburgh, named BodyMedia provides a system for wireless monitoring of their biometric data is often little more than one patch. The information collected is interpreted using a visualization software that creates a "documentation of the physiology of the body", which can be shared with the doctor through a website.
Meanwhile, other companies such as Samsung, Intel and Apple, have shown unprecedented opportunities in the area in which amorphous converged communications, information and entertainment, and all are developing applications to corner the market of so-called "digital home". The house itself, the clothing, the store become sites of processing and mediation information. The ordinary artifacts are reinvented as places where data is collected, evaluated and made input for subsequent actions.
And all the familiar rituals of daily life, basic things like how to wake up in the morning, going to work, or buying in a grocery store, are rethought as an intricate dance of information.
In South Korea, an entire city called New Songdo is being built from scratch with ubiquitous technology built into every door, every bus stop, even in the trash. Apparently, a life in New Songdo (or another of the "u-city" today are in the program) would be simplified and made less challenging at every step through the application of data in the computations necessary for the implementation of countless newspaper. The measurements provided include many aspects of life: the weather displayed on the bathroom mirror in the morning, the bonus credited to your account for the proper disposal of recyclables.
These systems rely on a wireless communication infrastructure, whose nodes are represented by embedded processors and embedded in the urban artifacts, and show the potential and the style of interaction typical of ubiquitous computing: a transaction between a person and a computer system proceeds automatically without the need for action to be expressions of a user's explicit will, of his intention, or simply without the knowledge of what is happening. This complex process can be defined as "computing power and information processing dissolving in behavior".

What could be the impact of physical computing on the experience that citizens have of the urban environment? How to design consistent and interactive urban artifact?
The study analyzes a variety of different factors that all compete to create a (pragmatic) responses to the questions set out above. First factor is the possibility offered by sensors and actuators to enable interactions that take place in an explicit way (as is usual in the discipline of Human Computer Interaction), but above all that can happen implicitly based on behaviors commonly assumed by citizens. The implemented project idea and the general approach follow an essential and minimum approach, in the belief that the script of the mode of interaction should follow the common sense of poise and does not require that users input unusual gestures.
The second contribution concerns the technical implications (also ergonomical) of the design of a graphical interface that works in a public environment. An interface that will appeal to different types of users, classified on their level of awareness and attention to media content and, even more simple, based on the proximity between users and artifact in the urban space and on the number of the individuals themselves.
The third point of interest is in the considerations arising from the observation of the prototype in use. Hence the final identification of theoretical categories for the design of complex interfaces (implicit / explicit, graphic / physics) for an interactive artifact in an urban context and audience.
The project is supported by the analysis of multiple case studies. The most significant are derived from experiments conducted by research teams respectively at Tangible Media and SENSEable City, both at the Media Lab (MIT). The The first in the discipline of digital interaction through physical interfaces, the second observation of urban behavior.
The project described in this study qualifies itself as an intersection between the two disciplines. The proof of concept was tested in an interactive totems designed and created for the municipality of Mantova.

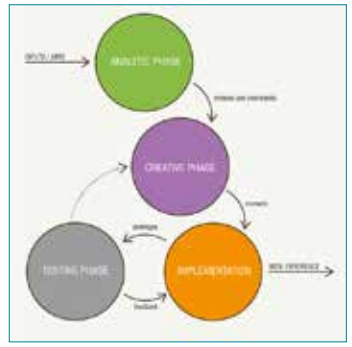
1. Conceptual visualization of the project idea.

SOCIALITY AND MEANING MAKING IN CULTURAL HERITAGE FIELD

Designing the Mobile Experience

Davide Spallazzo

The large-scale access to cultural resources together with the current change in the audience expectations has profoundly modified the contemporary visiting model, which often rests on passive contents' consumption, and it's unable to fulfil the objectives of education and enjoyment fixed by ICOM for museums.
Digital technologies and in particular mobile technologies are often pointed as a driver for the change and the next wave of innovation, but the employment of these tools in cultural heritage field is anything but unproblematic.
The research fits within this problematic area and aims at providing designers with a design framework and process, able to guide a conscious design of the mobile experiences, fully exploiting the potentialities offered by mobile technologies with clear objectives and the awareness of the means to achieve them.
Secondary research and case studies are the methods employed to build the design framework cited above, analyzing three main domains: mobile technologies and its applications in museums, cultural learning, sociality issues within cultural institutions and the world of games.
The intertwining between mobile devices and museums has a long history which dates back to the second post war and is today characterized by a new bursts of excitement: the sector of mobile technology is indeed growing fast and the new potentialities offered by smartphones open to new models of visit, but several academics, critics and museum practitioners agree that this technology isn't still fully exploited in the field.
The main hypothesis on which this dissertation relies is that a designed use of mobile technology during visits to museums, cities and cultural institutions can enhance learning and social engagement.
The theories about learning in museums and cultural institutions are several as well as those regarding mobile learning but they all share common references to broad learning theories, such as behaviourism, constructivism and socio-cultural theories.
Relying on these points of contact, three main learning approaches are proposed as guidelines for the design framework: a focused approach, providing visitors with precise information; an immersive approach, which provide visitors with an engaging experience; a collaborative approach, which attaches importance to socialization among visitors.
Museums and cultural institutions are indeed social spaces in which people gather, socialize and share experiences, giving life to diverse social configurations during the visit.
The models of sociality proposed by Debenetti is used to scaffold the design framework: the fusion visit, which stems from a complete sharing of the experience; the private experience, characterized by the total absence of social interaction; the separated visit, in which accompanied visitors decide to have separated experiences; and finally the pursuit of social interaction.
Visitors can also be socially engaged at different levels and the five step scale of social engagement proposed by Simon is used within the design framework: from a passive contents' consumption to direct social engagement, going through contents' handling, web 2.0 dynamics and indirect social engagement.
Sociality and engagement are also the filters used to map several applications of mobile technologies in cultural heritage field, analysis which shows mobile gaming as an interesting field to be addressed in order to gain insights and to draw mechanics of interaction.
Play and game, since the first "serious" definition by Huizinga, are indeed often pointed as powerful tools to engage people socially in enjoying and learning activities and secondary research has allowed to identify the defining traits of games, useful to scaffold the design framework and to analyze cases and best practices: liminality, rules, players, story and conflict are identified as the most recurrent characteristics of game and mobile gaming.
Fourteen cases in which mobile technology and gaming are used to enhance the visit experience, are analyzed in depth, in order to gain insights into issues related to mobile gaming, learning and sociality, helping to structure the design tool, that is the final output of the research.
The resulting design framework is structured through four main phases - analytic, creative, implementation and test - those of a common design process: brief and analysis, concept, implementation and evaluation plus some iterations through a recursive process of corrections and tests.
The first two phases are characterized by several sub phases, that guide developers in the definition of the mobile experience through a sequence, more or less linear, of decisions.
The thesis describes all the units encompassed within the framework from the analytic phase to the creative, that ends with the creation of the project scenario, while it doesn't deal with the implementation and test.
Two pilot project have been developed employing the proposed framework: the first, Looking for Achille Castiglioni (LfAC), has followed the entire process and is now a working mobile experience, while the second, developed with and for Museo Glauco Lombardi (MGL), has reached the end of the creative phase and hasn't been yet implemented.
The design framework has proven to be useful in supporting the design of mobile experiences for museums and cultural institutions, helping developers to take into account all the critical features and to optimize the design process.
The tool has also proven to be flexible enough to give birth to very diverse experiences: LfAC is a free multimedia tour played in downtown Milan, while for MGL two experiences have been designed, an indoor role playing game addressed to families and an outdoor location-based narrative experience.
The main contributions of the research, from the point of view of design discipline, are twofold: an extended role of designers that assume a key function in building mobile experiences for museums and cultural institutions and a new tool in designers' toolkit.
The structured attempt to foster a chemistry between mobile technology, cultural leaning and social engagement through a design approach is therefore the main contribution in the design discipline but it also fits within the broad current debate about mobile interpretation for museums and cultural institutions.



1. Design framework: diagram of the main steps.

2. Some images from the testing session of Looking for Achille Castiglioni.

EMBODIMENT OF EMOTIONS THROUGH WEARABLE TECHNOLOGY

A practice based design research

Secil Ugur

Aim & Methodology

Today, people are in an era of digitally mediated HHI (human-to-human interaction), which cannot provide full sensorial contact and therefore, emotions cannot be communicated completely. On the other hand, the intimate cover of the human body, i.e. garment is the interface, where many personal traits are embodied. With the improvements in textile and electronics industry, this embodiment can be carried on a higher level, where the garments become dynamic interfaces and extensions of the human body. The aim of the PhD thesis is to explore the communicative level of wearable technology through turning it into a living surface, which can convert digital data to physical in order to provide an emotional communication. This research aims to carry Human-Technology interaction into an alternative context, where technology dissolves in use and starts serving for enhancing Human-Human interaction. The research aims to answer the following questions:

Multi-disciplinarity | How can multi-disciplinary approach open new ways to design wearable technologies?

Soft and Hard| How can a designer integrate technology and garments by fulfilling aesthetical needs?

Sensorial Experience | How can wearable technology awaken sensorial perception?

Social Enhancement | Can wearable technology be a social medium to create new social interaction?

Ethical Issues | Can a garment that mechanically move and expose the inner state of the wearer be worn in public?

The PhD is based on the methodology of research through practice that includes prototyping and testing wearables that can embody emotions. Rather than reaching to specific results, this PhD aims to open up new questions that can be inspiration for designing new technological artefacts and interactions. Observing the interaction between the user and prototypes, the research overreaches the quantitative data and brings out qualitative data that can be used in order to give rise to new design approaches and practices. The methodology is a loop that consists of five steps: explore, theorize, act, observe and reflect. For each prototype there is the same sequence of exploring, acting and observing procedure. The reflection on the results of each test gives rise to a new research question that needs to be explored based on a multidisciplinary literature reviewing.

Literature research

The literature review stresses on three ways of extension of human body: skin, clothes and technology. Skin is the most intimate cover of human body that creates in and out distinction. The research addresses on this mysterious cover of human body, how it undergoes a change during the history of art, science and design. Secondarily, it focuses on garments that are second skins of the human body and their smart evolution with the improvements in material science and electronics.
1The research focuses on the third extension, technology, through underlining the issue of phenomenology with a view on technologies as prosthesis of human body. On the other side, a literature on emotions is reviewed by addressing physical, psychological and social levels according to scholars. The literature research finally addresses the emotion issue with the light of design and technology, by addressing emotional design, affective computing and emotional intelligence and concludes the review with a discussion and examples of how technology can mediate emotions.

1. Social Skin.

2. EMbody.

Hypothesis

The PhD argues that wearable technology can give new forms to social patterns through enforcing the wearer's existence and sensorial experience. Emotional communication through wearable technology can strengthen social bonds and reconnect people in a way, where the emotions are not hidden anymore, but shown as tangible artefacts. Besides, this can be transferred apart from the human body to other bodies in order to enforce the quality of communication over a long distance. To verify the hypothesis a scenario generation was done through dividing the interaction into three modalities: Me|Myself, Nearby and Faraway. In order to go deeper into each scenario, various product ideas were built as real and virtual prototypes.

Practice based research

In the practice part, user surveys were done in order to provide initial findings to understand the human body-emotion relation and user acceptance for wearable technologies. According to the results, two phases of prototyping were done: virtual and physical. In the virtual phase, an animated virtual dress was built by using 3D modelling tools in order to analyse user perception on moving garments and emotions. This user test provided findings about movement and emotional perception for developing the physical prototypes. The physical prototyping includes two series of products: Social Skin and Embody. Social Skin (Fig.1) consists of four wearables that can communicate emotion to nearby person. These prototypes were built base on biological data measurements through body sensors.
On the other hand, EMbody (Fig.2) includes three wearables that were built base on gestural measurements and multimodal sensorial outputs. These prototypes provide a tacit emotional language between two people in far distance. Each prototyping phase is followed by user tests, which explore different interaction issues. The tests were done in both controlled settings and real context; and obtain quantitative and qualitative data.

Conclusion

The results of the research show that although cognitive labelling of emotions can vary from one person to another, the sensation that they elicit can have similarities. The research argues that visceral sensation can be more descriptive than labelling emotions with words. The user tests show that simulations of different sensation, such as heartbeat, can be effective in communicating emotion in long distance. The results show that touch can create intimacy, attachment and a direct interaction. On the other hand, the research findings show that people are more comfortable to express their emotion with a self-activated system rather than an automatic system that tracks their biological data. The research contributes to knowledge by providing a methodology of design practice for designers of wearable technologies and opens up a new negotiation of theory and practice for a multimodal sensorial communication of emotions through technology.

COLOUR DESIGN EDU.SYSTEM

For a systematic and creative approach to an interdisciplinary colour education in design

Valentina Vezzani

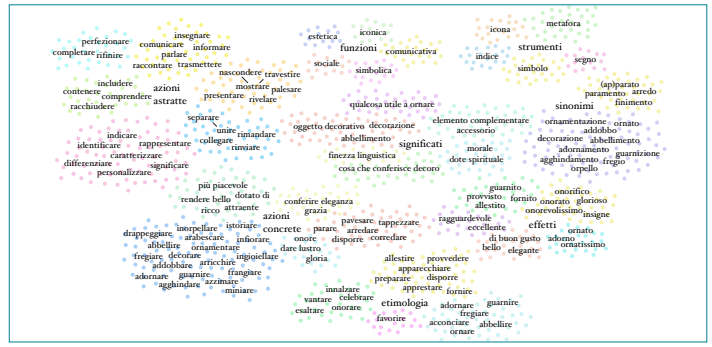
The Colour Design Edu.System research has been stimulated by the investigation on the contemporary colour scenario that Laboratorio Colore, Indaco Department of Politecnico di Milano, conducted between 2007 and 2008. This previous research allowed us understand the complexity of relationships among different and numerous disciplinary fields, production and project areas. In addition the results have been useful to start thinking about contemporary colour culture: is it important? if yes, in which fields and how? how has it developed during the time? What are the needs and problems of today?
To answer these questions, moreover the understanding of colour complexity and the lack of a shared knowledge on colour, the research has been based on the exploration of four macro-themes: interdisciplinarity, complexity, design and education.
Given the encyclopaedic nature of colour and the consequent impossibility to address the issue as a whole, the development of a unique methodology for all the disciplines that study it can't happen. On the contrary, a more and more marked sectoralisation of research in areas, however, not always in communication between each other has been favoured.
There is a strong will of knowing, exchanging, and sharing concepts and tools about colour, to activate interesting new thinking contaminations, and spark new research and testing processes. This is demonstrated by the growing number of organisations (i.e. associations, societies, discussion groups) and opportunities of dialogue (i.e. events, national and international conferences, festivals) where the numerous expertises and cultures meet and stimulate each other.
The will is not enough, and the risk of creating a 'Babel' – because of different backgrounds and languages – suggests to focus on the communication aspects.
The analysis of the colour scenario and contemporary colour knowledge has brought to frame the research question: "is it possible to manage the colour scenario, according to its interdisciplinary dimension, through the culture of design?"
Design, here considered both as design thinking and practice, is a tool, a 'knowledge agent', and thanks to its creative and systematic approach, it can give complexity any different configuration, easier to be understood and used.
Design thinking allows to move in a multiplicity of points of view and jump from one to another, to get a meta-point among all the different perspectives. In addition, the science of design could shape into a fundamental and common ground for action and intellectual communication through art, sciences and technologies.
This doctoral research focuses on more specific questions:
* how to share knowledge to support the construction of a global vision on colour?
* is it possible the construction of a common language that allows the dialogue among the different expertises and disciplines involved or interested to the colour scenario?
* can education have the key role being an opportunity to create a real shared colour knowledge, respecting the parameters of interdisciplinarity and complexity?
Education turns out to be important because it allows to sensitize people of colour issue, and prepare of interdisciplinary learning and research. In fact, it can be designed according to systematic and creative activities.
From the student perspective, education is an opportunity to get new methods and tools for managing specific knowledge, apply theory into practice, and finally dialogue with other disciplines and languages.
Then the research has been focused on the development and testing of an educational tool, that can support the research in the articulated world of colour, and prepare to the construction of a systematic and simplified knowledge on it.
The context of design schools, where Colour Design Edu.System Toolkit has been created and tested, was chosen because the Design discipline and practice demonstrate an high level of complexity, interdisciplinarity, then a large number of variables to be held under control through a systematisation.
The aim is to educate students to the wide and articulated knowledge of colour, and let them become aware of it and, particularly for the design area, of its importance as design component.
To design colour it is necessary to know about it, and have some tools to dialogue with different disciplines and 'languages'.
The Colour Design Edu.System Toolkit consists in a set of cards to support and manage the research-analysis and meta-design phases, and the Index (made by a set of cards too) with brief theoretical contents, to support the use of the cards and stimulate deeper researches about colour.
It is both a propaedeutic and supplemental tool for the design activity – that is a process partially personal in which the young designer finds and tests his own methods and tools to move across different design fields.
After the first process of data collection (by literature and desk research, case studies and a quick survey), the Colour Design Edu.System Toolkit has been tested through action research strategy in three design schools, different for culture and approach to design practice.
In particular, the cards have been tested at the École Nationale Supérieure des Arts Visuelles 'La Cambre' in Brussels (Belgium), at the School of Design of University of Leeds (UK), and at the School of Design of Politecnico di Milano (Italy), to verify the usefulness of the toolkit during the design process, thus to provide students a tool to research, dialogue and organise the colour and design complexity during both the analysis phase and the so called meta-design phase.
Finally the testing through workshops helped to understand the functionality of the cards (titles and categories) and their contents.
The use of this system of cards is integrated and supported by the Index, made by a set of cards in system with the above explained cards, in which some basic notions and theories about colour are contained.
The Colour Design Edu.System Toolkit has been designed also for teachers that can manage in a systematic, creative and interdisciplinary way the didactic and research activity especially in a design studio situation.
The pretension of Colour Design Edu.System is to be useful not only in the design field, it could be open to different fields of research and dialogue. As a tool for colour interdisciplinarity, it can gather different cultures and disciplines to contribute to the colour culture construction.
Hence, the concept of design community – 'design' is here understood according to the Latin term *pro-jèctus*, that means 'throw forth', i.e. an idea, a concept – has been taken into account when the use of the Colour Design Edu. System educational tool becomes an opportunity for different expertises with common goals (in this context, concerning with the colour subject) to overlap the cultural and disciplinary barriers between art, science and technology, which still exist and don't ease the rising of true and innovative 'contaminations'.
Potential developments for the Colour Design Edu.System are forecast in the world of web, the today's best 'place' for meeting and sharing knowledge. By developing a web platform, or better, linking the educational tool to an existing on line service for the colour scenario – for example, "Coloret", developed by Laboratorio Colore, Indaco Department of Politecnico di Milano (www.coloret.polimi.it) – different disciplines and expertises will gather, creating a systematic colour community that contributes to the dissemination of an interdisciplinary colour culture.

THE PROJECT OF THE DETAIL AND OF THE ORNAMENT AS POTENTIAL MEDIATOR OF THE VALUE (MATERIAL AND NON MATERIAL) IN THE ITALIAN FASHION SYSTEM

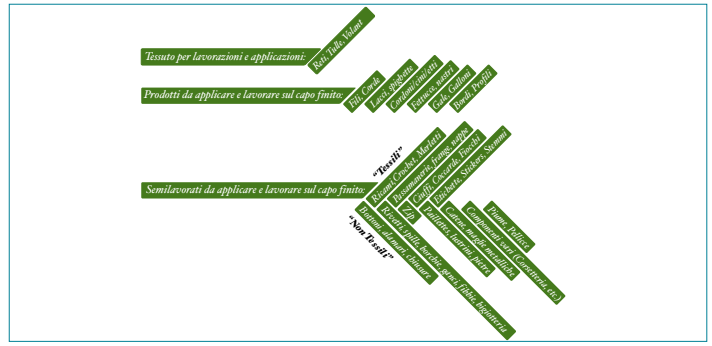
Tools and methods for the research towards innovation of the Details Fashion Sector

Anna Sara Zanolla Mancini

This research focuses on the Details Italian Sector of *Made in Italy* trying to find applicative hypotheses of support, tools and methods for its Small and Medium Enterprises. In the creative and productive process of a fashion object (dress or accessory) the contribute of the details and the ornamentation applied to it seem to emerge and become more and more important in the sense and in the technological contribution that they can give.
Due to both social and economical reasons that are the rising of the BRIC Countries, the lower cost of labour, the reduction of quality of the products, the real risk of falsification and also the constant dwindling of the will to or purchasing power of the consumers, *Made in Italy* and its Sectors are fighting against this whole phenomenon without effective tools and methods. They are trying to escape from this stagnant situation: can design be part of the solution?
During the research period a theoretical analysis of the concept of *detail* and *ornament* was made with a *design oriented vision* but also the support of the humanities both de-structuring their meanings and working on the phenomenology of the project of the detail and the ornament in the design discipline. At the same time, a desk and field research about the Italian Fashion System, the concept of *Made in Italy* and the Italian Detail Sector has permitted to understand the importance of the material and nonmaterial value of the Italian fashion product, that often through the detail and the ornament becomes a unique, non reproducible, significant and sensitive product.
The relationship between the product and the detail takes origin in the creative and productive process, where the "Detail SME" executes often specific requests and orders made by the fashion Brand.
In the complex and difficult economic context, adding value and identity to the fashion product becomes a need: the detail can't remain the result of execution processes.
Besides, next to the "conventional" fashion, a new generation of fashion designers that are extricating themselves among the strict rules of the conventional fashion and trying to find their own way to design and produce their collections is slowly appearing: a new context with new dynamics that takes part to the creation of the *Made in Italy* can be involved in knowledge and skills sharing.
Besides, this Sector can reach directly the society, that is groups of it or specific communities, as the *makers*, that request *enabling platforms* where it's possible to participate to the process and that permit them to connect with each other.
To change these directions and be part of the process in a push way, putting the detail and the ornament in the centre of the main project, the SME needs knowledge and capabilities to innovate it, its own processes and structure. To put in practise this hypothesis and to experiment new processes in which collaborative platforms for sharing knowledge and skills are built, three different actions where done: an explorative action in the education context trying to understand the potential role of the designer/ researcher in the process of innovation applied to the Detail SMEs; a design practice in India for the valorisation of the technical skills of the fashion handicraft through collaborative actions; a research/action experience in the educational context to experiment methods of transferring knowledge about the Detail Sector through a workshop. These actions made possible to focus on the importance of the educational aspect both for the SMEs' actors and workers and for the future researcher/designer that can be the link for the Sector to knowledge and the research.
Several educational programs can be planned, but due to the complex and specific



1. Tagcloud of the words found in the definitions of the term 'ornament' inside italian vocabularies.



2. Details and ornaments: product typologies of the Italian Fashion Details Sector.

characteristics of the Italian Fashion Sector a specific concept of a specific educational program has been made and inserted in the up coming Master in New Tech-Style Design promoted by the School of Design of Politecnico di Milano, Poli.Design Consortium, ISAD Superior Institute of Arts and Architecture (Milan) and the General Confederations of Industry of three Italian Industrial Districts (Como, Lecco, Bergamo), where open and collaborative knowledge and skills exchanges will be practiced.
Next to the educational aspect of the research, design can give tools to the Sector through the practice: best ones have been analysed, mapped and finally interesting and applyable aspects from their un-codified actions have been extracted, to develop possible strategies design driven that involve the designer as the mediator/knowledge worker/ manager/ researcher, the SMEs as active part of the knowledge and skills exchange and the community of both professional and non professional contexts.
This actions focused on education and tools for the Detail Sector can be split into six main outputs and direct consequences that are:

- *about people*: a change in the relationships among the actors inside the Enterprise and outside it, where the researcher/ designer is for the first time put in this Sector, the SME learns from the community and also gives technical knowledge to it, the Brands that more and more need scenarios of possible applications of the detail in even less time can obtain innovation (both sensitive and technological one) on its products, new groups of people, workers and researchers are created; -*about process*: a different way of manage the creative and productive process, where the Detail Sector can guide the innovation through collaborative practices;
- *about methods and tools*: educational and training actions are mixed with new practical approaches of learning by doing together; - *about products*: the specificity, the peculiarity and the identity of the fashion product is spread through the detail that cointains the results of the innovative creative processes activated;
- *about the System*: the Details Sector sells commodities or services no more, but also contribute to the designing of the sense of the Fashion Product; the value of Made in Italy as material and immaterial one is improved;
- *about how*: the most important point, because it involves social, economic, creative and productive dynamics that are shared through online and off line social platforms.

To sum up, to innovate the detail and the fashion ornament as potential mediator of both material and non material value of Made in Italy, SMEs of the Detail Sector can restructure their creative process improving collaborative processes in education, research and creative actions with the designer/ researcher through community practices.

COLLABORATIVE SERVICE BASED ON TRUST BUILDING

Service design for the innovative food network in China

Fang Zhong

The social innovation in China is confronting challenges on two different levels: on one hand, in the developed area, the urbanization and modernization degree has been rapidly improved, however, the public transportation, food security, air pollution and elderly people caring, those so-called urban diseases emerged rapidly in the past decade. On the other hand, the huge gap between the urban and rural areas is ripping the country. The industrialized agriculture can not support an ordinary life in the countryside, while the urban citizens are in a universal anxiety about the food safety.

In this background, the vitalization of the perurban area can be the attempt of reconnecting the urban and rural areas, with the collaboration of the citizens, the intermediate link in the distribution system can be shortened. With the active participation of the agricultural activities, the social cohesion in-between the citizens and the farmers could be strengthened during the interaction.

Thus the collaborative service is probed in this research in order to find out a possible solution of social innovation, and the food network is defined to be the research field. After a literature review, case studies and on-site survey, design workshops with specific themes were organized to test the research result and find out an applied strategy for the innovative food network in China.

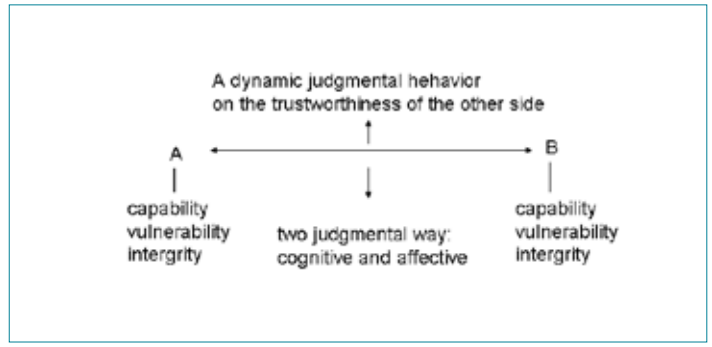
As defined by Putnam, the interpersonal trust is the essence of social capital, and the inadequate of social trust in the present Chinese society is one of the main reasons of the collaborative service, especially in the food network domain. Trust building behavior can be considered to be a judgmental behavior of the trustee's trustworthiness (See Figure 1). And following Mayer's clarification on trustworthiness, the capability, vulnerability (benevolence) and integrity can be evaluated separately or synthetically. And with McAllister's articulation of the two different forms of the interpersonal trust, this judgmental behavior can be fulfilled.

A service design strategy is proposed based on the desk research, field research result and the reflection of the design practices. This strategy starts from the setting up of a trustworthy innovative service by demonstrating the capability, benevolence and integrity of the service. The true and detailed information on the service initiation (WHY), service content (WHAT), service provider (WHO) and service enabling solution (HOW) plus positive civil behavior can be the effective parameter for the service customer to evaluate the capability, benevolence and integrity of the service.

In order to demonstrate these elements of trustworthiness, two different menthod_cognitive and affective_can be applied by the service provider. However, in addition to the direct trust between the service provider and customer, the indirect trust can also influence the judge. The collaboration in-between the service provider and customer is a bilateral evaluation of the trustworthiness of each other. Therefore, for the provider (organizer) of the collaborative service, the functional collaboration comes from the following steps:

1. Clarifying the content of the collaboration (which kind of collaboration is needed);
2. Defining the profile of the collaborative participant (will and interest);
3. Evaluating or improving the capability of the collaborative participants;
4. Preparing the alternative solution.

Based on the strategy, co-design practices are carried out with three creative partners: Calendar Restaurant as a community restaurant, Green Union as a customers' cooperative, and Little Donkey Farm as a community-supported farm. All the design results will be a part of their service platform. For the Calendar Restaurant, a new website is developed in order to initiate the collaboration in a monthly dinner. The identification of the service provider, the preferred service participant (client), the service content, the detailed information about the event and the content of the collaboration is the base of a mutual understanding and the further collaboration. Different SNS tools are linked on this website in order to maintain a long-term interaction.



1. The way of trust building in collaboration.

2. The website framework designed for the Calendar Restaurant.

For the Green Union, the design proposal is the improvement of the existing website with the focus on providing sufficient information about the products and effective interaction in-between the GU and the members. For the Little Donkey Farm, a toolkit combined ecological farming technology and the interaction platform in-between the farmers and the private garden members is designed to improve the service.

The research is an effort of interdisciplinary research. Anthropological and sociological methods were applied and combined with the literature research, and the theoretical research result was applied into and tested by the design workshops. Co-design practices functioned as the application of the service design concepts. Aiming to propose a suitable strategy to the neonatal innovative food networks in China, the feasibility of concepts is considered to be prior to the creativity.

However, this research is limited by the long-distance observation and the capability of applying quantitative research tools. And this will be improved in the further research.