The Chair of The Design Research Society Forward

The formation of the Design Research Society (DRS) is intrinsically linked to the emergence of design research as a recognisable field of study in the 1960s, initially marked by a ‘Conference on Design Methods’ at Imperial College, London, in 1962.

Its purpose, then and now, is to promote ‘the study of and research into the process of designing in all its many fields’. So DRS is an interdisciplinary learned society that seeks to achieve its aims through conferences, publications and information for its members and the wider research community.

As we met in Southeast Asia for DRS2012, design research had continued to evolve and develop whilst trying to address many of world’s most challenging social, technical and environmental issues. The advance of the digital economy and pervasive media had also created new fields of inquiry alongside, or as part of, the creation of the artefact. It’s within this context that Chulalongkorn University in Bangkok hosted the sixth DRS international conference. In furtherance of the aims of the Society the biennial conference series has always been open to a diverse range of design and design related disciplines.

The theme of the DRS2012 conference, ‘Re:Search: uncertainty, contradiction and value’, continued this tradition and sought to cover a wide range of perspectives on the theory, education and practice of design.

The biennial conferences serve several purposes. As a series of events they provide an influential forum for discussion and debate across our respective disciplines and importantly it’s an opportunity to disseminate high quality research and scholarship which has been subject to strict peer review. However, the conferences serve one further purpose, they reflect new kinds of design practice and theory which confront and challenge existing doctrines.

Over the last ten years we have seen the application of design expand to reflect modes of output and intervention in physical, virtual or conceptual form.

In a recent journal paper I suggested five themes to encapsulate the contributions made over previous conferences: Contextualisation, reflections on the discipline and the pedagogic and philosophical positions which underpin it such as design history, education policy and the cultural contribution and impact of design; Strategisation, the management and strategic approaches devised to derive benefit from design, and to improve social, cultural and political problems such as environmental and sustainability issues; Conceptualisation, our essential understanding of the creative process, the skills and experience of practitioners and the factors which influence the generation of ideas and concepts; and lastly, Implementation the processes, often iterative, through which design manifests itself including modeling, testing, prototyping and manufacturing.

These themes and the emerging fields of inquiry demonstrated by the DRS Special Interest Groups – Experiential Knowledge, Wellbeing and Happiness, Pedagogy, Human-Object Interactions (OPENSIG) and Inclusive Design – all feature in this years conference and reflect the evolving nature of design research.

As the production of knowledge is becoming increasingly collaborative and focused toward strategic research priorities, driven by sponsors and funding agencies, design, arguably more than any other discipline, has extended the parameters and boundaries of its associated domains of knowledge and practice.

DRS2012 extended these territories that bit further!

PROF. SEYMOUR ROWORTH-STOKES
Chair of the Design Research Society
Welcome to the proceedings of the 2012 Design Research Society International Conference hosted by Chulalongkorn University in Bangkok, Thailand. We are pleased to bring you the proceedings of this biennial international conference. The international DRS conferences are held during even numbered years in various countries around the world. Previous conferences have been held in London, Melbourne, Lisbon, Sheffield, and Montréal, and this year in the exciting city of Bangkok in Southeast Asia.

DRS and the Scientific Committee worked closely with the host organisers throughout the review process to ensure the continued quality and rigour of the review process. We are most grateful to the hosts of this year’s conference for the hard work they have put in over the past two years. A special thanks also goes to David Durling, who spearheaded the development of the conference presentation submissions and early decision-making in this process and without whose input this review process would not have been possible. As with every DRS conference, maintenance of the highest standards is important and sets the bar high for the published research papers, ensuring a solid content for the proceedings and a benchmark for peer review of research papers. This year the paper submissions covered extensive themes and emerging research that is broad in scope and depth, submitted with the conference theme of Re-Search: uncertainty, contradiction and value, in mind. The initial abstract submission was high with approximately 550 initial abstracts submitted. Of the 288 full papers submitted, 183 papers were accepted and of these 154 papers were presented at the conference along with an additional 23 poster presentations. It is interesting to note that this year local research scholars were active in presenting their research, adding a rich element to the conference topics on local themes and issues of relevance to design research. Strands include papers on such topics such as design theory, methods for design and research; reflective practice; interaction; user centred and participatory design, and design management among many others. Of additional note, we are also pleased that there were several Special Interest Groups of the DRS participating in the conference streams this year: EKSIG (Experiential Knowledge), WellSIG (Wellbeing and Happiness), PedSIG (Design Pedagogy), OPENSIG (Objects-Practices-Experiences-Networks) and a new interest group in Inclusive Design. This adds richness and depth to the conference strands, allows for multiple research perspectives and generates new knowledge.

The review process for the submitted abstracts and papers is a serious process that is supported by the DRS. Members of the Society assist organisers as advisors and reviewers alongside the invited reviewing team. The editor noted in 2010 that each DRS conference further develops and hones principles of high standards in the selection of papers that are presented and subsequently published in the proceedings. With this in mind, reviews are conducted through a multi-stage process to assure that only well written papers that represent cutting edge research are presented. Papers were accepted within streams that provided support for issues and concepts relating to new and emerging research.

As in 2010, the review of proposals for the 2012 conference was overseen by a small internationally based Review Committee appointed by the DRS, leading a large international invited review team of 181 persons. All reviews are double blind, meaning that the reviewer and the author are unknown to one another. We are very grateful to this independent group of international reviewers, all of whom contribute volunteer time and expertise in judging the quality of the papers and their relevance to the conference themes. Each full paper has been reviewed by at least two independent reviewers, along with at least one member of the Review Committee. Where possible, the expertise of reviewers is matched with the themes and/or subject of the paper. With the high quality and variety of expertise of the international review panel members many of whom are internationally prominent scholars, we are fortunate to be able to match fairly closely the topic with the various reviewers and their expertise.

We would like to thank the conference organisers, the DRS Special Interest Group convenors, the international reviewers, and our colleagues on the Review Committee: Richard Coles, Tom Fisher, Kristina Niederrer and Michael Tovey. We hope that you enjoy the conference and that these proceedings accompanying the conference are of interest and relevance to you, your students and your colleagues.

TIUU POLDMA, ANNA VALTONEN
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Re-consideration of the Role of Mythical Thought in Design: A study on alternatives for scientific design methods

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Abstract

Industrial Revolution brought about fundamental changes in the essence of design. These changes occurred through shaping Modern thought and were also a response to needs of modern world. Prominent Thoughts in Modern Design led the academics toward more concentration on Engineering and Industrial Production. This direction reduced the relation between designers and users, including also contextual factors. Consequences of this problem was resulted in anti-functional movements and also post-modern thoughts, in which directions such as emotional design, Cultural design were defined and the direction was changed toward mass production and regional production. Production in a regional way needs a better understanding of logical elements and users. One way to reach such a knowledge is through investigation of myths from different nations. This research tries to introduce a sort of specific mythical logic, in which it’s essence and functions have been shaped based on contradictory dualities. It has in itself the functional manner of human mind in it’s natural situation. It also has an ability to be shaped as a new trend in design theory based on personal understanding and consciousness of members of society. The aforementioned mythical thought can be used as a tool to generate more knowledge from users, or generate cultural and social features, it can also function as a tool to help the designers through social and logical elements.

Keywords: design theory, tacit knowledge, design methods, industrial design
Introduction

Scientific order and thought began by scientific revolutions of 16th and 17th Century and it went further by doubt in Greek Philosophical Vision through Philosophical investigations of Descartes (Collin, 1983: P.18). At this time modernity was shaped and its result was Pragmatic Movements of Bauhaus, Ulm, International Style and Rationalism. Industrial Revolution and the resultant Industrial Production brought about new needs and opportunities, which resulted in changes in relation with client and also changes in interaction between products and users (Michael, 2008). Supporters of Modernism and functionalism were trying to reduce objects to Formal and Functional aspects and also tried to offer products with high quality, long duration and cheap price, which needed standardization and use of simple and geometric forms (Hauffe, 2007, P.15). The beauty of Products relied on function, simplicity, rationality, novelty, originality and unity. Considering simplicity of forms and shaping functions through artifacts was a very important step in for advanced Industries while considering social needs (Vared, 2004, P.37-39). This problem was the only value generating point for them. Avant-Garde designers never considered emotional and cultural aspects with the users; they never incorporated them in Design. Designers of Modern Era looked for products, which could be global and could be used regardless of Regional and Geographical and could be used in every place and every time.

At the end of 1960’s, anti-functional movements in modern era were shaped in the names of Radical Design, in order to confront Consumerism and was based on political and social motifs. Beliefs of Radical Design had a very important aspect on further waves of Italian Design, such as Alchimia and Memphis group (Thomas Hauffe) and in 1960’s a transition of design from Modern to Post-modern was prepared based on them. Shaping this movement was occurred in continuum of the previous activities, with the aim of struggling with Pure-Functionalism of Modernism. Post-Modernism believed that contemporary emphasis on innovation and creativity, which was prominent in Modernism, is out of date. Each work of art would be meaningful only in it’s cultural, historical and social context, therefore innovation without cultural and historical association would be without identity and meaning (Lucie-Smith, 2003, P.254). Through Shaping post-modernism, approaches such as design and culture, and design and environment were shaped. At this time groups such as Alchemia and Memphis were shaped that were trying to generate a strong emotional relation between users and products, moreover expressive qualities and narrative structures entered the realm of objects. At this time, designers were trying to engage emotion into daily life of people and generating characters had an important role in shaping daily interaction with artifacts. Generally speaking, post-moderns were trying to omit modernist’ slogan : Form follow Function.

In post modern era, new visions and considerations came into existence: such as experience based design, Interactive Design, Emotional design and Conceptual Design. Experience based design was trying to generate new experiences for users in three levels of Aesthetics, Emotion and creating a memorable artifact in the mind of users (Lawson, 2004, P.171). Translating emotions and psychological needs of users into design features and their participation with designers, finally reached a design which was in accordance with the users view and needs, This became the main current in Interactive Design. On the other we also have Conceptual Design, here we witness a specific shape of art, which tries to reduce physical and external aspects and motivate mental power in the work of art (Lucie-Smith, 2003, P.201).

In post-modernism, Industrial products have to the right to introduce themselves as unique and un-repeatable objects. This Stands in contrast with the aim that many things
which originate from Artistic value would be multiplied for comprehensive communication. Artistic Diversity and co-existence between ceramic artifact and the ceramist, or existence of Industrial Architecture in space of our homes would show the possibilities of seeking a dialogue between art and industry (Mendini, 1996, P.7). At this time, thanks to the struggle between post-modernism and International Style and also thanks to mass-production, a sort of production logic based regional features came to existence. It was in reality a sort of production, with some similarity to Modern, in which objects and New products would express concepts, beliefs and thoughts of different societies. Post-modern thought let designers that instead of designing a product for all the societies, they could have their own design based on thoughts and tendencies in the society. Post-modernism used tools such as language, signs, Rituals and objects, narrative structures and myths. So the post-modern human can move between the world of artifacts as if he has entered an endless Odysseus. Nowadays, information technology has brought about a small but endless world for us. Therefore it sounds logical that design would follow Homer-like approach and fable saying approach. (Mendini, 1996, P.9). Mythologies, as generative features which express the everlasting thoughts of human, express Knowledge and old thought. The manner of human logic, in its epistemological sense, express a definition of life, a set of perceptual methods and brings a sort of ability, which can canonize and apply science, and in most of time would result as a tool for knowledge toward definition of vision in non-narrative way. Most of the artifacts of the world were the result of this integration and they have relied on signs, as a descriptive method, to reflect the knowledge of the era dominating culture, traditions and artifacts, most of contemporary designers have also used semiotics in product design as a production method. This thought would have their own specific results which can be found in pre-industrial era.

Mythology

Mythology in Old Greek Culture was an Vital Experience which was involved in daily processes of Human (Zeimaran, 2001). Greek mythologies were trying to express details of life, Gods, heros of stories, mythical creatures and origin of the world. Modern Scientists, through investigation of myths of Greek and Religious narratives, wanted to find a correct understanding on the essence of self-built myths (Hellas, 1952). Origin of Greek mythology was an attempt to explain the origin of world and it was only in the limited region of human understanding in order to help to know better the human (Klatt-Brazouski, 1993).

Mythology was the symbol of life before science and icon of archeological life. Change of myths in every nation, would represent change in life, change of social structures and change in thought and knowledge. In reality, mythologies would show a fundamental change in increasing attempt of human mind. Mythologies are narratives, which originates from Nature and mind of primitive human, and it comes from bilateral relation between these two. In other words, myth is an attempt to the relation between surrounding realities with meta-physical realities. In defining the phenomenon which human was not aware of its origin, have come to meta-physical phenomenon and this happens when human knowledge has not justified surrounding phenomena. In other words, human created myths in order to generate a peace between nature and him (Wikipedia.org, 2011).

Myths are trying to find the reason of phenomena and seek the destination about the common phenomena and reflection of long lasting beliefs of the society about fundamental problems which are un-understandable for human. Myth is not result of mere
experience, and does not try to express the mere truth, but tries to fertilize truth inside itself. Human generates profit from myths in order to know better the material world and reach a better lifestyle.

Mythical Vision narrates of other aspects of being. This realm is not in accordance with rational principles, it is in contrast with rationality and in some parts has a complete dominance on it. Mythical vision offers an immediate vision and has a hidden presence (Shayegan, 2000). Although this thought is old and originates from Pre-modern time, but it would not become old and it would not be wiped away. Modern thought has a dual origin, this duality is the origin of enlightenment. One of the dual polarities which is very prominent in modern thought, is the relation between myths and ration, which was the classical criticism in which rationalism in Modern Era had on Christian thought (Gadamer, 1993).

Scientific thought tries to grind the problems into their most little origins, so that it could generate an acceptable solution for each of them (Straus, 1980). However in mythological thought, there is no clear border between whole and particular, in reality whole is a part of particular and particular is also a representative of whole. In reality, in mythological thought, there is a current, which is in contrast to the main current in scientific thought, this way of thought tries to find the origin of phenomena based on whole. In reality those phenomena would be decomposed into particulars, so that the essence of whole projected on the system would be understood. In our way of understanding from works of art, a similar effect would happen, which is named as reversal. Based on this phenomenon, the way human perceives works of art is based on that in the beginning, the whole would be understood in the beginning and based on that particulars would be interpreted and understood (Straus, 1908).

Mythologists have used myths, based on two elements of synchronic and diachronic issues. However, those theories which investigate myths from the realm of culture and religion and consider that as a tool to understand Essential Being, a guide for human life or a tool to solve the scientific phenomenon through Myth of Creativity. These kind of theories lack a logical system and those philosophers who have studied myths from biological, Psychological and based on function of mentality, they have not considered a tangible logic for the myth. These philosophers believe that the best way to understand the truth behind myths is to investigate the human mind. There also exist people who have studied myths from structural viewpoint and would offer a sort of logic and rules for it. Claude Levi-Straus is one of them. Mythical logic belonging to Straus would try to generate a compromise between terms and opposite concepts which are not in agreement with each other and would enlarge process of replacement so much that original contrast would disappear. He believes that in order to understand the meaning of myths, internal and deep structures should be clarified. According to Straus, myth is nothing but narrations of human mind. This is an emphasis on connection between mind and language, according to Straus social element is dominant to personal element. In general we can say that, myth is the language of un-conscious that should be expressed in order to be understood (Wiseman, 1977).

The main function of myth, from viewpoint of Straus, is a logical expression of contradictory structures and presentation of a appropriate model so that it could conquer the contradictions. Myths use two methods of debate and analogy in order to conquering contradictions. Contradictions in myth would be borderless, like other phenomenon. These contradictions are result of struggling in humans, to be a human or not. Such problem generates struggles between human and nature, in other words, this is an expression of passage from nature to culture. The clash between contradictions would be in reality a plan for description of the world (Robert A. Segal, 2004).
The main hypothesis of Levi-Straus about myths is that they come to existence through procedure of change of one myth to another. According to Straus, nature of myths is that they are always in the process of changing from one myth to another and none of them have the final meaning. The procedure of change of one myth to another is not a linear process. Myths are shaped in related groups that carry part of the procedure of change. However, each myth is consisted of set of themes which is a sort of transformation from other themes of other myths. The general picture of picture of multidimensional pictures with axis of change and transition, it is an endless network of stories. The method of Straus in mythology is to divide fable like narratives into its particles, so that their framework would be found and detained how much this frame could be connected to other frames in other myths. He divides the linear passage of stories and shows how much a myth is consisted of different relations that could be synchronically considered as a structure. The general theme of all myths is transition from nature to culture. Transition from Culture to nature is the transition from raw and primitive to cooked and mature, which is narrated through mysteries and codes. Myth is a network that could be defined just by it’s structure. This network discovers meaning for the person, of course not the meaning of myth, but also the meaning of the rest of the world, or the considerations of the other part of the world, society, history, all of which are in the margins of consciousness, this includes also all the questions that exist for them. The meaning is not in Myth, but myth and all the considerations that myths create are structures in which we understand the other world, based on them (Wiseman, 1997). In continuum of investigation of myths, Straus divides the myths into their littlest units, and reaches synchronic and diachronic groups. Synchronic groups offer narratives which define a general concept and diachronic show phenomena which happens in a specific time. Based on this division, relation between units of myth can be generated, narrative-parts which have the main role in generating the chain of myths would be discovered. As a result, the main structure, which is extracted out of dual contradiction, would be discovered. These contradictions show the concept of culture and nature, that have been shaped, thanks to different social and cultural aspects. Logic in the myth is universal and would not change based on cultural and regional aspects, only output would change based on essence of input. This structuralist view of Straus for myth has generated a sort of action and reactions between input and output of myths, which could generate new methods and new theories in Design. Logic of Myths has had some general function like design theories. The only difference is in between input and output. However the main specifics of such a logic, which defines a general structure of mythical narratives, would generate the ability to enter theories of design, so that it would help designers to analyze better social features and extraction of design features based on dualities.

Mythology and Design

Design, in its essence, is a human activity in order to shape and build environment, this would be done based on patterns which do not exist in nature, in order to afford human needs and give meaning to their life (Heskett, 2002). The main discussion in Design Process is the way in which form is generated, which is a result of interaction between designers and their world. Design process is indeed a set of activities and practices which has been shaped in time and evolution of each process would be a step forward to pre-defined aims. In reality design process is aimed to reach a solution for design problem (Michael, 2008).

In describing the design process, there are two important visions: design theory and design methodology. Each one of them has a specific viewpoint and is differentiate-able in Design Process. The main important point in this discussion is how design is and how
it could be. According to Cross, in order to reach the difference that what design is, and how it could be, we need to find the difference between Design Theory (how design is) and design methodology (how it could be). In order to describe these aspects we need a theoretical framework; this framework is actually theory of design. Design needs a strong theory in itself so that there could be an order between different elements of design; it would be also needed to differentiate between different methods. The strong theoretical concepts would improve productivity and would generate a wider view and clearer one toward problems and design solutions. Design theory is indeed a functional theory, which means that it mostly include orders or tools that describe how to work. The main design theory is indeed the beginning point is the point where design is motivated, through definition of styles (Poelman, 2008).

Every manner of function and definable in design process could be considered as method for design. Design methods are ways, technique, tool or other instruments that would help designers reach new and creative solutions. (Cross, 2000)

The main approach of design methods are especially in affecting the decisions and designers tendency in design processes. Every method has its own procedure and is a process which has these conditions, having them would introduce it as method (Poelman, 2008)

- It should define a clear aim in Design
- Procedures and order of phases should be clear
- It should have application in different situations and should be usable
- Every one should be able to use it
- It should have an order and discipline and it should be clear what is the first step and when it finishes

Strategy refers to plot, program and sort of activities that would be shaped in order to reach a specific goal (Heuser 2010). Design strategy is a set of activities which are being conducted by designers or decision managers' team, so that activities would be led in order to generate steps toward final design. (Jone, 1992) Design theory is in reality a sort of rationality which can control the design process. Design theory is also affective in changing internal features in to external ones and they also shape the final solutions. Design theories are a sort of logic that which has the potential of activity and reaction, the same as logic of myth in this research. So that it explains the beliefs and consciousness of people in order to define better and understand-ability from receivers of them, in the shape of narratives.

Dominant Theories for new methods of design have divided them into two groups of innovative methods and logical or systematic methods. There are several methods which their goal was to motivate and stimulate creative thinking. Creative Methods of design, would be improved based on diversity of ideas, and it functions through removal of logical constraints, which ban idea generation and creativity, it also functions through improving domain of search and the environment in which idea generation functions (Cross, 2005).

Most of attention in design methods is about logical design methods. However, logical methods and creative ones in design are completely similar to each other and both methods try to reach a systematic process in design, improving the quality of decisions about design problems and helping the designers and design groups in order to manage activities. Moreover they tend to help group works and also helping designers to reach a specific agreement point for idea generation and activity, so that they would not stop in specific parts of idea generation (Cross, 2000).

Some parts of Creative methods have been aimed to make a mental spark to reach creative solutions, new ones and also stimulating mental creativity of designers based on
mind and unconscious thought of designers. Other group of creative methods, have been aimed at to reach solutions by injecting a specific idea current, mental territory or a very strong stimulation to designers’ mind. The main specific specialization of this method is clarity of domain or final features to offer the solutions. In general we can say that, when the idea exists in the mind of designers, designers would develop their own specifications based on the developing the idea and they go on generating solutions through integrating specifications with their required function.

In contrast with Design methods, there are also other logical methods in design, which the dominant logic on them would help to reach an acceptable solution for different design solutions, based on different forms or different mental currents dominating them. Some sort of logical methods would generate their input from users and target groups and affective elements of them would generate a solution, while there are also some other kinds of methods which would have a sort of systematic logic and a particular view is on them. These groups of methods would go forward through changing the design problem definition into smaller elements of different patterns of communication between them and would generate an appropriate pattern between features. Regarding the theories and logics of thought which have been aimed at design, there exists a specific form of logic which directs design as an activity between internal and external features and would affect the inputs, process and final outputs. This logic works the same as mythical logic. Designers can reach a general concept of a specific Social system, which has been concentrated through different ways through design. Based on different feedbacks of a social view and based on contrasts and dualities of contradictory concepts and also through expansion and investigation of activities in generating an independent whole, they could reach the design features. Different contradictions are in reality expression of a society or a social concept in the form of a narrative.

Discussion:

Human being, in every timeline have been involved into two kinds of thought: One is the thought which is dominant in society and would change based on social and thought changes and revolutions, while other kind of thought exists in the nature of human being and has been a sort of vision, rather than a form of thought; we know this second kind of knowledge as mythical vision or collective consciousness. The main point is that, while history goes forward, those thoughts which were built in that specific time would exist only in that specific time and would be replaced by new thoughts based on social and historical changes. But Mythical thought would be timeless and would exist in different timelines with human and in his nature. Structure and the manner of functioning of it would be because it is a part of true essence of human being and would not change. This vision is not old and would not be lost, but will continue to exist along with other thoughts or schools. The only change it could have is to exist behind other thoughts or temporary visions, however the essence and its function would not change.

Myths and mythical narratives are output of a mental and social system of thought, which expresses the way human being understands society. These outputs have been changed into mythical features. Such a logical current would be known as Universal Logic of Mythologies. Its functional domain is general, the only difference is between their outputs, which is the result of difference between cultures and nations. It’s general function would be also based on fellowship of meanings of methods in order to generate a whole. There are similar process in the domain of systematic theories in design.

Another point which legitimates the existence of mythical thought as a theory in modern world, are the discussions about difference between New science and old Knowledge,
this is one of the hot topics between post-modern philosophers. Some of them claim that a sort of new knowledge has come out of old knowledge and new science. Some other thinkers, such as Umberto Eco and many eastern philosophers, consider this thought as hidden, strong and changeless in the nature of human being and have discovered some traces of this movement which has been reached through a adaptation between modern and traditional thought. Jung have considered this logic as a part of personal and collective un-consciousness .Claude Levi-Strauss have also considered this as similar logic with human thought, which has been changed as a something different.

In the realm of Industrial Design , we have witnessed thoughts of Alessandro Mendini about the necessity to revitalize of traditional thought and a sort of rituals around objects and revitalizing the essence of object in modern civilization. Most of the tactics of User Centered design in this time try to answer the questions based on logical manner and post-Cartesian logic and engage just emotional in the design. It seems while dominance of scientific production in the early years of Industrial Design was a result of modern thought and logic, it would be changed nowadays based on collapse of mass production system and re-introduction of artistic skill and crafts.

Mythical Knowledge can legitimate and use science and in most of the times, science is a tool in the hands of this knowledge in order to generate vision in non-narrative formats. Most of the world’s products are result of this integration and based on signs such as manner of expression would reflect common knowledge in cultures and traditions in their own artifacts, many contemporary designers have applied semiotics in their design process. However there is not still a process which would use mythical logic as a dominant theory in design. Myths have a systematic structure, in which their function works as some theories of design , the same as logic in QFD methods, Kansei , User Centered design and also some systematic methods. In Mythical system, input would come from different domains of society and would be transformed so that mythical outputs in the shape of narratives and can be better understood by people. In other words, a sort of collective vision would be changed to a understandable and tangible output for the people. Mythical Outputs are offered in order to reduce distance between human visions and reach a common thought or way of thinking and action.

Logic of Mythologies have been consisted of a Logical structure which resembles some systematic methods of design, in which they have an activity and metabolism between inputs and outputs , and also it has an effect on inputs in order to generate outputs . Mythical features act like procedures of design methods in order to reach creative ideas, however this sort of creativity is much more nearer to the mentality of human being

Discussed logic would act like systematic methods of design and their current is based on internal features. The difference is that input elements in Mythical system is consisted of cultural features, and the other difference is in the type of external features , which are in the shape of narrative formats. Designers can use them in their idea making process to generate new design concepts. In order to reach the total form of myths, designers should investigate the external features and find the contradictory dualities in them.

This logic has the ability to change into a specific design theory, conceptual design based on social aspects and also beliefs of people which would be resulted from their internal vision. The main point, which is important to mention is its change-ability that would generate a whole out of contradictory concepts, in which their narratives and output could be visible. This logic has also the ability to extract concepts from daily life of human beings and their collective un-conscious and offer it to the designers in the form of contradictory dualities or specifications from cultural, emotional or religious contexts.

The first and the most important part of design process, is exploration and investigation of problem definition or design problem. In this part, logic and theory of this phase of research would act like methods named as boards, images, mind mapping and even more systematic methods in which the main goal of their activity is based on human elements and features. It is the same as Kansei Engineering ,QFD and further methods.

In idea generation method, methods such as Kansei Engineering and QFD could be used In order to let generated feature approach each other and also in order to reach final ideas for different functions. In order to reach new and creative ideas, we can use
process in Analogical methods, Limited expansion of Ideas and also morphological charts.

In the end, we need to notice that in process of investigation of myths and use of their logic, as it was mentioned before. Expression of myth as kind of mental logic, is not a pre-modern thought, but it is an expression which is in accordance with modern thought. The aim is not return to pre-modern and pre-industrial era, but the aim is to know the mental logic which are without unsystematic thought, and is also consisted of a complicated thought process which tries to differentiate and unify our knowledge from the Being.

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Engagement while Reading Manga: Measuring Indonesian readers’ immersion within manga’s universe

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Abstract
The introduction of Japanese manga to Indonesia has triggered a big impact toward the community, a proof of a successful intercultural reception. The widely reception of manga showed manga enormous capability in attracting the attention of Indonesian readers, which came from a different cultural background. Previous studies on manga (Schodt, 1983; McCloud, 1993 and 2006; Natsume, 2010) suggested that manga’s advantages specifically lay on its visual ability in putting the readers inside its universe or immersion, which is referred as narrative engagement (Busselle and Bilandzic, 2009), identification (Cohen, 2001), or experiencing the story (Jones, 2008). Immersion here referred to the feeling of being in the same universe as the characters, to participate within the story and to relate personally toward the characters. Developing from the field of cognition and perception, this study investigated the level of immersion among Indonesian readers while reading manga, as the influential factor behind manga’s successful reception. 59 young Indonesians between 15-24 years old were participated in an online questionnaire which explored their perception on manga visual attractiveness and the level of immersion constructed when reading particular scenes of manga. Utilizing specific form of questions, the participants were asked to rate manga visual attractiveness based on McCloud’s manga visual storytelling techniques (2006) and the visualization of particular manga scenes in relating to their feeling of immersion. Results indicated that beside the emotionally expressive effects as the most attractive factor of manga visual, Indonesian readers had the tendency to find their selves being part of the story, establishing a deep emotional attachment with manga. These findings further acknowledged manga’s capabilities in immersing its readers as an important factor in its successful intercultural reception.

Keywords: Manga, perception, emotional attachment, immersion
Introduction

The impact and influence of Japanese pop culture in the form of manga (a term for Japanese comics) in various countries outside Japan has been widely recognized (McCloud, 2006; Bouissou, 2006; Vanhee, 2006; Thompson & Okura, 2007; Dolle-Weinkauff, 2006). Previous studies on Japanese manga suggested that manga had been perceived as having different and unique visual style and storytelling compared to its foreign counterparts such as American comics or European comics/Bande Dessinee (Schodt, 1983; McCloud, 1993; Ingulsrud & Allen, 2010; Natsume, 2010; Odagiri, 2010). Cohn (2007) defined this distinctive visual as Japanese Visual Language (JLV). The differences seemed apparent because manga itself had evolved from the long history of Japanese’s pictorial culture. Furthermore, most Japanese manga artists have created manga with only Japanese readers in mind. Therefore it is common to find language and culture barriers between manga and its foreign audience. Despite these setbacks, the influence of manga outside Japan, including in Indonesia, have become more evident.

Manga was officially introduced to Indonesian readers through the publication of Doraemon, Dragon Ball, Chinmi the Iron Fist (known as Kungfu Boy in Indonesia) and Candy Candy by Elexmedia Komputindo in the beginning of 1990s. Despite significant cultural differences toward Indonesian readers, the popularity of manga was soon increased rapidly and produced a booming demand in the comic market at the end of 1990s (Ramadin & Ahmad, 2000). After around twenty years since its first introduction, manga nowadays are still dominantly present in the market (Bae, 2007). It is widely assumed that manga visual distinctiveness such as character designs, visual effects, paneling arrangements, along with its wide range of themes seemed to be the main factor in manga’s attractiveness, making manga easily being accepted among Indonesian readers. While at the beginning of its publication several methods had to be put in place, such as the flipped version from the original manga to accommodate different reading method (pages of manga are read from right to left while Indonesians are habitually read from left to right) and therefore minimizing possible cultural differences setback, the Indonesians are quick to adapt with those differences. The majority of manga published nowadays retain its original Japanese reading format, further suggests the successful cultural interrelationship.

Further studies on manga also suggested that manga’s advantages in easily being perceived by its readers specifically lay on its visual ability in putting the readers inside manga’s universe (Schodt, 1983; McCloud, 1993 & 2006; Natsume, 2010). The importance of the feeling of immersion related to the acceptance of a media had also been studied before, which resulted in the terms of narrative engagement (Busselle & Bilandzic, 2009), identification (Cohen, 2001), or experiencing the story (Jones, 2008). Developing from the field of cognition and perception, this study investigated the level of immersion among Indonesian readers while reading manga, as the influential factor behind manga’s successful reception.

Manga: Visual Communication on Comics

Various studies had acknowledged comic’s capability in connecting with its readers (Eisner, 1985; McCloud, 1993; Jones, 2008; Yang, 2008; Cohn, 2010; Medley, 2010). Jones (2008) also implied that comics employ techniques to amplify the feeling of presence. Furthermore, while inviting readers to participate within the story would be a common trait with other comics, manga has developed a different method in achieving it, in which McCloud devised it as manga visual storytelling techniques. These techniques amplified the sense of reader participation, in which the readers would feel of being part.
of the story rather than simply observing from afar (McCloud, 2006). He enlisted eight manga visual story telling techniques which are applied to create the intimate connection: iconic characters and variety of character design would lead to easy reader-identification; strong sense of place combined with small world details, wordless panels and aspect to aspect transition would trigger readers’ imagination and the feeling of being inside the story’s universe, empowering engagement toward the readers; subjective motion would put the readers in being part with the action; genre maturity would enable manga to satisfy a very broad range of readers’ interest; and emotionally expressive effects would put readers into the same emotion as the characters (Figure 1).

The ability of transporting audience inside the story’s universe is also recognized as an important factor in influencing audiences (Schodt, 1983; McCloud, 1993 & 2006; Cohen, 2001; Konijn & Hoorn, 2005; Jones, 2008; Busselle & Bilandzic, 2009). Busselle and Bilandzic (2009) in their study in measuring narrative engagement argued that engaging experience with narrative would affect enjoyment and agreement with story-related attitude. Study in game media further underlined the importance of narrative engagement and identification. The study by Park, et.al (2010) suggested that the compelling narrative and being involved psychologically with the game characters would motivate player to do well in playing games. Jones (2008) described this as ‘experiencing the story’, while Bloom (2010) mentioned it as ‘transported’, which is common term for psychologists who work in this area. He further suggested that it is natural that while reading a story, humans would experience the story as if they are in the character’s head. Moreover, the visual on manga, such as panel layout, images and script provoke a manga specific temporality within readers, ensuring the feeling of immersion (Natsume, 2010).

In relation with Schodt (1983) findings, McCloud (2006) argued that the particular genres of manga which aimed at particular readers were provided with specific visual storytelling techniques. As a genre that specifically aimed at girls, shoujo manga provides a window to connect with the emotional lives of its characters, while shounen manga (genre of manga aimed for boys) invites its readers inside the action, providing a visceral thrill which is enjoyed by its mostly male audiences. These unique storytelling techniques had put manga in the advantage position in creating closer relationship with its readers (Schodt, 1983; Cohn, 2007; LaPlante, 2008; Ingulsrud & Allen, 2010).

The other aspect of manga that positively perceived by its readers is its simple and distinctive visual. Manga extensively boasts a combination of iconic cartoon characters
with realistic backgrounds. The simple character design enabled for easy identification and representation (McCloud, 1993) and goes along with how human process visual information (Lang et al., 1999; Medley, 2010; Cohn, 2010). The realistic background would produce a strong sense of place, helping readers to connect with their memories and experiences to form strong personal relationship with the story universe (McCloud, 2006).

**Methodology**

**Respondents and Procedure**

Respondents were 59 young Indonesians (69% female), aged between 15 – 24 years old with the majority were students (58.6%) or fresh graduates from Visual Communication Design program, Bandung Institute of Technology (ITB), Indonesia.

Respondents were personally invited through social networking site of Facebook and assisted by colleagues from ITB. The questionnaire was created using web-based online survey application, Survey Monkey (http://www.surveymonkey.com). Running from June 1st to June 10th, 2011, a total of 110 respondents logged to the questionnaire with 77 of them actually completed it. A final 59 respondents were further selected based on their range of age (15 – 24 years old) since the purpose of the study was to investigate the phenomenon among young Indonesians. All respondents were purposely informed that the questionnaire intent was to obtain their personal opinion regarding Japanese manga.

**The Questionnaire**

The complete questionnaire consisted of 56 questions, after the additional demographic information. It is originally aimed to obtain descriptive result about Indonesian young readers’ perception about manga and how manga visual affect their style of drawing. For this study, responses from seven specific questions which measuring the manga’s visual attractiveness and the level of immersion while reading manga were analyzed. One question utilized finding by McCloud on manga visual storytelling techniques (see picture 1) in order to observe which visual aspect of manga as the most attractive. The other six questions asked the respondents to rate the level of immersion they felt while reading specific manga scenes.

These six questions were developed from the study by Jones (2008) about the audiences’ engagement level of comics and movies from comic adaptation. They were designed to measure four dimensions related to immersion level: engagement dimension (Q1: feeling being part of the story and Q5: participating within an action scene), spatial presence dimension (Q4: feeling being in the same location), social presence dimension (Q3: easy to identify with the characters) and parasocial interaction dimension (Q2: feeling the same emotion as the characters and Q6: understand the feeling of the characters by looking into their eyes). Each question was accompanied by compiled relevant scenes from One Piece, Twinkle Stars, Detective Conan, Akira, Dragon Ball and Rumored Midori-kun, respectively and was resized to fit the monitor screen while retaining its legibility and readability. All dialogue texts were translated into Indonesian. The scenes were randomly chosen from various manga titles, accounted for its representative content with each particular question. The depicted scenes included samples from both shounen and shojo genres. They were inquired through 7 (seven) points Likert scales from Not at all (1) to Very much (7). The language used in the questionnaire is Indonesian language, such as Dengan membaca satu adegan seperti contoh di atas, apakah Anda merasa menyatu dengan cerita yang disampaikan?
Engagement while Reading Manga: 
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(translated as ‘by reading to a scene such as described above, do you feel that you are being part of the story?’).

Results

Readers’ familiarity with manga

The majority of participants (94.8%) have known manga for more than three years. However, they did not interact regularly with manga (62.7%) nor read many manga during certain duration. 37% of them read 2-3 titles each month with 27.1% only read one title. The majority (71.2%) also read manga less than five times each week. Other 20.3% of the participants read manga 5-10 times a week.

Perception on manga’s visual attractiveness

Focusing on manga visual attractiveness, the participants (N=58) were asked to rate from McCloud’s findings on manga visual storytelling techniques. Among the eight aspects described by McCloud, emotionally expressive effects was voted as the most attractive factor (81%); followed by iconic characters (72.4%); small world details (75.9%); broad variety of character designs (63.8%); wordless panels (51.7%); strong sense of place (44.8%) and subjective motion (39.7%), respectively (Figure 2). One aspect, genre maturity, was excluded from the question because it mostly dealt with various themes of manga and did not specifically relate to visual of manga. Each respondent could choose more than one answer (multiple answers).

Figure 2 Readers’ rating of manga visual attractiveness
Source: Author (2011)

Manga’s capability in immersing the readers

Overall, the results showed average means above four (4.0), the mid point between 1 and 7, with the highest (5.90) in response for Q4: feeling being in the same location and the lowest (4.53) for Q6: understand the feeling of the characters by looking into their eyes. The result is summarized on Figure 3 and Table 1.
Engagement while Reading Manga: Measuring Indonesian readers’ immersion within manga’s universe

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Discussion

The overall results showed the tendency of supporting arguments about manga’s ability in providing high level of immersion toward its readers. Respondents acknowledged that the iconic characters, emotional expressions and world-building department of Japanese manga as the decisive factor in its visual attractiveness. The high-run of adrenalin commonly found within the genre of shounen and seinen manga, expressed through emotional facial expressions were made them to be perceived easily by readers, while the stories of emotion within the shoujo manga also related perfectly with its readers. Highly emotional scenes tended to trigger the relevant emotional feeling and detailed backgrounds contributed in giving the readers a vivid experience of being within the same environment. Both collaborated in building a high degree of immersion, putting the readers inside the story, as suggested by McCloud (2006). Moreover, the desire to experience emotions is considered as the motivational key in the use of entertainment media (Bartsch & Viehoff, 2010), which manga seems capable to ignite from its Indonesian readers.

Figure 3 Rating of immersion toward specific manga scenes

Table 1

<table>
<thead>
<tr>
<th>Questions</th>
<th>Manga Readers</th>
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<tbody>
<tr>
<td>Q1. Do you feel that you are being part of the story?(^a)</td>
<td>5.24 1.72</td>
</tr>
<tr>
<td>Q2. Could you also feel the same emotional feeling felt by characters within a story of manga?(^b)</td>
<td>4.54 1.72</td>
</tr>
<tr>
<td>Q3. Do you easily identify yourself with some characters in the manga you are reading?(^c)</td>
<td>4.85 1.45</td>
</tr>
<tr>
<td>Q4. Can you feel like you are being in the same location as the characters by looking at the background drawing?(^d)</td>
<td>5.90 1.07</td>
</tr>
<tr>
<td>Q5. Do you feel that you are participating within the action described in it?(^e)</td>
<td>4.54 1.57</td>
</tr>
<tr>
<td>Q6. Could you understand what the character is feeling by looking into his/her eyes?(^f)</td>
<td>4.53 1.63</td>
</tr>
</tbody>
</table>

Note: \(^a\)n=59, scene taken from One Piece. \(^b\)n=59, scene taken from Twinkle Stars. \(^c\)n=59, scene taken from Detective Conan. \(^d\)n=59, scene taken from Akira. \(^e\)n=59, scene taken from Dragon Ball. \(^f\)n=58, scene taken from Rumored Midori-kun!!
In regard of respondents’ immersion within the story and emotional engagement toward manga through its visual, responses were quite varied. Respondents tended to find their selves as being part of the story, especially while presented with highly emotional scenes; and tend to be easily feel being in the same location when reading manga with extensive and detailed background; both with significant high average rating (above 5, with 7 point scales). McCloud (2006) suggested that detailed and well research background drawings would connect with readers’ memory and experiences, giving the drawings character and credibility, not just letting the readers to blend within but also giving the reader the reasons to come back again and again.

The Indonesian readers also tend to find their selves attached emotionally to the characters; easily identified their selves with the characters, a condition established by Bloom (2010) as ‘transported’, when humans are moved by stories; even have feelings about characters and events that actually perceived as non-existence. Bartsch and Viehoff (2010) argued that readers of narrative media content tend to adopt the perspective of the characters, experiencing emotions that reflect their evaluation of events from the characters’ perspective. Perceived similarity is considered a central factor of characters’ engagement and motivates readers in liking particular characters (Konijn & Hoorn, 2005).

Furthermore, the participants feel to be participated within the depicted action scene; and understand the character’s feeling by looking through the character's eyes. Highly emotional scenes tended to trigger relevant emotional feelings. The orb-like eyes of characters from shoujo manga acted as the window to the soul, the place where emotions manifested (Schodt, 1983) while subjective motion in shounen genre triggered the readers’ high adrenalin (McCloud, 2006). However, the average ratings from the later conditions were not as high as the former (between 4 and 5, with 7 point scales). Nonetheless, all results were above the average points which showed significant effect. These findings also relate with the result from manga visual attractiveness question in which readers were heavily attracted toward emotionally expressive effects, small world details and iconic characters and further support previous studies by Schodt (1983), McCloud (1993 & 2006) and Natsume (2010).

Manga’s visual has a tendency in providing the feeling of immersion toward its readers. The readers were able to feel being inside the story and relating personally toward the characters, although the level of immersion proved to be varied in respond toward particular scenes. This showed manga’s capability in providing positive perception in the form of psycho-pleasure and ideo-pleasure, which closely related to Patrick Jordan’s theory (cited in Norman, 2004) of emotional connection between user and an entity. Further more, this also supports Wirth’ finding (cited in Tal-Or and Cohen, 2010) that the ability of entertainment to attract audiences depends on its ability to engage them, involving the audiences psychologically in many ways.

However, this study still has its limitation since the respondents were asked to rate only specific scenes rather than a complete comic book in the attempt to measure their immersion level. The nature of online questionnaire in which the respondents were reading through a computer monitor rather than a real comic book could affect the respondents’ reading experience. However, the habit of Indonesia readers who like to read the scanned version (scanlation) of Japanese manga should also be put into consideration. Scanlation is the online version of manga in which popular manga titles were scan page by page, translated mostly into English by amateurs and uploaded through the internet. Scanlation usually appeared shortly after the publication of the original manga in the magazine format and has gained steady follower from Indonesian manga readers.
Furthermore, there is also lack of comparison because the respondents also only faced specific scenes from manga without any other non-manga stimuli for comparison. Therefore, it is proposed to measure the level of readers’ immersion by reading a complete manga with comparison to other genre of comic books for the next study, along with developing more advanced and elaborate scale for measuring the readers’ immersion level.

Conclusion

As a part of an explorative study in investigating the reason behind the immense popularity and influence of Japanese manga among young Indonesians, this study concludes that manga visual distinctiveness served as the attractive element for the readers in which they were able to engage readers emotionally, bridging the ever-present cultural differences. Manga’s ability to dwell the Indonesian readers inside its universe by providing high level of immersion serves as the main factor behind its successful fast reception.

While the experiment in measuring readers’ immersion produced quite comprehensive results, it still has several limitations, most notably in the form of stimuli and the lack of stimuli comparison. The manner in conducting this study such as the use of online survey, the complexity of the questionnaire and images used as stimuli could produce biases results. The limited number of participants made the study’s analysis could not be generalized to represent the vast Indonesian manga readers. Therefore it is strongly suggested for refining the experiment methods and apparatus to clarify whether manga could truly provide deep emotional response through its visual toward its readers as argued earlier.

This study is exploratory in nature and is indeed a preliminary stage of an ongoing study about Indonesian readers’ perception toward Japanese manga. Nonetheless, it could be used for explorative and descriptive purpose on the perception of Indonesian young readers toward Japanese manga and the preliminary results obtained from this study could be used as the basis for further research.

References


Engagement while Reading Manga: Measuring Indonesian readers' immersion within manga's universe


Yours or Mine? Role sharing between industrial design and interaction design

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Abstract
As a profession, industrial design has been affected by different dynamics throughout its history. One of the dynamics which affected industrial design strongly is the arrival of new technology. One of the fields in which information technology revolution happened is the arrival of micro-electronics, particularly in the area of telecommunication. This created an entirely new area of professional practice which was first named user interface design, but then developed to become a new professional practice, interaction design.

Although interaction design is a growing profession today, interaction designers often have to explain what an interaction designer actually does and argue that their specialty is not something that anyone could do without a formal education both to stakeholders and clients who buy their designs. Furthermore there still seems to be confusion when the job of industrial designers and interaction designers are overviewed together.

The aim of this paper is to build a background for role sharing in design processes with a specific focus on industrial design and interaction design.

Role sharing in design processes is highly related with design practice. Thus the empirical data for this research has been gathered through two sets of interviews and also a validating case study based on a product’s design process.

There are significant parts of the design process in which interaction design and industrial design collaborate. The closest and the most intense collaboration take place in early phases of design process such as concept generation and creation of design alternatives which are explored in-depth in the paper.

Keywords: design process, industrial design, interaction design
**Introduction**

The role of the industrial designers has changed from a product-development oriented practice to include other aspects of business such as strategy work, understanding consumers, and publicity (Cagan, J., Vogel, C., M., 2002; Valtonen, 2007). During the 1990s and especially at the beginning of the new millennium, the term strategic design became widespread. The aim of the designers has been to move from an operative role towards work of greater strategic importance which means they began to participate in early phases of product development activities.

On the other hand, human beings have interacted with nature, equipment and machines since their existence; interaction design has a wide scope in this context. Penetration of information and communication technologies in everyday life have caused new types of products or more complex version of existing products to interact with.

Developments in information and communication technologies (ICT) has shifted industrial design discipline from the notion of product as object to product as event by the need of understanding dynamic and interactive products better within the scope of human behaviour. Creating new type of products, documents, environments and services have become widespread recently.

Starting out from the above explanations, this paper explores role sharing between industrial design and interaction design by especially emphasizing historical development of interaction design within industrial design profession.

**Method**

The empirical data for this paper has been gathered through two sets of interviews and also a validating case study based on a product’s design process. The first set of in-depth interviews with 25 industrial designers has been held in Finland, and the second set of interviews has been conducted with 5 industrial designers and interaction designers in the US. The case study has been conducted with a design manager, user researcher, industrial design lead and also interaction designers.

This research has been accompanied by a literature review to validate our findings for the research. Interestingly not much exactly about this topic has been written in traditional scholar journals but in design magazines so far. This paper is also an attempt to contribute to the literature in this respect.

The interviews were semi-structured in both sets. The data were connoted using broad headings which were prepared before the interviews. Under these headings, personal opinions and reflections were differentiated from statements that could be validated through other data. At this stage, also statements for some more specific issues such as integration of interaction design in product development activities, role sharing, prototyping, tools and methods, design management, the introduction of Computer Aided Design (CAD) tools, user interface design-themes that had appeared frequently during the transcription process-were also connoted.

The first set of interviews was conducted face to face in Finland with designers anonymously. Many of the designers have specialist roles or work as in-house designers in large corporations. The research is thus qualitative-as a courtesy to the small size of profession as a whole. The results from the interviews were then compared with information from other sources to get the full picture of the situation within industrial design as a professional practice.
The first 18 of the interviewees in the first set were selected using two separate methods. Some interviewees were chosen as typical cases of their specialization. The same people often seemed to figure in the press representing their own specialization as pioneers in their own area. Some of the initial interviewees were also selected by a method of quotation, where possible fields of specialization within industrial design were identified and the interviewees were selected as representatives of these fields. The method was especially used in the case of in-house designers where very little published data was available.

The first 18 interviewees were then complemented with a further 5, the interviewees being selected using the snowball method: all the subjects of the first interviews were asked if they knew other people who would be useful to interview and for what reasons. Some of the individuals thus mentioned were then selected for complementary interviews. In addition to the specialization areas, special attention on representativeness in the selection of the 23 interviewees was also directed to age, work history, location, gender, and education.

The first conducted interviews with 23 industrial designers were biographic interviews. When the research process proceeded, the first biographic interviews were complemented with second interviews concerning particular topics or bringing understanding to the chosen cases. Many of the interviews were with the same 23 designers, but also 2 additional designers were interviewed, making the total of the interviewed industrial designers 25.

The second set of interviews have been conducted face to face in Silicon Valley, USA with key professionals from leading industrial design and interaction design based consultancies that have pioneer work in the mentioned area internationally. This set of interviews has been conducted to examine how the field of study has been perceived; to examine definitions, design and development processes within a general perspective, and potential roles of industrial design and interaction design with the support of the key contacts from leading design consultancies at Silicon Valley in USA. The reason for choosing Silicon Valley in USA is that not only it has been accepted to be the centre for designing information and communication technologies (ICT) embedded products, but also has been the centre for key institutes and companies such as Xerox Parc, Stanford Research Institute (SRI), Apple and IDTwo in the history of interaction design.

During the set of second interviews, the design consultancies which have been contacted with, were determined due to 3 criterion: Consultancies which have both industrial designers and interaction designers in-house; in-house product design and development process; consultancies which have only industrial designers in-house; outsourcing interaction designers when required; consultancies which have only interaction designers in-house; collaborate with other design consultancies working on projects with their in-house industrial designers.

A Brief Historical View on the Birth and Early Days of Interaction Design

The job of industrial design has been changing since its existence. Furthermore industrial design profession has become more complex over the last 15 or so years with the advent of new technologies and methodologies in the design world. Issues and ideas such as sustainable design, user-centred design, use of computers, global manufacturing, global branding and consumerism have all had an impact on industrial design activity. One of the most essential issues for this research is the arrival of new technology.
On the other hand, the birth of interaction design is closely related with the development of computing systems and information and communication technologies. The paradigm shift in the nature of computer interfaces came in the late 1970s, when the first graphical user interfaces (GUI) were created. The GUI made the user interfaces much more intuitive, and also made it possible to develop the software code for the interface separately from the application code it was designed to support. Expansion was further emphasized by the fact that a growing number of products began to include microprocessors, displays and graphical interfaces. As the structure of the interfaces became more and more complicated and the technical abilities of the displays grew, the amount of information that was shown to the user also increased and became more complex and needed to be thoroughly designed in order to remain usable. As Löwgren and Stolterman (2004) states digital artefacts transformed from tools and information processors to communication media in 1990s; the most visible sign for this transformation is seen as the Internet. The arrival of the computer led not only to new tools for industrial designers, but also to new areas of work. Industrial designers had traditionally designed the physical form of products and appliances, including the graphics and knobs that were needed to use the product. When the products started including displays, the natural assumption was that the design of the content of this display, and physical keys for the interaction with the product, were part of the industrial design process. The new technology hence created a new area of work for industrial designers – user interface design. This created a new area of design that was first named user interface design and then became interaction design.

Interaction design has been used as a term firstly by Bill Moggridge and Bill Verplank in 1980s; as Verplank (2008) states they used this term to bring “graphical user interfaces to product design world”. Moggridge (2007) describes his first use of interaction design as:

“I had my first prototype [laptop] in 1981. I took it home and I started thinking, ‘Now I have a chance to use this myself.’ I sat down to work, trying to understand what was happening in this little electroluminescent screen. And within about five minutes I’d forgotten everything about the physical form of the product, I was so focused on that interaction with the software – I found that I was sort of sucked through the screen into this virtual world. Occasionally I’d remember, ‘Oh yeah, I designed this physical thing,’ but beyond that, the important aspect – the interface – was something that I didn’t yet know how to do. And so I decided to learn how.”

Today there is no commonly agreed definition of interaction design, its core can be found in an orientation towards shaping digital artefacts—products, services, and spaces—with particular attention paid to the qualities of the user experience. (Fällman, 2008).

To have an understanding on the current role of interaction design, it is necessary to get an overview on the emergence and role of interaction design in software development activities (Figure 1). Winograd (1996) describes the relation of design and software as follows:

*Design cannot be neatly divided into compartments for software and for devices: The possibilities for software are both created and constrained by the physical interfaces. In today’s world of computer applications, the vast majority of applications present themselves to users in a standard way—a visual display with a keyboard and mouse. But the future of computing will bring richer resources to physical human–computer interactions.*

...
Researchers are exploring further possibilities, including tactile input and output devices, immersive environments, audio spaces, wearable computers, and a host of gadgets that bear little resemblance to today's personal computer or workstation.

As experience with a wider variety of devices accumulates, the design of interaction based on new combinations of devices and software will be an important emerging topic in what we have—for the moment—called software design (Winograd, 1996: 3).

There was no need to have designers in software development activities at first because the users of software were the people who also built and used the products as shown in Figure 1. In other words, products were used by only “expert users” during this period. Furthermore, there were a few computers used by experts.

In the second period, managers were brought up into the process to help translating market opportunities into product specifications. This period refers to the one when software began to be used in work environments by relatively a wider range of users when we compare with the first period. As Edeholt and Löwgren (2003) the number of users increased due to the relatively wider use of computers.

When the industry reached to a mature level and software products were used by a larger population of users, the usability of those products turned out to be an important issue as those products were hard to use (Norman, 2002; Cooper et al., 2007).

The paradigm shift in the nature of computer interfaces came in the late 1970s, when the first graphic user interfaces (GUI) were created. The GUI made the user interfaces much more intuitive, and also made it possible to develop the software code for the interface separately from the application code it was designed to support. In this case the role of the designer has been limited to “look and feel” as Cooper et al. (2007) states which refer to create icons and other visual elements; graphic designers were involved as designers in software development activities. Although icons and visual elements were designed by graphic designers, this new area of profession was not an area for graphic designers who design static graphics such as posters and books or an area for engineers or...
programmers who produce codes (Winograd, 1996). Especially in the mid-1980s organizations discovered that the new generation of information technology required new and different skills from its creators (Löwgren and Stolterman, 2004).

Expansion was further emphasized by the fact that a growing number of products began to include microprocessors. As products increasingly included microprocessors, they also started to include displays and graphical interfaces. As the structure of the interfaces became more and more complicated and the technical abilities of the displays grew, the amount of information that was shown to the user also increased and became more complex. A specialized group of professionals was needed to design the information.

The final evolution phase as shown in Figure 1 is the one in which designers take place starting from early stages; they have roles not only creating visual elements but also understanding users and creating solutions for them. In this case, especially interaction designers have begun to take strategic roles in software development activities.

Work division between industrial designers and interaction designers: defining the roles and the process

The line between what is part of industrial design and what is not in the interface design process seems to be very fine. The area of HCI is broad and is performed by a multitude of professionals from engineers to cognitive scientists. The closest professional group to industrial design in this context is graphic designers. Many of the industrial designers who have focused on interface design have also acquired additional training in graphic design. But having additional training in graphic design has not been enough to design complex interactions.

The industrial designers themselves seem to draw a line between the interfaces on a computer screen and the usability of the product as a whole. They tend to see the first as graphical design, while designing a user interface for a physical product with a proprietary physical interface (i.e. hard keys) is industrial design. Many of the industrial designers see a difference in designing user interfaces that are entirely two-dimensional (i.e. on a computer screen, presumably best designed by graphic designers) and those that include physical, three-dimensional components. In this sense, industrial design is more about product-specific user interfaces than general platform user interfaces that could be used on any computer screen. One of the industrial designers describes this approach:

“I do user-interfaces that cannot be separated from the physical product, that include issues such as ergonomics. My work is not only considering hierarchies and such... It includes a graphical user interface but also a physical product.”

Moggridge (2005) describes the effects of digital technology in design:

... Now, there is an interesting convergence happening because as the digital technology spreads, it becomes more part of everything. Then gradually products have digital technology in them. So industrial design is in an era of converging. I think you find a lot of interaction designers working on interaction design solutions which have products in them. A lot of product designers are working on products that have interaction features in them. So they are tending to overlap, but there are only overlapping in the way that a furniture designer and an architect might overlap.

Still, the understanding that user interface design has been part of industrial design rather than graphic design seems to prevail among the industrial designers.
“My title is industrial designer comma user-interface designer” (Interviewee 1).

“All our user-interface designers are educated as industrial designers. We don’t have any graphic designers [hired]” (Interviewee 2).

However, when the user interface’s connection with the physical product gets vaguer, new user interface designer roles appear that are difficult to define even for the user interface designers themselves:

One of these user-interface designers works on demos. When a product is produced usually a demo about the product is done. It can be more in the spirit of marketing or as a user manual-type of demo. Usually the demo is put on a cd which the customer then duplicates to their different clients. This work, as I see it, could often be considered graphical work. (Interviewee 3).

The confusion between industrial designers and graphic designers in user interface design appears to be quite common, as the designers so eagerly describe how they differ from each other. The other group of people who work in close connection with user interface designers, the people who actually write the code for the user interface, are hardly even mentioned in the interviews. It is considered perfectly clear that this is a completely different group of professionals, usually with technical training, and that the designer delivers the user-interface design to professionals who then write the code and make it work in practice. Certainly, the designer does not perform this task. Professional user interface designers are a small and rather new group of professionals within industrial design. They are a highly skilled and well-educated group of professionals, but sometimes they face the fact that their counterparts are not well aware of their existence. The pioneers often have to explain the essence of what they do.

“Our head of product development said [in 1993]: “You are an industrial designer, why do you want to do this [user interface design]?” Then I had to explain to him that an industrial designer does this and this and…” (Interviewee 4).

In bigger companies, the tuition phase usually passes when the number of user interface designers in the company grows. Even in Nokia, today the biggest employer of user interface designers in Finland, there was only one user interface designer in the early and mid-eighties and more than a hundred 20 years later (Valtonen, 2007). In recent years the amount of interaction designers has increased in importance (Clatworthy, 2010). Hence Moggridge (2005) mentioned the changes in the number of interaction designers at IDEO as follows:

“In early 2000s, we used to hire tens of interaction designers, but by the beginning of 2005, we hired around 200 interaction designers at IDEO”

User interface designers who work within a corporation only have to go through the explanatory phase once, but user interface designers working for design agencies face this scenario on a daily basis. Very often the customer is using user interface designers for the first time. This sometimes reflects on the decision making process. Uncertainty as to who should make decisions about user interface design or which criteria should be used for the decision making is quite common.

Many people with an engineering background seem to think that anyone with the capability to think logically can do user interface design. I think that colour design is a little similar – people always tend to have a comment about them and no one is ever wrong about these issues. It is difficult as a subcontractor to start arguing about the issue as there are rarely any precise measurements to rely on. I think colours are a good comparison in the sense
that you spend weeks working on colour design and present the end result to the customer
who then collects all sorts of people just to tell you that they like or dislike a certain colour.
And there you’ve spent weeks doing research on what colour works the best and what
colour is in fashion in the coming year... Everybody seems to think that anyone could do
this job [of a user interface designer]. Your role as a designer is more to make sure that no
bad options would even be presented (Interviewee 5).

On the other hand, in early phases it seems harder for interaction designers to
communicate and give an understanding of interaction design to other stakeholders. In
other words, the role of interaction designers sometimes tends to be confusing for the
customer who buys the design. Cronin (2005) and Salomon (2005) emphasized that as
interaction designers, they spent much time trying to explain the content and scope of
interaction design to the clients and other stakeholders. Furthermore Anderson (2008)
and Bangsund (2008) explained that during the initial meetings, they observed that
people from employee companies understood the industrial design concept much more
easily, but did not understand the interaction design concept so easily.

Blending and Forming Roles: What could be Done Together and What Could be Done Separately

Internal specialization within professional practice arises when the skills applicable to a
given task area develop beyond the ability of individual practitioners. Division can often
be a strategy for upwardly mobile groups seeking to place themselves above their current
peers (Abbott, 1988). The jurisdiction of labour consists of usually two structurally split
equal parts and also a shared area without division of labour. As Abbott (1988) states
functional divisions are virtually required when conflict arises between two professions
that already hold secure full jurisdiction of other tasks.

The design process in this paper is based on the product development activity phases
which have been put forward by Ulrich and Eppinger (2004). The product development
activity consists of phases such as planning, concept development, system level design,
detail design, testing and refinement and production.

The work division between industrial design and interaction design is shown in Table 1
according to the second set of interviews. During the planning phase, both industrial
designers and interaction designers concentrate on user research, needs and
requirements of the client, market research data and literature review. Although both
design professions concentrate on the same factors, they handle those issues from
different perspectives. While industrial designers try to understand users from a
perspective based on ergonomics and anthropometrics, interaction designers concentrate
on understanding users’ mental models and processes. At the end of planning phase,
both industrial designers and interaction designers have roles in creating concept, use
and context scenarios. These steps in concept development phase are the ones which
collaboration and cooperation are seen the most between industrial designers and
interaction designers. Thus in concept development phase, the basic design decisions
are taken. Due to the basic design decisions, both design professions create alternatives
for the project. These alternatives are tested by gathering the mock-ups generated by
industrial designers and paper prototypes generated by interaction designers. Both
design professions generally work in their teams in system level design phase. At this
point, although neither of teams is totally independent to each other, they frequently
cooperate in order to discuss and exchange ideas. In system level design phase both
industrial designers and interaction designers continue creating design alternatives.
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Internal specialization within professional practice arises when the skills applicable to a
industry needs to be in close cooperation and collaboration in product development activities.
This research shows us that it is essential for interaction designers and industrial
designers to be in close cooperation and collaboration in product development activities.
This collaboration and cooperation should be especially intense in early phases in which
user research studies are conducted, essential design decisions are taken and initial
concepts are created.

When the design and development processes of the interviewees have been examined,
interaction design based consultancies stated that some industrial design based
consultancies contacted them to work together on a project after having fundamental design decisions, even after the product’s form has already been defined. Interviewees emphasized that this situation has negative effects on the final product’s success and the level of innovation.

Based on the statements of the interviewees, the most overlapping area between interaction design and industrial design is assumed to be creating consistency among physical controls and the user interface.

Findings of the interviews show that during the concept generation phase, roles of industrial designers and interaction designers have been imprecise in terms of creating the form of the product, the location, form, colour and material of physical controls which users interact with. In other words, industrial designers might propose ideas for interaction designers or vice versa. While the concept generation phase and design alternatives creation phase seem to be the phases which blend the activity areas and responsibilities for both design professions in a way, there are steps especially in creating design alternatives during which industrial designers and interaction designers are dependent to each other in terms of role sharing and information exchange.

Figure 2 shows the dependency between industrial designers and interaction designers during early steps of design process. According to the results of the interviews, the phase during which collaboration and corporation between industrial design and interaction design take place is concept development. During this phase there is information needed...
to be exchanged between industrial designers and interaction designers; that is to say, there are sub-phases in which both designers are dependent to each other: interaction designers need to get information about the screen dimensions in which the content and interaction is supposed to be embedded from industrial designers. Thus the dimensions of the product affect the dimension and resolution of the screen and those are the factors which affect the quality and quantity of information and the interface that are supposed be embedded in the product. But at this point, we foresee that not only industrial designers but also interaction designers might propose the mentioned dimension information. Although this information is directly dealt with the product’s form and is supposed to be within the role of industrial designers, it can be accepted as type of information in terms of product’s content and its dialogue with users at the same time. On the other hand, the prototypes concerning the use of both the digital content and physical content are supposed to be compatible with each other and constitute an entirety. Because of these reasons industrial designers and interaction designers are needed to work dependent and in collaboration to each other.

Products have become multifunctional and complex. Behaviours of such products are provided by dynamic interfaces instead of static ones. In this case, it is possible to accept that products are becoming “boxes” that shelter the hardware and functions in terms of physical considerations. This determination also shows that interaction design has begun to have a wider role than industrial design has in product development activities.

According to the results of this research, there are differences in terms of methods, techniques and design language in approaching the design problem and understanding users between industrial designers and interaction designers. Conducting case studies regarding this result might contribute to affect and develop thriving techniques, design and representation languages.

Besides products have become multifunctional, complex and ubiquitous, the interactions between users and products have also become more and more intangible including services. These factors cause a recent actor on service design to take place in product development activities. Another research on the relationship among these three professions might be conducted in order to re-define the roles in product development activities.

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Interviewee 1. Anonymous. Interview by Anna Valtonen.


Interviewee 3. Anonymous. Interview by Anna Valtonen.

Interviewee 4. Anonymous. Interview by Anna Valtonen.


Service Design for Social Interaction: Mobile technologies for a healthier lifestyle

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Abstract

This paper presents outcomes of a PhD research that explores the relations between service design, health and today’s social media specifically mobile technologies.

Mobile and social media tools offer new opportunities for a more user centered, socially connected, and economically sustainable healthcare system. A major focus of research is to understand how to bring users to involve in their own health management through mobile narratives social networks to incite social interaction in promoting healthier lifestyles. This research aims to identify the problem and explore answers through a practice-based approach. It is based on research through design model and explores the practices and processes of design through the participation in a focus project. Locast Health Project aims to provide a helpful set of tools for teen’s risk at obesity to record their socio-psychological environment and everyday health routines through participatory workshops. Video diaries, created by a mobile application, visualized & shared in real-time on a location-based platform. The exchange of information affects health decision-making with the aim to create a long-term behavioral change towards a healthier lifestyle. Results show that it is not far to imagine the use of mobile technology and civic media creation as a tool to understand correlation of behaviors and encourage active participation in your own health. Locast Health Diary helps developing awareness however, without an expert participation it may not be sufficient to determine behavioral change.

The research aims to explore the designer’s role, its relation with other disciplines in designing service for a healthier lifestyle and investigate the use of participatory and service design tools for the engagement of users in their long-term healthcare management.

Keywords: service design, healthcare prevention, social media, mobile phones, video diaries, location based platform and context awareness
Introduction

Healthcare is vital for our living. It is a complex problem area that needs different approaches to provide solutions from different perspectives. Technology enables to construct patterns to ease people’s life. Mobile technologies in particular offer opportunities to be socially connected and actively participate to create user content.

Design is a process that can make connections. Contemporary design thinking is moving towards service-oriented and participative approach to provide solutions bridging healthcare, as the problem area, and mobile technology, as the opportunity area. Service design finds new frameworks to intersect with the problem and opportunity area, providing future scenarios for a healthier lifestyle. These scenarios involve participation on everyday health and involvement in a social context for a healthier life.

Healthcare

Healthcare is a complex system where patients are not sufficiently considered as a relevant factor within the system. The future of Healthcare in era of chronic disease\(^1\) shall turn on the full engagement of people in their own healthcare: the promotion of good health and prevention of illness. (Wanles, 2002)

While new medical technologies will improve the practice of medicine to cure illnesses, it is even more critical to provide technology that promotes healthier lifestyle and social connections through supportive environments and platforms that proactively help people remain healthy, autonomous, and engaged in life.

Wellbeing requires long-term management with our own health engaging actively every day. This would bring less cost for healthcare and prevention of chronic disease, which aims to solve prior problems. Technology can help to manage and promote everyday health and social health connections enabling systems that can monitor, track and respond to changing health status; and digital spaces tailored to physical, cognitive, and social needs of individuals.

Helman (1995) claims that the patient is a network of physical and psychological functions and interacts with physical, biological, social, and symbolic. 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 biomedicine. As the World Health Organization (WHO) (1948) defines health as “a state of a complete physical, mental and social well-being”, not only the medical situation of the patient should be considered but also their everyday environment. This determinates an active engagement of patients in their health management. Furthermore as Rolyston (2004) states “The biggest untapped resources in the health system are not doctors but users”.

Mobile technology

In order to answer social needs of today, information and communication technologies are becoming increasingly important in our life and are used in many areas of everyday healthcare-wellbeing context. Mobile phones are now a tool to access various applications and services from self-managing our health data by tracking and measuring our everyday activities to socializing in web platforms to generate collective action within a community. Social support and a sense of belonging are a vital part of good health.

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\(^1\) Kung et al. (2008) state that chronic diseases determine 7 out of 10 deaths among Americans each year. More than 50% of all those deaths each year are due to heart disease, cancer and stroke account.
People who are a part of community have access to care and support from friends and neighbors. (Leadbitter and Cottam, 2004). In Healthcare, network phenomena might be exploited to spread positive health behaviors (Wing and Jeffery, 1999), (Bruckner and Bearman, 2005) in part because people's perceptions of their own risk of illness may depend on the people around them. (Montgomery et al, 2003) Sharing information and experiences with other people socially allows them being motivated for a modification of their behavior.

**Design Approach**

Within the economic and social changes of last years, design thinking moves towards a more service-oriented approach to encourage user, experts from different disciplines and actors of the system, to participate actively and solve complex problems in the design process. Service Design allows confronting the chronic disease problems on a higher level since their complexity requires different approaches and competences for a more holistic solution.

“…on-going shift towards an economy based on services and knowledge, a new vision emerged ‘from possession to access’ which we may define as the access-based wellbeing, quality of life tends to be related to the quantity and quality of services and experiences”. (Manzini, 2002)

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Sanders (2008) explains in her work that the evolution in design research, from a user-centered approach to co-designing, is changing the roles of the designer, the researcher and the person formerly known as the “user”. It is a change from a user-centered design process to participatory experiences where the aim is to design a system with multiple different perspective and a shared goal as Leivrow (2006) states “Participatory is both the means of designing usable and meaningful technologies as well as the outcome of successful systems.”

Participation and co-creation results in collaborative and distributed solutions tapping into people’s perceptions, expectations, desires and motivations. It is also crucial as Zuboff & Maxmin (2002) argue that co-creation should provide people with the support they need to follow through on decisions.

**Method**

The research is based on Frayling’s “research through design” model (1993) and explores the practices and processes of design through case studies and action research. A Practice-based approach has been adopted in health research giving balanced consideration to educate stakeholders and to generate new knowledge to further the capacity of science and practice as Jefferys and Lashof (1991) state.

As Schön (1983) introduced the idea of design as a reflective practice where designers reflect back on the actions taken in order to improve design methodology the development of design practices is considered not as the objective of the research, but as an integral part of the project. This practice-based approach is a systematic inquiry with systematic reflections that occurs in practice settings. The goal is to move the knowledge derived from creation to research. The main characteristic of this approach is the built-in flexibility of the process.
The contribution of the study investigates first, a series of case studies and background information related to mobile technologies, particularly, location based technologies, social media, and mobile narratives in healthcare context. Prior findings are collected through primary and secondary research methods, and various interviews with experts are conducted. Participatory workshops are realized regarding the future everyday healthcare scenarios through mobile phones. (Sanders et. al, 2010)

The main part of the research is conducted through an Action research strategy, as defined by Reason and Bradbury (2001), applied in the Locast Health Project using participatory narrative technique as mobile diaries and location based platform to record user environment and everyday health routines. The project aims to provide a helpful tool for obese teens\(^2\) taking advantage of the Locast platform developed at MIT. The primary aim is to help teens developing awareness of their daily habits and as a consequence, encourage them to change their behaviors towards a healthier life since the process of self-reporting allows people to self-reflect and share aspects of their daily life. As discussed by Grinter and Eldridge (2001) this process can also trigger participants to question their choices and everyday behaviors. The secondary aim is to provide an effective instrument to experts. Psychologists Csikszentmihalyi and Larson (1987) state in their study that they have recognized the need to monitor patients in situ versus asking a participant to recall an event a week or more after the fact. Also the study of asthma conducted by Rich (2000) shows that medical information gathering might be augmented by video diaries created by patients to show clinicians the realities of managing chronic disease in the context of their lives.

\(^2\) Actual or potential chronic patients

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**Figure 1.**

*Locast Health Project synthesis*

The Locast Health Diary project lasted 2 months organized in presentation workshop, Locast video diaries recording (including intermediate workshop), focus group and
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The contribution of the study investigates first, a series of case studies and background information related to mobile technologies, particularly, location based technologies, social media, and mobile narratives in healthcare context. Prior findings are collected through primary and secondary research methods, and various interviews with experts are conducted. Participatory workshops are realized regarding the future everyday healthcare scenarios through mobile phones. (Sanders et. al, 2010)

The main part of the research is conducted through an Action research strategy, as defined by Reason and Bradbury (2001), applied in the Locast Health Project using participatory narrative technique as mobile diaries and location based platform to record user environment and everyday health routines. The project aims to provide a helpful tool for obese teens taking advantage of the Locast platform developed at MIT. The primary aim is to help teens developing awareness of their daily habits and as a consequence, encourage them to change their behaviors towards a healthier life since the process of self-reporting allows people to self-reflect and share aspects of their daily life. As discussed by Grinter and Eldridge (2001) this process can also trigger participants to question their choices and everyday behaviors. The secondary aim is to provide an effective instrument to experts. Psychologists Csikszentmihalyi and Larson (1987) state in their study that they have recognized the need to monitor patients in situ versus asking a participant to recall an event a week or more after the fact. Also the study of asthma conducted by Rich (2000) shows that medical information gathering might be augmented by video diaries created by patients to show clinicians the realities of managing chronic disease in the context of their lives.

The Locast Health Diary project lasted 2 months organized in presentation workshop, Locast video diaries recording (including intermediate workshop), focus group and evaluation. It involved the participation of Boston Asian: Youth Essential Center (YES) which is a non-profit, community-based organization that aims to work collaboratively to provide services for youth as Prevention and Intervention programs. The aims of these programs address specific issues faced by youths and their families, and provide support and outreach for obesity prevention, diabetes, substance and tobacco abuse, which are funded from Federal Government Department of Health.

Participants are selected among teens which are a part of ‘Teens going Healthy’ an obesity prevention program which helps teens to confront with obesity problems and teach participants to make healthier food choices, be better food shoppers, and incorporate sports and other physical activities into their schedules.

Locast Health Project aims to provide a helpful set of tools for teen’s risk at obesity to record their socio-psychological environment and everyday health routines. The primary purpose is to push teens’ to develop awareness of their daily eating and activity habits, and as a consequence, encourage them to change their behaviors towards a healthier life. More in detail, the purpose is to evaluate if Locast health set of tools as the video diaries, the location based map and the social interaction tools can be useful to develop awareness of teens on their everyday health habits. The secondary purpose is to provide an effective instrument to nutritionists and educational experts.

Video diaries, created by a mobile application, are used as personal data collection system enabling teens to record their eating habits, physical exercises, and social activities during the day. The diaries are visualized & shared in real-time on a location-based platform, which provides a critical approach and creates access and typology of community services in the individual’s surrounding. The exchange of information affects health decision-making with the aim to create a long-term behavioral change towards a healthier lifestyle. The web based platform supports social networks where teens can share experiences in the community.

Three workshops include activities to map out teens perception, reality and future goals through cognitive, visual maps and questionnaires. Locast tools help to monitor the real environment and allow teens to compare their perceived activities in their mindset and activities that they perform in their everyday life. Weak and strong map helps teens to analyze their typical day and Locast day to create their future goal for a healthier lifestyle.

Figure 2.
Locast Health Diary Map and Videos
Participant observation recordings, pre and post project questionnaire surveys, visual and cognitive maps, structured and unstructured interviews with experts are being used as tools in the research process to investigate the usefulness of video diaries, the value of social network and the utility of location-based platform.

Six teens, 2 female and 4 male aged between 14 and 18 years, involved in an obesity prevention program in Boston participated in the project together with a nutritionists, a youth counselors and a intermediate person as healthcare consultant.

Results

The six teens uploaded 66 videos on the Locast website, 26 casts are in the Meal category, 9 cast are in the Snack category, 19 casts are in the free-time category, 5 casts are in the Speak your mind category, and only 2 casts are in the Community category. 20 casts were the highest number recorded by one participant, 4 casts the lowest. It depends from a variety of issues as the age group and personality of the participant. For example two participants are 18 years old and they are 12th grade senior high school students; other three are 14-15 years old, 9th grade high school students. The oldest, mostly have a tight schoolwork and exams. They record their casts more complete and create a more constructive narrative; three participants mostly did not speak much or in an incomplete way, and record less casts than others.

The comparison between typical day and future goal day in visual and cognitive maps compiled by each participant shows that all participants developed awareness on unhealthy habits but two of them didn’t want to change his behaviors in practice, although all of them state in the after project questionnaire they would want. According to questionnaires, they have all developed awareness on eating than exercise and free-time activities.

Analyzing the interaction on the web using Locast tools it’s possible to see that teens developed more awareness viewing others video diaries than viewing their own For example one teen commented on other teens’ video cast ‘Burger King for Lunch’: “Don’t eat tooo much. Fats are gona stack up in your blood vessels.” She has also commented in the discussion group, that viewing his video casts where he was always eating fast food discouraged her to eat fast food.

Privacy is an important issue for the social interaction on the website. According to the post questionnaire and discussion group some teens disagree that they felt comfortable recording their both eating and physical activity, however they somewhat agree that they felt comfortable seeing their own video on the website. Motivation is another factor to be considered while teens agree that technology was innovative and interesting to them and they did not encounter problems with the technology.

Consequently we are convinced that Locast Health Diary helps developing awareness however, without an expert participation it may not be sufficient to determinate behavioral change. As (Bhamra et al. 2008) states the elements of behavioral change, first user need to have Intention where, to develop awareness is from old habit to awareness to consideration. The project helps teens to clarify behaviors and choices of consideration for a positive change.
Focus group and expert interviews demonstrate that Locast Health can be an effective instrument for nutritionists, youth counselors and healthcare consultants in different ways. Medical experts see video diaries as a complementary tool applicable to really get an idea of the portion sizes and the environmental factors since the location-based map, is useful to estimate teens’ daily choices in community. For example, one teen was eating his lunch in a fast food chain outside school, due to availability and proximity to school, because he thinks that school lunch is not healthy and tasty. Educational expert see Locast Health Diary as a discussion tool able to monitor co-related activities and are interested in an extension of Locast Health Project as a part of obesity prevention programs and its application also to other wellbeing projects. This is a relevant result of the project since further refinement of action research according to Jacobs et al. [1992: 431] is that the results obtained from the research should be relevant to the practice.

**Discussion**

Despite the limited number of participants and the statement by Jacobs et al. (1992: 45) that action research “is characterized by the fact that problem solving, seen as renewed corrective actions, cannot be generalized, because it should comply with the criteria set for scientific character” we believe that sharing process and qualitative outcomes of this project can be useful to other researchers as experiential knowledge base.

Designer's role is to implement strategies and tools to produce a mutually agreeable outcome for all participants and nurture actors where they can take responsibility. As O’Brien (1998) states that to accomplish this, the researcher may necessitate adopting many different roles at various stages of the process as planner leader, catalyzer, teacher, listener, synthesizer, facilitator, designer, observer, and reporter.

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**Figure 3.**

Locast Heath Diary results analysis concerning awareness development and behavioral change

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**Table:**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Visual map</th>
<th>Cognitive map</th>
<th>Video diaries</th>
<th>Workshop Discussion</th>
<th>After-Questionnaire</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Awareness</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Develop awareness</td>
<td>Think to change</td>
<td>Develop awareness</td>
<td>Think to change</td>
<td></td>
</tr>
</tbody>
</table>

---

| Subject Aa | YES | YES | YES | YES | YES | YES | YES |
| Subject Bb | YES | YES | N   | YES | YES | YES | YES |
| Subject Cc | YES | YES | N   | YES | YES | YES | YES |
| Subject Dd | YES | YES | YES | YES | YES | YES | YES |
| Subject Ee | YES | YES | YES | YES | YES | YES | YES |
| Subject Ff | YES | YES | YES | YES | YES | YES | YES |

---

**Figure 3.**

Locast Heath Diary results analysis concerning awareness development and behavioral change
Due to the change in their role at different stages, the designer communicates with different actors as medical expert, educational expert, participants, and external intermediate person through using different research and design tools. As a designer, it is important to know how and in which phase to use visualization and communication methods to make participant understand things and which phase use research tools to collect data from the participants. For example in deployment phase, it is important that participant understand what to do, and in the evaluation phase designer need to know what to ask and how to gather information.

Designer’s interaction with other disciplines changes during design process of the project. In the phase of project development, designer’s role is mandatory in all phases except the prototyping phase where designer is not necessary as a prototyper but as an external reviewer or plan leader besides a primary or secondary support of a mobile or web engineer. Intermediate person is needed in all phases except prototyping phase to communicate between team members and the client. Experts are integrated into the projects not as a team member but as an external collaborator. In research phase, due to selection of secondary research tools, different competences but in common particular research subject as mobile technology for social interaction or healthcare could help for a wider research content. However, in concept development phase it is necessary to interact with different disciplines where the aim is to create innovative concept from different point of view, analyzing the collected ideas in realizable technology context, where most of the group discussions has occurred. For prototyping, it is important to have primary or secondary support of mobile and web engineer where in deployment phase the role of engineer stays as an external support to solve occurring problems.

Standard tools as questionnaires (pre and post project) and interviews have been used to gain information from teens and experts. Locast video diary has been developed on the basis of the existing MIT platform to actively involve teens. Ad hoc Visual and cognitive maps organized in typical day, Locast day, future goal day making comparisons possible between perceived habits, real behaviors and future goals has been created to support communication between participants during focus group. Ad hoc Video Analysis Cards containing Reference Image, Observation of video content, Participant Answer, Researcher Interpretation has been generated to summarize information for nutritionists.
This research aims to give a strategic contribution to design services towards healthier lifestyle and positive behavior change. Design offers methods and tools to reflect on users’ perception connecting products, services and actors in the context (Manzini, 2002). This could be an opportunity understanding the potential of technology and its relations between the users for creating new scenarios in other healthcare contexts.

Acknowledgement

We would like to express our gratitude to all TeDH (Technology and Design for Healthcare) research group at Politecnico di Milano and MEL (Mobile Experience Lab) research team at Massachusetts Institute of Technology. Special thanks to Boston Asian Youth Essential Center teens and workers, in particular YES youth counselor and Community Health Group health consultant at Tufts Medical Center for their contribution to Locast Health Project.

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A comparison of Diary Method Variations for Enlightening Form Generation in the Design Process

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Chalmers University of Technology

Abstract
This paper presents two studies in which an empirical approach was taken to understand and explain form generation and decisions taken in the design process. In particular, the activities addressing aesthetic aspects when exteriorizing form ideas in the design process have been the focus of the present study. Diary methods were the starting point of this research for investigating the form generation process through collecting self-reflective comments from the participants. The main focus of this paper is to address potentials and limitations of the three variants of diary method used for data collection, namely, unstructured diaries, structured diaries and visual diaries. A set of method evaluation criteria was developed to compare the structure of the diary variants. By qualitative analysis of the results and comparison of the diary variants, strengths and weaknesses of each variant were identified. One of the prominent factors in the diary variants was pegged to be due to the logging delay after the occurrence of the activities.

Keywords: design process, form generation process, research methods, diary research, diary formats
Introduction

Different models have been proposed over the years to portray the design process, generally describing design as a logical and methodical procedure (Cross, 2000; Lawson, 1997; Roozenburg & Eekels, 1995; Ulrich & Eppinger, 2008). Design is considered a divergent task requiring imaginative processes, which also include stages of convergent thinking (Lawson, 1997). Designers employ different means to exteriorize their imaginative thinking process (Archer, 1991) such as drawing and sketching (Goldschmidt, 2003; Purcell & Gero, 1998), verbalization (Dong, 2007; Jonson, 2005), the use of models and prototypes (Brereton & McGarry, 2000; Evans, Wallace, Cheshire, & Sener, 2005), and computer aided design (Lawson, 1997). The externalization of shape ideas is an essential part of the design process, which not only freezes and represents one instance of the designer’s cognitive process (Lawson, 1997) but also influences the design process (Menezes & Lawson, 2006). However, the interrelations between the design process and the visualization activities are not yet clear (Purcell & Gero, 1998).

To understand the design process has always been considered a challenge within the design research community (Blessing & Chakrabarti, 2009; Cross, 2011). Investigating the design process, since the 1980’s, has been in an experimental phase to find out how designers work and what impacts new tools and methods have on the design process (Blessing & Chakrabarti, 2009). Different research methods and approaches have been used in empirical studies to shed light on design activities, for example, interviews (Lawson, 1994), and observations (Bucciarelli, 1994; Schon, 1983). Regarding interviews, Cross (2011) mentions that the designers are not very good at explaining how they work since they mainly focus on the result of their projects when they are asked to explain how they design. On the other hand, Pedgley (1997) argues that designers are the only source for finding information about the underlying thoughts when designing, and therefore observation methods are not sufficient to investigate the design process.

Diaries are a research technique concerned with logging activities by the participants in a study during a certain period of time in chronological order (Rieman, 1993; Zimmerman & Wieder, 1977). They have been predominantly used in social sciences for gathering ethnographic data, and psychology for investigating autobiographical memory (Koriat, Goldsmith, & Pansky, 2000; Robinson-Riegler & Robinson-Riegler, 2009). Diaries have also gained popularity in the human-computer interaction domain and more recently in the engineering domain (Wild, Mc Mahon, Darlington, Culley, & Liu, 2009). However, according to Pedgley (2007) diaries have rarely been used for investigating the design process. The formats of dairy studies vary in terms of structure, complexity and layout which can influence the outcome of the study as e.g. shown in Hyldegård (2006) and Pedgley (1997). Diaries also vary in the format they are collected such as paper- or electronic based (Wild et al., 2009).

In the present study, an empirical approach for research into design was taken to understand and explain the form generation activities and the decisions taken in the design process (e.g. Dorst, 1995; Frayling, 1993). Diary method was the starting point of this research for investigating the form generation process through collecting self-reflective comments from the participants.
Aim

The aim of this paper is to compare the three variants of diary method, which were used to investigate form generation process and acquire an insight into the underlying cognitive processes when exteriorizing shape ideas in the design process. A set of method evaluation criteria was developed to address the potentials and limitations of the three diary method variants, employed for data collection in two empirical studies.

Research Design

The proposed empirical approach for investigating the design process was adopted in two studies conducted by the authors at Chalmers University of Technology in Sweden. Students of a Master program in Industrial Design Engineering participated in seven-week design projects, working roughly 20 hours per week. The design projects were to follow a five-stage framework: Exploration, Categorization, Interpretation, Generation, and Structuring. To investigate the design process from the designers’ perspective and let the researchers empathically participate, the participants were to document their working progress with a focus on form generation activities. The main difference between the unstructured diary and the structured diary was a template in the structured diary, addressing different aspects of the design process, explained further in Empirical study II.

Participants

A total of thirty-five students who were registered in Industrial Design Engineering master program participated in this study. They were taking part in a course on Advanced Form Design. All of the participants had a common experience from a prerequisite course on the same subject. They were encouraged to form groups of two or three students for conducting the design project.

Data Collection and Analysis

The participants were instructed on how to use the diary formats in the course briefing. The diaries were handed in via an electronic uploading function on the course homepage. During the project, the researchers also participated in weekly supervision sessions to observe the students’ process.

Analysis of the diary data was carried out based on the qualitative data analysis approach suggested by e.g. Miles and Huberman (1994), consisting of three phases of (i) data reduction, (ii) data display, and (iii) conclusion drawing and verification. The initial phase involved searching for themes, summarizing, coding, categorizing, and registering excerpts from the diary data in Excel matrices (separately for each participant). Finally, conclusions were drawn by interpreting the emerging meanings based on the patterns and by identifying regularities and possible explanations. The conclusions were verified by going through the diaries once again and by searching for corresponding results in other literature in the domain.

1 The projects were the main obligatory part of a course in Advanced Form Design. Within the framework of the project, the students were to look for approaches that would lead to a creative and experimental yet structured generation of formal product solutions.
2 The prerequisite course comprised of a number of exercises to explore form generation and to experiment with different design tools, such as CAD-software - solid and surface modelling, clay and paperboard modelling.
3 The categories were starting point, activity, goal, use of tool/method and the motivation behind it, output, issue/conflict for different stages of the project.
Method Evaluation Criteria

A set of criteria (Table 1) was developed throughout the empirical studies based on the similarities and differences experienced in the implementation of the diary methods, the analysis and the results. Four of the criteria in the table below; namely, Solo Effort, Mobility, Endurance and Delimitation (subject delimitation) are adapted from Pedgley (2007) on characteristics of data collection methods for investigating design activity. These criteria were used to compare the diary method variants.

Table 1 - Method Evaluation Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method execution</td>
<td></td>
</tr>
<tr>
<td>Solo Effort</td>
<td>The possibility to apply the method without employing a second researcher for data collection or analysis.</td>
</tr>
<tr>
<td>Minimized intrusiveness</td>
<td>The extent to which the method intervenes with the design process.</td>
</tr>
<tr>
<td>Mobility</td>
<td>Since designers have to work in different location during one project, the method should be accessible in different places e.g. at home, studio or different workshops.</td>
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<tr>
<td>Time aspect</td>
<td></td>
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<tr>
<td>Endurance</td>
<td>If the diary format is suitable for studying the whole design process regardless of its duration and not limited to capturing short segments of the process.</td>
</tr>
<tr>
<td>Regularity</td>
<td>If the diary format offers the possibility to track the design activities regularly.</td>
</tr>
<tr>
<td>Data quality and quantity</td>
<td></td>
</tr>
<tr>
<td>Richness</td>
<td>If the method results in gathering rich data through descriptive and detailed explanations and inclusion of necessary visual information to assist representation of the design process.</td>
</tr>
<tr>
<td>Integration of visual content</td>
<td>If the format enables the designer to include externalization of form ideas using sketches, renderings, etc.</td>
</tr>
<tr>
<td>Minimized data overload</td>
<td>If the method results in a too large amount of data.</td>
</tr>
<tr>
<td>Minimized data Loss</td>
<td>If the diary format results in losing important data.</td>
</tr>
<tr>
<td>Facilitate data analysis</td>
<td>If the method facilitates analysis phase due to the amount and structure of the data.</td>
</tr>
<tr>
<td>Delimitation</td>
<td></td>
</tr>
<tr>
<td>Subject delimitation</td>
<td>If the method focuses on a specific aspect of design activities to avoid data overload, for example through specific questions.</td>
</tr>
<tr>
<td>Delimitation on the verbal content</td>
<td>If the diary format enables free self-reflections and does not limit the verbal content through e.g. answers to specific questions.</td>
</tr>
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</table>

Empirical Study I

Twenty-four master students (22-29 years old, 17 men and 7 women) took part in the first study, carried out from March to May 2010. This group had a free choice of topic for their form generation projects. They were briefed to use aesthetic values (e.g. Hekkert, 2006) and product novelty (e.g. Cross, 1997) as driving forces in their design process and not to focus on technical functionality. In addition, they were asked to document their form generation process in an unstructured diary, submit a diary draft after four weeks and a final version at the end of their project.

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4 Ten students held a Bachelor degree in Industrial Design Engineering from Chalmers. The fourteen remaining students were exchange students with similar backgrounds.
Data Collection

Unstructured Diaries - The participants kept a retrospective diary during the seven-week design project. They were asked to describe and reflect on the activities related to their design process and the given framework of the project. They were also to report on the use of tools and methods during the project e.g. use of brainstorming methods, sketches, physical models, CAD modeling, etc. In addition, visual samples such as sketches and photos were required to be included in the diaries to facilitate studying the students' creative process. The length of the diary had a 10-page limit, excluding the visual content. The students were encouraged to keep a continuous track of their design activities and document them on a regular basis.

Results

A total number of twenty-four diaries, 7-34 pages long (excluding appendices), were gathered. They were documentation of different design projects with varying amounts of visual and verbal data. The unstructured diary format resulted in an extensive amount of data containing rich self-reflections and detailed descriptions (e.g. by explaining their activities in terms of tasks and sub-tasks) with annotated visual material. The diaries were often well structured as the participants had tried to represent a linear flawless design process, which led to the final results. Some of the participants had summarized and illustrated their design process using descriptive explanations, info-graphics and diagrams. Figure 1 shows an example of design process illustrations from one of the participants.

In some cases, the participants focused more on presenting the final result than describing their process. Although the students were encouraged to keep regular diaries in the course briefing, the mid-term diary drafts did not represent all of the form generation activities presented in their final diary. This indicates that the participants had not kept regular diaries, instead they had written most of the diary in the last weeks of the project. Figure 2 shows a draft document and a one-page diary excerpt, to exemplify characteristics of the unstructured diaries and the mid-term drafts.

Figure 1 - The design process referred to as "the complex process" (Participant J, page 3)
Introduction

An artist can have many methods of expressing his/her art; it could be on a canvas, with a sculpture or as an installation. The work of an industrial designer always has the (at least potential) result of an actual physical product. On the way towards this goal, the designer has many choices to make; eventual tools to use to develop the most interesting form. But traditionally you have the image of an artist just letting his/her imagination flow.

I'm interested in the difference between the creative processes within these two art forms. I want to find out if there is an alternative to the intuitive artwork for the artist and the opposite; if the industrial designer might work completely without formal form generating tools and still receive a comparatively good result? Could the form generation of the designer be purely intuitive and could the artist use form tools?

Central question

Are there examples of artists using form tools similar to the tools of the industrial designer - and are there industrial designers that strictly create forms in an intuitive way? How does this work and which are the tools?

 Aim

My aim is to search for form tools that are used today and new ways for artists and designers to generate forms.

Method

I will refer to my own work and others.

Analyzing the professional interview I had with Lare Falk, and some other written sources.

I might also try to find information through making my own interviews.

Implementation

Figure 2a - The whole diary draft document received from Participant M.

Figure 2b - This page was taken directly from a 34-page long diary (Participant M, page 19) in which detailed explanations, and annotated sketches were included to give accounts of the underlying thoughts when developing the sketches.
Having no restrictions on the content, the students had not limited their documentations to form generation activities but included other issues mainly regarding technical functionalities, for example:

_The segment on the helmet absorbs the shock and transfers the damage to the connecting point on the side of the head. The design allows a more lightweight solution than helmets on the markets with the same protection._ ( Participant P, page 16)

In an overall view, the results from this study indicate that iterations, in terms of recurring steps and use of tools and methodologies, played an essential role in the form generation process. For example iterations between sketching and use of CAD-software were documented in more than half of the unstructured diaries.

### Empirical Study II

The empirical study II was carried out from March to May 2011 in which eleven master students (21-29 years old, 5 men and 6 women) participated. The project topic for this group was predefined as “tableware”, without any restriction regarding choice of material or manufacturing technique. In the course briefing, the participants were instructed to document their form generation process using structured diaries and visual diaries.

#### Data Collection

**Structured Diaries** - Based on the experiences from using an unstructured diary format in the first study, modifications were made to the diary format. A structured one-page diary template with fixed response categories was developed for this study, to facilitate data analysis, to focus on form generation activities, to seek the underlying motivations behind the decisions made during the design process and to record participants’ retrospective reflections on their form generation activities. The template (Figure 3) consisted of several parts including steps, decisions, motivations, methods, conflicts, etc. Another modification was the incorporation of the instructions into the fixed-response categories of the template, as a need for repeating the instructions was found important in the first study. In order to track the chronology of the design process, the participants were to fill in the template weekly. The diaries were kept in electronic format and uploaded on the course homepage every week.

**Visual Diaries** - To compliment the structured diaries and include the visual data as a central part of the design process, a weekly documentation of the visual outcomes of the process was additionally required. This visual diary format was designed as A4 landscape, and could consist of scribbles, pictures, CAD-renderings and any other form of visual information essential for understanding the creative form generation process. Furthermore, the participants were encouraged to refer to their visual data in the corresponding structured diaries.

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5 Eight students had a bachelor degree in Industrial Design Engineering from Chalmers. The three remaining students were exchange students with similar backgrounds.
Results

After each week, 11 structured diaries and 11 visual diaries of varying length and details were collected. Figures 4 and 5 show sketches from two participants, to exemplify differences in visualization skills noticed in visual diaries. The varying characters of the diaries also reveal a great difference in writing and articulation between participants. For example, when giving motivations on the use of CAD-tools, participant R (week 7) had only mentioned “...to get a 3D feeling but also more and more developing final design”, whereas another participant gave more detailed and comprehensive motivations:

In CAD we used both Catia and Alias and we noticed that Alias was a better tool for the kind of shapes we wanted to create, mainly because it was easier to create the sharp transitions in Alias. CAD is an easy way to generate many form variations and to manipulate forms into new ones. (Participant K, week 4)

The analysis of the structured diaries revealed the chronology of the form design process in addition to its iterative nature. For example, participant A reported on recurring steps of gathering different inspirational material in different occasions.

To get inspiration I have also been looking [at] porcelain on the internet, to get a better idea on the possibilities of the material. (Participant A, week 1)

One step was to start benchmarking, to see if we had any main competitors on our concepts and also to get some inspiration on different solutions. (Participant A, week 3)
Results

After each week, 11 structured diaries and 11 visual diaries of varying length and details were collected. Figures 4 and 5 show sketches from two participants, to exemplify differences in visualization skills noticed in visual diaries. The varying characters of the diaries also reveal a great difference in writing and articulation between participants. For example, when giving motivations on the use of CAD-tools, participant R (week 7) had only mentioned “...to get a 3D feeling but also more and more developing final design,” whereas another participant gave more detailed and comprehensive motivations:

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(Participant K, week 4)

The analysis of the structured diaries revealed the chronology of the form design process in addition to its iterative nature. For example, participant A reported on recurring steps of gathering different inspirational material in different occasions:

“To get inspiration I have also been looking [at] porcelain on the internet, to get a better idea on the possibilities of the material.

(Participant A, week 1)

One step was to start benchmarking, to see if we had any main competitors on our concepts and also to get some inspiration on different solutions.

(Participant A, week 3)

Side-tracks were also noticed in the structured diaries, for instance, participant A referred to selecting specific concepts, sketches, and sources of inspiration during weeks 3, 5, 6, and 7. This indicated an underlying evaluation stage, but the participant did not directly report on how he had evaluated, chosen and refused specific ideas. Furthermore, reflections on conflicts and difficulties regarding form generation were documented:

“It is difficult to make the different parts fit together (in a sculptural way) and at the same time make them look good one by one without losing our expression.

(Participant V, week 5)

A holistic reflection on the whole process from the participants’ perspective was however lacking in the structured diaries, since the responses were limited to one-week chunks of
the process. Furthermore, to understand the structured diaries, it was necessary to go through the visual diaries in parallel.

**Integration of Results**

Based on methodological experiences from the two studies and the method evaluation criteria, a comparison was made between the three variants of the diary method. Figure 6 shows the result of the comparison. The combination of the structured diary and visual diary were identified as more appropriate for investigating the form generation process than unstructured diary, as they fulfill the criteria regarding *time aspect*, and *delimitations*.

![Figure 6 - Comparison of diary variants based on the method evaluation criteria. Fulfilling the criteria is marked with circles.](image)

**Method Execution**

Solo effort - It was possible to apply all of the diary variants without employing a second researcher for data collection or analysis. However to facilitate the analysis of the unstructured diaries, a second researcher who had no previous insight into the project was employed. It was proved possible to accelerate the data analysis with a second researcher, although a demanding initial stage for detailed explanations of the coding scheme was required to avoid misinterpretations.

Intrusiveness - All diary variants required logging from a later point in time and therefore were not directly intervening with the design process. However, the structured diaries called for a weekly reporting and self-reflections, which may have resulted in more awareness of the process and therefore influenced the planning for proceeding steps.

Mobility - The logging of data was found possible in different locations when using both structured and unstructured diaries. The visual diary was, in contrast, not equally accessible, as cameras, smart-phones or scanners were required to log the visual data.

**Time Aspect**

Endurance - All diary formats were suitable for capturing a seven-week design project, but the extensive data from the unstructured diaries was found difficult to analyse.

Regularity - The structured diary format and visual diaries with weekly intervals resulted in less logging delay after the occurrence of the activities, in comparison with the unstructured diaries. Reduction in logging delay limited the possibility of post-event modifications, which were noticed in the unstructured diaries. Moreover, the results of the unstructured diaries did not clearly reveal a time-line for the design process. Using
structured diaries with fixed time intervals helped capturing the chronology and order of the design activities by freezing the design process at regular stages.

**Data Quality and Quantity**

**Richness** - The free self-reflections encouraged in the unstructured diaries, resulted in a richer content, which had a more descriptive language, detailed explanations and occasionally inclusion of illustrations to better explain the design process. The structured diaries with the fixed response categories, in contrast, imposed limitations and in some cases may have resulted in brief and insufficient reflections.

Integration of visual content - The unstructured diaries accommodated the visual information, which made it easier to read and understand them. The structured diaries, however, did not accommodate visual data since this role was taken over by the accompanying visual diaries. The presence of a separate diary for visual data resulted in a more comprehensive visual content compared to the integrated visual information in the unstructured diaries.

Minimized data overload - The unstructured diary format led to an extensive amount of data, which in some instances was irrelevant to the focus of the present research. This was to a great extent avoided in the structured diaries.

Minimized data loss - The longer logging delay in unstructured diaries was associated with more recall effects which resulted in losing parts of the information necessary for fully capturing the design activities. For example, side-tracks were not included to the same extent as in the structured diaries.

Facilitate data analysis - The structured diary format facilitated the analysis phase, since the response categories were in line with the coding scheme used in the matrices. The extensive amount of data gathered from the unstructured diary format, on the other hand, required intensive work for data reduction, coding phase, analysis and interpretation.

**Delimitations**

Subject delimitation - All diary formats focused on form generation, as the students were encouraged not to include other aspects of the design process during the course briefing. However, the free self-reflections in unstructured diaries resulted in inclusion of other aspects such as technical functionality, group activity, etc.

Delimitation on the verbal content - The structured diary format imposed limitations on the verbal content as it sought answers to specific questions. For example, reflections on conflicts and difficulties in the structured diaries were mainly focused on the form generation activities in contrast with unstructured diaries.

**Discussion**

**Design Process**

The unstructured diary, structured diary and visual diary methods generated useful and rich data on participants' form generation process over seven-week design projects. This is consistent with previous applications of the diary method for studying design activities (Pedgley, 2007). A key finding to emerge from the use of the diary methods was the iterative nature of the design process. Returning to the preceding steps in the form generation process is one of the key characters of the design process which has repeatedly appeared in previous works (Cross, 2011; Lawson, 1997). However, it should
be noted that the results presented here mainly focus on evaluating the diary method variants used in this study.

**Memory Accuracy and Logging delay**

One of the most prominent findings from the methodological experiences was the effect of regular logging and minimized logging delay in the structured diaries which have resulted in more reliable information. In contrast, the unstructured diaries involved longer logging delays and therefore resulted in less reliable data. According to cognitive psychologists working with a focus on memory accuracy, forgetting is more likely to happen if there is a long delay between the occurrence and recalling of an event (Levitin, 2002). One explanation to retrieval failure is the interference and distraction caused by the following events and exposure to new information (Gronlund, Carlson, & Tower, 2007). Furthermore, Robinson-Riegler & Robinson-Riegler (2009) mention that repeated episodes of events lose their individualized character and therefore are more likely to forget. As certain activities occur repetitively in the design process, it is possible that the designers forget or exclude them from the diaries. Explaining the factors influencing the quantity and quality of the remembered data, Koriat, et al. (2000) state that there is a progressive loss of memory for details and that the gist of an event is remembered rather than details. Therefore, a minimized logging delay is preferred in diary studies to achieve detailed recollection of events.

**Contradictory evaluation criteria**

Some of the method evaluation criteria were identified as contradictory. For example, imposing a high degree of verbal delimitation facilitates the data analysis but can lead to data loss as the side-tracks were not included in the unstructured diaries. Conversely, a lack of delimitation may result in an extensive amount of information, making the data analysis difficult. More importantly, lacking delimitation can lead to losing the focus on relevant areas, e.g. covering issues regarding group dynamics in the unstructured diaries. This is consistent with previous recommendations from Pedgley (2007) for imposing subject delimitation on data collection tools for capturing accounts of design activity. In order to tackle the contradictory criteria of data overload, data loss and yet collecting rich and relevant information, using “open-ended” response categories, which allow self-reflections are recommended.

Other contradictory criteria were “minimized logging delay” and “intrusiveness”. As mentioned, the less the logging delay, the more accurate the retrieved information. It is therefore plausible that concurrent diaries will better contribute to accuracy of information retrieval. On the other hand, there is a risk that largely minimized logging delay might intervene with the design activity (Pedgely 1997; 2007). Therefore, the logging time should be carefully considered in order to avoid interfering with the designers’ line of thoughts, yet collecting accurate data. Thus, retrospective methods without too long or too short logging delay are potential candidates for investigating design activities.

**Explaining design activity**

The findings from the first study indicate that the participants had focused prominently on their outcomes instead of the process, in contrast to the second study. There were also indications of difficulties to articulate and express the design activities. This notion is consistent with the arguments of Cross (2011), that designers focus on their project results when they want to explain how they design. Zimmerman and Wieder (1977) also had mentioned the importance of articulation for gaining valuable information from diary studies. To understand the underlying thoughts and motivations behind design activities,
the designers are however the only source of information, regardless of their articulation abilities.

Limitations

Both studies required a high degree of participants’ engagement and devotion for using the diary method. In previous diary studies, the importance of participants’ dedication for sustaining diaries has been highlighted (Rieman, 1993; Zimmerman & Wieder, 1977). In the present study, the course examination was a strong incentive for the participants, as the diary documentation was a part of their examination. A major limitation for undertaking diary studies involving professional designers is therefore to provide incentive and motivation for expending dedicated efforts.

Although the combination of the structured diary format and visual diaries were found more suitable for capturing design activities, they have some limitations to consider. For example, they were limited to weekly reflections and therefore did not reveal a holistic overview on the design process from the participants’ perspective, which could be resolved with including an overall review submission in the last week of the project.

Concluding remarks

Three variants of the diary method were employed for data collection to acquire an insight into the form generation process. Evaluation criteria were identified to address the potentials and limitations of the three diary variants. One of the most important findings regarding the diary variants was the relation between the logging delay and the reliability of the gathered data. This was found to be mainly due to the retrieval failure and memory changes over time. The combination of the structured diary and visual diary were identified as more appropriate for investigating the form generation process than unstructured diary. Furthermore, the fixed response categories led to acquiring more focus on form generation activities, and demanding less effort for data analysis. To conduct diary studies, it is important to consider the contradictory evaluation criteria, in particular, finding a balance between logging delay and intrusiveness. Additionally, to collect relevant data, appropriate delimitations are required.

Future work should be directed at conducting similar studies in other design disciplines and more importantly with professional designers. In addition, possibilities of improving the diary structures should be investigated. Practical guidelines for implementing diary method in design research should be provided as well. Finally, since the visual information plays a central role in form generation process, great consideration is required for interpreting and analyzing the visual data gathered from the diary methods.

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References


A Socio-technical Framework for Collaborative Services

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\textbf{Abstract}

This research is about the role of service design and ICTs to create and facilitate the development of a sustainable local community. The notion of a sustainable community, and to a larger extent, a sustainable society, is based on a proposition that such a society exists in a form of a distributed network of local units in which the diversity and the localness of such units are preserved while innovations are shared.

In a project to develop sustainable food networks in Milan, we aimed at transforming local producers and consumers into a sustainable community, i.e., to assign them with the qualities of a sustainable society described above, through service design approach. Hence a socio-technical framework to develop strategies that can facilitate such transformation was developed. The framework consisted of 3 stages: (1) using social network tools, the existing relations among the users were analyzed in terms of the structure and the content; (2) based on the analysis, strategies to transform users into a sustainable community was developed; (3) strategies were fed back to designing service prototypes and a digital platform. In the paper, the application of the framework in designing a farmers’ market in Milan is introduced.

The originality of the framework is in that it supplements the existing service design process by offering a systematic approach to eliciting the relational needs of target users and developing service strategies that address them.

\textbf{Keywords: social innovation, sustainability, service design, social networks, information communication technologies (ICTs)}
A socio-technical Framework for Collaborative Services

Introduction

Society in transition

Several scholars have asserted that the contemporary society is going through a transition at the center of which lie socio-technological innovations that fundamentally change the way we live, produce and consume.

According to Murray (2010, p.4), “the early years of the 21st century are witnessing the emergence of a new kind of economy that has profound implications for the future of public services as well as for the daily life of citizens." This emerging economy, which the author calls a ‘social economy’, can be observed in many fields such as environment, care, education, welfare, food and energy. The characteristics of a social economy are the following: the intense use of distributed networks to sustain and manage relationships enhanced by information communication technologies (ICTs); blurred boundaries between production and consumption; an emphasis on collaboration among local units; and a strong role for values and missions (Ibid.).

Lessig (2008) describes the transition from the perspective of production and ownership. In his book Remix, he emphasized the increasing role of users in generating digital contents and claimed that there are three types of economies – commercial, sharing, and the mixture of the two called hybrid. Despite seemingly contradicting concepts, commercial and sharing economies can exist in parallel. For example in the music industry, the emergence of illegal file sharing on p2p networks has dropped the profit of record companies by 31%, which implies that even if practically every piece of music on the market can be found on p2p networks, some people continue to purchase music and therefore the parallel market exists (Ibid.). Lessig predicts that our economy will move towards more hybrids of commercial and sharing economies.

What Bauwens (2006) describes as a Peer-to-Peer society is coherent with the previous notions although his perspective expands to social, political as well as economic domains. In a society based on Peer-to-Peer dynamic (or simply a P2P society), equipotential members cooperate for the performance of a common task and for the creation of a common good based on a distributed network. The characteristics of a P2P society are the following: free cooperation between members based on distributed
networks, merit-based hierarchy and no prior selection to participation; production of use values; and participants’ free access to the use values.

Manzini (2008B) proposed that small, local, open and connected are key characters of an emergent sustainable society. The limited size of human beings – both physical and cognitive – brings into the limited scale of a system that we can comprehend and control. Because a small local system is easier to comprehend and control than a big centralized one, it is more democratic. The diffusion of the Internet allows people to remain small and local while open and connected to a bigger system where they all belong to, what he calls a ‘cosmopolitan localism’. As the Internet has brought power back to people, grassroots social innovations will bring more changes to our society than before in a sustainable direction.

Although the four notions come from different contexts, a social economy, a P2P society, hybrid economies and a sustainable society share common qualities: Firstly, they emphasize the rising power of small and local units in our society (e.g. individuals, communities, enterprises) which form a bigger system based on a distributed network; they are driven by the innovations triggered by discontent towards the current socio-economic systems; they are empowered by technological innovations that provide an infrastructure for networking and collaboration among the small and local units; consequently, the boundary between production and consumption is getting blurred; and finally, old and new elements coexist in harmony (e.g. market economy vs. social economy, P2P vs. centralized network, commercial vs. sharing economy).

In our daily life, an example of a local unit that triggers innovations and constitutes a distributed network can be a group of people who, confronting challenges in daily life, generate solutions to fulfill their own needs through collaboration. They are called a collaborative community and their solution is called a collaborative service. Collaborative services are an example of grassroots social innovation but they can also be created, supported and facilitated by design intervention. More specifically, designing for collaborative service involves designing a platform for action with which users will engage as both producers and consumers of solutions to their unmet needs (Manzini, 2008A). The design outcome is an empowering environment for generating a solution rather than a solution per se (Ehn, 2010).

**Collaborative service**

Collaborative service is defined as a type of service in which the final users collaborate to produce solutions to a wide range of social needs that existing solutions have failed to meet (Jegou & Manzini, 2008). Collaborative service is distinguished from other services in that it requires
relational qualities as a prerequisite to function. If successfully designed, a collaborative service leads to an enrichment of the relations of users. According to the definition, a collaborative service results in the production of two essential elements: technical solutions to user needs and social networks of target users. These two elements are interlinked and support the production of each other thereby creating a virtuous cycle: In the process of collaboration, social networks are formed and reinforced among users. Social networks, in turn, create a favorable environment to induce new collaborations (Figure 1).

**Figure 1 A virtuous circle between the production of solutions and that of social networks**

**Research question**

Production of collaborative service can be amplified through design intervention. An empowering environment or an enabling platform can be designed in a way to support the production of a solution or the production of social networks, either of which will facilitate the virtuous cycle. In service design process, the former relates to strategies that improve the functionality of a solution, i.e., making a service more usable, efficient and effective whereas the latter relates to strategies that contribute to enriching social networks of users, i.e., making a service more interactive (with other users), convivial and collaborative.

In a commercial service where the principal interaction occurs between a service provider and a customer, improving the functionality is the major success factor of the service. On the contrary, a collaborative service involves interactions between users and their social networks are a prerequisite for achieving the service goal, i.e., generating a solution to users’ needs.

In short, supporting both the functional and the relational aspect of a service is necessary for a successful production of collaborative service. Socio-technical intervention is the implementation of design strategies to facilitate the dual production of collaborative service. The strategies, in turn, are developed based on the investigation of users’ technical and social needs that are identified from user studies. Figure 2 illustrates the schematic process of designing an enabling platform for collaborative services.
Joon Sang BAEK and Ezio MANZINI

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Figure 2 A schematic process of designing a digital platform for collaborative services

In this context, two research questions were raised: 1) How to elicit users’ relational needs; and 2) how to create an environment (or a platform) that empowers users to generate collaborative services that fulfill such needs? Answers to the questions were sought in the context of a project called Nutrire Milano.

Project Nutrire Milano

The background of this project is the dissipation of a vast agricultural area surrounding Milan due to urban expansion and the jeopardy of losing local communities, their culture and businesses and as a consequence. Meroni emphasizes the importance and potential of peri-urban areas as below:

*It is the periurban area that lies between a town or city and its rural surroundings, and is a critical context for the sustainable development of any urban area. ... These areas are currently subject to urban expansion where formerly separate cities and towns merge into vast urbanised zones: the way this comes about is crucial for the development of a region. It is here that urban and rural dynamics meet, creating unique opportunities (or risks) to improve the quality of everyday life and make a decisive step towards sustainable territorial development.* (Meroni, 2008:14)
The area surrounding Milan is called the Agricultural South Park or Parco Agricolo Sud Milano (or Parco Sud) in Italian. It is a territory of 470 km² surrounding the southern part of the Milan city, in the region of Lombardy and its main utility is agricultural. It is partially owned by farmers and partly rented out to farmers by the local authority. It is facing multiple problems such as a decline of small farmers, overexploitation of the land due to agro-industrial production and a lack of investment that results in decreased economic profitability of the area other than the land itself (Ibid.).

In 2010, a project was launched by a consortium of Politecnico di Milano, Slow Food Italia and Università’ degli Studi di Scienze Gastroniche with an aim to create a sustainable food network in the Parco Sud and to support local producers by providing them with economically viable and environmentally sustainable service models. Over the next 5 years, the consortium will design service scenarios, conduct territorial analyses, develop service ideas and implement the most promising ideas into pilot projects, i.e., working prototypes and finally develop a digital platform that support the services.

The first pilot project: upgrading a farmers’ market in Milan

The first pilot project is to upgrade a farmers’ market in Milan using service design approach. This market is a Milan version of an international network of farmers’ market called the Mercati della Terra (the Earth Markets). Mercati della Terra were organized by the Slow Food with an aim to create a place where producers and consumers interact; to provide educational opportunities for consumers; and to promote culture, history, identity and health of the local community (I Mercati della Terra, 2010). Currently 16 markets are run in 5 countries – Italy, Israel, Latvia, Lebanon and Romania. The Milan edition was launched in December 12th, 2009 and since then it has been held once a month in a public park called Giardini Largo Marinai d’Italia. About 70 producers of local producers qualified by the Slow Food and mostly located within 40 km from Milan sell their products at the market. The products include vegetables, fruits, dairy products, processed foods, meat, wines, beers, breads, plants, honey and many others (Figure 3).
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Despite the high quality of products and their sustainable nature, farmers’ markets have remained marginal in Milan for several reasons: firstly, the prices are generally higher or perceived to be higher than other food sources. Many consumers expect the farmers’ market to be less an expensive place to shop than or at least competitive to other food sources (e.g. supermarkets) as they purchase directly from producers. However, depending on the type of products, the prices can be quite higher than ones in the supermarkets. Secondly, access to the markets is limited. The Mercato della Terra is held only once a month and in one venue. The Coldiretti Farmers’ Market is held once a week in two venues. Neither of them provides a delivery service. Thirdly, the variety and quantity of products are limited compared to supermarkets since the markets only deal with seasonal produce from local regions. For consumers who are used to buying year-round vegetables and fruits, farmers’ markets are an inconvenient choice. Ironically, despite a lack of variety of products and inconvenience, the demand exceeds the supply. In the recent years, a rising attention to food safety and food security in Italy has led to an increasing demand for quality agricultural products such as organic products (Euromonitor International, 2006). However, the number of small local farms has been decreasing and hence there are not enough local products to meet the rising demand of sustainable consumption. Lastly,
the farmers’ markets are not widely known among the citizens due to a lack of marketing strategies.

In this context, the first pilot project aims to upgrade the Mercato della Terra in Milan into an event that is socially, environmentally and economically more sustainable.

**Methods**

To collect data on users’ relational needs at the farmers’ market, surveys and interviews were conducted for the producers in the market. The data were collected for 3 months from August to October 2010. It aimed to collect the following data: basic user information, how producers and consumers are connected, and what kind of new services they want to participate in the future. In this paper, the data related to the producers’ connections are elaborated.

The survey was conducted both online and offline. The survey forms were distributed through email to the producers who had access to the Internet and paper copies were handed out to those who did not have access to the Internet at the market. 43 producers responded to the survey during this period (estimated on October 22nd). The response rate was 91% with margin of error 5% and confidence rate 95%. The surveys were designed using Google® docs.

The survey consisted of 75 questions and was composed of 3 sections:

- Basic information of users
- Degree of collaboration
- Social network analysis

Questions on basic information of users included the name and location of farm (producers), user’s age, gender, income level, education level, items produced and services offered (producers), places for shopping (consumers), the number of visits to this market and the use of ICTs in daily life.

In order to understand the details of their current collaborative activities, a method called ‘degree of collaboration’ was designed. Degree of collaboration reveals the content of users’ social networks and provides quantitative information to analyze the quality of the networks. It inquires users of: What type of collaborative activity they are involved; who they collaborate with; how long they have collaborated; how many people are involved in the activity; how frequently they get in contact with others to collaborate; and what technologies they used to collaborate.
The type of collaborative activity was defined based on the result of case studies on collaborative services (Baek, Manzini & Rizzo, 2010) and it was given as a multiple-choice question. The defined types are as follows:

- Creating/managing a direct network with consumers
- Aggregate social actions
- Socializing
- Providing mutual support to solve common problems
- Exchanging competences, time and products
- Sharing products, places and knowledge
- Others

Among the inquired attributes of collaborative activities, duration, frequency and group size are the factors that influence the strength of personal ties and are used to analyze the strength of social networks.

In social network analysis, the names of producers currently engaged in any collaborative activities were collected. The data were analyzed to understand the nature of the collaborative network structure. The data were then analyzed and visualized using social network analysis software. The UCINET 6 was used for network analysis and the Netdraw was used for visualization.

### Results

#### The degree of collaboration

65% of the producers reported that they were already engaged in various forms of collaboration with other producers in the market. The most frequent type of collaborative activities was ‘exchange of exchanging competences, time and products’ (e.g. time banking, selling other producers’ products in farm stores) (54%). It was followed by ‘creation and management of a direct network with consumers’ (e.g. solidarity purchasing groups) (29%); ‘provision of mutual support to solve common problems’ (21%); ‘socialization’ (18%); ‘sharing products, places and knowledge’ (14%); and ‘others’ (18%). Others included collaboration between producers of the same item (e.g. plant producers sharing pollens for pollination, rice producers helping each other in husking, collaboration between beer producers), collaboration between producers of supplementary items, i.e., supplementary parts of a product or a service (e.g. a jam producers and a baker collaborate to produce a tart), and
collaboration between producers in the same region (e.g. a consortium of the producers of the Parco del Ticino).

Although the duration of collaborative services varied according to the type of services, the majority of the producers’ collaborative groups have lasted from 1 to 9 years. This was followed by ‘more than 20 years’; ‘less than 1 year’; and ‘from 10 to 19 years’. In fact, 90% of all collaborative groups have lasted for at least 1 year indicating that their tie strengths are both strong and weak.

The size of collaborative groups differed from one type of collaboration to another. Groups for socialization was relatively bigger than other type of groups with the majority having more than 50 members. Groups for sharing products, places and knowledge and exchanging competences, time and products, on the other hand, were more evenly distributed in terms of the size with a slightly larger number of groups under-10 or above-50 members.

The frequency of interaction varied in the type of collaborative activities. Groups for socialization had more frequent interaction among members than any other types, followed by creating direct networks with consumers and exchanging competences, time and products. Throughout all types, 60% of the respondents met at least once a month.

When the producers were asked if they were interested in participating in new collaborative services to facilitate the organization of the farmers’ market and to improve the quality of its services, more than 70% responded that they would be interested in using a digital platform to inform consumers what they will bring to the next market, 50% said they are willing to advise consumers on urban farming and 30% answered they were interested in car pooling to come to the market.

**Social network analysis**

The social network of the producers in the farmers’ market was obtained by analyzing the description of their collaborative activities: partners, location of farm, products and services. Out of 43 respondents, 2 responded twice and therefore the total number of valid responses was 41. Although 28 producers responded that they were involved in collaboration with other producers, only 16 of them identified the names of their collaborators. The rest 25 producers were thus treated as isolates. 4 producers did not identify their names and were marked as X, XX, XXX and XXXX.

Figure 4 illustrates the social networks of producers in the farmers’ market. The nodes indicate the producers and the arrows indicate collaborative relationships. A → B means that producer A claims to collaborates with
producer B but not vice versa. A ↔ B means that both A and B claims collaborate with each other.

Figure 4 Social networks of producers at the farmers' market

The social network diagram reveals that the producers' social network structure is fragmented, consisting of several isolated groups and individuals. In order to identify the nature of the collaborative groups, additional information of the producers obtained from the survey was utilized. Figure 5 is a network structure of the producers with each node indicating the type of their products. 5 producers did not identify their produce and hence were marked as a question mark. The majority of the nodes have the identical or related type of products with their neighboring nodes, supporting the survey result that the exchange of competence, time and products frequently take place among producers of the same product type. Another type of collaborative service shown in the figure is mutual support. For example, a bread maker and a jam maker collaborate because they produce pies together.
Likewise, the postal codes of the producers were mapped onto the nodes to identify a correlation between the location of the producers and collaboration (Figure 6). The result showed that the producers’ collaborative groups are often based on geographic location. Most of the producers were collaborating with partners within 30 km. Exceptions were a network between the producer M3 and the producer A who were 50 km away and a network between the producer L1 and the producer P which were 210 km far away. Both M3 and A produce dairy products. L1 produces milk, cheese, beef and salami while P produces olive oil. The result indicates that the producers’ social networks are fragmented into groups based on locality.

Figure 5 Collaboration between the producers of the same type of items (in orange dotted line) and of supplementary items (in green solid line)
Discussion

Degree of collaboration

Analysis of the degree of collaboration contributes to revealing the state of social infrastructure to start collaborative services and how it can be improved. The fact that the majority of the producers are currently engaged in some type of collaboration with other producers at the market indicates that there already exist social relations necessary to initiate collaborative services among them. Provided that their social relations are mostly built upon face-to-face interaction on a regular basis for at least 1 year (in some cases more than 20 years), a significant part of their relations are likely to be based on strong ties.

An observation of users’ collaborative activities also provides insights on what kind of services to design in order to effectively fulfill users’ social needs. The fact that certain types of collaboration proliferate than others indicates the users’ preference on different collaborative service types. The producers have a high demand for sharing and exchanging time, products and competences. For example, they wanted to share the following resources: A shared distribution channel in the city and to manage logistics for the service (55%), a counseling on technical and fiscal issues related to their businesses (29%), financial resources to transform a conventional farm to an organic one (4%), solutions to agronomic and technical problems (3%), and collaborative restaurants.
(3%). The tools and infrastructures that the producers are willing to share with others included store in the farm (26%), a meeting space (17%), transportation to the market including a fridge van (17%), store in the city (11%), tractor (9%), warehouse (6%) and workshop (3%). The competences that they wanted to share with other producers included stock breeding (33%), alternative cultivation techniques (29%), knowledge on horticulture (17%), specialized staff (17%) and sales staff (4%).

Based on the identified needs and resources of the producers, ideas to fulfill their needs were developed. One of them was an organization of shared transportation of their goods to the market. The producers arrive at the market with the goods to sell by their vans in the early morning and leave the market around 5 PM. Carpools can be organized with a support of a digital platform. The platform provides necessary tools to organize carpooling such as a map to identify the locations of farms; a carpooling software that makes carpooling easy and efficient; a database that contains information relating to carpoolers such as who they are, how much products they need to bring to the market, the type of products, and if they need special assistance (e.g. fresh items need a fridge van).

**Social network analysis**

Although the majority of producers in the market answered that they collaborate with other producers, their network structure revealed that only 40% of the respondents were connected to other producers and that the network structure consisted of disconnected groups. Looking inside the groups, the members were connected via both strong and weak ties and what hold them together seemed to be mainly two factors: product type and geographic location. Outside these collaborative groups are individual producers (35%) and consumers (80%) who are not involved in any collaboration.

Figure 7 illustrates in a simplified diagram how the users of the farmers market currently interact with one another.
The tools and infrastructures that the producers are willing to share with others included store in the farm (26%), a meeting space (17%), transportation to the market including a fridge van (17%), store in the city (11%), tractor (9%), warehouse (6%) and workshop (3%). The competences that they wanted to share with other producers included stock breeding (33%), alternative cultivation techniques (29%), knowledge on horticulture (17%), specialized staff (17%) and sales staff (4%).

Based on the identified needs and resources of the producers, ideas to fulfill their needs were developed. One of them was an organization of shared transportation of their goods to the market. The producers arrive at the market with the goods to sell by their vans in the early morning and leave the market around 5 PM. Carpools can be organized with a support of a digital platform. The platform provides necessary tools to organize carpooling such as a map to identify the locations of farms; a carpooling software that makes carpooling easy and efficient; a database that contains information relating to carpoolers such as who they are, how much products they need to bring to the market, the type of products, and if they need special assistance (e.g. fresh items need a fridge van).

Social network analysis

Although the majority of producers in the market answered that they collaborate with other producers, their network structure revealed that only 40% of the respondents were connected to other producers and that the network structure consisted of disconnected groups. Looking inside the groups, the members were connected via both strong and weak ties and what held them together seemed to be mainly two factors: product type and geographic location. Outside these collaborative groups are individual producers (35%) and consumers (80%) who are not involved in any collaboration.

Figure 7 illustrates in a simplified diagram how the users of the farmers’ market currently interact with one another.

Figure 7 The market as a network of tightly knit groups

Despite the sustainable nature of a farmers’ market, the Mercato della Terra in Milan can be further improved to meet the criteria of a sustainable community as proposed in the introduction. It means reinforcing existing social relations and, at the same time, creating weak ties that connect isolated individuals and groups through design intervention. A community thus built is open to new members and actively reaches out for them with promotion and communication strategies (Figure 8).

Figure 8 The market as a network of tightly knit groups and individuals

Socio-technical framework

A sustainable transformation of the farmers’ market can start with the development of service strategies and an enabling platform that stimulate new collaborative groups or support the existing collaborative groups. Table 1 lists the examples of service strategies and corresponding platform features generated during the project.

Table 1 Examples of service strategies and platform features
The analysis of social network structure and content can be incorporated into a service design process to provide data necessary to effectively address the need for a sustainable transformation.

Identification of the resources and the problems that a community has is an input to generate socio-technical intervention, i.e., service strategies, that successfully fulfill user needs. During the Nutrire Milano Project, a resource-problem matrix was used to facilitate idea generation of socio-technical intervention to support dual production of collaborative services (Table 2). The matrix has the design problems in the column, and the resources in the row. In the synthesis phase, the blanks are filled with strategies to solve the defined problems.

<table>
<thead>
<tr>
<th>Service strategy</th>
<th>Platform feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social events at the market such as tasting laboratories, demonstrations by producers, shared tables</td>
<td>A multimedia repository to share the records of events at the market</td>
</tr>
<tr>
<td>Shared logistics for producers to bring their products to the market</td>
<td>An online carpooling system to support organization of shared logistics among the producers</td>
</tr>
<tr>
<td>A neighborhood dinner club for producers to get to know one another and to share information, competences and resources.</td>
<td>An online community for producers to continue discussions at the neighborhood dinner club.</td>
</tr>
<tr>
<td>Occasional GAS</td>
<td>An online community to organize occasional GAS</td>
</tr>
<tr>
<td>GAS extended (for large organizations such as schools, offices or apartment houses)</td>
<td>A social commerce platform for GAS extended</td>
</tr>
<tr>
<td>A food box delivery service</td>
<td>An e-commerce system for a food box delivery service</td>
</tr>
</tbody>
</table>

Table 2 A resource-problem matrix for brainstorming socio-technical intervention
Socio-technical intervention is the combination of social and technical intervention. Social intervention in the context of collaborative service refers to intervention to reinforce and maintain the social relations of users in a direction coherent with the service goal. Under the goal of creating a sustainable community that is small, local, open and connected (Manzini, 2008B), social intervention includes a series of social activities that aim to achieve a balanced composition of strong and weak ties in a community. It means to create a network of local collaborative groups that are open to new innovations, connected to one another through weak ties and at the same time maintain their local values and strong interconnection between members. In the farmers’ market in Milan, social intervention includes events such as the tasting laboratories, demonstrations by producers and ‘convivial tables’ for people to eat and socialize (Figure 9). They contribute
to making the market a convivial community by creating opportunities for social interaction among the producers and the consumers.

Technical intervention on the other hand is intervention to improve the performance of a service is related to the production of a solution. With technical intervention, a service becomes more efficient and effective in fulfilling users’ needs. Online and offline tools that reinforce the operation of the market are a typical technical intervention (Figure 10).
Articulation of service concepts and strategies lead to defining a platform concept and features. In Table 3, service strategies were generated using a resource-problem matrix and then corresponding platform features were brainstormed.

**Table 3** A resource-problem matrix with a brainstorming result
Conclusion

The socio-technical framework for collaborative services provides designers with a systematic and balanced approach to designing a digital platform that addresses both relational and functional needs of local communities. It involves socio-technical intervention to strategically facilitate the formation and/or transformation of social networks towards a sustainable society. A successful use of the framework would empower local communities to generate solutions that meet their social needs with a digital platform equipped with features that support collaboration.
Although the framework has been tested in a particular project and its extended use remains to be validated in the future, we predict that it can be applied in a wider context for the following reason: The methodology of the framework consists of quantitative methods – surveys, social network analysis, degree of collaboration – that can be replicated and qualitative methods – a resource-problem matrix and brainstorming – that bring specificity to the context of its use. Another future work is to validate the framework by assessing the performance of a platform with respect to achieving its goal.

Acknowledgement

This project was conducted with a fund from the Fondazione Cariplo and in collaboration with the Slow Food Italia and the Università degli Studi di Scienze Gastronomiche. We thank people who collaborated on this project and the producers in the farmers market who participated in the survey.

References


Website

Learning from Media Studies Theory and Design Practice: Using the interpretive nature of film media for the communication of tacit knowledge in design research

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Abstract
This paper investigates the interpretive nature of film media as a format for tacit knowledge communication in design research. Film is already utilised in this capacity for documentaries and fictional films and the theory of tacit communication is well understood in the field of media studies. Lessons from the use of film in design practice, although more typically used for explicit communication, are also considered.

The paper sets the historical context of film theory covering narrative, documentary types, aesthetics, and drawing on semiotics and rhetoric in design. The author describes two case studies: extensive design research was summarised into a short film for communication to an executive audience of decision makers at the University of Technology Sydney in 2008-9; and looking at the impact of introducing a film summary requirement for graduate project research in the Innovation Design Engineering department at the Royal College of Art from 2006-8.

The author’s conclusion is that there is merit in design researchers understanding film theory and practice to better leverage the medium for both tacit and explicit design research communication and the research process.

Keywords: design research, tacit knowledge, film theory, design communication, visual communication, media studies
Introduction

This paper investigates the value in the communication of tacit knowledge in design research through film. In the last 20 years, the advent of affordable multimedia computers, video cameras and high definition mobile phones has eliminated the barrier to entry for film as a tool for design researchers. As a result, film is a common medium in research for purposes that include documentation for discovery, exploration, consultation and presentation. The advantage of using film in design research are described by Arnall and Martinussen (Arnall & Martinussen, 2010), who use film to communicate interactive technology and provoke an internal discourse among themselves through the process of making the film:

‘The form of film – that embodies both a highly reflective design activity and communicative qualities – is an ideal medium for interaction design research, where it can coalesce knowledge around practices and processes and project towards potential futures. Film allows for a degree of probing, explanation and reflexive understanding of emerging technologies, but through its communicative qualities, also opens up for participation in broad social and cultural discourses around technology.’

Ylirisku and Buur (2007) advocate film use for design research and innovation, highlighting the advantages of being able to edit social events and activities to make meaning. Filming to observe everyday activities is also valuable in the exploration and discovery period of research (Raijmakers et al, 2006). Joost and Scheuermann (Joost & Scheuermann, 2006) consider audiovisual rhetoric in design for both production and analysis:

‘Rhetoric can be consulted as a description model for the design process since it names categories both for the production and analysis of media. There are two approaches: on the one hand, the question aims at the influence of rhetorical strategies on the productive process of design, on the other hand it aims at the application of rhetorical categories for the analysis of media.’

Film is well suited to rhetoric in design research, ie: the art of persuasion. Aristotle’s work on written and spoken rhetoric is considered to be definitive (Golden et al, 2007) and his theory of rhetoric maps onto the medium of film because the medium is versatile enough to fulfill Aristotle’s three audience appeals of 1) logos: order and knowledge; 2) pathos: emotion; and 3) ethos: beliefs and ideals (Aristotle, 384 BC - 322 BC). More controversially for research, providing there is a target audience film also works for the ‘new rhetoric’ (Perelman & Olbrechts-Tyteca, 1969) of non-formal arguments in which arguments are framed for a specific audience to best achieve audience adherence, a process that in itself determines what constitutes reasonableness and facts. In a visual context, Barthes (Barthes, 1990) and Eco (Eco, 1972) considered the rhetoric of the image, and the importance of rhetorical argumentation in design was highlighted by Buchanan (Buchanan, 1985). Rhetorical methods are very important for tacit knowledge communication in film media, though they are not exclusive in this role, and are represented within some of the defined documentary film types that are discussed in this paper.

Thus, in terms of tacit knowledge communication the literature in design research confirms the value of film as a tool for this. The case is also made by the broader philosophical and semiotic literature on visual semiotics, as well as the much longer history of rhetoric. The paper further investigates the specificity of the interpretive nature of film media in design research for the communication of tacit knowledge in design research by formally setting out and applying media studies theory to the analysis of a
professional case study by the author and the analysis of a group of graduate design research case studies that each span foundation research, ideation and prototyping for a diverse combination of products and services. These investigations are complemented by a consideration of film in design practice.

**Tacit knowledge**

In the literature, Polanyi’s (Polanyi, 1967) important work on tacit knowledge in the fields of social science and philosophy of science argued that creative acts, including scientific discovery, draw on personal knowledge and feelings in addition to more formal knowledge that can be stated in explicit propositional terms. Polanyi argued that both tacit and explicit knowledge are present together within an individual’s thinking as a kind of dynamic tension as they engage in exploration or an attempt to understand something. Furthermore, Polanyi wrote that motivation and passion drives us to discovery and that the process of discovery involves the holistic use of all our faculties.

Polanyi emphasized the importance of tacit knowledge across all areas of research, from analytical science through to more qualitative social research. The challenge is that the communication of tacit knowledge is not always suited to being codified through text or verbal media: imagine reading a manual on how to walk the tightrope, or how to win at chess using an instruction book that specifies how to play creatively for somebody that has never encountered chess before.

Sol Worth, film maker and arguably founder of visual communication (Worth, 1974), described how tacit interpretation was intrinsic to the medium of film and evoked either natural or symbolic sign-events (Worth, 1981):

‘Natural events.. are those which we interpret in terms of our knowledge (or belief) about the conditions that determine their existence. The meaning of these events for us, in fact, can be said to derive precisely from those existential conditions. In contrast, symbolic events are events that we assume to have been intended to communicate something to us. Further, we assume that these events are articulated by their "author" in accordance with a shared system of rules of implication and inference. That is, they are determined not by physical or psychological "laws" but by semiotic conventions.’

Within the domain of tacit knowledge is the hunch, instinct, or values. Tacit knowledge exists within individuals or groups as personal knowledge that may be held in diverse formats such as imagery, concepts or feelings. As such, tacit knowledge poses the challenge of how it might best be communicated. D’Eredita (2006) considers three propositions for the cognitive proliferation of tacit knowledge. These are: (i) episodic, through experience; (ii) the result of constructive collaboration, such as within an organisation; and (iii) the construction or relating of episodes.

In evaluating which of D’Eredita’s propositions could be adopted for the communicating tacit knowledge, the first two are both problematic outside of a learning environment context with the right time and resources. The third, the construction or relating of episodes, is feasible with a viewer or an audience situation. The audience situation would typically utilise film, or perhaps an interactive web page, but could include theatre or other performance types. In any of these formats there are still challenges in getting transferral of the specifically intended tacit knowledge.

It is significant that D’Eredita writes about cognitive proliferation as opposed to communication, effectively setting out the importance of this process as one that impacts on our deep knowledge. In film making, this is in alignment with Mamet’s ideas about leveraging the sub-conscious of both the director and the audience (Mamet, 1992). This
cognitive proliferation is hard to analyse: McLuhan’s position from a media studies perspective is that reverse engineering this kind of transfer to establish cause and effect is all but impossible, writing that “program and ‘content’ analysis offer no clues to the magic of .. media or to their subliminal charge” (McLuhan, 1964).

It is possible to create films that are free of tacit knowledge. Mamet rails against these films as being the norm rather than the exception in terms of commercial output from Hollywood, with such films majoring on endlessly explained narrative techniques and excessive use of dialogue that bores the audience with information and leaves them with little for the imagination.

From the described literature investigation of tacit knowledge, it is clear that tacit knowledge must be considered an important part of both quantitaive and qualitative research which includes design research in its many manifestations. These points are further investigated through the author’s use of case studies set out in this paper.

**Film aesthetics and the syllogy**

Buckland (2010) notes that, in the first half of the last century, two competing theories emerged that argued for film as an art form. The formalists – among them Eisenstein and Arnheim – believed that the value of film lay in its inability to exactly imitate our normal visual experience of reality. The realists – including Bazin and Kracauer – argued that the recording capacity of film meant that it perfectly captured our visual experience.

Although these two theories have evolved and expanded, many films are hard to categorize in this way. Films which favor the long shot place an emphasis on allowing events to unfold and veer towards realism. With short shots, it is the assembly of the shots and their juxtaposition which give meaning, satisfying formalism. Where editing becomes very expressive in order to apply symbolic and metaphorical meaning, it becomes montage.

Mamet clearly argues for the short shot as the best way of achieving a cause-effect syllogy, in which meaning is created from the juxtaposition between two shots, as the method by which a film-maker can communicate to their audience. Mamet also makes a case for short shots to give an audience a more immersive engagement that differs from ‘watching a play’. The long shot and the short shot both offer modes for tacit communication.

Further, Mamet writes that when shorn of dialogue a film its robustness in terms of the syllogistic mode of communication is evident, even claiming that a good film script should be able to do completely without dialogue. Mamet argues that fairy tales, our own dreams, spoken jokes, and even children’s cartoons, are good syllogistic formats in which simple ‘shots’ combine for deeper meaning.

**Film narrative**

A narrative comprises a series of events that depend on each other through cause and effect. In film-making, if an event doesn’t impact on a subsequent event then it can often be left out – it is effectively extraneous in narrative terms. Exceptions are descriptive events that may describe a space, for example. Cause-effect logic is the foundation of narrative. The theorist Todorov (1969) sets out three narrative stages: a state of equilibrium; the disruption of this equilibrium by an event; and the successful attempt to restore the equilibrium. Each stage goes through a turning point to get to the next stage and involves a transformation. Although this is predominantly the format for fictional
films, some of the case studies described herein also made effective use of this narrative structure in staged fictional scenarios within documentary formats.

Narration may follow a protagonist exclusively, and this is termed ‘restricted narration’, whereas narration that follows many characters, or uses the director’s viewpoint, is ‘omniscient’ (Bordwell, 1985). Restricted narration can generate mystery, and omniscient narration can be good for suspense. Accordingly, films will often switch between these types of narration.

Bordwell (Bordwell, 1985) seeks an account of narrative activity in film through representation, structure, and process. He promotes the view of the Russian Formalists of the 1920’s that filmic narration involves the two principal formal systems of ‘syuzhet’ which is plot, and ‘style’ which is film technique, to cue the viewer to frame hypotheses and draw inferences. Bordwell considers film viewing to be a cognitive Constructivist dynamic psychological process manipulated by perceptual capacities, prior knowledge, and the material and structure of the film itself. The viewer will attempt to construct an intelligible story from the film, and in their drive to anticipate narrative information a confirmed hypothesis readily becomes a tacit assumption.

Film offers a number of narrative types, categorized by Bromhead’s examination of documentary film’s relationship with reality and cinema (Bromhead, 2009) in terms of four modalities: linear-storytelling, discursive-information, episodic-juxtaposition and poetic-visual.

The French philosopher Bergson (Bergson, 1907) first associated thought process with the form of the movie, implying that the ease with which particular movies can be understood is related to our cognitive processes. According to Kermode (Kermode, 2010), the film critic:

‘cinema has such a profound effect upon the viewer because it substantially mirrors the function of memory. When we look at the world we allegedly see a linear narrative assembled with invisible old-fashioned Hollywood continuity editing rather than nouvelle vague European [films].’

Directors risk alienating audiences when they deviate from a linear narrative, although there are plenty of examples where it has worked in cinema and avoided Kermode’s ‘nouvelle vague’ criticism.

Mamet too complains that European art films can veer away from a coherent juxtaposition of scenes that then loses the audience because although they will try to make sense of the sequencing, it effectively becomes like looking for pattern in chaos. Mamet is unrelenting in his conviction that a director does their job well if their concepts are accurately conveyed to an audience and not left open to interpretation, with such conveyance working for both explicit and tacit elements.

**Documentary types**

Buckland (Buckland, 2010) gives three conditions for a documentary: events must be unstaged; they must be non-fiction; the documentary film-maker’s role is to observe. Buckland notes that the film making process makes the role of film-maker strictly that of observer impossible because of the need to ‘shape’ a film through editing and camera work. He considers it acceptable for a documentary maker to ‘shape’ events, but not to ‘manipulate’ events by hiding the processes used to shape those events. The latter becomes propaganda.

The five types of documentaries (Nichols, 1989) are:-
Expository: using an authoritative voice-over to complement the image with additional abstract information or to comment on events in the image. This is a classic approach that creates a sense of objectivity.

Observational: unobtrusive recording of people’s activities that are not addressed to the camera. While intimate, it excludes interviews. This is very direct at capturing unfolding events.

Interactive: the film maker is present on-screen and conducts interviews and conversations with people being filmed. The film-maker because an active participant in events, and edits the film to present an argument.

Reflective: this examines the way events and people are filmed, allowing the viewer to understand the whole film-making process, and making the conventions of representation apparent.

Performatve: the focus is on the expressive and poetic aspects of the film, typically presenting the subject in a stylized, subjective way that may include re-enactments. For the viewer, it is more experiential and can distort events.

Narrative is important in many documentaries, either for scenes within them or for the entire film – the latter is particularly so in the case of performative documentaries.

**Case studies**

**Professional documentary: ‘The shape of things to come’**

The ‘shape of things to come’ was a short 4 minute professional film that was produced in 2009 (view at [http://youtu.be/eumpJknzI4s](http://youtu.be/eumpJknzI4s)). The film was created to communicate the essence of a 12 month design research project to investigate the emerging field of UDM, or Urban Digital Media (Barker & Haeusler, 2010), and its potential for application across the campus of the University of Technology Sydney through a site-wide strategy. The field of UDM relates to digitally-enhanced public spaces and was part of the university’s objective of being a leading technology campus. UDM includes integrated digital-physical spaces for creative working, collaboration, leisure, and social interaction. The research work was commissioned by the University of Technology Sydney and was headed up by the author. There were three other outputs from this work: a text-based 100 page book of research summarizing user workshops, consultation, and stakeholder feedback from the city of Sydney in Australia; a similar book encapsulating consultation with additional experts in the city of London UK; and a 20 page glossy color booklet containing the executive summary of the research with explanatory diagrams, and photomontaged hand-drawn illustrative design concepts for a number of campus locations. The research involved detailed consultation exercises with over 100 participants through interview and workshops. Participants ranged from staff, students, experts, industry, university partners and other stakeholders. The film-making involved a crew of 18 people working over a 4 week period.

The author created the film as a way of communicating the design research and a futurology vision of where an implemented UDM strategy could lead the university. The film was used twice: once to get final feedback from the 100 people consulted during the research, and once for communicating to an executive audience of 15 decision makers at the university that included the vice chancellor and his management team. The management team was also provided with the other research outputs.

The initial reason for creating the film was because based on past experience it was felt that the busy university managers would struggle to read and absorb the printed research
outputs. However, because the film making was initiated near the end of the research activity, the author realized that it also had the potential to communicate a vision of the university set in the near future, in which the UDM recommendations had been implemented. A performative documentary method was used with a poetic-visual narrative in order to really engage the audiences imagination and carry them along with a real sense of how the UDM campus experience would feel. The author wanted to generate the same sense of excitement and energy that had taken place in the user workshops as people described how they would feel about experiencing the implemented versions of ideas that they were scoping. With the user-centered design aspect to the work, there was evident value in the tacit knowledge that the users communicated to the researchers: about feelings, atmosphere, and senses of value. To capture and convey this, the author revolved the film around expository interviews that were set about 5 years in the future with several imagined and successful graduates who were describing personal user scenarios of how the UDM campus had impacted on their time at the University of Technology Sydney and their subsequent careers. Within ‘The shape of things to come’ there were essentially four cause-effect narrative syuzhets, each told by a fictional graduate. To reinforce the spoken narrative, and switch between restricted and omniscient narration to create a more expansive feeling, these natural event interviews were intercut with animated versions of the hand-drawn illustrations that were used in the booklet. Interviewees were clearly located in their imagined places of work. With little movement or action by the actors on screen, long shots dominated the cinematography. The film opens with a high speed film sequence of the campus and surrounding streets going from night to morning, a symbolic event for a busy ‘new dawn’ of UDM as the roads filled with cars. The film concludes with a similar scene but going to night time and achieving closure as the credits roll.

After both film showings, through questionnaires the audience confirmed that the film gave them a real sense of how the new campus would feel, that they felt an emotional empathy with the fictitious interviewees, and they shared the sense of how the success that the interviewees articulated had a lot to do with the UDM experience. Hence, the audiences were convinced by the rhetorical method used. The questionnaires showed that over 90% of the audience were in favor of the UDM plan proceeding. The senior managers of the university subsequently approved the pilot phase of the UDM strategy. Importantly, the value of the research documents was also highlighted as essential for providing supporting evidence. Hence a rhetorical film method was effective at capturing and conveying participant’s vision from the workshops.

**Design research documentaries by graduate student groups**

Group industrial design research projects were introduced into the second year curriculum of the graduate Masters program run by the author at the Royal College of Art in 2006. The scope of investigation included foundation research, ideation and prototyping for diverse products and services. Previously the students had worked alone and produced a written thesis of their work. Moving away from the written thesis model, a requirement was introduced for the groups to each produce a 10 minute film to communicate their design research. The research projects took place over a very intense 3 month period, with film work running continuously during this period along with a more intense editing stage in the last two weeks. The film and an exhibition of the work was then used by the course examiners to assess the work, and the films subsequently exhibited to the public along with any physical artifacts. Students continued to produce a thesis for a separate design-based project.
From 2007, students were given an introduction to the technical aspects of film making as part of a short design module prior to the group design research work. The students were not given any back grounding in film theory. The rationale behind the switch to film media was driven a number of factors: students were increasingly showing ‘raw’ film clips to illustrate parts of the research in presentations; highly visual and interactivity research was proving increasingly difficult to summarize in written reports even with illustration; examiners and staff were finding that the written format was not always well suited to conveying user centered design, user studies, interaction design or design futurology. It had also been noticed that when students had previously chosen to use well edited film in their presentations to communicate tacit knowledge, the audience had been more responsive and examiners agreed that they were getting a better understanding of the work.

The film theory analysis of the 25 films created in 2006-8 by teams of 3-4 people is shown in Table 1 below. This analysis was undertaken when all the films had been made. The films were examined by the author according to the types described in this paper, namely: narrative modality, documentary type, viewpoint, syllogistic syuzhet, and events. Some films were mixed-mode, in which case the dominant or most relevant category is used. Viewpoint was often not applicable (N/A) because there wasn’t an actor in the film.

<table>
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<tr>
<th>Research project</th>
<th>Type</th>
<th>Narrative modality</th>
<th>Documentary type</th>
<th>Viewpoint</th>
<th>Syllogistic syuzhet?</th>
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<td>N/A</td>
<td>Yes</td>
<td>Natural</td>
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<td>Hera.miko</td>
<td>Fashion</td>
<td>Discursive-</td>
<td>Expository</td>
<td>N/A</td>
<td>Yes</td>
<td>Natural</td>
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<td>Plastique</td>
<td>Exhibition</td>
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<td>N/A</td>
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<td>Interaction</td>
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<td>information</td>
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<tr>
<td>Robots</td>
<td>Interaction</td>
<td>Poetic-visual</td>
<td>Observational</td>
<td>N/A</td>
<td>No</td>
<td>Symbolic</td>
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</table>
Table 1
Analysis of graduate group research projects at the Royal College of Art, London UK


There are a few notable trends in the data, although it is a relatively small sample set. Many of the product categories use a discursive-information narrative, an expository documentary style, a syllogistic syuzhet, and natural events. This was a straightforward approach that was information rich but not always engaging for the audience or very good at tacit communication, although the latter was not always needed. Some of the more experimental and conceptual research made use of symbolic events. Exhibition and interactive research included more observational documentaries.

The film theory analysis shows that many film typologies were used by the students. These were chosen intuitively and on the basis of their own experience of film making as well as their observation of other research films: after 2006, students were able to view work from previous years. The grades of the work, as assessed in conjunction with external examiners, improved notably and the examiners’ reports noted the value of the medium for both explicit and tacit communication. The examiners still met with the
graduate groups to discuss the work and see any artifacts, but the quality of the discussions improved dramatically in terms of critical analysis. Additionally, the public response was very positive when the work was exhibited. The system introduced a virtuous circle: graduate students could learn from their peers’ efforts. The external examiners reports also noted improvements year on year. Although the data from 2009’s films was not analyzed, the quality matched 2008. Further improvement in the quality of the design research communication would be encouraged by an introduction to film theory as well as professional training in film making and a better understanding and allocation of the roles of a production crew.

The communication of design research through film media in all of the paper’s case studies was through a documentary approach. A key difference between the two case studies previously described is that the first was professionally created and the second comprised films by relatively untrained graduate students. However, they both demonstrated that the film media could be very effective to convey knowledge. The cost difference was dramatic: the professional film budget, with many favors drawn to keep it well below commercial rates, was about £10,000. The student films essentially had no budget. The professional film had a dedicated production crew and used high quality lighting, sound and cameras, as well as good locations and real actors. There is a role for both extremes. Further, based on the author’s personal experience, an understanding of film theory and practice should improve the research communication by the graduate students even if they still use basic equipment.

### Film use in design practice

Many films used in design practice are explicit functional presentations. The use of film media is reasonably well established as a tool in design practice for communication of information with clients, just as it is in business for investors, and in marketing and advertising for customers. An attribute of film media used in such a context is the way in which it lends itself to summarisation since the explicit communication component of film media is necessarily restricted by the format; even an in-depth 40 minute television documentary is typically limited to a 3-4 page script of double-spaced type. When successful, the distillation of the complex findings of a research activity into film does not have to diminish the value of the original information.

Other practice-based films are more tacit. Early examples include much of the film work of the designers Charles and Ray Eames (Eames & Eames, 1950-1982), who made over 100 short films from 1-30 minutes. These were highly diverse in their nature, ranging from explaining mathematics and computers, to the nature of photography, and the production of fiberglass chairs.

Contemporary design practice can cross over into marketing and branding, either at a strategic or object level, or both. The use of film as a means of tacit communication is a common language between design practice, marketing and branding. In contrast to the sometimes laborious modern Hollywood style of exposition, McLuhan pointed out that the advertising agencies in the USA realised in the 50’s and 60’s that they got better audience traction by creating positive brand and corporate identification through communicating compelling abstract ideas as opposed to a direct sell of a specific product features or functions.

This was illustrated in the television series ‘Mad Men’ (Weiner, 2007), set in the 60’s and in which the Maddison ad company pitches the 35mm Kodak slide projector as a time machine for memories. They rename the slide holder ‘wheel’ as the ‘carousel’ to draw on the association with the pleasure and nostalgia of childrens’ fairground rides. Hence, the
ad companies are often selling dreams. In a real campaign, Apple showed how sociable the iPod was. They told the narrative of a girl and a boy on a bus getting their iPod earphones muddled up and becoming partners because they discovered they liked each others’ music. In reality the iPod is the opposite: it is arguably an anti-social way of hermetically sealing users from engagement with others (Orlowski, 2005). But the friendly face of the brand has stuck.

In design practice, presentation films at client meetings are usually accompanied by the presence of the practitioners. Design practice typically uses film media intuitively and based on experience as opposed to film theory.

Interestingly, design practitioners and design researchers can be self-stereotyping in terms of their distinct approaches and methods (Design Research Society, 2010), with the former being about creativity and predominantly qualitative, and the latter being analytical and quantitative. This makes it harder for the research to bring value to the sphere of practice. Because tacit knowledge is important to both practice-based and theoretical research methods, it can act as a basis for understanding and collective values in both domains. This is essentially in alignment with Glanville’s (Glanville, 1998; Glanville, 1999) compelling argument that research should be intrinsic to design and vice versa.

**Conclusion**

The argument has been presented that film media has a useful ability to convey tacit knowledge for design research. This does not mean that film has exclusivity to that function, but as McLuhan’s ‘rich’ medium it is suited to this purpose. The principles of film theory and practice are the same regardless of whether the audience comprises researchers, clients, or user groups. It is the decisions of the film maker that will determine the effectiveness of the knowledge transfer. Kress (Kress, 2003) points out that as a prospective enterprise designers must choose a medium that best shapes that which they wish to make, given the audience, available resources, and the various constraints.

There were multiple advantages for film making in the design research case studies described. The main advantages are summarized:

- Communication of tacit knowledge and recording research that is hard to capture in a document
- Visual exploration of present or future scenarios
- Improved observational processes through film making
- Documentation of design process to improve design process – a positive feedback loop for researchers
- Quality of design outputs – qualitative improvement compared with previous documentation approaches
- Effective and efficient engagement with audience

The film making by researchers was generally using standard consumer equipment which has fallen in price and improved in quality to the point where good results can be achieved for research presentation purposes. The case study in which a film crew was assembled was better suited to a corporate presentation. However, advances in video filming options such as the use of Digital SLR cameras is narrowing the difference down to sound and lighting limitations rather than visual capture, depth of field, or resolution.
The author also found that researchers under the age of around 30 has already undertaken a lot of film making for recreational or personal use and were familiar with film editing techniques and basic production. This has been helped by the abundance of video capture devices such as smart phones, and free or cheap editing programs on personal computers.

Researchers do however benefit from learning film theory to take their work beyond an amateur level and offer them more range and capability, allowing the researcher to take advantage of the bullet points set out above. Film making benefits from film theory, training and practice. Designers generally have an affinity for narrative and visual communication and learning film making is relatively easy to accomplish.

Communicating design research to a research community as opposed to a client may or may not necessitate tacit knowledge transfer. This depends on the research. Practice-based research will also various demand a tacit approach. The proximity and overlap of practice based design with marketing and branding and the shared medium of film has enhanced the professionalization of film making techniques in design practice.

As with all creative media, success is not guaranteed with tacit knowledge transfer in film. In caution, not all the interacting factors that influence knowledge sharing are necessarily fully understood and described in the literature (Alony, 2006).

The risks of narrative in film include incorrect or uncorroborated evidence, spin, misleading representation – accusations not infrequently made of advertising and marketing. So to fully communicate design research film sometimes needs to be supplemented by a text document or an expert may need to be on hand. Tacit knowledge communication can also give rise to ambiguities which can risk ineffective use of design (Dumas, 2000), in contrast to safer explicit knowledge formats.

To conclude, the understanding of film theory and its relationship to design research creates opportunities to better leverage the medium’s value for the application of tacit knowledge communication in the contexts of research, education and practice. Furthermore, there is value in both tacit and explicit knowledge communication and these are complementary and not contradictory.

Acknowledgements

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The role of Industrial Design Consultancies in Diffusing the Concept of Ecodesign

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Abstract

While the discipline of industrial design can contribute to developing more environmentally friendly products, researchers have found that even in companies with environmentally progressive products, engineers are more readily involved in ecodesign activities than industrial designers. Some authors propose to fundamentally change the context for designers and free them from their current role of serving the economically motivated manufacturing industry. This would allow them to generate sustainable solutions and actively contribute to sustainable development. Other scholars direct their attention towards the knowledge and ability of industrial designers to conduct ecodesign activities. The role industrial designers can take for ecodesign within their current environment remains unclear.

This paper applies the framework of diffusion of innovations (DoI) to discuss how industrial designers can take a more active role in integrating ecodesign within an economically motivated context, using the example of an industrial design consultancy (IDC) collaborating with commercial client. For actively diffusing ecodesign, the paper proposes that an IDC needs to fill the roles of a local innovator and of a change agent. To do this the IDC needs to internalise knowledge on practicing ecodesign as well as convince its client of probable business opportunities for ecodesign. To identify these opportunities it can either draw on research into the current context for ecodesigned solutions or utilize design activity as a strategic resource to identify a potentially unarticulated demand for ecodesigned solutions.

The paper concludes by pointing out areas of further research such as empirically exploring how knowledgeable IDCs are in terms of ecodesign and how they gain trust and credibility in their role as change agents. Thereby context specific factors need to be taken into account such as industrial design education programs as well as the cultural environment the IDCs operate in.

Keywords: strategic design, ecodesign, industrial design consulting
Introduction

Ecodesign is understood as considering environmental aspects during the product development process. This activity represents a valuable contribution to sustainable development (Vezzoli & Manzini, 2008). Developing theory to understand how to select and conduct ecodesign activities has been an ongoing process since ecodesign first became popular in the beginning of the 90s (Thorpe, 2010). Most reference cases for the development of ecodesign theory happened in an experimental environment (Bakker, 1995; Clune, 2009) or in the context of pilot projects (Lothhouse, 2004; RMIT, 2011; Sherwin, 2000). In real world commercial product development processes, ecodesign practice remains limited (De Leeuw, 2006). Industrial design is frequently proposed as a key facilitator for ecodesign (Best, 2009; ICSID, 2010). Ecodesign literature discusses a vast range of activities. They span from incrementally improving existing product concepts (Wimmer, Züst, & Lee, 2004) to radically rethinking the value system of our entire material culture (Walker, 2006) and strategically developing and implementing holistic concepts in line with a shift of our society towards sustainability (Fry, 2008).

Within the breadth of this spectrum, it is not clear which role industrial designers can take for ecodesign in the context of providing their services to commercially motivated clients from the manufacturing industry.

The aim of this paper is to theoretically discuss and frame how industrial design can play a more prominent role for integrating and practicing ecodesign within a commercial environment by using the example of an industrial design consultancy (IDC) collaborating with a client. The proposition developed in this paper is all inclusive of IDC practice but allows accounting for individual cultural differences of IDCs around the globe as highlighted in the conclusion. The paper draws out key areas that need to be investigated further to clarify barriers and enablers for ecodesign practice by IDCs.

Besides informing further research, this paper will help IDCs working for commercially motivated manufacturers to better orient and direct their ecodesign related activities.

The next section of the paper reviews the aspects of the role of the designer for ecodesign which have been discussed in the academic literature in more detail. This review highlights that the role of industrial design for integrating ecodesign in a commercial environment has not yet been clarified.

Aspects of the role of the designer for ecodesign

While there is much literature dealing with the question how to design more environmentally sustainable solutions, it is not explicitly suggested who should actually conduct ecodesign activities (Hassi et al., 2009). The role of representatives of individual disciplines for ecodesign such as engineering, design or marketing is not made explicit by most authors. Only a handful of authors devote special attention to the role of the designer. Two aspects of how industrial designers can contribute to developing more environmentally sustainable solutions are identified and discussed further in the remainder of this section:

1 A number of synonymous terminologies are interchangeably used to describe industrial design or product design consultancies such as design agencies, design offices, design companies, design bureaus, and design firms. To be consistent the paper uses the term “industrial design consultancy” (abbreviated IDC) throughout.
1. The designer as the maker of ecodesigned concepts

The designer as the maker of ecodesigned concepts

The activity of design is targeted at intentionally shaping the properties of a product (Luchs & Swan, 2011). Industrial designers therefore have a key role to play for ecodesign in being the maker of ecodesigned concepts (Lofthouse, 2004; Åkermark, 2003). Technological product properties such as the material the product is made of (Brezet & Van Hemel, 1997) as well as cultural product attributes such as the emotional attachment of the consumer (Chapman, 2005) determine the environmental impact of a product. Bhamra & Lofthouse (2001, p. 1) find industrial designers are drawing ‘from a wide range of fields such as mechanical design, marketing, psychology and artistry’. This broad background allows them to deliberately influence technologically related issues as well as cultural aspects to design solutions with a low environmental impact. This multidisciplinary understanding also allows industrial designers to integrate and synthesize the perspectives and requirements of different stakeholders within the product concepts. This quality of design is particularly important for practicing ecodesign as it requires considering the perspectives of stakeholders along the entire life cycle of the product (Steelcase, 2007). In being the maker, industrial designers play the important role of facilitating the existence of ecodesigned solutions (Thorpe, 2010). Without this activity, the possibility of giving preference to an ecodesigned concept over a conventional one is simply not given.

Experiments and pilot projects with industrial design students and professional industrial designers have verified their capability to utilise the entire breadth of their background to generate solutions with a low environmental impact to fulfil a need (Bakker, 1995; Clune, 2009; Sherwin, 2000). One can conclude that if required to practice ecodesign, the skill set of designers would be well suited to do so. Besides highlighting the necessity that relevant environmental information is available to industrial designers the experiments did not explicitly take into account under which circumstances this potential can unfold.

The designer in the context of a paradigm shift towards sustainability

Several authors (Fry, 2008; Morelli, 2009; Walker, 2006) point out that our economic system and the industrial context designers are working in is inherently unsustainable. They see a new context for design activity emerging in the course of a sustainable development for society (Manzini & Meroni, 2007). In this new context, designers do not sell their services anymore to the commercially driven manufacturing industry. They rather help to co-create value for all the stakeholders involved in and affected by providing and using a solution (Morelli, 2009). This can include, for example, local government, local crafts persons, NGOs and the users of the solution. The focus of design furthermore shifts away from increasing the comfort for the user to generating enabling solutions (Morelli, 2009), facilitating learning and social exchange (Morelli, 2009) and context based well being (Manzini, 2003). Fry (2008) and Wahl and Baxter (2008) explicitly allocate an active role to designers in contributing to this new context by shaping and being shaped by more sustainable and collaborative concepts.

How can industrial designers take an active role to integrate ecodesign in their current work environment?

The work of Walker (2006) shows that changing the overall context for design can unlock the potential of design activity to generate solutions that are in line with a sustainable development. Sherwin’s (2004) observations support the claim that the current context for
most professional designers is not beneficial for them practicing ecodesign. He finds that even in companies which are regarded as progressive in terms of the environmental performance of their products, ecodesign is practiced to some extent by engineers but rarely by industrial designers (Sherwin, 2004). While a number of designers may break with the traditional role of design being primarily a service supplier for the economically motivated manufacturing industry it is safe to assume that most designers will still be active in this context for some time. Not seizing the potential that industrial design holds for ecodesign in this context represents a missed opportunity (Sherwin, 2004). It therefore is useful to clarify how industrial designers can take an active role in their current work environment to allow for the integration of ecodesign. The next section draws on the diffusion of innovations theory to provide a framework to discuss the integration of ecodesign into the collaboration of an IDC and a commercial client.

**Diffusion of innovations as an overarching framework**

Ecodesign is a well established concept in academia, but in commercially driven product development processes its integration is limited (De Leeuw, 2006; Tukker, et al., 2001). If ecodesign is practiced within this context it usually focuses exclusively on the mechanical engineering phase (De Leeuw, 2006). Recent research by the authors into how Australian, German, Chinese and Californian IDCs communicate ecodesign found that the majority of IDCs for all countries do not advertise their services in this area (Behrisch, Ramirez, & Giurco, 2011b). Those who promote ecodesign services mainly show an exclusively technologically focussed approach (Behrisch, Ramirez, & Giurco, 2011b). This suggests that in a commercial context practicing ecodesign is not yet widely and comprehensively adopted by IDCs. Integrating it within this context can be seen as novel and classifies as an innovation.

This section draws on Roger’s (2003) framework of diffusion of innovations (DoI) to outline the broader context for integrating ecodesign into the product development process. DoI provides a generic model that describes ‘how an innovation gets communicated in a social system through certain channels over time’ (Rogers, 1995, p. 5). DoI is a well established framework which Rogers first published in 1962 (Rogers, 1962) and has been refined in 5 editions. A successful diffusion process leads to the adoption of the innovation and an unsuccessful one to its rejection (Rogers, 2003) - The DoI model describes a four phase diffusion process:

1. knowledge (about the innovation)
2. persuasion (to adopt the innovation)
3. decision (to either adopt or reject the innovation)
4. confirmation (of the new approach)

Various channels are used during the diffusion process to communicate two types of information about the innovation in the diffusion system: information about how the innovation works, termed software knowledge² and the innovation evaluation information (Rogers, 2003). Software knowledge is important during the knowledge stage and in the case of an actual adoption of the innovation. The innovation evaluation knowledge informs about (probable) consequences of adopting or rejecting the innovation (Rogers, 2003). The availability of this information and its appropriate communication are important during the persuasion phase and the decision phase. The following sections review the availability of ecodesign software knowledge and specify the diffusion system. Thereafter

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² The term “software knowledge” is adopted from the diffusion of innovations literature and used throughout this document to refer to knowledge about how use or apply a particular innovation. It should not be confused with knowledge about how to use computer programs or languages.
the role of the IDC for the availability of the innovation evaluation information and the software knowledge is discussed.

**The availability of ecodesign software knowledge**

Many ecodesign publications are mainly concerned with communicating software knowledge. This support has largely been developed by academia sometimes in collaboration with industry. It covers three areas:

1. Making environmental information available during the design process to select and direct ecodesign activities that are promising to facilitate a low environmental impact (see for example: Crul, Diehl, & Ryan, 2009; SolidWorks, 2010)
2. Providing inspiration for ecodesign activities by either suggesting possible design activities or by providing inspiring examples (see for example: Lofthouse & Bhamra, 2005; Benyus, 2008)
3. Support to manage and monitor the integration of ecodesign in the product development process (see for example: Jones, Harrison, & McLaren, 2001; Vogtlaender, Hendriks, & Brezet, 2001)

This software knowledge about ecodesign is made available to IDCs in the form of manuals (see for example: Crul, Diehl, & Ryan, 2009; Tischner, Schmincke, Rubik, & Proslcr, 2000; Wimmer, Züst, & Lee, 2004), tools (see for example: Lofthouse & Bhamra 2005; SolidWorks, 2010) and checklists (see for example: Datschefski, 2001; Luttropp & Lagerstedt, 2006).

Industrial designers can acquire ecodesign software knowledge in various ways. In the United Kingdom Mawle et al. (2010) found that the most common ways designers source information are via online resources as well as discussions with fellow designers and experts they trust. Other possibilities for building up ecodesign software knowledge are continuing professional education programs or diplomas as well as reading the available literature in a self teaching approach. To some extent ecologically sustainable design is also increasingly integrated in the undergraduate education of industrial designers (Ramirez, 2007).

Knight and Jenkins (2009) observe that generic ecodesign support can be problematic and that tools and guidelines often need to be tailored to the specific context of each individual product development process. Such observations of real world processes show that there still is room for improving software knowledge for ecodesign. While there are still areas for development Hassi et al. (2009) state that it is already quite clear what needs to be done to generate more environmentally friendly solutions. This matches the findings of Boks (2006) who states that there are already enough tools and suggests focusing more on understanding the dissemination and communication of ecodesign knowledge within the context of an ecodesign process. The next section outlines the diffusion system in order to propose a framework for this activity.

**The diffusion system**

Rogers (2003) describes two types of diffusion systems: the centralised and the decentralised diffusion system. In the centralised diffusion system, an institution has developed an innovation. On behalf of the central institution, change agents who are knowledgeable but not necessarily proficient in applying the innovation promote it to potential adopters. In a decentralised diffusion system, local innovators are the key drivers for developing the software knowledge and act at the same time as change agents, diffusing the innovation to potential adopters they can influence. Three central roles are present in both types of diffusion systems:
1. a central institution or a local innovator who supplies the software knowledge
2. a change agent, promoting the innovation
3. a potential adopter

Academia plays the leading role in developing most of the software knowledge for ecodesign and takes the role of the central institution. When integrating ecodesign in the product development process the IDC and the client company are both in the role of the potential adopter. Academia is usually not involved in the collaboration between the IDC and its client. It is not clear who takes the role of the change agent, promoting the innovation within the collaboration between the IDC and its client.

Three scenarios are plausible. The first scenario would be an external change agent. An example would be a government introducing and enforcing a legislation that demands ecodesign software knowledge. Until today, efforts in this direction such as the European WEEE directive have had very limited success in stimulating ecodesign in commercial product development (Mayers, 2007). The second scenario is that the client takes the role of the change agent. In both of these cases, the role of the IDC would be passive. It would simply be acquiring and applying the available software knowledge. The third scenario is that the IDC itself takes the initiative and promotes ecodesign. This scenario where the IDC becomes the change agent allocates the most leverage to design and therefore is of most interest from the perspective of the IDC.

This scenario can be described as a staggered diffusion process. The IDC does not act on behalf of a central institution that actively supports applying the software knowledge in case of an adoption. Therefore the IDC has to be able to acquire the necessary software knowledge itself first before being in a position to diffuse the innovation in the collaboration process with its client. In other words two successive adoptions are necessary: first the IDC has to adopt the software knowledge, made available by academia. This allows them to become local innovators. As a second step, the IDC diffuses the innovation to its client. In the context of this staggered diffusion system the next section discusses the innovation evaluation knowledge paying special attention to the role of the IDC for its availability.

The innovation evaluation knowledge for ecodesign

In the first step of the described adoption system the IDC internalises the software knowledge for practicing ecodesign. Research into the attitude of industrial designers towards ecodesign has revealed a high degree of curiosity on the side of industrial designers to try out and experiment with ecodesign, just driven by the novelty of the topic (Sherwin, 2000). This venturesomeness greatly reduces the barrier for them to internalise the necessary software knowledge for becoming local innovators (Rogers, 2003). While being highly innovative, IDCs are commercially driven businesses whose interest is earning an appropriate monetary reward for the services they conduct for their clients. Integrating ecodesign into the product development process increases its complexity (Åkermark, 2003). The usual client who is primarily commercially driven is only likely to invest in the services of the IDC (including applying ecodesign) if the client is convinced that they will result in a benefit from a business perspective. Such benefits can either be due to increased savings or increased revenue as a result from the product development process.

For successfully taking the role of a change agent, the IDC needs to be able to identify and communicate the potential of business opportunities for ecodesign concepts. There are two different perspectives on how business opportunities can be identified (Shane, 2003). The first one suggests detailed research into the status quo to uncover present opportunities. The second perspective proposes that it is possible to actively
influence the emergence of opportunities by creatively generating and offering new solutions. The next section discusses these two perspectives in more detail and their implications for the role of the IDC.

**Identifying opportunities through research in the status quo limits the possible scope of ecodesign**

Present opportunities that have not yet been realized by others or not yet fully exploited can be uncovered by researching the status quo of influential factors such as the available technology or the preferences that consumers express (Shane, 2003). Research following this line of thought suggests that consumers only have very limited motivation to increase their spending on currently available solutions with a low environmental impact (Boks & McAloone, 2009). Accordingly there are very limited opportunities for the client company to generate more revenue by increasing its sales through ecodesigned solutions.

It has been observed that some ecodesign activities, mostly ones that increase the efficiency of resource use of existing product concepts, bring along cost savings as well (Knight & Jenkins, 2009). This makes these types of ecodesign activities attractive from a business perspective. Ryan (2003) notes that a lot of easy to facilitate efficiency improvements with an inbuilt saving potential have already been realised. While this can still represent a promising area of development for less progressive companies it is important to note that this approach has an intrinsic limit to the scope of ecodesign activities. This limit is reached as soon as the investment necessary to practice ecodesign exceeds the potential savings. Furthermore it needs to be highlighted that choosing economic efficiency improvements as the guiding principle for ecodesign activities brings along a major problem. It restricts the ecodesign activities to those that have an obvious inherent potential for financial savings and does not necessarily prioritise those that would be most promising for designing solutions with the lowest possible environmental impact.

**The strategic use of design activities can uncover a not yet articulated demand for ecodesigned solutions**

The other perspective proposes that identifying business opportunities involves a strong creative element of actively generating and offering solutions that have not been there previously; this approach is particularly relevant in cases when important factors for business opportunities are changing (Shane, 2003). Several factors that play a role for ecodesign are experiencing change. Examples are an increasing scarcity of resources (Köhler, Bakker, & Peck, 2010) and a stronger environmental consciousness amongst consumers (Boks & McAloone, 2009).

Being particularly concerned with integrating the consumer perspective in the product development process, the increased environmental consciousness amongst consumers is the most interesting factor from the perspective of the IDC. As outlined in the previous section, this increased awareness did not yet result in a changed buying behaviour (Boks & McAloone, 2009). However this only is a reaction towards currently available ecodesigned solutions known to the consumers. As such a viewpoint does not necessarily account for the success of new concepts or new elements of concepts it is often referred to as rear view mirror perspective (De Mozota, 2003).

Design is found to be ‘a problem solving process (for example, making life easier) as well as a problem-seeking process (for example, to discover hidden needs)’ (Best, 2009, p. 40). Several authors propose that design has the ability to uncover not yet fully articulated consumer needs and can generate the necessary information to go beyond the rear view
mirror perspective (Best, 2009; Brown & Katz, 2009; De Mozota, 2003). The strategic use of this quality of design can be described as a process that consists of a divergent phase, a feedback loop and a convergent phase (Brown & Katz, 2009).

During the divergent phase designers creatively develop a number of ideal solutions from the consumer perspective; this is a very intuitive process that requires a high degree of sensitivity on the side of the designer for social trends (Utterback, et al., 2007). While this process is also informed by research into the current context, the most important part is the designer’s interpretation of these social trends. It is crucial that designers do not prioritize their own values as they would in that case only design for themselves (Utterback, et al., 2007). With this insight, designers visualise and prototype suggestions which they thereafter test (Brown & Katz, 2009). These tests can involve experiments with consumers, focus group discussions, self observation or other approaches. Via a feedback loop the learning from this process reinforces and potentially alters the initial project requirements (Dubberly, 2004). This is an iterative process, possibly involving several feedback loops. In the divergent phase industrial designers focus more on generating ideal solutions from a consumer perspective than on strictly complying with all project requirements. This approach often causes industrial designers to come up with suggestions that are outside the initial project boundaries (Utterback, et al., 2007).

This divergent phase is followed by the convergent phase (Brown & Katz, 2009) whereby the initial requirements as well as the insights gained previously serve as the selection criteria for narrowing down the solutions to the concepts which are then taken further in the product development process (Dubberly, 2004).

This process allows uncovering potential consumer demands that are not yet fully articulated in tandem with creating solutions for these demands. In the context of an increasing environmental awareness amongst consumers which has not yet matured to an explicit demand, this activity is highly relevant for identifying potential business opportunities for ecodesign. As the ecological properties of the designed solution can become a crucial aspect for selling the product, this approach has the potential to indentify business opportunities where it makes sense to invest in ecodesign activities that are not directly linked to economic savings.

The role of the industrial design consultancy for providing the innovation evaluation knowledge

This paper proposes that an IDC can take an active role as a change agent in the diffusion process of ecodesign by convincing its client of the existence of probable business opportunities. The previous sections have outlined two perspectives on how to identify business opportunities.

The first is via research into the current context for ecodesigned solutions. For conducting this activity, the IDC has to be in a position to deliver credible research results to their clients. While IDCs conduct research for their projects (Utterback, et al., 2007) it has not been clarified yet to what extent they can focus this activity on identifying opportunities for ecodesign. Important aspects are not only the necessary knowledge to understand ecological issues in the context of the product’s life cycle but also how the IDC gains credibility in the dialogue with the client. As outlined above, relying primarily on research into the current context is likely to limit the scope of ecodesign activities to eco-efficiency improvements that also have an inherent cost saving potential.

The second perspective on identifying business opportunities suggests that the strategic use of design can uncover a latent demand for ecodesigned solutions. To facilitate the strategic use of design in the collaboration of an IDC and a commercial client, several
requirements have to be fulfilled. As described in the previous section, the strategic use of design activity is an exploratory and creative process. Without having executed the process, it is not possible to have certainty about its outcomes (Dubberly, 2004). This uncertainty requires a high degree of trust on the part of the client in the capability of the IDC. Optimism, motivation, openness to new solutions, time and the availability of resources are crucial to overcome drawbacks (Brown & Katz, 2009). During this exploratory process, the IDC and the client have to continuously share their learning.

While design has reportedly been used in a strategic way by IDCs in the collaboration with a commercial client (Brown & Katz, 2009; Feldman & Boult, 2005), its application for ecodesign in that context has not been explored in detail yet.

### Conclusion

This paper has reviewed the academic literature for aspects of the role of the industrial designer in conducting ecodesign activities. This has highlighted the importance of understanding how industrial designers can take an active role in integrating ecodesign software knowledge throughout their collaborations with their clients from the economically motivated manufacturing industry. To discuss this role in the context of an IDC collaborating with a commercial client, the diffusion of innovations theory (DoI) has been used as an overarching framework.

This paper proposes that the IDC has to fill two roles. It firstly has to become a local innovator for ecodesign and internalise the software knowledge for ecodesign provided by academia. It is unclear if IDCs are yet knowledgeable enough in ecodesign to successfully fill this role. Therefore evaluating the level of software knowledge for ecodesign currently present in IDCs is an important area of further research. A better understanding of the most effective channels and modes for disseminating the software knowledge to the IDCs also needs to be gained. Country specific factors often impact on the availability of ecodesign software knowledge. For example the availability of continuing professional education programs with focus on ecodesign varies between countries. Furthermore Utterback et al. (2007) found that the discourse within the design community affect the practice of IDCs. Consequently the attitude towards ecodesign of influential discourse participants like local and global industry associations as well as opinion-leading IDCs and individual designers also impact on the diffusion of software knowledge amongst IDCs.

The second role the IDC has to fill is as a change agent by identifying and communicating business opportunities arising from ecodesign activities. This paper suggests that the IDC can acquire this information by either relying on research in the current context for ecodesigned solutions or by strategically using design activity to uncover a potential not yet articulated demand for such solutions. It remains unclear which channels IDCs use to disseminate the innovation evaluation knowledge and how their clients react to it. It furthermore has not yet been investigated how IDCs gain credibility and trust from their clients. This is necessary to conduct the activities to generate the innovation evaluation knowledge and use this information for setting directions during their collaboration. In particular not all collaborations between IDCs and their clients offer the possibility to use design activity as a strategic resource for ecodesign. It is an exploratory process and brings along drawbacks and the necessity to investigate potential dead ends. This makes it crucial to have sufficient resources available and to approach the process with motivation and optimism (Brown & Katz, 2009). Such factors are partly determined by the prerequisites of the client and the consultancy, e.g., the type of industry of the client, the available budget or the experience of the IDC to use design activity strategically. To develop a clearer understanding about the importance of individual factors influencing the capability of IDCs to act as change agents for ecodesign, further research into real world
collaborations between IDCs and their clients is necessary. Similarly to the process of IDCs acquiring software knowledge their interaction with their clients is strongly influenced by the cultural context they operate in. This makes it necessary to take aspects like general design awareness, business communication practices and the sensitivity amongst society towards environmental issues into account.

Further research

This paper is part of a PhD research project exploring the role of Australian IDCs for ecodesign. The goal of this PhD is to test and refine the theoretical proposition outlined in this paper within the Australian context. Accordingly the key research questions are:

- How proficient are Australian IDCs in ecodesign software knowledge and under which circumstances do they apply it?
- Do Australian IDCs act as change agents for ecodesign?
- If so which factors determine their capability to generate innovation evaluation knowledge for ecodesign?
- How is ecodesign software knowledge and innovation evaluation information communicated and disseminated within the collaboration between the IDCs and their commercial clients?

The data for this research project will be collected in a staggered approach. A website content analysis of which results already have been published (Behrisch, Ramirez & Giurco 2010a; 2010b; 2011a; 2011b) provides a broad overview of the share of IDCs communicating ecodesign services well as the prominence with which individual ecodesign services are advertised. The investigation of the websites also has been used to generate a list of ecodesigned products which are seen as promising case studies. In particular the KeepCup (KeepCup, 2012) and the 321 Water (HalfaTeaspoon, 2010) are likely to be the results of product development processes where design activity was used in a strategic way for ecodesign. To investigate the individual product development processes in more detail data will be collected from interviews with IDCs and their client companies as well as from case description material such as online articles.

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What do you mean, user study?
Translating Lorm, Norm and User Research

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Abstract
In this paper, we discuss the value of including “out-of-norm”-users in the design-(research-) process for Human-Computer-Interaction (HCI). On the one hand we criticize the position that proposes majority-oriented design conclusions to be the guiding principle in usability-focused design approaches. On the other hand we are concerned with the active engagement process of disabled people and their carers as conscious actors for novel forms of HCI.

Keywords: normality, diversity, user, deaf, deaf-blind, interaction, disability
In the terms of design in relation to social change, Manzini (2010) states that change must come from what is configured as ‘normal’. One of the most interesting challenges of academic discourse as well as design practice is about re-configuring ‘normality’. As Tom Fisher (2010) points out: “Design is able to engage with that reconfiguration”. This relation becomes clearer, for instance, by taking a closer look at current uses of the term “usability”, the definition of which has expanded to include “all interactions that take place between human beings and the designed world they live in” (Bremner 2008, 425). Bremner describes how everything from industrial products to screen interfaces to services and experiences can be discussed in terms of usability nowadays: “Regardless of the different forms these interactions might take, it is clear that designers have been increasingly required in almost every professional design practice to continually consider (and reconsider) user perspectives, needs, desires, expectations, behaviors, and aptitudes throughout the entire design process”. However, a too-strict focus on usability may place the designer in a dilemma that is strongly linked to constructs of “problems” and “normality”, especially if we keep in mind the broad diversity of potential use-cases, -contexts and users.

The aim of our research is to produce new knowledge on the interdependence of three elements: the cultural construction of normality, the social inclusion/exclusion of human beings, and the design of (in this case technology-related) prototypes/products.

**Background**

Perhaps the most striking feature of human beings is their diversity (Heidkamp, 2010, 8). Much of the diversity in the human species results from the cultures each human group has created and passed on from one generation to the next (Spradely 1980). If researchers are to understand this diversity, they must begin by carefully describing it. Spradley defines three fundamental aspects of human experience as the core issues of studying a culture: cultural behavior, cultural knowledge and cultural artifacts (Appel 1973). Our project aims to gain an understanding of all levels, but the primary focus is on behaviour and artifacts. Furthermore, it has to be seen in the context of the participatory shift in design research.

Design and design research involves people now more than ever – in most cases the potential “end users” (Ehn 1987, 2001, 2009; Sanders 2002, 2002). Such research includes a variety of approaches, ranging from user research, cultural enquiries, usability studies to participatory design or Living Labs. Joost describes the great potential of including people from diverse (e.g. cultural, demographic, social, ability- or gender-related) backgrounds in the process of technological innovation processes: to reflect our society’s variety can help us to develop new and alternative concepts that go far beyond the stereotypical image of the standard user (Joost 2011).

A major focus in our project lies on the aspect of “sociability”: In this context, sociability refers to a desire of a person or group to interact or affiliate with others through the establishment of social relationships (Wekesa, 2010, 116). In the light of a global and digital change, the requirements for sociability as well as its forms of appearance have obviously been changing. The ability (or task) of design to enforce sociability is inter alia discussed by Lengyel (2009), who describes design not as a technical or artistic event, but first of all as a sociocultural phenomenon.
Situation

According to Zirden, today systemic “normality” basically guarantees the functioning of western societies (Zirden 2003, 29). This system is oriented towards proportion, relation of quantity, average peaks and percentage. The coordinates of normality, here to be regarded as criteria for evaluation of human beings, are reflected in school grades, the evaluation of work or health, and many more. Today’s normalizing society indeed appears to be more flexible in setting its limits of tolerance. However, various scientific, technical and economic resources are being expended in order to earlier locate and eliminate potential anomalies (ibid.).

Matthews et al. (2008, 58) regard “interaction design” as a “document of the recognition of the importance of understanding the development and consumption of technology as being irredeemably situated in human, social and organizational contexts. Yet it also is an acknowledgement of the central role of the designer in shaping human interaction with technology”.

The ongoing changes in Information and Communication Technology (ICT) have made “social interaction an increasingly important topic for interaction design and technology development” (Kurvinen et al, 2008, 46). Investigations and outcomes are here often focused on majorities of (potential) users and usage, whereupon pertinent questions concerning a constructing moment of normality are often neglected.

Chow and Joost underline here the importance of taking into account such sociological and ethical questions, so as “not to address [a] user group as ‘old’ – meaning unable to use ‘normal’ technology” (Joost/Chow 2010, 166).

Assuming that man-made constructions and technologies have influence upon the individual, it becomes comprehensible that technologies “enforce normalcy” (Davis 2002), meaning that they have an effect of “reproducing an ableist framework, rather than building in, creating and contributing to new modes of living which embrace difference and diversity” (Goggin 2008, 11).

Issue

In the context of so-called “disability”, the controversial issue of the social meaning of “normality” becomes quite obvious. There are certain connotations that go with the topic “disability”, and these are usually rather negative. The degree of negativity can range from (or be based on) lack of knowledge, ignorance, uneasiness, compassionateness, all of which occasionally flow into positive or negative ableism*. (* Footnote: Disablism is a form of social prejudice against people with disabilities, also known as disablism or disability discrimination. For further reading: Campbell 2008, Clear 1999)

This does not necessarily refer to an intentionally oppressive and discriminatory process arising from the belief that people with disabilities are inferior to others, but it can include a certain kind of unintentional ableism. For instance: a key concept in disability rights is that treating everyone as if they are non-disabled is effectively discriminatory in itself – treating everyone as if they can access written material, premises with steps, and so on, excludes disabled people.

Against the background of a worldwide demographic change of increased life expectancy, we are facing an burgeoning number of individuals who are disabled or in need of care (Tervooren, 2002, 1). Thus the phenomenon “disability” is going to become a “universal experience of our society” (Hermes, 2007). Societal definitions of disability will have to be reformulated, in order to avoid exclusion of growing parts of society. This
will require analyzing societal norms, traditions and values that lead to certain perspectives on disability. Moreover, it is quite possible that certain classification criteria, nowadays related to “illness” or “anomaly”, will be different in future.

In our previous and ongoing research on diversity-centered design we have already shown and discussed the complex correlation of design and disabilities (Bieling 2010a). A special focus lies on the disclosure and discussion of normative implications of design in the context of socio-material assemblies (Galloway 2005; Latour 2009; Schillmeier 2009).

Our main proposition for approaching this complex topic has been a general change of perspectives: what, if we understood disability not necessarily as a deficit, but as an expertise? (Bieling 2010b). This is an approach that, in a modified way, has also been proposed by Heylighen/Devlieger/Strickfaden (2009).

In our work we have shown that interesting aspects from disability contexts can be transferred to HCI e.g. aspects from deaf sign language can be implemented in gesture based interfaces. Additionally, car navigation systems could be optimized by acknowledging learnings from how blind people navigate. Based on such insights we have developed a series of prototypes for new interaction systems (Bieling 2009).

In the following section we will discuss two different cases. Each including a specific prototype for interactive ICT, each based on certain “disability contexts” as starting points, and each developed in a participatory process with disability-related experts of everyday lives.

In a further step we will then discuss insights and results from this participatory design research project with a team consisting of researchers and doctoral students from the Berlin University of the Arts (Design Research Lab) in collaboration with members of two deaf-blind Institutions: the Oberlinhaus (Babelsberg) and the ABSV (Allgemeiner Blinden- und Sehbehindertenverein Berlin).

**Method/Approach**

DeCouvreur describes the importance of building upon knowledge and skill acquisition from all stakeholders simultaneously and on the spot. In terms of assistive devices this process is already implemented on a daily basis by caregivers, occupational therapists and even disabled people around the world (DeCouvreur 2010). An equal relationship between users and design researchers is constitutive for the participatory approach (Ehn/Bradham 2002).

In order to emphasize deaf and deaf-blind perspectives, we set out two participatory processes (case 1 and 2). In case 1 we worked with a group of six deaf participants (2 female and 4 male, age 16 – 26) and two interpreters. In case 2 we worked with a sample of six deaf-blind participants (4 female and 2 male, age 60 – 74), three blind participants (who were capable of the tactile hand-alphabet Lorm, which will be described later) and two of their carers, who also served as our main interpreters. The integration of real users was important for our research approach, since from an emancipatory perspective, the participants can be regarded as experts of their daily life.

In our previous research on diversity-centered design we have discussed the complexity of participatory design in disability contexts, as well as its attempt to build on the use of local implicit knowledge (Bieling 2010, 2011; Bieling/Joost/Mueller 2010). In contrast to these projects (which mainly focused on deafness and blindness), the projects described
in this paper were different in terms of the active involvement of our participants. While in our previous projects, the “making”-perspective (Sanders 2002) played a central role, this time we focused more on the “saying” (in terms of evaluating) and “doing” (in terms of implementing) –perspective. Both perspectives where intensively linked to our observations, meaning that we immediately discussed our insights with the participants in order to achieve a proximate understanding of the situations.

**Case 1 (“Call my attention”)**
The first case evolved from an iterative research and development process in collaboration with members of the Berlin based Deaf-Community Sinneswandel/DeafBerlin.

Marginalized communities like the deaf are excluded from several forms of communication. Together with a group of deaf people, we conducted a series of workshops, whose aim it was to explore how disability effects everyday life actions and how we (e.g. designers or “non-disabled” people) can learn from it. It was impressive to see how (improvised) solutions can help or try to compensate disability, but also how many more possibilities in communication are drawn from a disability. Thus we gained insights on how disability can enlarge our spectrum of how and for what purpose we can use communication.

As one of the outcomes of this workshop series, we developed the mobile application “Call My Attention” (CMA) (Bieling/Westermann/Joost 2011). The app is based on a phenomenon concerning immediate line-of-sight signaling, that can be found in both deaf and non-deaf contexts: amongst deaf people, for instance, communication can take place easily, even over distance or in very loud environments, but only as long as people stay in eye-contact. Also for non-deaf people immediate line-of-signaling can be difficult, such as in loud or crowded environments.

The app responds to the problem, especially when quick action is needed. It proposes a mobile device function to be used like a remote control and enables the user to achieve immediate attention of nearby friends, by simply pointing at the person and pressing a button. Immediately the callee’s phone vibrates and displays the caller’s position. As simple as depicted in Fig. 1, attracting someone’s attention using the “Call My Attention”-app involves few steps:
What do you mean, user study?

Translating Lorm, Norm and User Research in this paper were different in terms of the active involvement of our participants. While in our previous projects, the “making”-perspective (Sanders 2002) played a central role, this time we focused more on the “saying” (in terms of evaluating) and “doing” (in terms of implementing) –perspective. Both perspectives were intensively linked to our observations, meaning that we immediately discussed our insights with the participants in order to achieve a proximate understanding of the situations.

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The person (caller), who wants to gain attention of a particular person (callee), targets this person with his mobile phone and presses a “buzz”-button (Step 1). The CMA-app, which requests the current location periodically, sends a call-request to the CMA-server. This request contains the caller’s ID, location and the direction in which the device is pointing (using the device’s compass) (Step 2). The CMA-server gets location updates from every device, which runs CMA in the background, periodically. Upon receiving a call-request, the database of active users is queried for people located in buzz-distance and corresponding angle of the caller (Step 3). The server uses C2DM (Cloud to Device Messaging) to send a message to the determined callee, containing the name and location of the caller. Additionally, the caller gets a feedback for his buzz-request (both in positive and negative case) (Step 4). Finally the callee receives the name and location of the caller. The CMA-app starts vibrating and upon bringing the app to the foreground, it shows the caller’s name and a compass needle pointing towards her/him (Step 5).
Fig 2: Screenshots of the CMA application. The picture on the left shows the standard screen, offering the immediate possibility to buzz a nearby person. To the right, the callee screen informs about a request, showing name, distance and orientation from the current viewing direction. Additionally, the location can be shown using Google Maps.

The simple fact that there is no need for complicated phone calls or SMS, makes this app especially helpful for deaf or hard-of-hearing users (supporting their communication and therefore enhancing their independence and flexibility), but also generally helpful for non-deaf people, e.g. in loud and crowded environments.

Case 2 (“Mobile Lorm Glove”)

The second case evolved from an iterative research and development process in collaboration with members of two institutions: The Oberlinhaus (Babelsberg) and the AHSV (Allgemeiner Blinden- und Sehbehindertenverein Berlin).

Marginalized communities like deaf-blind people are excluded from several forms of communication and access to information. Deaf-blindness is a dual sensory-impairment with a combined loss of hearing and sight. The sensory condition of deaf-blind people varies depending on the reasons of their disability. It can be either congenital or caused by accidents or illness. It is difficult for deaf-blind people to connect with the outside world because of the lack of a common language.

Particularly people with deaf-blindness acquired late in life have the opportunity to use “Lorm” for communication with the outside world. Lorm, developed in the 19th century by deaf-blind inventor Hieronymus Lorm, is a tactile hand-touch alphabet, in which every character is assigned to a certain area of the hand. The “speaker” touches the palm of the “reader’s” hand to sequentially draw the characters onto it by tracing lines and shapes. This requires both conversation partners to be familiar with Lorm, and physical contact is necessary. Those preconditions often lead the deaf-blind into social isolation and render them dependent on people relaying information around them.

In our project we developed the Mobile Lorm Glove (Gollner/Bieling/Joost 2012): a mobile communication and translation device for the deaf-blind. The prototype, a hand glove made of stretchy fabric equipped with an input unit on the palm of the glove and an output unit on the back of the glove, translates “Lorm” into text and vice versa.
In the very beginning of the project we started with observations regarding communication and user behaviour followed by a participatory process concerning interaction design and usability of the prototype as well as materials used for it. As a result a functional prototype for user-tests was developed.

Textile pressure sensors located on the palm of the glove enable the deaf-blind user to “lorm” onto his or her own hand to compose text messages. A Bluetooth® connection transmits the data from the glove to the user’s handheld device. It is then forwarded to the receiver’s handheld device in the form of an SMS. If the wearer of the Mobile Lorm Glove receives a text message, the message will be forwarded via Bluetooth® from his or her handheld device to the glove. Initiated by small vibration motors located on the back of the glove, tactile feedback patterns allow the wearer to perceive incoming messages.
Lorm to text
The deaf-blind user wears the Mobile Lorm Glove on the left hand and uses the tips of
the fingers of the right hand to lorm onto his or her own left hand to compose text
messages. The left hand is open with its fingers slightly spread. Each entered character
is forwarded to the handheld of the user via a Bluetooth connection.

When a sensor is touched, a vibrotactile feedback is generated by the corresponding
vibrating motor on the back of the glove to confirm the input. To provide appropriate user
comfort we avoided placing motors on the knuckles.

Text to Lorm
Once the wearer of the Mobile Lorm Glove receives a text message, it is forwarded to the
glove from his or her handheld device via Bluetooth and translated into the Lorm
alphabet. Initiated by the small vibrating motors, tactile feedback patterns allow the
wearer to perceive the incoming messages.

To simulate the sensation of a continuous movement with discrete actuators, the human
sensory phenomenon called the “funneling illusion” is applied. The user’s tactile
sensitivity and the speed of lorming vary. Therefore the maximal applied intensity and the
speed of lorming can be adjusted individually to serve the user’s needs.

The Mobile Lorm Glove provides particularly two innovative ways of communication for
deaf-blind people. It supports mobile communication over distance, e.g. text message,
chat or e-mail, and it enables parallel one-to-many communication, which is especially
helpful in school and other learning contexts.

Communication over Distance
When communicating with a deaf-blind person, physical contact is no longer the only way
to do so. The wearer of the Mobile Lorm Glove can now compose text messages and
send them to a receiver’s handheld. The received message can either be directly read
from the handheld or translated into Lorm alphabet using the Mobile Lorm Glove. It can
also serve as an interface to compose e-mails or to chat with someone.

Simultaneous Translation
When communicating with a person without knowledge of Lorm, the wearer of the glove
composes text messages as described earlier. The written message appears on the
screen of his or her handheld and can be read by the other person or translated by any
text-to-speech software. This also works vice versa.
Until now, when socializing, every deaf-blind person needs a personal translator. The
newly developed device also enables parallel one-to-many communication, which can be
especially helpful in school and other learning contexts.

Information and Entertainment
Deaf-blind people depend on information relayed to them by people around them. Using
the Mobile Lorm Glove a broader range of information may be accessed. The interface
can be used as a translator, for example with websites, e-books or audiobooks.

With this newly developed technology and interaction, it will soon become possible to
also “feel” information that was not accessible to deaf-blind persons before. The Mobile
Lorm Glove functions as a simultaneous translator and makes communicating with others
without knowledge of “Lorm” possible. As a result, it empowers deaf-blind people to
engage with a wider social world and further enhances their independence.
Our next step will be a study which aim is to verify the functionality and effectiveness of (parts of) the system in different real-life situations, especially those of non-deaf-blind people.

Results and Discussion

What both cases have in common, is this: the resulted prototypes do not only serve specific needs of certain people (e.g. help deaf-blind people to communicate with others), but can also be helpful to a broader spectrum of people in certain situations.

The challenge of the designer is not only to meet functional, aesthetic, economic etc. requisites, but also to be aware of influencing common definitions of disability and therefore substantiating and clarifying an enhanced and reflected understanding as well as the societal process of modifying general perspectives on disability.

The analysis and reflections on our approach provide important messages towards designing for and with people who have specialized needs. We shall highlight it with Strickfaden’s proposition: “The main message is to recognize the abilities, expertise and inherent performances, practices and actions of people”. (Strickfaden/Devlieger, 223)

Conclusion

Chosen to underline the discussed issue of design’s ambivalent relationship to normality, cases have surely to be seen in a broader perspective. The important issue here is that the mentioned prototypes do not only address the needs of a certain group of (here: deaf or deaf-blind people) but also widen the field for potential use by a larger group of people in different contexts. In contrast to the generally defined concept of normality – which does not make sense in the context of technological innovation – we consistently disregarded the so-called rules of normality (and therefore “normal users”), thus serving both product innovation and societal norm definition.

In the long term, the process and the outcomes of our two cases demonstrate that changing the perspective and acknowledging disabled people’s expertise, might not least help to make our world more accessible, for all of us. Solely the influence of design as practice (congruent to architecture, urban planning, politics, media, film industries etc) on the complex phenomenon “disability” is binding for further investigation in terms of a cultural, artificially made and socially practiced exclusion. In an iterative and ongoing research process our collaboration with the mentioned institutions has already lead to inspiring new insights.

Our investigation highlights the importance of taking into account different perspectives – not least in a design process. Further work will be required to investigate wisely a methodological suitability. Although this research takes place in the domain of disability related topics, the overall scheme has implications for a general view on diversity-centered design.

Finally our work contributes to a growing body of research that brings designers and researchers from different disciplines closer to understanding (not only) their “user” groups, but also to transferring knowledge to a broader range of potential appliance. It shows the limitations of many ‘user centered projects’ by not focusing on standards and norms. This surely is a worthwhile topic and a valuable approach and has the potential to impact design research outcomes in profound ways.
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Intuitive Interaction and Older People

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Abstract

Older people often struggle with using contemporary products and interfaces. They show slower, less intuitive interaction with more errors. This paper reports on a large project designed to investigate why older people have these difficulties and what strategies could be used to mitigate them.

The project team found that older people are less familiar with products that they own than younger ones, while both older and middle aged people are less familiar with products that they do not own than younger ones. Age-related cognitive decline is also related to slower and less intuitive performance with contemporary products and interfaces. Therefore, the reasons behind the problems that older people demonstrate with contemporary technologies involve a mix of familiarity and capability.

Redundancy applied to an interface in the form of symbols and words is helpful for middle aged and younger old people but the oldest age group performed better with a words only interface. Also, older people showed faster and more intuitive use with a flat interface than a nested one, although there was no difference in errors. Further work is ongoing in order to establish ways in which these findings can be usefully applied in the design process.

Keywords: intuitive interaction, older people, observational analysis
Introduction

Intuitive interaction involves the use of knowledge gained from other products and/or experiences (Blackler, 2008; Blackler, Popovic, and Mahar, 2002, 2010b; Hurtienne, 2009; O’Brien, Rogers, and Fisk, 2008a). Therefore, products that people use intuitively are those with features, functions and/or processes that they have encountered before.

Several different researchers on three different continents using a variety of products, interfaces and experiment designs have all found that prior experience is the leading contributor to intuitive use (Blackler, 2008; Hurtienne, 2009; O’Brien, 2010), and intuitive interaction has become strongly linked with familiarity or prior experience (Blackler, 2008; Blackler, et al., 2010b; Hurtienne and Blessing, 2007; Hurtienne and Israel, 2007; Marsh and Setchi, 2008; Mohs et al., 2006; O’Brien, et al., 2008a; O’Brien, Rogers, and Fisk, 2008b).

Our first three experiments with people performing set tasks with camera and remote control interfaces showed that intuitive interaction is based on past experience with similar products and product features. Technology familiarity (TF) was used in all three experiments to gauge past experience with relevant interface features. It was measured through a questionnaire, in which participants provided details of their experience with products with similar features to those they would encounter during the experiment. More frequent and more extensive use of the products in the questionnaire produces a higher TF score (Blackler and Hurtienne, 2007; Blackler, et al., 2010b). Familiar features were used more intuitively, and people with higher TF completed tasks more quickly, with more intuitive uses and less errors (Blackler, 2008; Blackler, et al., 2010b).

However, these experiments also suggested that older people use complex products (cameras and universal remote controls) both more slowly and less intuitively, even when they report equivalent levels of prior experience (Blackler, 2008; Blackler, et al., 2010b). Drawing on our initial experiments, O’Brien (2010) conducted two studies into prior experience and its effect on technology use for older people. She showed that prior experience was the most common reason for successful technology use, but was not always sufficient on its own. O’Brien also found that High TF older adults using a video camera, digital radio alarm clock and e-reader did not perform as well as younger adults, and prior experience was important for technology use, but it did not explain all the differences between age groups. Other researchers have also found that older people use interfaces more slowly and with more errors (Langdon, Lewis, and Clarkson, 2007; Lewis, Langdon, and Clarkson, 2008).

As a result, we have spent the past four years investigating intuitive interaction for older people. This large Australian Research Council funded project, based at the People and System (PAS) lab at QUT, has investigated several themes related to intuitive interaction and ageing. These were: technology familiarity, cognitive decline, and design approaches. This paper offers a cohesive overview of the whole project. All data were analysed using Noldus Observer and SPSS, although full statistics are not reported here due to space constraints. Full results of each experiment can be found elsewhere (Blackler, Mahar, and Popovic, 2010a; Lawry, Popovic, and Blackler, 2011; Lawry, Popovic, and Blackler, 2009; Lawry, Popovic, and Blackler, 2010; Reddy, Blackler, Mahar, and Popovic, 2010; Reddy, Blackler, Popovic, and Mahar, 2011; Reddy, Blackler, Popovic, and Mahar, 2009).
Microwaves Experiment

This experiment was designed to investigate the differences between three different age groups and two different microwave interfaces. This was a matched subjects 2x3 experiment design. Independent variables were age group and microwave interface. There were 36 participants, 18 in each microwave group and 12 in each age group. Age groups were Younger (20-39), Middle (40-56) and Older (57+). Participants were matched for TF, education and gender. Dependant variables were time on task, percentage of correct uses, and percentage of intuitive correct uses. Participants were video-recorded performing three set tasks on touchscreen microwave prototypes in the laboratory while delivering concurrent protocol (Figure 1). They also completed a TF questionnaire and follow up interview.

The central executive is the component of working memory that controls cognitive tasks like attention, reasoning, problem solving and language (Baddeley, 2000; Morrison, 2005a). There is a growing body of research evidence pointing to age-related deficits in central executive functioning (Fisk and Sharp, 2004). Based on Baddeley’s model of working memory (Baddeley, 2000), we devised a battery of computer-based tests to measure a range of Working Memory functions. They were all administered on the touchscreen. The software recorded reaction time and accuracy (Blackler, et al., 2010a; Blackler et al., 2011).

Analysis

The audiovisual data were coded using Noldus Observer software. Correctness and intuitiveness of feature uses were determined by a process we have used successfully over the past several years (Blackler, 2008; Blackler, Popovic, and Mahar, 2004). This involved coding each feature use, using a set of heuristics based on the literature. Intuitive uses show less evidence of conscious reasoning in the verbal protocol, are typically fast, have low latency, participants are fairly confident they are pressing the right button, and they may mention that they have seen or used the feature before (Blackler, et al., 2011).
Results

Results of a multiple regression analysis showed that time to complete tasks was most impacted by reaction time and accuracy on the phonological transform test (Figure 2). The next most significant variable for time on tasks was TF (Figure 3), followed by hits on the sustained attention test. The percentage of intuitive correct uses was impacted most by sustained attention accuracy, and also by TF. Percentage of correct uses was most related to phonological transform accuracy, followed by TF (Blackler, et al., 2010a).

Figure 2. Time to complete tasks and phonological transform RT

Figure 3. Time to complete tasks and TF
Discussion

As we had found previously (Blackler, 2008), this experiment showed that TF is a vital factor in fast, correct and intuitive use of an interface. The other variables that had the most impact all require use of the central executive (phonological transform and attention). These results could explain some of the differences between younger people and high TF older people that O’Brien could not, as differences between age groups appear to relate to cognitive decline as well as TF.

Familiarity Field Experiment 1

Because intuitive interaction is based on past experience, familiarity with relevant products or interfaces is essential. Familiarity Field Experiment 1 was designed to investigate participants’ familiarity with products that they owned. The Independent Variable was age, with 32 participants in four age groups (18-44, 45-59, 60-74, 75+), balanced for gender. The dependant variables were measures of familiarity identified through the coding process (Lawry, et al., 2010). Time to complete tasks was not relevant as all participants were completing different tasks with different products.

The experiment was conducted in the participant’s home with a product that s/he considered him/herself to be familiar with. A semi-structured interview was conducted, going into depth about the product the participant chose as familiar. The participant was then required to describe how s/he performed a common task with the product (we called this “task recall”). S/he then performed that task with the product, while delivering concurrent protocol (“observation”). A retrospective protocol was completed after the observation.

Analysis

The semi-structured interviews were transcribed and then scored. The more familiarity demonstrated by an answer, the higher the score. All audiovisual data were coded for accuracy and also with three levels of familiarity: (1) very familiar, (2) moderately familiar and (3) not familiar. Some of our earlier heuristics for coding intuitive interaction were integrated into this coding scheme. Familiarity was identified by relatively fast and flowing interactions, pre-emptive movements, low levels of verbalisation, and high levels of situational awareness (Lawry, et al., 2010).

The task recall was transcribed and compared to participants’ actual behaviour during the observation. Noldus Observer was used to code actual behaviour in relation to the way the participant described how s/he would do the task. By comparing the steps the participant described to perform the activity, with the steps that s/he actually undertook to execute the task, it was possible to identify the level of familiarity the participant had with the product. Each step observed during the execution of the selected task was coded. The ‘grouping’ code was used when participants described multiple steps together as a single step or sentence. Groupings were hypothesised to demonstrate higher levels of familiarity.

In addition to these relational codes, ‘procedures’ were coded within the observation. Procedures were coded when participants demonstrated high levels of familiarity with two or more steps in a process during the observation, suggesting that they are grouped cognitively. This differs from the grouping code as the grouping code applied to the description made beforehand, whereas the procedure code applied to steps performed during the execution of the task.
Results

Findings suggested that there was a significant difference in familiarity between the youngest age group (17-39) and the two oldest age groups (60-74 and 75+), in terms of interview score (Figure 4), percentage of time in procedure (Figure 5), steps coded as grouped, percentage of steps in procedure, and grouped steps in procedure (Lawry, et al., 2009; Lawry, et al., 2010).

Discussion

This experiment showed that older adults have a significantly different relationship to familiar contemporary products than younger adults. The findings suggest that this is primarily a result of a much higher level of knowledge of contemporary products among
younger adults. For example, in the Semi-structured Interview, the youngest age group provided more comprehensive answers to questions relating to comparisons between products, and answered questions about the potential for expansion of functionality. The youngest age group also used their familiar products for more activities that any other age group, thus suggesting a high knowledge of product functionality.

The observational data showed that younger adults were the most familiar with their selected product and that familiarity differed significantly between the youngest and the oldest age groups. Also the differences in familiarity among the three oldest age groups were negligible. These results suggest that a generational difference in familiarity with contemporary products may be occurring between the youngest and oldest age groups. Docampo Rama (2001a) and her colleagues (Docampo Rama, de Ridder, and Bouma, 2001) conducted research into technology generations. Docampo Rama et al. (2001) describe the effect of generation as a discontinuous effect, while the effect of age is continuous, or linear. The results of this experiment demonstrate a discontinuous effect, suggesting that the differences in performance are a result of different prior knowledge. Docampo Rama (2001a) also found no significant differences between the three older age groups when generational effects were present.

Familiarity Experiment 2

Familiarity Experiment 2 focused on the use of products that the participants were not already familiar with. Independent variables were age group (18-44, 45-59, 60-74, 75+) and product (four products). There were 32 participants, balanced for gender. The dependent variable was level of familiarity, assessed through a coding scheme. This was a mixed 4x4 experiment design with a repeated measures condition (product), so each of the four age groups was split into two smaller groups to counterbalance and control for any order or training effects. Groups were also balanced for education and gender.

The four products were two alarm clocks and two cameras. There were several tasks to be completed for each product. The participant read a task sheet, and was then shown the product briefly. The participant then explained how s/he thought s/he would perform the specified task (“primed task recall”), and then performed the task while delivering concurrent protocol (“observation”). After the observation a short interview was conducted, asking about what aspects of the task the participants found difficult and why. This process was repeated for each product. The experiment was conducted in the laboratory and in two senior citizens centres, with conditions controlled as much as possible.

Analysis

All audiovisual data were coded for accuracy and also with three levels of familiarity as in Familiarity Field Experiment 1 (Lawry, et al., 2010).

Each action in the primed task recall and observation was coded. The list of actions was specified beforehand, and some actions were made up of several steps (e.g. inserting the SD card into the digital camera), while others were a single step (e.g. turning the camera on). In the Primed Task Recall, the task sheet provided a certain amount of knowledge of the process, so if a participant simply verbalised the process as it appeared on the task sheet, it was coded as not familiar.

The Retrospective Interview was coded based on the nature of what the participant discussed. Comments that were positive in nature, such as “…it was easy to use”, suggested higher levels of familiarity. Comments that were negative in nature, such as “it wasn’t obvious how to turn the flash off”, suggested lower levels of familiarity.
Results

Findings from Familiarity Experiment 2 suggested that, with products that participants had never used before, there was a significant difference in familiarity between the youngest age groups and all three of the older ones, as measured by the primed task recall (Figure 6), the observation (Figure 7), and the retrospective interview.

Discussion

The results show that there are very significant differences between older and younger adults, and that there are not significant differences among the three older age groups. These results differ from those found in Familiarity Experiment 1, where the youngest groups differed from the two oldest group but not from the middle aged group, and this implies that middle aged people (40-59) are able to become familiar with products they
own but, like older people, show significantly less familiarity with new products than younger people (Lawry, et al., 2011).

These findings show that familiarity with contemporary products does not decline linearly with age, but drops around the mid-40s. This suggests that the findings from this experiment are the result of differences in prior knowledge, rather than any age-related declines in cognition or other abilities.

**Redundancy Experiment**

This experiment was designed to investigate whether the problems older adults experience with new technologies could be mitigated by employing redundancy in interface design. The Independent Variables for this experiment were interface design (Words only, Symbols only and Redundant [both words and symbols]), and age group (18-39, 40-64 and 75+). Of 50 participants 40% were males and 60% females, ages ranging from 18 to 83 years (M = 51, SD = 21). Groups were balanced for gender. The dependent variables were the time taken to accomplish the two set tasks, percentage of intuitive events observed and errors. We also measured working memory function and TF. This experiment was conducted in the laboratory. The data collection methods included observation of set tasks, concurrent verbal protocol, interviews, a TF questionnaire, and a working memory test battery similar to that as used in the microwave experiment. A Go/No go task, a measure of sustained attention, was added to the cognitive test battery for this experiment. A software prototype of a body-fat analyser, a non-invasive self-care health product, was used to complete the tasks on a touchscreen (Figure 8).

**Analysis**

For this experiment, we coded events. A task comprises a set number of events, and each event needs one or more actions to complete. For example, inputting participant’s age is an event, and this event includes the actions pressing up or down arrow and pressing the OK button. There were 8 “events” embedded in the set tasks.

Coding heuristics were based on those used previously (Blackler, 2008). Coding was done based on observation in conjunction with verbal protocol using Noldus Observer software. When participants performed an action quickly, with ease and did not verbalise (or at times verbalised after, instead of while, performing the action), that interaction was
coded as an intuitive event. All videos were coded by two independent raters to validate the data.

Results

As expected, results suggested that a negative correlation existed between TF and time to complete the task. Younger people also tended to score higher on TF and were more likely to use interfaces faster than older people. An analysis of variance showed a significant main effect of Age on time to complete task. The effect of age was much larger for the Redundant and Symbols only interface than it was for the Words only interface. The difference was reflected in a significant Age x Type of interface interaction. Older people took lot less time on the Words only interface compared to the Redundant interface (Figure 9). Older people also made more errors on the Redundant interface when compared with the Words only interface. This was reflected in a significant interaction between Age x Interface on percentage of errors made. Older people also used the interfaces significantly less intuitively than younger ones and found the Words only interface more intuitive to use (Figure 10).

![Age groups](image)

**Age groups**
- □ 18 to 39 years
- ○ 40 to 64 years
- ◻ 65+ years

**Figure 9. Interface and time to complete tasks**
Results

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Figure 9. Interface and time to complete tasks

Intuitive Interaction and Older People

Figure 10. Interface and Percentage of intuitive uses

Multiple regression analysis of the data showed that Visuo-spatial sketchpad capacity and Phonological transform response time significantly correlated with time to complete the task. Score on the Go/No go task had most impact on number of intuitive uses and errors. As the Central Executive plays a key role in controlling and directing attention (Morrison, 2005b), this data supports results from our microwave experiment.

Discussion

Surprisingly, redundancy in interface design resulted in faster and more accurate performance for younger and middle aged people, but a words only interface worked better for older people (65+). Also, we again found that components of CE function impacted on time, intuitive uses and errors, suggesting that cognitive decline as well as familiarity are affecting older people in their use of new technologies.

Interface complexity Experiment

This experiment was designed to investigate the relationships between age, interface complexity, anxiety and intuitive use. This experiment used a mixed between and within-participants design. Independent variables were complexity of interface (nested or flat – repeated measure), induced stress (high or low – between groups) and age group (17-34, 35-49, 50-64, 65-72, 73+). 50 participants (10 each in five age groups, balanced for gender) participated in this experiment, ranging in age from 18-84 years (M = 54, SD = 18). The dependent variables were time on task, errors and percentage of intuitive interactions.

In the laboratory, participants were asked to complete two real-life style tasks with a virtual pet on a touch sensitive tablet (iPad). They completed one task using a nested interface and the other using a flat interface (Figure 11). The tasks were counterbalanced to avoid training and sequencing effects. During the tasks they received either positive or negative feedback about their performance via the screen, in order to control the induced stress variable. Data collection methods were observation of interaction, TF questionnaires, and cognitive measures.
Analysis
The coding scheme for this experiment was the same as that used for the redundancy experiment, except that we coded each “use” (every time a participant touched the screen), rather than groups of uses, or “events”.

Results
Low TF participants took significantly more time to complete the task, compared with Mid TF and High TF participants, on both types of interface and both stress conditions. There was a significant effect of Interface type on time to complete the task (Figure 12). The participants took significantly more time to complete the task on the Nested interface when compared with the Flat interface. Age also had significant effect on time to complete the tasks, with the 73+ age group taking significantly more time when compared with the four younger age groups. The 65 to 72 group also took significantly more time than the youngest age group, 17 to 34. There was a significant Interface type x Age interaction. Type of interface had a significant effect on the 73+ and 65 to 72 age groups. Both of these groups took more time to complete the task on the Nested interface than the Flat one. There was also a significant Interface type x Stress interaction. The time to complete the task on the Nested interface differed significantly between High and Low stress conditions, whereas on the Flat interface there was no significant time difference between Low and High stress conditions. Interestingly, on the Nested interface participants took significantly less time in the High stress condition.

A 3 way mixed ANOVA revealed a significant effect of type of Interface on percentage of Intuitive uses (Figure 13). This indicated that the participants used the Flat interface more intuitively when compared with the Nested interface. Age also had a significant effect on percentage of Intuitive uses. The age effect was significant between age groups 17 to 34 and 65 to 72, 35 to 49 and 65 to 72, and 35 to 49 and 73+. 
Figure 11. Flat and nested interfaces

Analysis

The coding scheme for this experiment was the same as that used for the redundancy experiment, except that we coded each "use" (every time a participant touched the screen), rather than groups of uses, or "events".

Results

Low TF participants took significantly more time to complete the task, compared with Mid TF and High TF participants, on both types of interface and both stress conditions. There was a significant effect of Interface type on time to complete the task (Figure 12). The participants took significantly more time to complete the task on the Nested interface when compared with the Flat interface. Age also had significant effect on time to complete the tasks, with the 73+ age group taking significantly more time when compared with the four younger age groups. The 65 to 72 group also took significantly more time than the youngest age group, 17 to 34. There was a significant Interface type x Age interaction. Type of interface had a significant effect on the 73+ and 65 to 72 age groups. Both of these groups took more time to complete the task on the Nested interface than the Flat one. There was also a significant Interface type x Stress interaction. The time to complete the task on the Nested interface differed significantly between High and Low stress conditions, whereas on the Flat interface there was no significant time difference between Low and High stress conditions. Interestingly, on the Nested interface participants took significantly less time in the High stress condition.

A 3 way mixed ANOVA revealed a significant effect of type of Interface on percentage of Intuitive uses (Figure 13). This indicated that the participants used the Flat interface more intuitively when compared with the Nested interface. Age also had a significant effect on percentage of Intuitive uses. The age effect was significant between age groups 17 to 34 and 65 to 72, 35 to 49 and 65 to 72, and 35 to 49 and 73+.

There was also a significant three way interaction between Interface x Age x Stress for percentage of intuitive uses. In the Low stress condition, Age had significant effect on intuitive uses using both Flat and Nested interfaces, with a significant difference between 35 to 49 and 65 to 72 on Flat interface, and a significant difference between 35 to 49 and 50 to 64, 65 to 72 and 73+ on the Nested interface. Age also had significant effect on percentage of errors made. Overall, older age groups made more errors on both types of
interfaces when compared with younger age groups. However, type of interface had no effect on errors.

Figure 13. Percentage intuitive uses by interface and age under A. Low Stress and B. High Stress conditions

Results of a multiple regression showed that visuospatial sketchpad capacity and Phonological transform response time significantly correlated with time to complete the task on the Flat interface. Phonological transform response time and Attention also had significant influence on time to complete the task on Nested interface. Sustained Attention had a significant effect on Intuitive uses on Flat interface, and sustained Attention Reaction time and Visual transform response time had significant effect on
Intuitive uses on Nested interface. Visual transform had a significant effect on number of Errors on Flat interface, and sustained Attention had a significant effect on number of Errors on Nested interface. These results suggest that these aspects of CE function, which are affected by age-related cognitive decline, have again had an impact on the performance of older people. It would also appear that attention in particular is more important in using the nested interface than the flat interface.

Discussion
As expected, older people scored less on TF questionnaire, took more time to complete the tasks and used interfaces less intuitively. Furthermore, all age groups took significantly more time to complete the tasks on the nested interface, possibly because it required more actions to complete the tasks. On the flat interface only the oldest age group (73+) had significantly less intuitive uses than the younger groups, whereas on the nested interface all three age groups over 50 had significantly less intuitive uses. This finding supports existing data that suggest older people find nested interfaces more difficult to use (Detweiler, Hess, and Ellis, 1996; Docampo Rama, 2001b). The impact of attention on performance with the nested interface could provide an explanation for this. However, older people did not make significantly more errors compared to younger groups on both types of interfaces. This supports Processing-speed theory (Salthouse, 2010), which suggests that older people tend to trade speed for accuracy.

Surprisingly, the older age groups completed the tasks faster and used the interfaces more intuitively under the High stress condition. It could be that the High stress condition was inducing only an intermediate level of arousal, which can improve performance, rather than high levels of stress, which can decrease it (Yerkes and Dodson, 1908).

General Discussion
Our research has concurred with that of others (Langdon, et al., 2007; Lewis, et al., 2008; O’Brien, 2010) in showing that older people do indeed have more problems than younger ones in using contemporary products and interfaces. They are slower, make more errors and show less intuitive uses.

This research has begun to unravel the reasons behind these differences in interface use between older and younger people. We have found that older people are significantly less familiar with contemporary products than younger ones. However, when products that participants have not seen before are used, Middle aged people (40-59) as well as older people (60+) are significantly less familiar, whereas with products they own only older people (60+) differ significantly from younger ones (18-39). This suggests that middle aged people are able to become familiar with their own interfaces, but can still struggle when presented with a novel interface (Lawry, et al., 2011). Therefore, lower familiarity affects people from middle age onwards for novel products (Lawry, et al., 2011), and from early old age for products they own. We have developed a Familiarity Identification Tool (FIT) to assist designers and researchers in discovering familiarity of target users during the design process. This has been trialled and showed some success and is now undergoing further development.

The performance of older people with various interfaces (microwaves, body fat indicator and virtual pet tasks) is affected by decline in central executive function as well as lower familiarity (Blackler, et al., 2010a; Reddy, et al., 2010). This means that the older groups are struggling with two factors that make interface use more difficult – not only are they less familiar with contemporary interfaces, they also are less able to process information in working memory whilst using them.
Various design approaches have been recommended and used to attempt to make interfaces more usable for older people. We investigated two of these – redundancy and simplicity. Redundancy was less effective for the oldest age group, although it did make the tasks faster and more intuitive for middle aged people. The oldest group did better with the words only interface, while the youngest group was hardly affected by the different interfaces. This may be due to increased clarity and lack of clutter in the words only interface as compared to redundant interface, or it may be related to familiarity of different age groups with the mainly contemporary symbols used, or familiarity with use of symbols in interfaces per se.

Simplicity showed more expected outcomes – a flat interface was faster and more intuitive for all age groups to use, and older people were significantly slower and had less intuitive uses on the nested interface. However, there were no significant differences in error rates between the interfaces, and low level stress does not appear to have a detrimental effect on performance and may in fact be helpful. Therefore, while flat interfaces would appear to be the ideal, in a non-time critical task and when a flat interface is not possible due to space or other constraints, a simple nested interface that uses words only may be a suitable compromise. This may not allow fast and intuitive use but could be low in errors. However, the nested interface used in our experiment used only two options with up to three levels in each. This may be the level of simplicity required to get this kind of compromise to work.

**Conclusion and further work**

Designers need to stop assuming that all target user groups are familiar with all the interface elements that they may wish to apply. Older people are significantly less familiar with contemporary interfaces than younger ones, and they form an increasingly important group in the marketplace. Designers need to adequately understand the familiarity of all target users with potential interfaces. Our FIT tool should help them to do this.

Then they need to apply the users’ knowledge to suitable interfaces. Redundancy, although often applied, may not be the answer to making interfaces more intuitive for the older age groups. Flatter interfaces may help as all participants in the interface complexity experiment used the flat interface more quickly. However, these may not always be possible and a compromise on a simple nested interface may not have too much impact on error rates, although it could impact on time and intuitive uses.

Further work is ongoing. More tools that can assist designers and researchers in discovering familiarity and applying it to interfaces are under development. These need to be more extensively tested in industry before they can be released.

**References**


only two options with up to three levels in each. This may be the level of simplicity but could be low in errors. However, the nested interface used in our experiment uses words only may be a suitable compromise. This may not allow fast and intuitive use if the interface is not possible due to space or other constraints, a simple nested interface that would appear to be the ideal, in a non-time critical task and when a flat interface is used. Redundancy was less effective for the oldest age group, although it did make intuitive uses on the nested interface. However, there were no significant differences in error rates between the interfaces, and low level stress does not appear to have a much impact on error rates, although it could impact on time and intuitive uses.

References


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Simon Lawry (PhD) has recently finished his PhD at the School of Design at the Queensland University of Technology. His research focuses on the intersection of experiential knowledge, industrial and interaction design, and intuitive interaction. His unique research approach has utilised knowledge from cognitive psychology in order to understand how to access user knowledge in robust ways. This aim of his research is to enhance the independence of older adults by helping designers create more usable products (s.lawry@qut.edu.au)
Abstract

Higher Education is experiencing an increasingly diverse student population. Students bring a range of skills and experiences to their courses; they have different backgrounds and different needs. This fluidity requires an approach to teaching that encompasses the social aspects of learning. It has been suggested that authentic approaches to teaching and learning can assist in offering a perspective on learning which views learning as 'enabling participation in knowing'. We propose that the authentic learning practices developed in The Gift design project, discussed in this paper, constituted approaches which acknowledged that students’ interests and experience are intrinsically bound up with motivation and engagement and, as such, have a major influence on the ways in which learning is constituted and developed. The Gift project has developed a range of innovative formative strategies which have provided both students and tutors with opportunities to become involved in peer assessment and review, peer feedback and reflection on learning outcomes. This re-conceptualisation of the assessment process has provided valuable insights into the development of learning skills such as problem solving, critical analysis, and the development of creativity and learner autonomy.

Keywords: international, formative assessment, peer review, the global studio


Background

Higher education in the United Kingdom is currently undergoing significant challenges and pressures in relation to change. The successful learner is now not viewed as someone who can acquire knowledge and skills, but as someone who knows 'how to learn'. Communication, collaboration and problem-solving abilities are seen as positive qualities in the learner, and positive educational outcomes (Benson & Toogood, 2002).

These concerns are reflected in the national agenda to raise the standards of learning and, as such, have become an important national priority. Various studies (e.g. BIS, 2009; Kogan & Teichler, 2007) indicate that today's graduates need to be able to: apply knowledge when working with people, be able to work independently, be efficient problem-solvers, engage in self-evaluation, and be able to develop higher order skills to become 'lifelong learners' in an increasingly globalised, technological world. The Leitch Report (2006) has highlighted the role of Universities in developing 'Lifelong Learners'. Lifelong learners are described as to: 'learn independently, think creatively, solve complex problems, manage time effectively, show determination and resilience, and work with others.' (Institute of Directors, 2008, p. 22)

The increasing globalisation of the production, distribution and consumption of goods and services is both the condition for, and the consequence of, major changes in the ways consumer products are developed, manufactured and consumed (du Gay, 1997; Hawranek, Jung, & Tietz, 2005; Hoppe, 2005; Reich, 1992). These changes include the contemporary shift to the geographic distribution of design teams. Therefore, designers nowadays often find themselves developing products that will be designed, produced, marketed and consumed globally in markets distant to the country were they are based. They also might need to collaborate with colleagues who might be based in different countries. This means that designers often require additional skills to those needed in more-traditional workplaces (Larsen & McInerney, 2002; O'Sullivan, 2003; Song, Berends, van der Bij, & Weggeman, 2007; Xie, L, Fung, & Zhou, 2003). In addition, this situation of 'virtual worldwide collaboration' and the new emphasis on speed and flexibility requires a new and different approach for managing new product development – which utilises a parallel way of working that involves regular customer/client input whilst being heavily reliant upon clear and precise communication. This approach requires designers to work well with others in a high pressure, tightly focused environment.

The Global Studio has been developed to prepare students for this method of working for markets and production in other cultures and distant locations. The idea of the Global Studio is inspired by the changes that current trends in manufacturing have shaped the way designers develop their products (Bohemia, Harman, & Lauche, 2009). A large body of research has signalled the shift from a linear and hierarchical model of product development and manufacturing, where everything happened in proximity, to a model of ‘agile’ manufacturing characterized by virtual partnerships and the dispersal of the design process. The new global division of labour has meant that design teams are now scattered across the world as they contribute to the different components of the same commodity. For designers these changes mean cultivating additional skills to those required in a traditional work environment. The Global Studio addresses the need for a learning environment that prepares students for this virtual, networked world (Bohemia & Harman, 2008).

Since its launch, the boundaries of the Global Studio have continued to expand through the delivery of unique teaching projects with the collaboration of leading international academic and industrial partners. ‘The Gift’ project is one of these initiatives, developed...
in partnership with universities across the world. Throughout The Gift project students take up both the roles of the ‘client’ and the ‘designer’ with students based at other universities. Communication between students was conducted online using web tools, emails, Skype and teleconferencing (Bohemia, 2011; Ghassan & Bohemia, 2011). Issue The project involved students who were based in Canada, England, Japan, Taiwan, Australia and Korea.

**Objectives**

The idea for the theme employed in The Gift project was inspired by the anthropologist Marcel Mauss’ classic book ‘The Gift’ (Mauss, 1950, 1990). This text puts forward a theory which argues that ‘giving’, ‘receiving’ and ‘reciprocation’ are fundamental social activities linked to interaction between humans. These interactions are part of cultural practices and ‘carry meaning[s] and value[s] for us, which need to be meaningfully interpreted by others, or which depend on meaning for their effective operation.’ (Hall, 1997:3) One of the aims of the project was for participating students to begin to explore the ‘work’ artefacts ‘do’ in relation to social practices (cf. Johnson, 1988). The project aimed to encourage students to explore various questions related to intercultural communication and Design and to enable students to develop key skills not only in product design and development, but also in cross-cultural communication. The project aimed to provide students with opportunities to gain experience in using ‘distance communication tools’ and gain critical peer feedback from the other students involved in the project. The project aimed to provide opportunities for students to explore cultural aspects associated with an overseas client and to act as a client in return. Pivotal to the success for the project was the exchange and evaluation of information between the different groups of students.

The social practices investigated during the project related to the ‘giving’, ‘receiving’ and ‘reciprocation’ of gift(s) designed by the participating students. This project was an opportunity to open spaces for participating students to discuss rituals, ceremonies and protocols related to ‘gift exchange’. It was also an opportunity for students to investigate their own and their collaborators’ cultures (Bohemia & Ghassan, 2011b).

**Teaching and Learning**

The teaching and learning strategy for the project employed pedagogic strategies which were designed to develop a range of student attributes. These included core design skills, communication skills, problem solving skills, group working and collaborative skills, time management and project development and skills in relation to the development of criticality. The project approach was to make the task as ‘real’ and meaningful for the students as possible. This involved designing the project to include a range of ‘authentic’ learning experiences and activities, with the aim of providing students with a ‘vehicle’ to both become engaged in the project and to act as a means to provide relevance for the task. This included inviting speakers to seminars to discuss their own experiences of giving and receiving ‘gifts’ when visiting different cultures.

The teaching and learning between the collaborating institutions was delivered using a blended learning approach utilising a combination of online learning and face-to-face teaching delivery. The online learning was delivered via Web 2.0 technologies and the face-to-face delivery was conducted through what can be referred to as studio-based learning environment (Bohemia & Ghassan, 2012, in print).

In this project, students were asked to write a brief which would lead to the production of the gift they would be designing. The lecturers emphasised to students that they would be
unable to complete the task alone - they would need specific cultural information from their collaborators in order to write a brief that would take into account cultural differences or similarities and specific cultural contexts / mores / rituals / celebrations (Bohemia & Ghassan, 2011a).

**Authenticity and Learning**

The rationale for studying teaching and assessment practices which are made ‘authentic’ and ‘meaningful’ in some way to students, either individually or collectively, is supported by both research in relation to formative assessment and the improvement of performance (Black & Williams, 1998b) and also research which looks at the impact of socio-cultural influences on learner motivation and participation. Bloomer (1997), for example, argues that dispositions towards learning and achievement are ‘socially and culturally grounded’ and profoundly affected by personal identities. It is important, therefore, that teaching and learning approaches take social differentiation into account, as well as individual attributes and attitudes to learning.

‘Motivation and approaches to learning cannot, therefore, be isolated from the unstable yet important contexts of learners own interests’. (Ecclestone, 2001)

The concept of authentic learning became popular in learning theories such as situated learning and cognitive apprenticeship (Seely Brown, Collins, & Duguid, 1989) that focus on learning in meaningful contexts (i.e. work or culture). Authentic assessment was seen as increasingly important in competence-based assessment to measure whether the student was capable of functioning in the world of work. There was a perceived gap between what is taught and assessed in Higher Education and the skills required for work (Biemansa, Nieuwenhuijsa, Poella, Muldera, & Wesselinka, 2004).

Guiller, Durndell, and Ross (2008) completed a study of students’ perceptions of authentic learning activities in relation to the amount of previous experience they had. This previous experience included professional experience and experience of studying. Guiller, et al. (2008) argued that the influence of authentic assessment on student learning was influenced by two major factors – the level of relevance students felt the task had in relation to professional life and the amount of study experience the student had acquired. Guiller, et al. (2008) argues that authenticity is multi-dimensional and is not an objective construct. Therefore students’ perceptions of the authentic activity will differ, not all students will see the assessment in the same way and this will, in turn, influence the assessment. Guiller, et al. (2008) states that useful areas for future research might include:

‘Contexts where learning and working ‘are not so tightly integrated’ or where the future work field is much broader and therefore less clear.’ (Guiller et al., 2008, p. 184)

Guiller, et al. (2008) argues that if assessment is viewed as authentic by students it would be an important factor in ‘bridging the gap’ between learning and working.

**Authenticity and Information Technology**

The internet and the growth of technology and simulation technologies have resulted in an interest and expansion of teaching activities linked to authentic learning. Authentic learning environments can be developed in both digital and real life settings (Lombardi, 2007). Authenticity has been viewed as a student-centred form of learning, where students ‘solve ambiguous problems with real-world significance’ (Lombardi, 2007; Maina, 2004; Rule, 2006).
These ambiguous problems can have a range of possible solutions (Herrington, Oliver, & Reeves, 2002) and can be viewed as close comparisons to emulating the work of real-life experts. Digital simulations have grown in technology education as they are viewed as appropriate and ‘safe’ arenas in which to practice the development of skills. Squire and Jenkins (2003) and Oblinger and Hawkins (2006) suggest that on-line simulations are not enough by themselves, but must be incorporated into a course. They suggest that students will become motivated to look for information to support on-line learning and simulations from books, papers and other materials to support their performance in a virtual environment.

Messick(1994) discusses authentic learning tasks in relation to simulations and argues that there are two types of simulation: construct-centred and task-centred authenticity:

‘In the task centred approach to authentic assessment, credibility depends on the simulation of as much real-world complexity as can be provided... The construct centred approach (focuses) on constructs of knowledge and skill and the conditions of their realistic engagement in task performance. Aspects of the test situation can be controlled or standardised. Such simulated tasks are authentic in that they replicate the challenges and standards of real-world performances and are representative of the ways in which knowledge and skills are used in real-world contexts, even though they do not simulate all of the complexity of real world functioning. No situation can be exactly like the real world. Teachers would have to distinguish which aspects of knowledge they wanted to assess and incorporate this into the assessment activity.’ (Messick, 1994, p. 58)

Herrington, et al. (2002) discuss the use of authentic learning activities in on-line learning environments, and state that there are many benefits for learners. Their research is based upon constructivist philosophy and they discuss research in response to curriculum advances in technology. They argue that their methods have been successfully used in a range of disciplinary areas. They discuss patterns of engagement, and state that engagement involves a ‘suspension of belief’ on the part of the students. Herrington, et al. (2002) propose ten characteristics of authentic learning activities. These include activities based in real situations and activities which included development of conceptual skills such as critical thinking or problem solving:

1. Authentic activities have real-world relevance.
2. Authentic activities are ill-defined, requiring students to define the tasks and sub-tasks needed to complete the activity.
3. Authentic activities comprise complex tasks to be investigated by students over a sustained period of time.
4. Authentic activities provide the opportunity for students to examine the task from different perspectives, using a variety of resources.
5. Authentic activities provide the opportunity to collaborate.
6. Authentic activities provide the opportunity to reflect.
7. Authentic activities can be integrated and applied across different subject areas and led beyond domain-specific outcomes.
8. Authentic activities are seamlessly integrated with assessment.
9. Authentic activities create polished products valuable in their own right rather than as preparation for something else.
10. Authentic activities allow competing solutions and diversity of outcome.

Herrington, et al. (2002) have used these ten principles to identify cases within their own institution to research. They state that identification of courses which have these characteristics as their core design is difficult, and research is ongoing. One strong emerging theme in their research is that the view of authenticity emerges from tutors’ ‘own imaginations’ and views of learning.
The Gift project can be viewed as an International, authentic learning collaboration. The project shares many of the features of authentic learning which have been outlined above, and, in addition, breaks new ground through its innovative approach to the development of learning and teaching practices.

Evaluation of Student Surveys

A comprehensive analysis was undertaken of the Gift project. The international project consisted of 80 student groups, made up of 233 students, who were surveyed at mid-project and final project stages. In addition all students were asked to complete a self-evaluation in relation to their experiences of the brief given for the project and their experiences of the design concept. The individual surveys’ can be accessed at www.globalstudio.com

The following sections provide an account of the student’s experiences during and after the project.

The Sections have been grouped into themes which have been developed from the key questions in the students’ survey. These themes relate to the teaching and learning experiences of the students and include data from the four student surveys undertaken. The themes are:

1. Understanding the design phases – developing core design skills
2. Using communication technologies to develop communication skills
3. Developing collaboration skills - group work across distance - understanding the challenges of working in distributed design teams
4. Peer observation, review and feedback
5. Problem solving and critical analysis
6. Developing Intercultural communication skills
7. Time management and project development skills
8. The extent to which authentic, meaningful learning activities, developed through the Global Studio, have prepared students for design collaborations across distance

Methodology

Students were asked to undertake a self-evaluation of their experiences of the project. The students were asked to complete a survey and rate their experiences on a scale between 1 and 5. Scale: 5 = Very much, 4 = Somewhat, 3 = Neutral, 2 = Not very, 1 = Not at all

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<tr>
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<td>54 / 96%</td>
<td>46 / 74%</td>
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<td>9 / 56%</td>
<td>12 / 40%</td>
<td>0 / 0%</td>
<td>150 / 64%</td>
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Theme 1 - Understanding the design phases – developing core design skills

The overwhelming response from students in relation to developing the design brief involved was breaking the task down into carefully structured sections, with each section having to be carefully considered. Students related that it was important to be as clear as possible. The most successful briefs were made up of simple brief based on universal ideas. Groups reported the importance of careful, relevant research and information to aid the development of the research brief. Groups reported finding the brief clear to follow and commented:
“The brief is easy to understand but still leaves a lot of room for creativity”

Some groups commented that they felt they hadn’t developed the brief enough, or included enough information and clarity to allow other design teams to design from it. When this was the case, students commented that the use of pictures and more detail would have been useful.

Students stressed the importance of understanding cultural norms of particular countries in order to interpret certain aspects of the brief properly:

“You need to research the country’s culture in depth as this has a great effect on your concept and thought process”

In order to develop a clear brief was clear which the groups felt comfortable in handing to another design team, students regularly mentioned that the design they created had to be meaningful to the group, based on the research they had undertaken. Students reported that this meaning and relevance was fundamental to the design process, and the quality of the research undertaken had a direct bearing on the strength of the final design concept.

Some students reported very enthusiastically about the project, mentioning some potential issues when working collaboratively:

“I think I may have taken control of the project. Maybe it could have had more group input”

Students reported that a lot of their research came from personal projects on food and cultures, they used information given to them by their partner university relating to culture and value systems:

“We used the information they give us in relation to religion and ceremony. Our research was extensive and we feel that our concepts conveyed this in depth”

and:

“We looked for many useful materials and used them effectively”

Students reported that taking time to carefully consider how both cultures were involved in the concept created a meaningful experience; students reported developing friendships which helped them to express themselves in a creative way. Students reported checking and verifying their research on an on-going basis:

“During the design process, we kept going back to the research to make sure everything was appropriate”

Students commented on the amount of detail they included in their projects and the realisation that this attention to detail formed the basis of a successful design brief:

“I now understand the amount of work and detail needed to write a successful brief”

and:

“We found our university had ten departments. We used this research to design a concept which had ten parts”

Groups reported that having “such an open brief” made agreeing on a topic “quite tricky”. Students commented that this could be a ‘fun’ process, but at the same time initial
indecision and a lack of structure often made things harder in the early development stages of defining the brief.

“This was quite hard because you have to be selective about what is included and sometimes I was unsure of what was crucial information and what was less important.”

Groups stated that deciding on the concept was ‘the hardest part’; once this had been decided on students reported that the development and research stages developed more smoothly. The majority of groups divided the brief into several parts; with each member being allocated a particular area to work on, with ideas being gathered together after a period of time. Students reported improving their visual representations of the brief and gaining understanding of core brief writing aspects:

“We all sat together and bounced ideas off one another. This session worked very well and I’m pleased with the outcome.”

**Theme 2 – Using communication technologies to develop communication skills**

All groups reported trying to simplify ideas and represent ideas much more understandably in visual form to overcome language problems. Students used a range of communication technologies to develop communications between groups. Most of the communication was on Skype, Facebook, and MSN. Groups also used their University email account. WordPress was very useful to create a sense of identity and a point of meeting. Translation at times could be misunderstood; students reported giving careful consideration to communication to ensure that your counterpart group understood each other’s views and ideas.

“Actually it's hard to communicate with non English country. However with web pages, we can talk about each ideas more easy”

and:

“I've learnt Wordpress and it's interesting because personally I would like to make a personal blog by Wordpres. We found this most useful to communicate with our collaborators, and made the language barrier easier to cross”.

Students reported using these technologies improved communication, facilitating participation and collaboration:

“It has helped me understand their cultural experiences and helped my time management b/c of the time change”

and:

“I have improved my appreciation for blogging”

Groups discussed the usefulness of alternative ways to communicate ideas other than through text, this was seen as a way to develop ideas, when ‘deeper’ technical discussions could not take place because of the language barrier.

Students reported developing their evaluation skills through the act of posting comments, views and comments on the on-line blog:

“By trying to evaluate every word or image I post I can control how things are perceived, also to central the direction of our designs”
Conflicting ideas, lack of structure and time constraints often made things harder in the early stages of defining the brief.

“This was quite hard because you have to be selective about what is included and sometimes I was unsure of what was crucial information and what was less important.”

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“By trying to evaluate every word or image I post I can control how things are perceived, also to central the direction of our designs”

and:

“It’s a chance for us and them to think and paraphrase before posting up, a useful way to do feedback”

Some students expressed concern over the lack of communication from some groups:

“It would have been much better if they would have got on webcam but ’cause it’s all written like an e-mail I don’t think I’ve benefitted communication wise from the online component”

and:

“It’s the best way to communicate via overseas; however I prefer a face to face scenario due to the instant feedback and response that can be gained”

Students reported being ‘on-line’ more often, to check for new posts, groups reported that this process helped them both their communication and Information technology skills:

“It made me check the website more often checking for updates”

It gives an obvious way of communication although it would be better if the messaging was instant.

Keeping in contact with group members and easily sharing concepts and ideas.

Theme 3 – Developing collaboration skills - group work across distance - understanding the challenges of working in distributed design teams

Groups discussed the issues involved in developing effective collaboration across distance, students reported using drawings and notes to discuss and develop ideas. These drawings would often be completed ‘live’ during a Skype session, to illustrate ideas:

“We sketched during our meetings with the other group to explain the concepts”

Skype was highlighted as a very useful way of communicating and an aid to help clear up misunderstandings or clear up any issues relating to the design concept.

“We had great communication. Skype cleared up many issues”

and:

“I communicated well with my team, so they knew exactly what was going on, though notes, annotations and sketches. Then team helped me communicate these ideas to our collaborators”

Students commented that being in ‘constant contact’ with their counterpart group made the project run very smoothly. Skype and Wordpress particularly were deemed very useful for relaying visual messages with minimal text. Groups reported using Storyboarding and Sketch sheets to communicate ideas, with a few key words. This technique minimised the potential for mis-understandings due to language:

“We tried to minimise annotations and purely express visually if we could. Our collaborators’ were very good at this”

and:
“We had weekly meetings and communicated often over the WordPress site and Skype”

Students commented that the experience of working with students from another country and culture had been a valuable experience for them:

‘Every country has a different way and culture of designs. Knowing how the Korean’s think about their designs and the whole story towards the final design’

and:

‘Learning the ways they worked in comparison to us was very interesting. Different ways to tackle the same problem. Proved that communication is vital and without it the project would just come to a stop’

In relation to culture and collaboration:

‘Because I learnt about them, their lifestyle, and culture and what design means to them at their university. It opened my eyes to different cultures as well as the difficulties of collaborating with designs throughout the world.’

**Theme 4 – Peer observation, review and feedback**

Groups commented that they had learnt new methods of presenting thoughts, through mind maps and Photoshop. Students related sense of pride that they were able to give feedback which was useful to other groups in the design of their project:

‘I am proud to give some ideas and directions of working to make the team go ahead’

Peer review was considered an integral part of the design process, students commenting on the usefulness of giving and receiving feedback on their thoughts and ideas:

‘We communicated well with the other team. We hit targets and were clear and precise when giving feedback’

The feedback process facilitated students decision making and helped them evaluate their progress:

‘To improve our group we needed to add more information to decision making and take a more focused role when coming up with ideas’

Feedback was viewed as vital to designing an appropriate concept, students commented that the range of communication technologies made it easier to ask questions and gain feedback. Students commented that the design process was not always an easy one:

‘Sometimes we have worked well together but sometimes we have struggled’

Whilst some groups struggled with communication:

‘Lack of communication. More than a week would go by without any feedback’

and:

‘It’s a little complicated to understand what we have to do between clients and designers. But I suppose that it can help you to reflect on two different ways of design’

Groups commented that the peer review process had helped them appreciate and understand different approaches and perspectives in relation to the design process:
“Different points of view, different thinking. Sometimes I’ll lose the way. But I think I realise during the project. This is a very good way of learning from each other”

**Theme 5 - Problem solving and critical analysis**

Students reported that communicating through language barriers, communicating ideas and collaborating with international partners helped them develop problem solving and critical analysis skills. The development of initial ideas, working as a group, setting each other tasks were all mentioned as activities which helped individuals and groups problem solve:

‘We worked through a number of ideas and worked well in developing them’

and:

‘Ideas generation, getting ‘stuck in’ to develop ideas and concepts’

‘Worked well on concept and scenario generation I developed a better understanding of other countries culture and values’

In relation to keeping in contact with other groups, students mentioned that the time difference made communication difficult, when messages were posted online it often took a long time for the other groups to reply. Groups commented that this factor slowed proceedings down, but also provided opportunities to problem solve – students had to think and plan ahead in relation to different time zones and prioritise what work needed to be discussed.

“Sometimes the time difference was frustrating, we missed our two first meetings because the time difference was not calculated correctly”

and:

‘Working as a group is always a challenge. Working with another group halfway around the world is even more challenging.’

Some groups reported confusion and anxiety at the beginning of the task, the students who negotiated different ways to communicate across the time zone differences and developed effective communication pathways appeared to be more successful at managing the design process. Students commented on the need to problem solve in relation to developing effective communication:

‘To communicate with a foreign country is a big challenge, because we have different culture, you really need to be careful and to observe the emotion of the issues we discuss’

The groups had to think carefully about ways to communicate their design concepts to each other, taking into account language differences. This involved students having to problem solve in relation to finding ways to communicate ideas without using a lot of text and unfamiliar technical words, to reduce potential errors in communication:

‘I feel I can improve my concept through a series of story boards that are very minimal with language so the guys from Chiba can understand’

and:

‘We used drawings to best communicate concepts. We needed to be clear - pictures are more advised’
Theme 6 – Developing Intercultural communication skills

Students observed that it was a challenge to run a cross continental project. They talked about the difficulties involved in setting up a regular timetable. Groups discussed ideas before posting them on the website. Groups stressed the importance of being very clear on the website, through using appropriate headings and good quality photos/images.

Regular meetings on Skype were viewed as very important to the development of intercultural communication skills; this was a very popular medium for the students to communicate through. Groups related that they tried to keep their briefs clear through imagery and bullet points so they could be easily interpreted across cultural groups. Teamwork was mentioned as being very important to the development of intercultural communication skills:

“We needed to explain ourselves better. This would have been easier if we had been more organised”

Students were creative in getting their ideas across, posting videos online so counterpart groups could view their institution. There was some frustration in relation to the amount and timing of posts from some groups:

“Our Brief was well laid out, we organised meetings and contacted the group successfully but wish the other group would post more often”

and:

“Communication with our counterparts has been difficult; we ask them questions on the blog, but they did not respond, when they used Skype the group responded and they were able to exchange ideas”

Groups stated that they had discussions into aspects of different cultures and how their designs could incorporate different cultures:

“For each concept I had to explore the culture, the trends because we don’t make design with eyes closed”

and:

“I did not know anything of Taiwan, not even its location. How bad is that? Very! They opened me up to how different people throughout the world perceive different gestures. It was interesting to see the difference in cultures and try to adopt the ideas to fit both, I came to realise that views and traditions vary widely”

Theme 7 – Time management and project development skills

Some groups stated that they felt some amount of confusion at the beginning of the project. Students reported feeling unsure about what was required of them, and anxious that the brief was ‘too open’. Students stated that the open brief felt unclear and ‘scary’ and that they had difficulties in understanding the theme at the beginning of the project and difficulty in deciding who was designer and who was client.

All groups commented upon the importance of making a realistic schedule of work to be completed:

“If our team had made a schedule would have been more organised”
Groups also commented that they would have preferred a timetable to be ‘imposed’ on them, instead of having to organise their own timetable. The groups who organised their schedule soon into the project reported satisfaction at having completed the task on time and within the given objectives:

‘We finished the project in a logical order, with good scheduling and sharing of tasks’

Communication was deemed to be key to the completion of tasks within schedule:

‘As a group we met regularly and communicated well which aided the completion of the task’

and:

‘We followed a logical order from design concept to final product’

**Theme 8 – Using authentic, meaningful learning activities for design collaborations across distance**

Students work was developed through sketching and mind maps. Visual aids were used to represent ideas. Story Boards and CAD presentations were also used. Groups reported using many sketch sheets to demonstrate the ways in which their research shaped the design process:

‘Our three initial concepts were very visual and out team easily understood our ideas’

Students used video and comic story boards to develop ideas. Mind maps were popular and used extensively, although some students commented that perhaps they used them a bit too much:

‘We made a mind map outlining the things we thought were important in gift giving, which we used to determine what we would do with the exchange of gifts’

and:

‘Could have sketched more, spent too much time mind mapping’

Sketching was used a great deal and students commented that this was central to the process:

‘We sketched, mocked up small foam models to understand how we would interact with the Gift. We used a lot of pages of sketches to find the final design’

Sketching was deemed a very useful way of exploring different cultures and values:

‘Sketching was the easiest way for me to explore all areas of the culture and design idea’

And for working out technical details:

‘Sketching became a big part when we were working out the engineering/functional side’

The task provided a ‘vehicle’ for students to develop a gift which would be viewed by the recipient as meaningful, innovative and considerate. Groups stated that it was very useful to work with people that you have no physical access to – students commented that it was helpful in streamlining ideas and simplifying visuals to express ideas.

The project gave students opportunities to learn across distance. Students commented that the skills developed would be very useful in future projects:
‘Learning about others and cultures, explaining designs and using different influences have improved my skills’

The very real issues students had to contend with, in relation to time zones, cultural differences and language barriers provided an authentic learning experience which would be impossible to replicate in a classroom based setting:

‘I appreciate time change and culture barriers more. I will carry this experience and use mistakes to improve’

and:

‘I have definitely learnt how to tackle a group project more efficiently, understanding that defining times to meet is very important. Yes, this project has taught me a lot about working in distributed teams, trying to overcome language barriers, and I do feel more confident for the future’

Discussion

The Gift project has developed a range of innovative formative strategies which have provided both students and tutors with opportunities to become involved in peer assessment and review, peer feedback and reflection on learning outcomes. This re-conceptualisation of the assessment process has provided valuable insights into the development of learning skills such as problem solving, critical analysis, and the development of creativity and learner autonomy. Assessment has been acknowledged to have a major effect on what, and how, people learn. Debates into the role of assessment, and what should and what should not be assessed have previously focused predominantly on ‘generic performances’, ‘critical outcomes’, ‘skills’ and ‘employability’ (Barnett & Coate, 2005). Research in higher education has acknowledged that a wider conception of learning and assessment needs to take place, and much current research, theorised from a constructivist paradigm, has focused on exploring the situatedness and complex nature and relationship of assessment and learning. Improvement in assessment was identified by Subject Review (Quality Assurance Agency for Higher Education, 2003, p. 27), as:

‘The single intervention by universities and colleges that would improve the quality of the student experience’.

Formative assessment has been identified as being an effective means through which to develop students’ understandings and improve the learning experience. Formative assessment can be described as a learning and teaching approach which responds to student learning on an on-going basis – it provides feedback which is timely and can be acted upon to improve learning and performance. The Organisation for Economic Cooperation and Development (OECD) has advocated formative assessment as an effective learning strategy:

‘Teachers using formative assessment approaches guide students toward development of their own “learning to learn” skills – skills that are increasingly necessary as knowledge is quickly outdated in the information society. (OECD, 2005, p. 22)

A prominent theorist in student development, Baxter Magolda(2001), discusses the concept of ‘self-authorship’. The term is used to describe students’ feeling that they have control over the content and direction of their work. Baxter Magolda(2001) outlines the conditions which can help promote this for learners – primarily through educational institutions modelling self-authorship, but also through embedding assessment and
teaching practices which validate learners’ capacity to know, situate learning in learners’ experience and mutually construct meaning. These strategies can be related to the authentic learning activities developed during the Gift Project, through the development of relevant and meaningful learning activities.

**Conclusion**

Higher Education is experiencing an increasingly diverse student population. Students bring a range of skills and experiences to their courses; they have different backgrounds and different needs:

> 'With a diverse student body, no fixed start or end point can be assumed – consequently, no selection of items can be appropriate to meet the needs of all. The challenges of diversity demand a more fluid conception of teaching.' (Northedge, 2003, p. 47)

This fluidity requires an approach to teaching that encompasses the social aspects of learning. Authentic approaches to teaching and learning can assist in offering a perspective on learning which views learning as ‘enabling participation in knowing’ (Wenger, 1998). The highly influential work of Lave and Wenger (1991) provides a perspective on learning which offers a model of learning based on equity in that it invites partnership and the sharing of knowledge and ideas, rather than a transmission or acquisition view of knowledge and learning. This perspective views knowledge as constructed within a community of discourse, where participants are able to access the curriculum at different levels according to their experience. This curriculum is complex, multi-layered and provides opportunities for learners to become a participant at different levels. These levels of complexity are multi-faceted, very often with high levels of authenticity. The Gift project was designed with this complexity in mind; it offered students opportunities to engage with the curriculum at a range of different levels.

The authentic practices developed in The Gift project constituted approaches which acknowledged that students’ interests and experience are intrinsically bound up with motivation and engagement and, as such, have a major influence on the ways in which learning is constituted and developed.

Black and Wiliam (2000) state that:

> ‘Beliefs about the goals of learning, about one’s capacity to respond, about the risks involved in responding in various ways and about what learning should be like (all) affect the motivation to take action, the ability to choose action and commitment to it.’

Some students reported initial difficulty in engaging with the project and stated that they felt ‘confused’ and ‘dis-orientated’. Taplin(2000) states that students can often have difficulty in changing to self-directed learning when they have had previous experiences of dependent learning habits, and can become unhappy when support is withdrawn. Taplin(2000)argues that more independence in learning may result in students’ feeling anxious or uncertain with regard to the new experience. This is something to consider for future development of The Gift project, the literature in relation to autonomy has revealed that the student response to learning activities which are designed to promote learner autonomy can be varied; this variation may be dependent on a number of factors, including the ways in which the learning activity is constructed by the tutor and presented to students.

The Gift project presented students with many new ideas and concepts to engage with. Mann (2001) states that students may find it easier not to engage, as being presented with new ideas may present a risk:
‘Most students entering the world of the academy are in an equivalent position to those crossing the borders of a new country – they have to deal with the bureaucracy of checkpoints, or matriculation, they may have limited knowledge of the local language and customs, and are alone.’ (Mann, 2001, p. 11)

Mann (2001) argues that the organised nature of higher education suppresses creativity, which is the element which is actually needed to engage in learning. Mann (2001) also relates that the current emphasis in assessment is about outcome rather than process; systems of exams and assessment separate students from the possibility of being autonomous in assessment. Mann (2001) argues that if the institution and the lecturer decide on the content/pace of learning, the students do not own the learning process and there will be a sense of alienation and unequal distribution of power in the relationship. In this instance, the authentic learning activities, developed within The Gift project, may be able to provide the meaning and relevance which Mann describes as being essential for learner engagement.

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References


Designing as a Language for Self-Dialogue and Value Clarification

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Abstract
The design research described in this paper used generative tools in co-creation sessions with users in a Danish bank. The aim was to investigate users’ relationship to money and to banks. In a follow-up interview participants stated that they had changed their perception and behaviour in relation to money – and in accordance with their values. Thus, contrary to expectations, the research did not lead to co-creation of values, but rather to a hypothesis that generative tools can act not only as a “language for co-creation aimed at the collective creativity” (Sanders & Stappers, 2008) but even as a “language for self-dialogue and value clarification aimed at the creativity of the individual” (Sørensen, 2011).

In the ensuing research (2011) I proved this hypothesis, i.e. that designing can be used as a language for self-dialogue and value clarification by developing a radical new banking-service, “The MoneyWorkshop”. Here customers are offered generative tools and special assignments in order to clarify their values and possibly change their relationship to their personal finances. The majority of the participants in the workshop subsequently changed their perception and behaviour.


Keywords: generative tools, self-dialogue, value clarification, cognitive strategies
Introduction to research

The current Ph.D. research into strategic design was conducted at a medium-sized Danish bank, Middelfart Sparekasse. My aim was to investigate values – the current values inside and outside the organisation – and possibly create ‘something new’, a radically novel approach.

‘Money’ in this context represents the specific banking product. The dominant concept and metaphor in the western world is that capitalism and money is ‘good’. ‘Money’ and what money means depends on the context, whether we live in a boom or in a crisis. ‘Money’ has two distinct meanings, however: a monetary value that allows us to buy things, and an emotional value, which connects money to feelings. When we set up budgets we typically use rational arguments related to the monetary value, whereas when we spend money we are often emotionally affected by the outside world, being addressed as ‘customers’ and being persuaded to buy things that make us happier, more attractive etc. ‘Money’, therefore, seems to capture us somewhere between sense and emotion, which means that diverging values are often tied to money.

The point of departure of the current research is the fact that our values – including the conflicting values – are rooted in dominant metaphors and mental mappings which affect people’s individual perception and behaviour in relation to money. The research focuses on how individuals, by design, can reframe themselves and/or their situation and subsequently change their perception and behaviour in accordance with their stated wishes.

Generative tools play a central role in this process.

Generative tools, a language for co-creation

In co-creation processes, generative tools are used as thinking tools. The pioneer within the field of co-creation, E.B. Sanders, calls generative tools “a language for co-creation aimed at the collective creativity” (Sanders & Stappers, 2008). Sanders claims this language is characterised by two things: First of all the language is predominantly visual and the ambiguity that often characterises visuals does indeed affect the participants’ way of thinking. Second, a key concept in the language of co-creation is ‘making’ and the fact that participants are ‘creating’ makes the use of the language a kind of creative process, a design process. Sanders outlines the use of generative tools as follows:
[The generative tools] take advantage of the visual ways we have of sensing, knowing, remembering and expressing. The tools give access and expression to the emotional side of experience and acknowledge the subjective perspective. They reveal the unique personal histories people have that contribute to the content and quality of their experience. These are qualities useful to those of us involved in making people-centred decisions (Sanders, 2000, 8).

Generative design makes us see things as they could be and “empowers everyday people to generate and promote alternatives to the current situation” (Sanders, 2006). This field is in particular represented by pioneer Elizabeth Sanders, but also Stappers (2008), Visser (2009) and others.

The elements of the generative tools are components, and together they form a ‘toolkit’. Participants choose from the components and create ‘artefacts’ that express their thoughts, feelings and/or ideas. The artefacts can have different forms, e.g. collages, maps, stories, plans and/or memories. When creating the artefact there is usually only one rule, you can do whatever you want, as long as it makes sense to you.” (Sanders, 2000, 9)

The current research applies generative tools in a novel manner.

**Design experiments in the current research**

The research on which this paper is based includes altogether 43 participants, both customers in the bank and potential customers. The Ph.D. thesis (Bonde Sørensen, 2011) and this paper include material representing 20 participants (10 customers and 10 potential customers).

The workshop participants were asked to complete different assignments, priming them to think about their perception of money and their behaviour related to money, for example by asking them to comment on statements printed on postcards, or think about how they talk about money by ticking off their preferred statement on a piece of paper, which expressed metaphors, personal metaphors and value-laden metaphors.
Later participants were asked to make collages about their perception and relationship to money and to banks within different ‘time-framings’: the present, the past and the future. These are generative assignments that include a narrative perspective and playing different roles. Finally, participants were asked to make a personal statement in case they wanted to change their perception and relationship to money. After approximately six weeks, when participants came back for a follow-up interview, the majority had changed their perception and behaviour in relation to money.

The following paragraphs are extracts from the creative session. This participant, ‘The-50-a-day-guy’, is a potential customer and a design student. He presents his collages, which represent different time frames: the present, the past and the future.
An example from the MoneyWorkshop, “The-50-a-day-guy”

Figure 2.: The-50-a-day-guy’s illustration of his current situation
(Bonde Sørensen, 2011)

Description of the present situation

A: the interviewer

B: the participant, “The-50-a-day-guy”

A: We are in the present.

B: That’s right. That guy there, that’s me. I have a lot of money that is flying out the window because I spend it on all sorts of things without realising it. And the other one over there, that’s my bank looking at me, keeping an eye on me. They are really quite nice, that’s why they are wearing rabbit slippers. I think my bank is quite nice although they keep an eye on me...

A: Although what?

B: Although they keep an eye on me.

A: OK.

B: Well, that’s good, otherwise ALL my money would disappear. And this
one is our relationship. Very square, professional, not very emotional. That is reflected in the way they are set up. That’s why I drew an ice cube. It’s blue and cold....

A: And what is the ‘Bang’ over there? What does that mean?

B: That means that they are keeping an eye on me, and when I spend too much money a warning shot goes off: ‘Bang’!

Figure 3: The-50-a-day-guy’s illustration of his money memories

(Bonde Sørensen, 2011)

Description of the past situation

A: the interviewer

B: the participant, “The-50-a-day-guy”

A: So, where are your memories about money?

B: They are here. This is my mother. She looks older than my mother. We did not have much money and I lived with her. We had what we had, and we spent what we had. That’s why I have this "Spend it, spend it, otherwise it is just sitting there." That was my mother’s philosophy, that’s how I grew up. But there were limits, of course. We did not spend indiscriminately, then we would have run out of money by the end of the month.
A: So she did actually control spending?

B: Yes, she did, but she never saved up for anything. We never travelled or anything. ...

Figure 4: The-50-a-day-guy’s illustration of his desired future situation

(Bonde Sørensen, 2011)

Description of the desired future situation

A: the interviewer

B: the participant, “The-50-a-day-guy”

A: So here you show the future.

B: That’s what I would like to be, a “Money-Man-JAZZ” – be more in charge. And that one is my financial advisor – he looks nice enough, well, still very professional. “Hey Sebastian, how’s it going? Let’s talk about your finances”. That’s what they are already doing. Our relationship should be nice and relaxed, we should sit like two teddy bears and chat – and the interior decor? Well it’s…it doesn’t really matter, it could be a little warmer... I would like the bank to change its way of thinking, the way I have shown here. I would like to present an idea to them and then they do the rest. That would be cool.

A: Great. Thank you.
Having made and reflected on different ‘time-framings’, participants are asked whether they wish to change their current perception of and relationship to money. If yes, they are urged to develop and create a personal statement.

**Developing a personal statement and goal**

Developing a personal statement is an assignment that follows up on the previous assignments and ‘time framings’. It is a generative assignment that offers participants the opportunity to define or redefine their role and personal goal.

In the first assignment, participants have already reflected upon ways in which they would like the future to be. In the second assignment, they might see patterns from the past, but now they are offered the possibility of taking action and becoming ‘the agent’, they wish to be – here referring to Kenneth Burke’s model for analysis, The Pentad, which is applied (Burke, 1945). There are other ways of changing behaviour, but in general people do not seem to reflect about their dominant values in relation to money, which is why there often is a need of becoming agents.

The MoneyWorkshop offers participants the possibility of making a personal statement, which can work as an instrument in order to act, gain control or spend their personal finances the way they wish, and in accordance with their ‘higher idea’ or reflected values. This can also be considered a personal mental strategy.

In the following paragraph ‘The-50-a-day-guy’ presents his personal statement.
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In the following paragraph ‘The-50-a-day-guy’ presents his personal statement.

Figure 5: The-50-a-day-guy’s personal statement.

(Bonde Sørensen, 2011)

A: the interviewer
B: the participant, “The-50-a-day-guy”

…AND this one contains both things – my future, that I want to change my view of money. I have created this slogan for myself, and I think it will work quite well. It says, "50-kroner a day keeps the bank away"… This is what this means. DAY 1, you take a 50-kroner note and put it there and so on and so forth.

A: OK, I see.

B: Then I am in control, you see. Because when you get money, say 3,000 a month, then you think: ‘Oh, I have 3,000, I have lots of money at the beginning of the month, and then I spend it, right? And then suddenly there’s very little money left. That’s why it is easier to divide it up into small packets and then I think, ‘OK, I have so and so much’.

A. Yes, I see.

B. I think it’s cool. And if I go shopping and spend, say 150 kroner, then I’ll still have enough for the next three days.

A. Super. Thanks a lot.
Approximately six weeks later, the participants are invited to participate in a follow-up workshop. They are not informed about the content of this workshop, but my main objective is to find out whether participants have changed their perception and behaviour in relation to money. Secondarily, I ask them related questions about their experiences, e.g. what made the greatest impression when they were doing the workshop etc.

The following is a description of ‘the post situation’ of ‘The-50-a-day-guy’. ‘The post situation’ is how participants describe their current situation approximately six weeks after participation in the MoneyWorkshop.

**Description of the post situation**

*A: the interviewer*

*B: the participant, “The-50-a-day-guy”*

A: Well, it’s been a couple of weeks since we last met. What did we do last time?

B: Last time? You gave us a box full of stuff, and we had to answer some questions by cutting and pasting something together that indicated what we wanted our bank to be like, how we view our bank as customers etc. and come up with a statement which characterised our relationship to money.

A: Yes, do you remember?

B: Yes

A: What was it?

B: I came up with the statement ‘50 kroner a day keeps the bank away’, I think.

A: That’s right. What do you remember? Or what made the greatest impression on you doing this collage?

B: I think it was how much my parents, you know, their relationship to money, has influenced my attitude... I had not thought about it before, but I guess I am much the same, that I’ll spend money as long as I have it.

A: Have you thought about it since?

B: Well, yes, a little, I thought that...

A: What?

B: It’s a little strange, or, I don’t know, I don’t think I could have changed it.
Well, maybe if things had been different, maybe I would have had more money, I don’t know...

A: OK, What made you think that if things had been different when you were growing up, things might be different for you today? Do you see new possibilities now, or what?

B: I am not sure. That’s the way I grew up and my attitude to money and to many other things – maybe. It’s a little deeper than just realizing, “Oh, I really should be saving up some more”.

A: But do you think you can change?

B: Yes, I do.

A: How?

B: By following my rule. Maybe. Set more limits, while still living according to the same principles, but don’t go through all the money at once.

A: I have to ask, that statement you came up with, have you thought about that?

B: Oh yes.

A: Yes? How?

B: Quite a lot, actually. Every day I make a lot of 50-kroners. And I spend 50 kroner a day. Plus or minus. That’s great.

A: So, it works?

B: I think so.

How the MoneyWorkshop works

The pioneer of the concept of generative tools, Elizabeth Sanders, argues: “We interpret what is happening around us with reference to our past experiences” (Sanders, 2001, 2), which can also be referred to as mental mappings and/or metaphors. More precisely, our beliefs and values shape the stories we add to situations.

By changing core beliefs and altering the stories we make up, we can slowly affect the deeper beliefs and values we hold about ourselves, the world around us, and our habitual ways of thinking and behaving. In Paton & Dorst’s understanding of framing, ‘reframing’ refers to “building a new frame for oneself, based on changing one’s view due to briefing interactions – although it is acknowledged that reframing can also occur as a result of reflection”, as Paton & Dorst explain (2010, 318). In line with Paton & Dorst, Schön argues that the designer “understands a situation by
trying to change it, and considers the resulting changes not as a defect of the experimental method but as the essence of its success" (Schön, 1983, 151).

In the current research framing is one way of seeing a situation; you can do several framings, finding new ways of seeing a situation. Reframing is changing your perception, which can include deeper self-reflection about unreflective, or maybe underlying and subconscious mental mappings and/or dominant metaphors, and seeing the situation anew, just like the participants in the MoneyWorkshop are urged to reframe their current money situations into preferred ones. They reframe themselves and/or their money situations by design and designing.

Graphics as cognitive tools and metaphors play a central role in this case.

**Graphics as cognitive tools**

Graphics can be considered cognitive tools, enhancing and extending our brains and mental imaging. In his book *Visual Thinking in Design* Colin Ware (2008) provides guidance for designers on how to present information, which aids the thinking process of their audience. He refers to new scientific knowledge from the discipline of human visual perception and transforms this into concrete ideas. Ware explains that we should understand perception as a dynamic process, implied by the term “Active vision.” He explains, “…we should think about graphic designs as cognitive tools, enhancing and extending our brains. Although we can to some extent form mental images in our heads, we do much better when those images are out in the world, on paper or computer…etc., which all help us to solve problems through the process of visual thinking”. Ware claims, “we are cognitive cyborgs in the Internet age in the sense that we rely heavily on cognitive tools to amplify our mental abilities” (Ware, 2008, ix). Neuroscientists support the claim that humans think in images and often in visual images rather than in words (Pinker, 1998, Damasio, 1999). Similarly Kazmierczak claims “visual representations as revealing mental models, rather than depicting what we see” (Kazmierczak, 2002,1).

The brain is most effective, Ware claims, when visual and language modalities are combined, and he continues his argument that the science of perception must take design into account because the designed world is changing people’s thinking patterns. He says: “Designed tools can change how people think” (2008,181). Mental images are internalized active processes; much as our inner dialogue is internalized, visual imagery is based on the internalized activities of seeing. Ware explains:
**The generative metaphor and construction of meaning**

Metaphors and in particular generative metaphors are paramount in this way of working with the collages. The reason why a metaphor is so powerful is because “it carries within itself a leap in logic in which the audience supplies the missing information” (Barnes, 2009, 423). Metaphors have the ability to disconnect language from the literal meaning. Metaphors rename things, but they do so selectively, which means they isolate certain characteristics and hide others through means of comparison. Similarly metaphors also hide their logic. They carry within them a hidden syllogism, and because humans are naturally logical, the verbal leap in logic is powerful.

In his theory about the generative metaphor Schön (1993) distinguishes between two different traditions associated with the notion of a metaphor. The first one “treats metaphors as central to the task of accounting for our perspectives on the world: how we think about things, make sense of reality, and set the problems we later try to solve”. In this sense “metaphor” refers both to a certain kind of product – a perspective or frame, a way of looking at things – and to a certain kind of process by which new perspectives on the world come into existence. In this tradition metaphorical expressions like “Man is a wolf” are significant only as symptoms of a particular kind of seeing, such as the “meta-pherien” or “carrying over” of the frames or perspectives from one domain of experience to another. This is the process Schön calls “generative metaphor” (Schön, 1993, 137).
Both meanings of metaphor are present in the collages. ‘The-50-a-day-guy’ uses several metaphors in his descriptions of his situations. He uses metaphors in order to describe his current situations: The picture illustrating his financial advisor shows a ‘traditional’ picture, but under the table, the “rabbit slippers” are visible, which to the participant means, “they are really nice”. The picture and description of “money flying out the window” is a clear example of the current money situation, a current frame and perspective on money, whereas “the Money-Man-Jazz” is a generative metaphor, meaning ‘being in control’. This generative metaphor moves the frame into a new one and acts as a reframing of the participant’s relationship to money (Schön, 1993). Likewise ‘The-50-a-day-guy’ explains his mother’s philosophy as “spend it, spend it, spend it, otherwise it is just sitting there”, like a kind of song or a saying, very spirited and visual.

This person uses both ‘generative metaphors’ and ‘cognitive scripts’. Cognitive scripts are “organized patterns of thought or behaviour” – a kind of thinking pattern. They have been characterised as ‘the tapes we play repeatedly in our heads’ – the things we tell ourselves over and over again, often without conscious awareness.

The generative metaphor helps the participant to ‘move’ from one situation to another, but it also permits us to construct meaning. According to Waks, generative metaphors permit us to ‘construct meaning’ in changing circumstances, providing continuity between our older experiences and our new situations by pointing at similarities or familiar resemblances between them. Here Waks also refers to Schön:

*We constantly find ourselves in disorienting situations, which must be conceptually ‘re-framed’, and until we discover through ‘frame-experiments’ a conceptual frame-work for the new situation we cannot even begin to determine what the relevant facts are, or what evaluative criteria apply. Metaphors permit us to bring ‘the familiar’ to bear in the unfamiliar in such a way as to yield new concepts while at the same time retaining as much as possible of the old* (Schön 1963 p. ix in Waks, 2001, 38)

Similarly Kazmierczak argues that ‘meaning-making strategies’, or the way we make sense of our experiences, are largely unconscious processes of mapping “sensory experience onto the inner world of cognition via metaphor.” The metaphoric nature of that process refers to the “understanding and experiencing one kind of thing in terms of another” (Lakoff & Johnson, 1980).
Thus the mechanisms of the MoneyWorkshop relate to the design activities ‘framing’, ‘reframing’ and ‘design as doing’ (for elaboration, please see Ph.D. thesis by Bonde Sørensen, 2011). There is, however, a significant factor, the personal statement, which contributes to the MoneyWorkshop becoming a language for self-dialogue and value clarification that can act as personal mental strategies in line with the ideas expressed in Thought Self-Leadership.

**Designing as language for self-dialogue and inner personal strategies**

The process of the MoneyWorkshop described above echoes Manz & Neck’s idea about Thought Self-Leadership. Self-Leadership was originally applied to organisations, developed with the purpose of improving employees’ performance. Self-leadership seeks to appeal to an individual’s inner motivation, as Neck & Houghton explain: “Self-leadership is a self-influence process through which people achieve the self-direction and self-motivation necessary to perform” (Neck & Houghton, 2006).

Thought Self-Leadership consists of specific behavioural and cognitive strategies designed “to positively influence personal effectiveness”. The underlying premise is that people can influence or control their own thoughts through the application of specific, cognitive strategies and ultimately impact individual and organisational performance (Manz and Neck, 1991).

Neck and Manz’s theory about Thought Self-Leadership addresses the effect of self-talk and mental imagery on performance and claims that people can influence or lead themselves “by controlling their own thought through the application of specific cognitive strategies which focus on self-verbalisations and mental imagery” (Neck & Manz, 1992, 696).

In their article “Thought Self-Leadership: The Influence of Self-Talk and Mental Imagery on Performance” Manz and Neck (1992) give an outline of how cognitive strategies can change dysfunctional beliefs and assumptions and thus improve thinking patterns and performance. Mental imagery and self-talk are key concepts in these strategies, the authors argue. Whenever we imagine ourselves performing an action in the absence of physical practice, we use ‘imagery’, the formation of mental images defined as “The mental invention or recreation of an experience which, in at least some respects, resembles the experience of actually perceiving an object or an event, either in conjunction with, or, in the
absence of, direct sensory stimulation” (Finke, 1989 in Neck and Manz, 1992, 684). Similarly Manz explains mental imagery as follows: “We can create and, in essence, symbolically experience imagined results of our behaviour before we actually perform” (Manz, 1992, 75). From these views, mental imagery refers to imagining a successful performance of the task before it is actually completed. Weick’s concept of ‘future perfect thinking’ provides a parallel argument when he states "...If an event is projected and thought of as already accomplished, it can be more easily analysed" (Weick, 1979, 199).

Self-talk and mental imagery have been examined and tested in various disciplines including sports psychology, counselling psychology, clinical psychology, communication, and education (Manz & Neck, 1992, 682) and refer to Seligman’s statement:

One of the most significant findings in psychology in the last twenty years is that individuals can choose the way they think (Seligman, 1991).

According to Godwin, Neck and Houghton (1999) TSL cognitive strategies include the self-management of:

- Beliefs and assumptions (the elimination or alteration of distorted individual beliefs that form the basis of dysfunctional thought processes)
- Self-dialogue (what we covertly tell ourselves)
- Mental imagery (the creation and, in essence, symbolic experience of imagined results of our behaviour before we actually perform) (Manz, 1992)

The figure below illustrates, in simple form, the relationship between what Manz calls ‘self-leadership components’ and goal performance. As outlined in the former paragraphs visuals stimulate and even reveal mental models (Kasmierczak), and metaphors can make participants reframe their situation (Schön). Doing design includes reflections with materials – all activities that have the capability to challenge and even change mental imagery, beliefs and assumptions. Thus, I consider the MoneyWorkshop to be an example of Thought-Self-Leadership stimulated by both the ambiguity of the visuals and the ‘making’ process. Hence this method of designing becomes a crucial component in Thought-Self-Leadership that stimulates new personal inner strategies.
In an extended illustration of the Thought-Self-Leadership model, the component ‘script’ is included, which I consider to be the personal statement that functions as a script, e.g. the statement: “50 kroner a day keeps the bank away” or other of the personal statements, some of them illustrated in figures, 5.9 – 5.12. ‘A behavioral script’ is “a sequence of expected behaviors for a given situation” - a notion from psychology used “to train new skills” (Barnett, D.W. et al).

The following statements are examples of workshop participants’ imaging and/or scripts that function as their mental strategies and make them change their perception and behaviour.

Figure 6: Simplistic rendering of the relationship between Thought-Self-Leadership components and individual goal performance

(Manz, 1999)
Figure 7: A personal statement saying: “Enjoy it wisely”
(Sørensen, 2011)

Figure 8: A personal statement saying: “Saving is travelling”
(Sørensen, 2011)

Figure 9: A personal statement saying: “Life has to be fun, money is energy”
(Sørensen, 2011)
Conclusion

In the current research I have proved the hypothesis that people actually can change their thinking patterns including ‘dysfunctional’ beliefs and assumptions by design and designing. In the “MoneyWorkshop” customers and potential customers are offered generative tools, designed to guide people through different time framings. In this process unconscious and dominant metaphors are often revealed, which makes it possible for people to ‘reframe’ themselves and their understanding here of money and private economy. The workings of the MoneyWorkshop is explained as “Thought-Self-Leadership” (Manz & Neck, 1992).

In this research the majority of the participants changed their perception and behaviour. They claimed they felt empowered as they were now acting in accordance with their values. Moreover they appreciated nobody was talking to them, but instead they were stimulated to talk to themselves and reflect upon deeper values.

In the bank employees are now researching the possibilities of implementing the MoneyWorkshop as a radical new service that offers customers and non-customers tools to help them to clarify their dominant values. Related to this new type of service is the idea about the “Self-Leading Customer” (Bonde Sørensen, 2011) – a new customer type who is interested in taking control and becoming ‘a conscious customer’.

In a broader perspective I can imagine designing as a language for self-dialogue and value clarification to be a new interesting field within design theory and practise:
In the field of participatory design and co-creation, a new need for value clarification prior to co-creation may arise. In the example from this research a young girl stated that she wanted to change to another bank and have a financial advisor who could help her set up a budget and help her gain control over her money; but after the workshop, she changed her behaviour and thus the wish she had stated in the workshop changed accordingly. Similarly, in e-trans, a user-driven innovation project about electric cars at Kolding School of Design, Denmark, users paradoxically claimed they did not want to drive electric cars! On the other hand they generally claimed they wanted more sustainable solutions. Again, an example of conflicting values in which value clarification might be an interesting activity prior to the co-creation of values.

As we become more and more aware of the possibility of changing our thinking patterns, an increasing interest and demand for methods and languages for personal reflection and value clarification is likely to arise.

References


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References


The paper includes passages from my Ph.D. thesis: “When designing emerges into strategies - in an organisation and in individuals” (Sørensen, 2011).
How can Feminism contribute to Design? A Framework for a feminist Design Research and Practice

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Abstract
In this paper, I present a framework for a feminist design research and practice. It aims to guide design decisions from information, ideation to evaluation from a feminist point of view. It tries to facilitate the selection of appropriate approaches and methods in each phase with regard to feminist demands and requirements to support a feminist design on a methodological, practical and evaluative level.

The framework integrates different gender theories whose perspectives correspond to main phases and focuses that can be regarded as mandatory for human centered design. The framework integrates the feminist standpoint theory, the theory of gender performativity and the concept of ‘doing gender’ expanded by the actor network theory.

The feminist standpoint theory guides the designers’ attention to marginalized target groups and experiences within the phase of information and ideation. Feminist poststructuralist theories like the theory of performativity focus on the cultural construction of gender in media and artifacts. Consequently, they have a natural link to the design domain and can guide designers’ decisions during the phase of inspiration and ideation. Design in this phase is challenged to invent new forms of gender representations and experiences to contribute to a socially fair and plural society. If a design concept or artifact meets feminist demands and requirements just becomes visible in interaction and use. The concept of ‘doing gender’ in combination with actor network theory focus on socio-material interactions and promise to provide benchmarks for a feminist design evaluation.

The application and empirical benefit of the framework is illustrated by a brief case study. The example shows how feminist perspectives can enhance the selection of methods, the critical reflection of designers’ gender assumptions and the evaluation of design results with regards to their failure or success in terms of changing gender roles and behavior to meet social equality.

Keywords: feminism, gender studies, feminist design research, feminist design, participatory design, human centered design
Introduction

Today, technology has left the professional arena and penetrates our everyday lives and culture. As a consequence, it determines more than ever the ways we think, we act and finally the ways we are. This development introduces the ‘third wave in HCI’ that is also denoted as ‘cultural turn’ (Bardzell, 2010:1304; Bødker, 2006; Maass, Rommes, Schirmer, Zorn, 2007:15). This development has led to new design spaces which puts non-rational as well as feminist issues on the design agenda (Bardzell, 2010; Bødker, 2006; Harrison, Tartar, Sengers, 2007) and makes technological development and design more human-centered than before, e.g. domestic technology deals with gender norms, gendered division of labor and space, ubiquitous computing addresses questions about space and (dis-)embodiment, affective computing, intimate interaction or experience design deal with issues of identity, gender performances, privacy, intimacy, generally with human relationships and emotions (Bardzell, 2010).

Feminism is a certain mindset that provides values and perspectives which become therefore more and more relevant for design of information and communication technology (ICT). It has also established alternative ways of doing science and research and contributed to a pluralization of methods and knowledges. Moreover, it appreciates values like subjectivity, partiality, perspectivity, situatedness, contextuality (Ernst, 1999; Haraway, 1988) which matches with basic considerations and aspects of design. For this reason, feminism supposes to provide fruitful perspectives, concepts and approaches for a contemporary design research and practice, but unfortunately they are still not systematically considered or integrated within the process of information, ideation and evaluation. Currently, gender is either considered in a stereotypical way or completely ignored which supposedly does not lead to neutral or genderless results, but probably in a continuing confirmation of the male norm.

I develop a framework which aims at guiding design decisions during the phase of information, ideation and evaluation from a feminist point of view. This framework is the core element of my PhD thesis which is still under theoretical as well as empirical refinement. In this paper, I present its current state of development. It bases on feminist theories or – better - gender concepts which are partly applied in the field of Human Computer Interaction (HCI) like the feminist standpoint theory or feminist deconstructivist concepts. The framework aims at a systematic integration of feminist perspectives and approaches into design on a methodological, practical as well as evaluative level.

First, I summarize the basic feminist research requirements and show its impact on different design fields. Then I describe the current state of my feminist framework and its theoretical references and finally illustrate which impact it has on design research, practice and evaluation by using one of our design research projects as case study. This brief analysis show how interpretations, methodological and practical decisions we made in our project might have been improved by following the framework’s critical views and recommendations.

Feminism and its Consequences for Science, Research and Design

Feminist Aims and Requirements

When we refer to feminism, then we address a certain mindset which influence the way we do science, research and design.
Feminism is a certain epistemology which generally criticizes power structures that functionalizes human properties for the justification of socio-material differences. In this respect, it explicitly focuses on socio-material inequity caused by gender or gender-related aspects (Ernst, 1999; Olesen, 2005:237-240). Gender is not the only criteria which is used to produce socio-material hierarchies, but in Western Societies it belongs to the most essential and powerful aspect of social, political and economical differences and power segregation.

On a political level, feminism aims at the abolishment of gender differences, social inequity, power hierarchies and oppression and strives for social change in favor for a democratic, gender equal, socially fair and plural society (Ernst, 1999:32).

On a scientific level, feminism tries to initiate social change by changing cultural meanings. It strives for producing new knowledge and new forms of representations which also require the development of new methods and techniques for gathering insights, for their analysis and documentation (Olesen, 2005:252 - 256). The aim is to show that knowledge is partial, historically and socially situated, culturally constructed and therefore changeable (Ernst, 1999; Haraway, 1988). Consequently, objectivity does not exist from a feminist point of view, because every knowledge is liable to certain interests and power structures.

There are essentially two ways, feminists try to initiate social change: They focus on social groups which are at the edge of society in order to produce new knowledges based on their perspectives, attitudes and experiences (Haraway, 1988:584). Looking from the edge, respectively marginalized point of views show that knowledge is contingent which means it is related to one’s social position in society which offers or restricts certain resources and options for participation. Another way to initiate social change is to modify or invent new categories of cultural meanings. For this reason, feminists aim at inventing and establishing new forms of gender representations. Consequently, they are naturally linked to the design domain.

Designers in the service of feminism are challenged to produce material as well as digital interfaces which provide alternative gender representations, experiences and behavior on the level of everyday culture. The interfaces can be regarded as materializations or visualizations of the designers’ more or less consciousness assumptions about usage scenarios, usage contexts and user groups. In the latter respect, they address the aspect of gender whose representation and mediation have crucial effects on ordinary images as well as behavioral patterns that might be associated with masculinity or femininity.

Although feminist theories and approaches differ in their focuses and ontological concepts of gender, they have some goals and requirements in common. I summarize the ones which I regard as mandatory for doing research and design in a feminist (Ernst 1999, 2002; Haraway, 1988; Olesen 2005; Weber 2007) and human centered way (Krippendorff, 2007; Björgvinsson, Ehn, Hillgren, 2010):

- Focus on marginalized and disadvantaged groups of society.
- Foreground the voices of them.
- Make power structures visible among the participants, side with the disadvantaged among them.
- Establish an emancipated relationship between all participants.
- Integrate the researched in the whole process of research (from research to analysis to documentation) and design (from information to ideation to evaluation)
• Question your own assumptions and prejudices, avoid stereotypical perspectives and presentations.
• Change the situation/position of the researched by offering them critical ways of thinking, new ways of expression as well as new opportunities of action.
• Support social justice, social integration and democratization by enhancing their acceptance, social integration, participation and their options for actions.

In summary, feminist research and design leads to participatory approaches which start from human experiences as informational and inspirational basis in the service of a democratic, social fair and plural society which can be regarded as the overall goal feminist researchers and designers want to contribute to.

Referring to Cockton’s (2011) categories of design choices and situations, feminist design research and practice is human-centered or belongs to what Cockton calls ‘Design for human outcome’ (Cockton, 2011:87). This design model is different from applied arts and engineering because of its particular considerations of the beneficiaries. Feminist design research and practice is also different from user- or customer-oriented models rooted in innovation research and management science, although they have similar names like e.g. ‘user-driven innovation’. They promote a democracy in terms of market competition and economic revenue as well as innovation in terms of marketable and economically successful products (Björngvinnsson et. al., 2010:42) which do not meet feminist values and goals.

From this point of view, we can see that the feminist mindset also guides the selection of design approaches and methods which have to be compatible with or at least tailorable to feminist values and goals.

**Feminist Perspectives in current Contexts of Design Research & Practice**

There are a number of examples from different design fields (e.g. technology or interaction design: Trauth, 2006; Bardzell, 2010; Cassell, 2002; Maass et al. 2007; Oudshoorn, Rommes, Stienstra, 2004; Rommes 2000; product design: Brandes, 2001; Brandes, Stich, 2004; Ehmberger, 2007; Kirkham 1996) where the gender dimension is considered or reflected from a certain feminist point. In the field of HCI e.g., socio-cultural or feminist researchers and developers are either inspired by phenomenology (Suchman 1987; Suchman, Jordan, 1989), feminist standpoint theory (Bardzell, 2010) or theories of deconstructivist feminism (Cassell 2002; Haraway 1988; Maass et. al. 2007; Weber, Bath 2007).

Nevertheless, gender does not belong to the mandatory focus or repertoire of designers. In design practice gender is either addressed in a stereotypical way or completely ignored. Technical devices for female customers are e.g. disguised as jewellery or designed in accordance to the scheme of childlike characteristics which make the devices look ‘cute’. In books about interface design (Apple Computer, Inc. 1992; McKey, 1999; Shneiderman, Plaisant, 2009), usability (Krug, 2006; Nielsen, Loranger, 2006) or interaction design (Cooper, Reimann, 2003; Preece, Rogers, Sharp, 2002) the user is still genderless which does not necessarily lead to neutral or genderless results. These phenomena certainly maintain traditional power structures, gender images and the male norm.

For these reasons, a design model is missing which systematically integrates feminist perspectives, theories and approaches into each phase of the process from design research to practice to evaluation.
Framework for a feminist Design Research & Practice

Research Questions

My theoretical framework tries to give answers to the following questions:

- How can feminist perspectives and approaches be systematically integrated in design research and practice?
- How can they guide design decisions in the phase of information, ideation and evaluation from a feminist point of view?
- Which existing design approaches correspond to feminist requirements and therefore can be tailored to or specified for a feminist design research and practice?
- What makes the result a feminist artifact?

Construction and theoretical Basis of the Framework

The following framework aims to guide designers’ decisions during the whole research and design process from an explicitly feminist point of view.

The tables below show its current state of development and construction. Table 1 displays the identified design phases and focuses I define as mandatory within a human centered design model according to Cockton (2011:87) In this respect, designers start from everyday experiences and demands of people as a source of information and inspiration for their artifacts whose effects can be observed and evaluated in interactions. These phase and focuses I defined in table 1 match with the ones of the feminist theories I briefly describe in table 2. These theories provide the basis for my framework. Table 3 illustrates the consequences each gender perspective has on design research and practice. It is the core element of the framework because here design research, practice and evaluation are specified in a feminist way. Table 4 shows exemplarily which design approaches are compatible with the respective feminist stance while each feminist perspective promotes different design results. Some examples of possible results are listed in the last row of table 4.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information &amp; Inspiration (Design Research)</td>
<td>Humans &amp; Experiences</td>
</tr>
<tr>
<td>Inspiration &amp; Ideation (Design Practice)</td>
<td>Artifacts &amp; Media</td>
</tr>
<tr>
<td>Evaluation &amp; Information (Design Evaluation, Research through Design)</td>
<td>Socio-material Interactions</td>
</tr>
</tbody>
</table>

Table 1

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Feminist or Gender Theory [Schools of Thought]</td>
<td>Experiences, everyday lives, life worlds of marginalized groups e.g. women et. al.</td>
<td>Artifacts and media representations referring to gender</td>
<td>Social Interaction, interaction between human and non-human actors (with regard to gender)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2

Table 3

Table 4
Table 2

<table>
<thead>
<tr>
<th>Feminist Design Approach</th>
<th>Feminist Standpoint Design</th>
<th>Feminist deconstructivist Design</th>
<th>Feminist interactionist Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus</td>
<td>Marginalized Humans &amp; Experiences</td>
<td>Artifacts, Objects, Media</td>
<td>Socio-material Interactions</td>
</tr>
<tr>
<td>Addressed Design Phases</td>
<td>Information + Inspiration (Design Research)</td>
<td>Inspiration &amp; Ideation (Design Practice)</td>
<td>Evaluation &amp; Information (Design Evaluation, Research through Design)</td>
</tr>
<tr>
<td>Design for use before use</td>
<td>@ project time</td>
<td>Design after design @ use time</td>
<td></td>
</tr>
<tr>
<td>Design in the Service of...</td>
<td>Social justice, participation, democracy, empowerment, self-responsibility</td>
<td>Critical reflection, provocation, irritation, deconstruction, transformation</td>
<td>&gt;Feminist evaluation according to the tasks, aims and properties defined in the left and middle column&lt;</td>
</tr>
<tr>
<td>Design Task/ Aims</td>
<td>Enhancement of democratic participation and life conditions, initiation of passionate controversies, offer of new perspectives and courses of actions, empowering, pluralist, diverse, controversial</td>
<td>Break with conventions and beliefs, invention of new realities and meanings, offer of new experiences, initiation of controversies</td>
<td></td>
</tr>
<tr>
<td>Design Properties, Effects</td>
<td>deconstructive, non-conformist, critical, provocative, controversial</td>
<td>deconstructive, non-conformist, critical, provocative, controversial</td>
<td></td>
</tr>
<tr>
<td>Design Trigger</td>
<td>human driven</td>
<td>design driven</td>
<td>human design driven</td>
</tr>
</tbody>
</table>

Table 3
How can Feminism contribute to Design?  
A Framework for a feminist Design Research and Practice

<table>
<thead>
<tr>
<th>Examples of corresponding Design Approaches and possible Design Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Corresponding Design Approaches (Examples)</strong></td>
</tr>
<tr>
<td>Participatory Design</td>
</tr>
<tr>
<td>Human Centered Design</td>
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<tr>
<td>Pluralist Design</td>
</tr>
<tr>
<td>Experience Design</td>
</tr>
<tr>
<td>Underdetermined Design</td>
</tr>
<tr>
<td><strong>Results (Examples)</strong></td>
</tr>
<tr>
<td>'Design 2.0', Open source movement, Do-it-Yourself, non-intentional design</td>
</tr>
</tbody>
</table>

Table 4

**Feminist Standpoint Theory**

The feminist standpoint theory (Ernst, 1999: 17; Haraway, 1988:578; Harding, 1993, 2003; Olesen 2005:243-246) focuses on experiences and everyday lives of marginalized groups, therefore it can particularly guide designers’ attention and decisions within the phase of design research to gather information and inspiration (table 3, left column).

This theory is inspired by Marxism which follows the main thesis that being – determined by one’s socio-material resources, respectively restrictions - determines one’s self-consciousness. From this point of view, gender is a condition as well as a result of one’s social-material experiences. That means gender decides next to other factors like education, ethnicity, age etc. about one’s position within a societal hierarchy. One’s societal position determines one’s socio-material resources or deprivations which then determine one’s socio-material experiences in return.

In the context of design, the feminist standpoint theory guides researchers’ and designers’ attention to social groups with are conventionally not in focus like e.g. women, ethnic groups, handicapped people, seniors etc. Their perspectives, experiences and demands certainly inspire new concepts and design solutions which generally increase social diversity. “Feminist standpoint theory’s privileging of alternative epistemologies simultaneously introduces a new domain of user research - the “marginal” user, which forces us to think through what that would mean - and implies a new set of strategies and methods for user research.” (Bardzell, 2010:1302).

Consequently design approaches like e.g. participatory design (Björgvinsson et.al., 2010; Ehn 2008; Sanders, 1999-2008; Sanders, Stappers 2008) or pluralist design (Bardzell 2010: 1306 ) are compatible with a feminist standpoint perspective as far as designers put marginalized groups into the centre of attention, cooperate with them on an emancipated basis and finally avoid the recreation of cultural stereotypes (table 4, left column).

**Poststructuralist or Deconstructivist Feminism**

Inspired by cultural studies poststructuralist, postmodern or deconstructivist feminist theories (Ernst, 1999; Haraway, 1988; Schößler, 2008: 85-104; Olesen, 2005:246-250) focus on the cultural construction of gender in media and artifacts like e.g. scientific texts, literature, art, movie, design etc. In this respect, they are closely linked to the design domain.

Poststructuralist feminists claim that there is no causal relationship between gender and sex, because gender is not determined by nature, but by cultural norms and representations which are potentially changeable. Gender just pretends to have a ‘substance’ because of the repetition of gender norms which guide people’s body language, the way they behave, act and dress. Judith Butler is one of the most popular...
representatives of this feminist school of thought. She created a theory of gender performativity (Butler 1990; Schößler, 2008:95-104) which base on the following assumptions (Butler 1990:8-9):

“(...)gender is neither the causal result of sex nor as seemingly fixed as sex. The unity of the subject is thus already potentially contested by the distinction that permits of gender as a multiple interpretation of sex. If gender is the cultural meanings that the sexed body assumes, then a gender cannot be said to follow from a sex in any one way. (...)When the constructed status of gender is theorized as radically independent of sex, gender itself becomes a free-floating artifice, with the consequence that man and masculine might just as easily signify a female body as a male one, and woman and feminine as a male body as easily as a female one.”

Poststructuralist feminists aim at overcoming traditional power structures and supporting a pluralistic society by inventing and establishing new categories of meaning and ways of representation besides gender stereotypes. Design in the service of deconstructivist feminism is especially challenged in the phase of ideation to provide concepts and artifacts for new gender experiences to contribute to gender and social diversity. Following Butlers request for gender confusion, design in this feminist tradition is obviously related to critical design or design noir (Dunne 2000; Dunne, Raby, 2001). It may produce ‘provotypes’ (Mogensen, 1991) which provide irritations and poses question about the nature of gender. In this respect, design would fulfill what Krippendorff (2007:74) has defined as main design task:

“In effect, designers need to question the prevailing ontological beliefs. Being afraid of undermining common convictions makes for timid designs. (...) Proposing what everyone knows or already uses is not design at all.”

The current visualization of my framework (table 3) recommends using the feminist standpoint theory in combination with the feminist deconstructivist perspective. Alternatively, they can be used as stand-alone approaches which lead to different design approaches and results (table 4).

Feminist standpoint design is principally an open form of design that takes advantage of the natural diversity of human beings. In this context, the designer is just a facilitator for social participation and controversies. They can be initiated during the phase of research using a participatory design approach and/or by the designed artifact that provides spaces, possibilities or tools for co-creation. Examples for feminist standpoint design may be social software applications, the open source movement or the Do-it-Yourself movement which require people’s contributions, exchanges and active participation to survive.

In contrast to that, feminist deconstructivist design is more instructive or message-oriented. In this context, designers want to draw attention to something. Consequently, they have to implement a certain message into an artifact that pose critical questions or make certain cultural phenomenon visible which are hopefully understood or discovered by the users.

Consequently, the framework urges the designers to think and consciously decide about their role within the process of design. It also reveals a general dilemma of a feminist design research and practice which is mentioned by Sengers et. al (2005:50-51) with regard to the development of their concept of reflective design: On the one hand it requires the involvement of the researched during the whole process, on the other hand it maybe sometimes necessary or more effective to actively promote feminist goals and
values through design in order to avoid the reproduction of the status quo and to accelerate social transformation.

**Ethnomethodology and Interactionism**

Which effect a certain design concept or artifact has and if this effect meets feminist requirements and goals finally becomes visible in interaction or in use. For this reason I refer to the concept of ‘doing gender’ and the actor network theory which promise to provide suitable benchmarks for evaluating design from a feminist point of view (table 3).

The concept of ‘doing gender’ (Kessler, McKena, 1985; West, Zimmerman, 1991) which originate from ethnomethodology and interactionism (Garfinkel, 1967; Goffman, 2001) focuses on how gender is constructed within social interaction. Objects are also mentioned as components of social interactions, but not explicitly examined. For this reason, there may be a need to expand it by aspects of the actor network theory which focuses on interactions between humans and non-humans which I have not theoretically explored yet. Consequently, the third column is actually the weakest and less theoretically underpinned area in my framework.

The ethnomethodological concept is very similar to the deconstructivist gender model. Both base on the same ontology that regards gender as a cultural performance or ‘a socially scripted dramatization of the culture’s idealization of feminine and masculine natures’ (West, Zimmerman, 1991:17). They also have an overlap in focus regarding gender representations like body language, behavior and style that are also crucial reference points in social interactions. In this respect, West and Zimmerman differentiate between ‘identificatory displays’ referring to aspects of the outer appearance and ‘gender displays’ referring to norms of gendered behavior and actions (West, Zimmerman, 1991:19). But there are differences in the concepts with regard to the changeability of gender: While Butler (1990:9) regards gender as a ‘free floating artifice’ which can culturally performed, West and Zimmerman (1991:23-24) claim “if the sex category is omnirelevant’ (…) gender is unavoidable”. This thesis is contrasted by the concept of ‘undoing gender’ (Hirschauer, 2001) which has the same theoretical origin.

Regardless of these similarities and differences, the interactionist perspective may not provide another feminist point of view but it provides control, if the requirements and goals of the preliminary perspectives are achieved.

For this reason, I’m convinced that theories which focus on gender from the perspective of socio-material interactions complete the framework. They promise to link ‘design for use before use’ with ‘design after design at use time’ (Ehn, 2008: 93-95) that maybe anticipated due to user tests or better becomes accessible in field observations of real world environments (table 3). The evaluation standards are provided by the feminist perspectives of the standpoint theory and the theory of gender performativity and can be controlled within the third column which represents the area where research through design (Findeli, 2008, 2010; Stappers, 2009) takes place. There the artifact plays a double role: As object or product for use and as ‘epistemological carrier’ that provides new knowledges about its appropriateness for its purposes of use as well as about its feminist appropriateness which is not necessarily the same. What works well from a user’s perspective may not satisfy feminist demands as exemplified in the following case study.

**Application of the Framework and Conclusion**

In the following, I exemplarily apply the framework to one of our design research projects in order to test its potential to systematically guide design decisions in a feminist way. This retrospective analysis provides interesting insights which show that the framework
can indeed enhance the feminist quality in the phase of information, ideation and evaluation.

**Case Study: Female Inspired ICT Services**

In 2009 we initiate a participatory design research project which aims at the development of new applications and services of information and communication technology (ICT) that explicitly considered women’s demands and desires (Buchmüller, Joost, Bessing, Stein, 2011). For this purpose, we invited 55 women and 18 men which differed in age, education, cultural background and life style (living as a single, in a relationship or in a family). The women were clustered into age groups according to certain life phases, while the male group was a cross-generational group that served as a kind reference group to explore the origins of differences or similarities which might result from gender or from other mentioned factors.

Every group passed through the same research process which consisted of a two-weeks self-observation phase based on cultural probes and a two-days ideation workshop. The core task within the workshop was that each participant created a prototype which materialized her/ his vision of future communication. We additionally used a mixture of social scientific methods likefocus group discussions and role play to get in close dialogue with the groups as well as questionnaires to ask about the participants’ communication habits and technical equipment. That way, we got a lot of detailed and personal insights about the role of ICT in their lives, their likes, dislikes and emotions towards ICT as well as their desires and future visions. We actively involved the participants into the research phase, but did not integrate them during analysis and ideation as required by feminist research.

**Feminist Analysis and Conclusion**

In accordance to a feminist standpoint perspective, we put a marginalized group in the center of attention: Women’s experiences are still neglected in the male dominated technological research and development (BMBF 2010:400,401; European Commission 2006). We also considered the aspect of diversity within the sample and within the mixture of methods we used. Moreover, we decided for a participatory design approach in order to cooperate with our participants on an emancipated basis which also fulfils a basic feminist research requirement.

But in this respect, the feminist standpoint perspective would have enhanced our methodological selection. While we followed the participatory design approach developed by Liz Sanders (Sanders, 1999-2008; Sanders, Stappers, 2008), we should have preferred Pelle Ehn’s approach. He regards participatory design not as an approach to enhance communication between different stakeholders to provide empathy as a basis for satisfying user needs by appropriate and marketable products. Ehn and his research group regard participatory design as a political intervention in the service of social change towards democracy and empowerment of marginalized groups (Björgvinsson e. al., 2010; Ehn, 2008). Consequently, their version of participatory design is completely compatible with feminist requirements and goals. Using this approach might have even led to different design concepts and solutions.

In retrospection, some of our design results seem to be too conformist. One example: We developed an ICT service called ‘Family Wheel’. This service was developed based on insights we gathered from our female participants in the so called rush-hour of life (women between 29 - 45 years old). As we know from research, they had to deal with a lot of organizational duties that especially increased when little children or parents in need for care were involved. Even if partners were more involved in household chores,
supportive grandparents, friends or neighbors were around, it was mostly the mothers who organized the family and household duties next to their own affairs. On the one hand they appreciated ICT for being always available, especially in case of unforeseen events and the need for spontaneous organization concerning family and friends. On the other hand they complained that there was still a lack of suitable ICT services to provide organizational relief or to make organizational distribution more efficient. However, no one of our female participants complained explicitly about a gender unfair distribution of private or family duties.

The ‘Family Wheel’ is a tool for distributing spontaneous daily tasks among a local group of people. It aims at providing organizational relief, strengthening local bonds and supporting a better distribution of tasks among the members of one’s social network. Within our user tests, the female as well as male test persons appreciated the service very much. Unfortunately, we overlooked some essential phenomena: The mothers within the test group tended to use it as a ‘mothers’ wheel’:

“Such a service would be so helpful for exactly the typical Kindergarten pick up situation (...). Many women I know are both mothers and freelancers, they would surely find this very useful.” (Female, 32 years). “A friend of mine’s always been the social center, organizing everything, even before she became a mother. I’m not a ‘center’ myself but I’m part of her planning, so I often get calls if I can babysit or act as key service. Therefore I’d find it practical to log in or out of her family Wheel when I’m available.” (Female, 29 years.).

Other female test users regarded the service as a welcomed tool to ask for help or reject their help in an nonpersonal way which seemed to be a problem in direct or personal communication – an issues that was not mentioned by any of our male participants.

“I’m rather a part of other mothers’ wheels. I often get called to take care of their children, which I don’t mind doing. However, sometimes would be nice to ‘deactivate’ myself from their reach.” (Female, 36 years).

The Family Wheel may facilitate women’s daily organization but unfortunately not in a feminist sense. It seems to provide a substitute for a fair division of labor between parents and a solution for women’s fear to articulate their demands which maintain traditional gender roles and female behavioral patterns. Referring to family issues from a feminist standpoint perspective, we would have also drawn attention to fathers as a marginalized group with the aim to make them participate more actively in family duties. From a deconstructivist point of view, it was essentialist and conservative to assume that our female participants doubtlessly felt like women, our male participants doubtlessly felt like man and that couples or parents ‘naturally’ consisted of opposite heterosexual subjects – gender images we did not question during our research and design process. These pitfalls might have been more easily discovered or even avoided by referring to the feminist perspectives and goals provided by the framework.

This short analysis shows that the framework could have enhanced the feminist quality of our research approach, the evaluation and refinement our design concepts which should become more ‘critical’ or ‘noir’ as recommended from a feminist deconstructivist point of view.

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How can Feminism contribute to Design?
A Framework for a feminist Design Research and Practice


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Design for NOTES: A new vision of a flexible endoscopic platform

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Abstract

In the continuous quest for better surgical treatment, reduction of physical trauma, faster postoperative recovery and better cosmetic results, technological progress and the evolution of several diagnostic and therapeutic techniques have led to the rapid development of mini-invasive techniques that use the human body’s natural orifices and thus completely eliminate all types of incision. One of these techniques is NOTES (Natural Orifice Transluminal Endoscopic Surgery), a surgical technique that accesses the peritoneal cavity and thorax through natural orifices without generating any scars.

The purpose of this research is to develop innovative technological tools for mini-invasive surgery through an interdisciplinary and user-involved approach. The goal is to improve interaction with the surgical tool, physically as well as cognitively. This allows the development of solutions that meet the needs of the surgeon and the medical team, and ultimately is for the benefit of patients and the evolution of medical science. This paper will introduce the reader to the challenges in undertaking a user-centered design approach for design of medical equipment. Based on the considerations above, this project was decided to undertake an innovative research exploring the surgery world in terms of design to find effective and innovative design solutions through multidisciplinary collaboration between the Laboratory PUL (Product Usability Lab), Biodesign Lab of the INDACO Department, Politecnico di Milano and the AIM Academy (Advanced International Mini-invasive Surgery) of Niguarda Hospital.

The research objective is to provide new scenarios and guidelines for the design of flexible surgical platforms. The overall approach was a user-centred and user-involved design process with use of structured methodologies stemming from the design discipline.

Keywords: NOTES, mini-invasive surgery, user-centered design, ergonomics
Introduction

Over the last decades, surgery has evolved towards becoming less and less invasive. Laparoscopy implied a major paradigm shift in the 1980’s and 1990’s and progress within several diagnostic and therapeutic techniques have led to the rapid development of mini-invasive techniques that use the human body’s natural orifices and completely eliminate all types of incision. One of these techniques is Natural Orifice Transluminal Endoscopic Surgery (NOTES), a surgical technique that accesses the peritoneal cavity and thorax through natural orifices without generating any scars. Thus, leading to enhanced well-being, faster recovery and less postoperative complications for the patients.

The technologic development of surgical techniques does not only affect the patients; it has also a great impact on the work condition of the surgeons managing the interventions. Technologically advanced surgical equipment managing complicated high precision interventions implies a large workload for the surgeon, both cognitive and physical. Long-lasting interventions where the operating surgeon cannot take a break further increase the load and put demands on the design of the surgical environment in general and on the instruments in particular.

However, despite technological leaps to the benefit of the patients’ health and well-being, the ergonomics and usability of surgical instruments have not evolved notably over the years that mini-invasive techniques have been present. It is though unhesitatingly so that not only the surgical instruments’ interface towards the patient is of significance for the prosperity of the intervention; also the interface between surgeon, instrument and surrounding context may influence performance of the surgeon in the short run - and certainly will so in the long run.

One of the major problems that limit the ability to operate endoscopically only, without the need of additional abdominal incisions, is the lack of ergonomically designed tools, facilitating the precision demanding tasks of the surgeon. The NOTES technique is still in need of dedicated tools and technology to improve, in order to broaden the range of interventions possible. The instrumentation in use today, is rigid and does not allow the same flexibility as in traditional and endoscopic surgery, limiting the amount of operations possible to perform. The use of specifically designed, flexible surgical equipment is fundamental in mini-invasive surgery, increasing the range of possible motions and enabling the use of these techniques even in tight spaces, where the human hand cannot reach. In this context, one may speak of surgical flexible platforms, a new generation of tools that stem from an evolution of the endoscope into a new system that allows the same potential and versatility as traditional surgical techniques.

In the last ten years interest in science projects and the study of specific solutions regarding the human being has accentuated and increased the cooperation between different disciplines, such as, bioengineering and medicine. For industrial design engineering, just like for other disciplines, there has been a noticeable change in the approach towards the human being and its body. In this scientific and cultural context, biodesign therefore concentrates on the human body as a physio-biological unicum for its oriented analysis, technology and applications.

This study aimed to answer to the question: How can theories and methods from the user-centered design field help improving surgeons’ performance by minimizing cognitive and physical workload during mini-invasive surgery in general, and NOTES technique in particular?
This kind of project needs an interdisciplinary approach typical of Biodesign discipline, a nucleus of competencies in the areas of design, ergonomics, medicine and engineering.

**Background**

Ergonomics as a science has, since its early findings that performance of industrial workers decreased when working under non-ergonomic circumstances (Bubb, Feussner, Vereczki, 2003) implied the development of ergonomic tools and equipment as well as work procedures that minimize fatigue and stress related injuries. Moreover has it contributed with knowledge of the natural body postures as preferable when under physical load, as well as the importance of avoiding static postures and repetitive movements during prolonged time.

However, along with the expansion of ergonomic knowledge and ergonomically correct equipment, it has been noted that the amount of stress related injuries do not decrease with the same rate. One explanation may be that under the pressure of mental workload such as stress, demanding tasks or overwhelming information input, we are prone to taking shortcuts and using our body and tools in ergonomically incorrect ways (Bligård and Osvalder, 2010). Thus, cognitive and physical factors must be studied together with the aim to develop products with good usability as well as characteristics that enable good physical ergonomics.

Bligård and Osvalder (2010) suggest a more holistic approach for such studies, taking contextual factors as well as user characteristics, tasks to be performed and human-machine interaction into account. This view is well inline with the ISO definition of usability, defining the term as “...the effectiveness, efficiency and satisfaction with which specified users achieve specified goals in particular environments” (ISO DIS 9241-11). Hence, usability is not a property of an isolated product but a characteristic that occur in a use system during the interaction between user, product and context with the aim to reach a certain goal.

The need of such a holistic approach when studying surgeon’s work conditions in mini-invasive surgery is supported by the findings of several studies on the same subject. In a survey answered by 100 surgeons, 58% reported pain in neck and lower back during interventions lasting for over 4 hours; however only 3% applied ergonomic guidelines for surgery (Dalla Toffola, et al. 2009). A combination of high levels of physical and mental stress of surgeons during laparoscopic surgery is reported by Vereczki, Bubb and Freussner (2003) with the occurrence of the so-called surgical fatigue syndrome for operations lasting over 4 hours. The syndrome is characterized by “mental exhaustion, reduced dexterity and a reduced capacity of good judgments”. In an observational research study of medical staff during 12 endoscopic operations, both physical and cognitive problems were reported caused by factors concerning design of instruments used, contextual factors such as light conditions and lack of space and complexity of tasks to be performed (Goossens, et al. 2003).

Regarding physical ergonomics of mini-invasive surgery, several studies have been made on laparoscopy, but less on newer techniques including NOTES. The studies of laparoscopy show that surgeons have a more straight, but at the same time more static posture compared to open surgery (Abu-Ghaida, et al. 1996). The static loads lead to discomfort and pain in neck, shoulders and back, in one study reported by as many as 80% of the approached surgeons (Goossens, et al. 2006).
Method

A field study was carried out in Niguarda Ca’Granda Hospital in Milan, Italy, in cooperation with AIMS Acadamy, Product Usability Lab and Bio Design Department of The Politecnico di Milano. The study was divided in two parts; the first part keeping a broad perspective on the use system around mini-invasive surgery, and the second part with a targeted focus on usability and ergonomics of the endoscope.

Part 1: Observational Research

Observations were made in order to get a broad and basic understanding of the work conditions for surgeons during intervention in the operating theatre. Eight surgeons training laparoscopic and endoscopic surgery in vivo, were studied by direct non-participant observations during four sessions in total. The operating theatre as context was studied during observations of a preparation session before surgery. The documentation method was mainly video acquisitions, but also photography and field notes.

The analysis of the gathered data mapped the use system and its ongoing interactions and aimed to identify contextual factors influencing the performance. The surgeon’s interaction with the context, i.e. surgical equipment, assisting physicians and patient was mapped and an Hierarchical Task Analysis (HTA) (Stanton, 2006) was made in order to map the task of performing an endoscopic gastrostomy, a surgical opening into the stomach typically used for enteral feeding.

Part 2: Usability Test

A usability test was arranged in order to investigate ergonomic and usability aspects of NOTES surgery. The test included six participants: two novice users, two with medium experience and two highly experienced endoscope users. A various expertise of the participants was desired in order to investigate how experience influence posture and load.

The usability test was set in an operating theatre (see figure 1) with actual equipment and assistance including endoscope, endoscopic instruments and monitors (all equipment from Karl Storz) as well as a trained nurse operating the endoscopic instruments. The test contained three tasks of increasing difficulty:

- **Manoeuvrability**: *touching points on 2D surface*. The participants were presented to a closed box with the numbers 1-12 written on the inner backside. By inserting the endoscope tube through a hole on the front side, they were to touch numbers in a given sequence. Each number was fenced with a five centimetre deep and seven centimetre wide tube to force manoeuvring perpendicular to, as well as parallel with the back surface. The closed box aimed to simulate a real surgery setting, where the participant needed to use the monitor for visual feedback of manoeuvring during the task.

- **Operativity**: *moving objects in 3D*. In an identical box setting as above, the participants were given the task to move a number of rubber rings between cones located on the bottom surface of the box. The rings were to be moved in a given sequence and were grabbed by an endoscopic grasper operated by the assisting nurse. In this task, the participants capability of manoeuvring the endoscope, maintaining position during operation and coordinating actions with the nurse, was tested.
- **Gastrostomy: simulated surgery.** The participants were asked to perform a gastrostomy simulated on a pig stomach. The task included inserting the endoscope tube through the orifice of the stomach, manoeuvring to the site of the gastrostomy and cutting and opening in the wall of the stomach. The whole procedure was assisted by the nurse operating the endoscopic instruments.

In order to estimate the usability measures effectiveness and efficiency of the endoscope, the performance of each participant was in the first two tasks measured in time and number of errors, while in the final task measured in time and quality of the cut.

A detailed analysis of the usability of each action of a surgery was performed on the third task of the use test. The analysis was based on the HTA from the first part of the analysis and each action was graded on a scale from one to five, where one meant no usability problem and five meant serious usability problem, immediate intervention required.

Besides analysing usability aspects of the use test, the interaction between user, endoscope and context was investigated in an ergonomic point of view. For the ergonomic analysis three different ergonomic evaluation methods were used. Ovako Working Posture Analysis System (OWAS) (Corlett and Bishop, 1976) was used to estimate the risk of body disorders due to postures used when performing endoscopic interventions. It gives a quick but rough estimate of the risk for injuries related to a prolonged work in a certain posture. By rating the posture of back, arms and legs as well as the load carried, a value between one and seventeen classified into one of four action levels, is gained. Rapid Upper Limb Assessment (RULA) (McAtamney and Corlett, 1993) focuses on arms and shoulders and was used in order to target the investigation on the most critical body parts during use of endoscope. In RULA, the body is divided and evaluated in two parts: upper limbs and trunk/head/legs, hence giving arm- and shoulder postures extra weight. Besides rating the posture, extra points are added if a body part is twisted, abducted or static. A final score, given on a scale between one and seven is, like in OWAS, classified into one of four action levels.
Ultimately a PLIBEL (Kemmlert, 1995) analysis was made in order to map physical ergonomics with social and contextual factors. Throughout the analysis, the researcher relates the contextual factors with how they may contribute to ergonomic injuries.

Based on the knowledge gained by the study, requirements and guidelines were stated as synthesis and brief for future design of flexible endoscopic platforms.

Results and Discussion

Part 1: Observational Research

The initial study provided the researchers with a basic and essential understanding of the use system surrounding mini-invasive surgery; including patient, medical staff, surgical equipment, the operating theatre as physical context as well as duration of tasks and procedures. Special attention was drawn to how the surgeon interacted with staff members and artifacts during the operation procedure.

![Main interactions during operation including patient, medical staff, surgical equipment and the operating theatre](image)

**Figure 2** Main interactions during operation including patient, medical staff, surgical equipment and the operating theatre

In the use system of endoscopic surgery, the surgeon is the centre and the junction point; as good as all information is either an input to, or and output from the surgeon and (s)he interacts with several information sources, see figure 2. The communication occurs as visual, auditory and verbal information exchange as well as tactile interaction with instruments and regulators.
Visual information is obtained mainly from monitors, showing e.g. the video acquisition of the endoscopic camera and vital parameters of the patient. Monitors are situated at several locations in the operating theatre, distracting the surgeons attention among them. Note that the visual interaction with the surgical tasks is not direct by looking at the patient as in open surgery, but mediated via the endoscopic camera and attached monitor.

Auditive and verbal communication occurs as signals from equipment and dialogue between staff members. Essential is the dialogue between surgeon and the assisting nurse, operating the endoscopic instruments.

Among the tactile interaction, the knobs on the endoscope handle maneuvering the shaft and the two foot pedals activating the endoscopic instruments are central. However, the tactile interaction is somewhat distort compared to traditional surgery, as movements required to operate the tool as well as the tactile feedback of the same, is not direct, but a representation of the physical reality only. Compare with steering a motorcycle with your hands, arms and weight, feeling the friction of the street when turning, in contrast to a motorcycle game controlled by your fingers pressing the arrow keys on a computer keyboard.

**Part 2: Use Test**

**Usability test results**

The performance of the participants in the usability test was measured in time and errors for the two first tasks and in time and quality of the scar in the third task. The quality of the cut was determined by the deviation in millimeters from the desired width (15 mm) and in the accuracy of welding the edges. see table 1,2 and 3. The test results tended to diverse more between the experienced and novice users in the third and more complex task, compared to the two earlier where all participants managed the tasks in a timely manner and with relatively few errors.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Time</th>
<th>Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Novice</td>
<td>1'28&quot;</td>
<td>1</td>
</tr>
<tr>
<td>2 Novice</td>
<td>3'09&quot;</td>
<td>3</td>
</tr>
<tr>
<td>3 Medium experienced</td>
<td>1'09&quot;</td>
<td>1</td>
</tr>
<tr>
<td>4 Medium experienced</td>
<td>1'41&quot;</td>
<td>0</td>
</tr>
<tr>
<td>5 Expert</td>
<td>1'23&quot;</td>
<td>1</td>
</tr>
<tr>
<td>6 Expert</td>
<td>2'21&quot;</td>
<td>1</td>
</tr>
</tbody>
</table>

**Table 1**

Usability test task 1: Maneuverability

<table>
<thead>
<tr>
<th>Participant</th>
<th>Time</th>
<th>Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Novice</td>
<td>2'33&quot;</td>
<td>2</td>
</tr>
<tr>
<td>2 Novice</td>
<td>1'57&quot;</td>
<td>0</td>
</tr>
<tr>
<td>3 Medium experienced</td>
<td>2'40&quot;</td>
<td>3</td>
</tr>
<tr>
<td>4 Medium experienced</td>
<td>4'47&quot;</td>
<td>4</td>
</tr>
<tr>
<td>5 Expert</td>
<td>1'38&quot;</td>
<td>0</td>
</tr>
<tr>
<td>6 Expert</td>
<td>2'21&quot;</td>
<td>1</td>
</tr>
</tbody>
</table>
A New Vision of a Flexible Endoscopic Platform

Visual information is obtained mainly from monitors, showing e.g. the video acquisition of the endoscopic camera and vital parameters of the patient. Monitors are situated at several locations in the operating theatre, distracting the surgeons' attention among them. Note that the visual interaction with the surgical tasks is not direct by looking at the patient as in open surgery, but mediated via the endoscopic camera and attached monitor.

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**Table 2**
Usability test task 2: Operativity

<table>
<thead>
<tr>
<th>Participant</th>
<th>Time</th>
<th>Quality of scar</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Novice</td>
<td>10'44&quot;</td>
<td>+5 mm, welding failed, burnt tissue</td>
</tr>
<tr>
<td>2 Novice</td>
<td>11'05&quot;</td>
<td>+5 mm, welding failed, burnt tissue</td>
</tr>
<tr>
<td>3 Medium experienced</td>
<td>6'58&quot;</td>
<td>+2 mm, edge partly welded</td>
</tr>
<tr>
<td>4 Medium experienced</td>
<td>8'37&quot;</td>
<td>+4 mm, edge welded, some burnt tissue</td>
</tr>
<tr>
<td>5 Expert</td>
<td>5'33&quot;</td>
<td>±0 mm, straight welded edge</td>
</tr>
<tr>
<td>6 Expert</td>
<td>failed</td>
<td></td>
</tr>
</tbody>
</table>

**Table 3**
Usability test task 3: Gastrostomy

HTA
An HTA for a gastrostomy, colour coded with five grades where red indicated operations with most severe usability issues. In the gastrostomy task, operations with red grading all included interaction between surgeon and the assisting nurse, operating the endoscopic instruments. These operations turned out particularly difficult due to the fact that complex and precision requiring tasks required coordination between two users.

Ergonomic Analysis
Below follow summarized results from the ergonomic evaluation methods used: OWAS, RULA and PLIBEL.

The OWAS analysis resulted in a posture and load related rate of five, on the scale from one to seventeen, see table 4. The rate belongs to action level two out of five (where five indicates the highest ergonomic risks): Posture slightly incorrect. Corrective measures in the near future. The main finding of the OWAS analysis was ergonomic stress caused by unbalanced weight on the feet, since the surgeon repeatedly operates one of two foot pedals and constantly needs to switch pedal.

<table>
<thead>
<tr>
<th>Body part</th>
<th>Position</th>
<th>score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Back</td>
<td>straight</td>
<td>1</td>
</tr>
<tr>
<td>Arms</td>
<td>both arms below shoulder height</td>
<td>1</td>
</tr>
<tr>
<td>Legs</td>
<td>Weight on one leg when using foot pedals</td>
<td>2</td>
</tr>
<tr>
<td>Load</td>
<td>1,3 kg</td>
<td>1</td>
</tr>
</tbody>
</table>

**Table 4**
OWAS score
In the RULA analysis, one score was generated for each of the body parts, see table 5. The ultimate score generated according to the RULA methodology was six, on a scale from one to seven, corresponding to the third of the four action levels (where the fourth indicates the highest ergonomic risks): *Investigations and changes required soon.* Notable are the high scores for wrists, arms and neck. The wrist gained a high score due to repetitive movements when turning the knobs that maneuver the flexible shaft. The arms are kept in a static position when holding the endoscope and pauses are seldom taken due to the fact that the instrument is entirely handheld. The high neck score originated mainly from the fact that the position of the main monitor forced the surgeon to twist and bend the neck to see the video acquisition of the endoscopic camera.

<table>
<thead>
<tr>
<th>Body part</th>
<th>Position</th>
<th>RULA score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper arm</td>
<td>45°-90° lifted</td>
<td>3</td>
</tr>
<tr>
<td>Forearm</td>
<td>&gt;90° lifted, out to side of body</td>
<td>3</td>
</tr>
<tr>
<td>Wrist</td>
<td>0°-15° bended upward, bent from midline, twisted</td>
<td>5</td>
</tr>
<tr>
<td>Neck</td>
<td>10°-20° bended forward, twisted</td>
<td>3</td>
</tr>
<tr>
<td>Trunk</td>
<td>0°-10° bended backward, twisted</td>
<td>2</td>
</tr>
<tr>
<td>Legs</td>
<td>Well supported</td>
<td>1</td>
</tr>
<tr>
<td>Muscle use</td>
<td>Mainly static</td>
<td>1</td>
</tr>
<tr>
<td>Force and load</td>
<td>1,3 kg</td>
<td>0</td>
</tr>
</tbody>
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**Table 5**

RULA score

The PLIBEL analysis generated a number of contextual factors with impact on the use situation. They are all stated in table 6 below, with the affected body parts marked up.

<table>
<thead>
<tr>
<th>Contextual factor</th>
<th>Neck, shoulders, upper back</th>
<th>Elbows, forearms, hands</th>
<th>Feet</th>
<th>Knees, hips</th>
<th>Lower back</th>
</tr>
</thead>
<tbody>
<tr>
<td>The walking surface is often slippery, and uneven due to extensive cabling on the floor</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The space is too limited due for work movements due to bulky equipment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endoscope interface towards surgeon not ergonomically designed</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height of operating table not properly adjustable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
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In the RULA analysis, one score was generated for each of the body parts, see table 5. The ultimate score generated according to the RULA methodology was six, on a scale from one to seven, corresponding to the third of the four action levels (where the fourth indicates the highest ergonomic risks):

Investigations and changes required soon.

Notable are the high scores for wrists, arms and neck. The wrist gained a high score due to repetitive movements when turning the knobs that maneuver the flexible shaft. The arms are kept in a static position when holding the endoscope and pauses are seldom taken due to the fact that the instrument is entirely handheld. The high neck score originated mainly from the fact that the position of the main monitor forced the surgeon to twist and bend the neck to see the video acquisition of the endoscopic camera.

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</tr>
<tr>
<td>Risk of fatigue when using foot pedal, especially searching for it without leaving the screen with the eyes</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One leg is used more to support body due to one foot use of pedals</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Back is kept flexed forward and slightly twisted</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neck is bent sideways and mildly twisted towards the screen</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endoscope handle is manually lifted and kept in shoulder height</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endoscope is repeatedly moved and carried in uncomfortable way, causing physical fatigue</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>During intervention tasks are continuously repeated, causing physical fatigue</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeated manual work when manoeuvring cause physical fatigue</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeated work is performed with uncomfortable hand position due to lack of ergonomics in the handle</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6

PLIBEL analysis

PLIBEL also provides a number of questions regarding psychosocial factors to consider, in this analysis resulting in the following envisagements:

- There is limited possibility for pauses during ongoing surgery, causing physical fatigue and mental stress.
- The surgeon has little influence of what tasks to perform and in what order to perform them, since the surgery procedure must be kept.
- The work is often performed under time pressure and stress.
- During surgery, unusual and unexpected situations may occur, that requires immediate attention form the surgeon.
- The environment in the operation theatre is not always optimal when it comes to sound level, temperature and visual clarity, e.g. light level and visibility of screens.

In summation, the results of the usability test indicates that the usability of the endoscope itself is not low, but that the complexity of surgery (gastrostomy) as a task is high, rightly requiring an expert user. This result is verified in a similar study of endoscope use (Goossens, et al. 2006). Added to the high cognitive load of the task itself, the constant interruptions of information input from apparatus and fellow staff members, tend to cause mental stress. As Vereczkei, Bubb and Feussner (2003) point out “mental stress can be compensated for with mental effort, but such efforts surely lead to earlier fatigue, which can be a significant handicap during operations that last for hours”.

The physical stress originating from static posture, unbalanced leg position and repetitive wrist movements appear similar to what has been shown in studies of laparoscopic surgery. However with the significant difference that it is even harder for the surgeon to take micro pauses since the endoscope, in contrast to the laparoscope, is entirely handheld without any external support. Thus, an unnatural hand- and wrist position must be kept for a prolonged time, causing numbness in hands and fingers.
Conclusions

A scientific and ergonomic approach, adopted to analyze both the performances and the workload of surgeons, provides the guidelines for designing of innovative technologies able to satisfy the requirements, defined with the user-centered design (UCD) approach. This research study enables a mapping of the main psycho-cognitive criticalities in the surgeon-system interaction, of the resulting risk factors and of the user needs and expectations.

Practically through the original choice of integrating and applying the specific tools of ergonomics with the care for the difficulties that may be related with the observation of a critical environment, the project is designed to create an initial database of surgery assessment, giving rise to a primitive innovative path (through the own instruments of ergonomist) that can lead us from the currently in-use equipment to the innovative and flexible surgical equipment for NOTES.

In details the use of ergonomic instruments can lead to:

- comprehend the limits in the developing stage of the clinical instrumentations in general and in particular it could help reduce the number of errors and the performance problems of the surgeon/instruments/patient system due to an overload of stress and tiredness.
- contribute to the identification of the critical aspects and of the main components of the surgical process itself.

Final objective of the project expresses in the realization of a systematic collection of guidelines, which constitutes the synthesis of the analysis performed during project development.

Guidelines

Below follow a number of guidelines for future development of an endoscopic platform. The guidelines are divided in three categories regarding ergonomics, endoscope and context respectively.

Physical ergonomics

- Design the handle in order to keep arms from 15° to 45° during the phase where the surgeon is holding the endoscope.
- Forearms must be positioned from 0° to 90° to achieve the most suitable position to minimize arm fatigue.
- Wrist should be kept in a neutral position, 0° flexed, straight and not twisted, to prevent numbness in hands and increase the precision of the most delicate tasks such as the use of the endoscopic instruments.
- Trunk should be as straight as possible in neutral position, from 0° to 10° without being twisted it or bent neither backwards nor forwards.
- The position of the neck should be kept between 0° and 90°, as neutral as possible without being twisted neither backwards nor forwards, especially during the use of endoscopic instruments.
This research study enables a mapping of the main psycho-cognitive criticalities in the physical ergonomics context respectively. Below follow a number of guidelines for future development of an endoscopic platform.

Guidelines

- Able to satisfy the requirements, defined with the user-centered design (UCD) approach. Workload of surgeons, provides the guidelines for designing of innovative technologies.

A scientific and ergonomic approach, adopted to analyze both the performances and the surgeon-system interaction, of the resulting risk factors and of the user needs and expectations.

Conclusions

Final objective of the project expresses in the realization of a systematic collection of ergonomist) that can lead us from the currently in-use equipment to the innovative and flexible surgical equipment for NOTES.

Practically through the original choice of integrating and applying the specific tools of the surgical process itself, the project is designed to create an initial database of surgery instruments to eliminate the need of coordinated actions between two users.

Context

- Human-machine interaction and machine-machine interaction should be redesigned to create better work environment to prevent accidents due to the bad setting of cables, instruments, screens and tools with cable.

- Standard display of the instrumentation of the surgery room should be designed to speed up preparation for surgery and to guarantee surgeon and assistants a reliable working condition.

References


Digitally Printed Textiles: New processes & theories

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Abstract
Advances in technology are increasingly defining the character of knowledge (Harrod 2007), and highlighting the opportunities that exist for artists, designers, craftspeople and researchers to use new technologies for extending the breadth and scope of contemporary practice. An example of this is the digital printing of textiles. Not only are the printed images themselves open to novel forms of manipulation and interpretation, through the use of innovative fabrics, dyes and techniques, but the technologies involved in the digital printing process increasingly provide designers with a wide range of new options. On the one hand, it is possible to take an aesthetic approach to textile design while on the other technology-based or process-driven perspectives may also be exploited (Potter 2002). However, what happens in the studio environment when these disparate domains overlap?

This paper investigates the relationship that is forged when traditional craft practices and advanced technology are brought together through studio inquiry. In order to challenge this phenomenon and the subsequent issue of subjectivity, my practice-based research uses grounded theory to reveal how the use of traditional materials and techniques can be integrated within digitally printed textile design to develop a general theory relating to contemporary design practice. A range of experiments were undertaken to encourage convergence with neighbouring disciplines, and a series of questionnaires, then semi-structured interviews conducted with skilled practitioners from adjoining fields to confront current perceptions of design practice, and challenge non-objective research positions in the creative industries (Frayling 2011).

Keywords: digital printing, textiles, craft, design, theory
1. Introduction

Design researcher and embroiderer Karen Nicol maintains that few of today's designers have the traditional skills and practical knowledge essential in her specialist field (2009). This means that when designers attempt to combine traditional practices with new technologies, their lack of expertise often results in the balance shifting towards advanced technology. Furthermore, writer and former curator Rachel Weiss warns us that if care is not taken, the process of mastering craft skills may be overlooked, resulting in designs that lack the very qualities that often make them unique (2008). The intertwining of meaning achieved by joining the handmade with the digital, the material and the nonmaterial, can provide new opportunities for textile designers; although, as with any new technology, the novelty factor may initially engulf the very practices it invades. Artist and researcher Barbara Bolt suggests that the ‘privileged place of art’ is a result of its unique position as an environment in which making, using tools and materials takes place in the naturalistic setting of everyday life (Bolt 2006: 5). It is from within this unique studio setting that I have been exploring the use of different types of traditional crafting methods and processes alongside advanced technology, including the use of natural dyes plus inks specifically developed for large format inkjet printers, and experimenting across a range of substrates from the hand-spun and woven to high-performance synthetic fabrics. Although, as design theorist Ken Friedman points out, if we are to fully comprehend how a discipline, such as textile design, can operate within the context of ‘processes, media interfaces or information artefacts’ (Friedman 2008: 153), it is first necessary to develop a theory. However, a formal theory is developed out of a very different set of conceptualising tools than those generally found in the studio environment, therefore I decided to use my own design practice to determine what there was about digital textile printing that might be revealed by taking an in depth, personal view of how I work. As Victor Margolin recently pointed out, designing creates new products and so any investigation into design should, to a certain extent, focus on ‘how that is done, what new products might be produced, and how’ (Margolin 2010).

2. Research Question and Problematic

First I needed to develop a system for making explicit the tacit and intuitive types of knowledge that I, as a textile designer, produce. Friedman explains, ‘only explicit articulation permits us to contrast theories and to share them’ (Friedman 2008, p. 158). He warns that some designers mistakenly confuse practice with research, pursuing their normal design activities rather than using inductive inquiry to develop theories. As a way of approaching what I do when I work, and in a manner that allows theory to be formulated, I began this Ph.D. research by proposing a question that was both open-ended and achievable through self-conducted practice, so that I could place myself at the centre of the researchable environment. This question was: How can craft practices be used as interventions in the digital printing of textiles?

Working in the studio constituted a natural form of inquiry, so this project sat between realist and relativist ontological positions (Gray & Malins 2004), and a key requirement was, therefore, that the research needed to highlight exactly what was going on at the same time as the creative work was being carried out. Designer and researcher Kristina Niedderer explains that knowledge generated during the making process, procedural knowledge, can partially be communicated through verbal means, and sometimes by providing others with detailed descriptions; but, she maintains that much of this information can only ever be transferred, or made explicit, by demonstrating either in-person or by using a video recording to enable someone other than the practitioner to learn how it is created (Niedderer 2009a). Furthermore, Michael Biggs and Daniela Büchler point out that the research question, to a certain extent, can imply a particular answer depending on the context (Biggs & Büchler 2007). For example, my research is located in the field of textile design and therefore a scientific answer would not be appropriate; however, during the initial stages of the studio inquiry a process was discovered that allowed cooling properties to be incorporated into the surfaces of the digitally printed textiles. This process, although interesting and prompting suggestions from myself and peers about future possible research projects, after being written up with a patent attorney, was in danger of leading the research down a scientific route, and away from the original Ph.D. proposal and research question. A patent application was subsequently drawn up in order to truncate the idea for use at a later date, and the documentation of how the process came about was analysed to explain how practice could generate abductive thoughts suitable for inventions (Polanyi 1974), rather than the traceable inductive reasoning required for research purposes.

3. Methodologies and Methods
My project uses creative practice in a manner that suits the nature of my own particular discipline. This is a non-objective stance and is therefore an issue of much widespread debate and discussion (Durling & Niedderer 2007). The methodologies I chose were studio practice, and Barney Glaser and Anselm Strauss’s grounded theory (1967). I felt that reflection on creative endeavour in action combined with an explanatory qualitative approach would best enable me to generate suitable data for developing theories from within digitally printed textile design practice. I wanted to ensure that procedural knowledge was made available through research methods that were compatible with the way I normally work and permitted the use of materials and techniques in as natural a manner as possible.

Artist-researcher Nithikul Nimkulrat informs us that the majority of recent art and design research projects in Finland are practice-led and, in her experience, the research component is generally kept separate from the practical side. She found that documenting through writing helped her to highlight ‘thoughts, intentions, and decisions’ (Nimkulrat 2007: 5). In my research I also embraced these recording methods and found that by using textile design practice as both method and methodology meant that the project’s data generating tools were different from conventional methods found in other disciplines (Niedderer 2009b).

Also, Biggs and Büchler claim that practice-led research comes under the umbrella of academic research, and is therefore similarly required to seek out concepts from practice that are transferrable. By exploring the relationship that exists between the outcomes of my work and that of other designers, I was able to acknowledge the subjectivity of each participant, including myself, while also using a common language to begin to confront the problem of non-objective viewpoints (Biggs & Büchler 2008). Although many experienced researchers, like Carole Gray and Julian Malins, provide a compelling case for the practitioner-researcher to explore this area, they also admit that the real world is not predictable, it is immensely complex, and, as a reflective practitioner, our passions and insights can help us tackle the constructed realities of the human existence, while acknowledging that ‘no two human beings are identical’ (Erlandson et al. 1993: 21). The challenge for my research was thus to attempt to use the grounded theory approach to ongoing practice in order to intertwine theoretical knowledge with practical knowledge (Bourdieu 1990: 26). To do this I found it necessary to reduce my practice to a form of designing a research outcome from the practice of designing, while simultaneously documenting in as many different media as possible, encouraging different interpretations, so as to gain as much rich data as I could (Erlandson et al. 1993: 31).

To address these concerns, the research methods I adopted were the reflective journal, grounded theory, observation, questionnaires and semi-
structured interviews. I discovered that by documenting ongoing production details in a reflective journal, written notes, photographs, sketches, making fabric samples, plus my everyday experiences as a practicing designer on a regular basis over a period of more than two years, I was able to record both minute facts as well as emerging ideas. These details were also recorded in a temporal manner that helped ensure that retrospective entries were avoided. However, the processes and responses created by me were influenced by many factors, such as my own cultural background, visual memories, and previously mastered skills, including those that are well embedded and were therefore acted out as second nature. Also, the use of grounded theory meant that I was constantly revisiting the documentation, making observations from the data and realigning my practice according to previous judgments and noting substantive theories as they emerged. As Stephen Scrivener states, research in design is undertaken with the requirement of contributing to design practice, so the outcomes of research must be integral to what designers create and how they do this (Scrivener 2009). Ceramicist and researcher Katie Bunnell recalls that during her Ph.D. Viva Voce her examiners repeatedly raised concerns about the unique nature of her single case research, questioning its transferability to the wider realms of practice (Bunnell 2001). She maintains that she defended her chosen methodology, stating it had been disseminated through international exhibitions and her publicly accessible thesis. Her stance supports with that of researchers Yvonne Lincoln and Egon Guba who declare that the value of such forms of inquiry are gauged by the extent to which any outcomes can be transferred to other situations (Lincoln & Guba 1985). However, for a designer, using grounded theory as a methodology, their experience is not the same as undertaking normal design practice because, for one thing, the process of creating needs to be repeatedly interrupted with the direction altered each time to encompass new conditions of emerging substantive theories: this was a slightly different way of working for me, but one that became more natural as the project progressed. As many of my past experiences fed into this current project, I believe the characteristic of the research was constructed, rather than determined (Willig 2008: 13), and hence it could be described as post-positivist critical realism, because reflecting on observation is always open to debate, and can never be completely certain or predetermined. It was therefore necessary for this research to employ multiple research methods to ensure that triangulation was, as far as possible, allowed to compensate for the irregularities that existed in the data, its analysis and synthesis.

The desire to generate a theory from practice meant that I selected the full version of the qualitative research method, grounded theory (Glaser &
Strauss 1967); this enabled me to more deeply investigate what happens during the process of designing within my studio. Unlike Descriptive Phenomenological Analysis (Langridge 2007), in which the phenomenon under investigation could only be described, not explained, with Interpretative Phenomenological Analysis (Willig 2008), it was possible to allow the data to be analysed for explanations, thereby unearthing why the phenomenon under scrutiny had occurred. I used IPA as an accompanying research method because it enabled me to incorporate, through questionnaires and semi-structured interviews, the opinions and reflections of a range of practitioners from adjoining disciplines, including printmaking, illustration, photography, cinematography, graphic design and typography. For these methods I selected 24 participants, four from each area, for the questionnaires and then a further six skilled practitioners, one representing each discipline, for more in depth, semi-structured interviews.

As empirical inquiry sits between social science and critical reflection on practice (Friedman 2008: 158), the challenge for me as a practitioner-researcher was to strike a balance between making explicit knowledge that was instinctively tacit, and documenting the creation of practice as honestly, fully and transparently as possible, so that rich data were generated from both sides. Initially this was from a wide range of categories, to help develop fledgling substantive theories; then, increasingly, I narrowed the focus so that a more general conceptual picture developed into a formal theory.

4. Substantive and Formal Theories

By evaluating the data from consecutive digitally printed samples, it became clear that the structure of the substrate, the type of material used in the substrate’s manufacture, the luminosity of the fibres, the resolution of the image, the range of colours used for the final image, the choice of dyes, the fixing process, the pre-coating solution applied prior to printing, the particular digital printing process, and even the type of printer, all played a significant role in determining the success or failure of the final aesthetic of each sample; further digital prints were then produced, narrowing down the variables within each sample group. New levels of properties from the evolving categories were revealed, eventually focusing on the substrate, the dye, and the printer. It was possible to extend the category designation when an emerging category seemed to be incomplete, yet showed promise (Guba & Lincoln 1981). By using IPA, involving questionnaires and interview transcripts, I attempted to discover if there were any common themes from the phenomenon highlighted by the digitally printed textile samples, by comparing the series of outcomes with the reflections from each of the participants regarding their own practice. If my intention had been to describe the concept then mere
description would have sufficed, but my interest lay in discovering a theory that could help explain why outcomes of creative practice involving advanced technology are often not as interesting or exciting as they could be, in order to provide practitioners in general with information that might help them create more desirable artefacts and reach out to wider audiences.

4.1 Reflective Position of Researcher

Philosopher and sociologist Pierre Bourdieu highlights that a major concern for researchers like myself involved in practice-led inquiry is the problem of objectivity (Bourdieu 1990). While many researchers encourage the potential for unique insights to be revealed from this type of research (Sullivan 2005; Gray & Malins 2004; Durling 2000; Yin 1994; Erlandson et al. 1993), all concede that the researchers’ aim of reproducible objectivity can never be fully realised. However, a number of safeguards are suggested to avoid unbalanced views and to acknowledge, negotiate and engage with other professionals, to gain ‘feedback, support and advice’ (Gray & Malins 2004: 21). Bourdieu also states that, ‘knowledge does not only depend […] on the particular viewpoint that a ‘situated and dated’ observer takes up vis-à-vis the object’ (Bourdieu 1990: 27), and he acknowledges the baggage that an objective observer brings to their relationship with the object, including their preferred forms of communicating, or language. While I can never be an impartial spectator, I have found that by reflecting on the various documented outcomes, my role as a designer allows me to gain a unique perspective on my particular practice, and as my aim is to create an understanding in relation to digitally printed textile design, even though I am not seeing the whole picture from every angle with all possible eyes (Nietzsche 1969), I am at least observing and experiencing it from the point of view of someone on the inside who makes, rather than merely watches, records or surveys. The internal processes can possibly be compared to the shadows in Plato’s analogy of the cave in which, without the benefit of light from all sides, connections and associations are read into the interactions and relationships that are formed between two-dimensional shapes in a three-dimensional environment (Plato 2000). I would argue that with my own practice there is enough information, albeit not all of it wholly explicit, that similarly allows associations and theoretical assumptions to be made. After all, as Gray and Malins point out (2004), the use of creative practice is a subjective process, and there may not be any clear universal truth to be had anyway.

Artist and researcher Stephen Scrivener suggests that Donald Schön’s theory of the reflective practitioner (Schön 1983), gives us a means of accessing the way creative thought works from the inside, including
influences from previous experiences, by allowing multiple perspectives of
the act of creating to be revealed (Scrivener 2002). Scrivener and
Chapman then propose that this reflective practice is grounded in current
work, and is subsequently realised through future projects (Scrivener &
Chapman 2004). What this means is that ‘an interactive cycle’ carries the
reflective practitioner forward from an initial phase through consecutive
stages, when the various issues being dealt with by the practitioner may
be repeatedly revisited and revised to seek out additional ‘knowledge and
information’ in support of the outcomes of the project (Scrivener &
Chapman 2004: 3). Only once the reflective practitioner feels confident
that the aims of their project have been achieved will this cyclic action
come to a close with one final, all-inclusive, reflective stage. This last
phase, say Scrivener and Chapman, pulls together the various aspects
and outcomes of the entire project, including rich thoughts and reflections
on how it was conceived, received, perceived and actually carried out. At
this point, they maintain, the process of reflection provides information
from three main areas, those from, ‘pre-, within- and post- project’, and
supplies the practitioner with extensive documentation on the work, details
of the outcomes and the decisions that were made (Scrivener & Chapman
2004: 3). As a reflective-practitioner myself, I suggest that Scrivener and
Chapman’s argument concerning the interactive cycle appears to be
remarkably similar to the practice-led research I have been conducting
along the lines of grounded theory. For one thing, both are driven and
carried out through the act of practice, as a primary methodology; for
another, the reflection and cyclic readjustments made at repeated intervals
are also a common theme; the need to seek, or look for, additional
information following each of these reflections is also similar for both; and,
once a final stage has been identified, as with consolidating the saturated
category of the grounded theory, one last reflective act is undertaken to
ensure that all possible options and perspectives have been taken into
consideration. It is also interesting that Schön’s original reflective-
practitioner theory (1983) has been stretched by Scrivener (2002), as it
mirrors the option to stretch the theory if necessary provided by Glaser
and Strauss in 1967, at the end of their original proposition of grounded
theory; and, all three time-lines are taken into account before, during and
in the future, allowing transferability. It would appear that the value to
research of this type of investigation into a subjective area allows the
problematic, non-objective position of research into practice to free itself
and come out in support of the subjective voice of the reflective
practitioner by grounding the research in practice, conducted through
practice, by practitioners, for practitioners.

Schön also outlines the professional practice of a psychotherapist who, he
explains, ‘anchors the inquiry in the patient’s transference’ and thus, ‘the
relationship between patient and therapist can serve as a window on the patient’s life outside therapy’ (Schön 1983: 119). It is worth noting that psychoanalysts and their patients do not engage in visual contact during sessions. The fact that the psychotherapist can, as Schön believes, access the environment of the patient through their relationship, shows another field in which, like my own, a subjective single-case scenario can be understood in a viable way. Even through my design practice is far removed from the disciplines of psychotherapy or psychoanalysis, as Schön makes a case for architecture having a number of similarities with the former profession, my extensively documented engagement with textile design practice can be shown to act similarly as a window into how I work (Schön 1983: 129).

### 4.2 Diagrams

**Diagram 1: Making tacit knowledge explicit.**

![Diagram 1: Making tacit knowledge explicit.](image1)

**Diagram 2: Developing theory out of practice.**

![Diagram 2: Developing theory out of practice.](image2)
4.3 Theories

Artist and author Graeme Sullivan wrote that, ‘both knowledge production and the functions to which knowledge is put’ are most useful when theory and practice are integrated (Sullivan 2005: 87). He maintains that the benefit of this approach to research is that it helps to reveal intricate details about a practitioner’s own understanding and the impact of their work on the life-world. Although he advocates a critical reflection and continual questioning of the value of practice within the research setting, he also highlights the potential for certain aspects of design to be ignored or misrepresented in the critical debate if care is not taken, and he suggests that it is only by repeatedly challenging the outcomes of practice-led research that the truth can start to be revealed.

Designer-researcher Michael Hohl’s recent Ph.D. research uses Radiomap, ‘a graphical user interface’, as the environment for gathering data for use within an adapted version of grounded theory (Hohl 2009: 189). He claims that it is useful for prior knowledge to determine how an artefact is appreciated or received, and that the use of advanced technology, as in his case, can cause this balance to shift, leaving the relationship between the medium of expression and the concept unclear. As the technology becomes more familiar to the artist or designer, as well as those perceiving an artwork, he says that may result in the idea, rather than the advanced technology, taking the lead (Hohl 2009). Similarly, in my project, while I used the full version of grounded theory so that I could repeatedly revisit the studio environment for further data gathering, I also found that the lack of prior knowledge regarding certain aspects of technology and materials was problematic when it came to interviewing participants from neighbouring disciplines.

Revisiting the data meant that a distinct idea started to be formed about how digital prints differed from traditional screen prints. Once this could be communicated in abstract terms (Peirce 1878), it allowed me to conduct further experiments using digital printing intertwined with hand-crafted interventions to see whether or not there existed tangible ways of narrowing the aesthetic differences between samples and results.

5. Analysis and Discussions

Two important aspects of naturalistic research are that data are gathered in the research environment, but it is important that the process of analysis takes place away from this site; and, Erlandson et al maintain that the ‘interaction between data collections and analysis is one of the major features that distinguish naturalistic research from traditional research’ (Erlandson et al. 1993: 114). I found that this away-time gave me the chance not only to reflect on the work outside the studio, but also allowed
me to discuss current issues and seek advice from other practitioners before heading back to gather further data. Often unforeseen outcomes or discoveries were noted, for example, during a period of experimentation in a glass workshop I developed a novel and sustainable process for transferring digitally printed images to secondary substrates. As Sharan Merriam observes, this kind of flexibility provides data with a richness that would not have been possible with more established research methods (Merriam 1988).

I found that my aim of understanding and explaining what it is I do during studio practice was assisted by the common conventions of perception, language and methods of articulation that I experienced when I formed relationships across the adjoining disciplines (Niedderer & Roworth-Stokes 2007). As such, through these interactions I found that peer responses provided me with useful, albeit similarly subjective, contrasting views of design practice involving traditional processes and advanced technologies. Also, naturalistic inquiry, while taking place in the real world of the various studio settings was only as real as the practitioners themselves were willing to reveal (Erlandson et al. 1993) so, while practitioners created, they needed to reflect freely, without constraints, if meaningful data were to be generated. However, each of the interviewees possess skills and knowledge that have taken years to master, so these aspects were relatively difficult to communicate as explicit knowledge in interview settings, even within their own studios, and it was this particular knowledge that I was attempting to capture.

Taking a reflective-practitioner’s position during the project gave me the ability to understand and challenge my practice in action, sequentially, thereby enabling me to become involved from inside the environment of inquiry and to create a window through which to access documentation in various forms of media. The outcome of the analysis was a working theory: While digital can enable practitioners to be less worried about making mistakes, it usually requires an outcome to be predetermined at the outset, so there is less scope for random exploration.

6. Conclusion
Sullivan recently highlighted that the challenge for practice-led researchers is to alter the boundaries of their research to ensure that it is more adequately aligned with the creative work they produce (Sullivan 2008). For me, using grounded theory alongside my studio practice for my current doctoral project has enabled me to develop a number of new processes, including a novel method for producing fabrics with cooling properties, and an original sustainable way of transferring digital images from reclaimed inks, while simultaneously documenting and reflecting on the ongoing studio inquiry. This led from substantive emerging theories to a more formal theory being developed, allowing me to extend the scope of the research while simultaneously minimising the differences within the boundaries of the categories being analysed. In this paper I have outlined how I approached the development of a formal theory out of my own studio practice of digitally printed textile design. Specifically I have focused on my experiences of the issues of subjectivity and transparency. I have also endeavoured to interact with practitioners from neighbouring disciplines in an attempt to create transferable skills and ensure that the documentation is appropriately communicated. In this way, I have shown that grounded theory within textile design practice can offer a real-world opportunity for theory development out of contemporary design practice.

References


Author Biography

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As a designer, her practice combines craft, structured and digitally printed textiles. She was awarded the ‘International Linen Woven Textile Bursary’, the ‘Incorporation of Weavers Award’, the ‘Habitat Award for Printed Textiles’, & the ‘E.J.D. Poole Memorial Award’, Bradford Textile Society. Her practice-led doctoral research explores the use of craft processes as interventions in the digital printing of textiles, challenging existing boundaries and confronting contemporary perceptions of textile design practice.


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ilo Cards: A tool to support the design of interactive artifacts

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Abstract

In this paper we describe the "i/o cards", a tool comprising 31 paper cards that enables participants from different backgrounds to engage in creative collaborative activities in the design of interactive artifacts. These artifacts comprehend a wide range of design products in which physical instance and electronic behavior are integrated. Three workshops are described to illustrate different contexts and methods where the tool was already applied. The data gathered in the activities was used to improve the cards and to attest its role in improving certain aspects of the design process. At the end, four ways in which the i/o cards can be used to support creative activities are discussed.

Keywords: design process, design tools, interactive products
Introduction and motivation

External representations, such as language and graphics (Scaife & Rogers, 1996), are important to support the externalization of ideas during a design development. In a recent article, Dix and Gongora (2011:31) explore the idea saying that “externalization involves the embodiment, representation and exploration of our own thoughts”. As the authors state, “externalization is the step beyond, the active shaping of the world as an intellectual resource, maybe a uniquely human ability and certainly the foundation of culture and civilization” (Dix & Gongora, 2011:31). In a way, it is a crucial element on the endless human effort to shape the world.

Externalization can take many forms and serve many purposes (Dix & Gongora, 2011), still it is usually accompanied and facilitated by external representation. Language and body gestures can be accompanied by all kinds of tools and techniques, such as sketches, prototypes, models, images and movies. Designers make use of every means of expression they can envision and attain while developing an idea themselves or within a group context, as well as when they have to communicate their projects to others.

One approach to facilitate externalization and communication during the design process is to organize blocks of contents into tangible paper cards (Halskov & Dalsgard, 2006). These tools can range from very simple solutions, such as writing down words or printing images to stimulate associations, to more complex and elaborate ones, such as the experience design cards, developed by Shedroff (2009) and the methods cards, developed by the design company IDEO (2002). According to Moggridge (2007:669), “each of the fifty-one [methods] cards contains exploratory text about how and when the [research] method can be used and a brief example of its application to a real design project, with an illustrative and sometimes whimsical image on the other side”.

One of the ideas behind developing and using these tools is that once they are designed, the application techniques can vary according to the context. As Shedroff (2003:162) states, “simply shuffling through the cards and posing the questions creates an opportunity for designers to remember to address more issues than might be in the initial project brief. The innovation consists primarily in convenience, and designers, of course, can create their own cards that address their own issues and processes”. When used in the context of a design process, cards are not prescriptive; rather they act as a support for inspiration, organization and communication of ideas.
To share the findings and contribute to experiences that apply paper cards as a support for externalization during the design process, this article introduces and describes the i|o cards, a card set that can be used as stimulus within creative activities in the design of interactive artifacts. For the purpose of this proposal, these artifacts comprehend the whole range of wearable devices, objects, installations and spaces in which physical instance and electronic behavior are integrated. They are an outcome from a context where “these two trends – the massive increase in computational power and the expanding context in which we put that power to use –both suggest that we need new ways of interacting with computers, ways that are better tuned to our need and abilities” (Dourish, 2003). Specifically the cards can be used to help design processes with focus on physical computing concepts and technology (O’Sullivan & Igoe, 2005).

With the purpose of presenting and discussing this tool, first the cards are presented in detail. To illustrate and stimulate the discussion, three workshops where the cards were applied are presented, as well as the findings that have been guiding its development. Next, the potential and limitations of this tool are organized and discussed. To conclude, since this is an ongoing project, the actual state and next steps are outlined.

**i|o Cards**

The i|o cards compose an open source tool of 31 paper cards, divided into two main categories, namely structure and behavior. The 24 cards from the structure group symbolize technical elements of the interactive artifact and the eight cards from the behavior group represent content issues from the interaction that the artifact mediates. The name, “i|o cards” holds this division, where “i” stands for inputs, “o” for outputs and the character “|” represents what happens between these two extremes, in other words, the implemented behavior.

The structure cards were inspired by the basic components a novice interested on sensing and controlling the physical world with computers gets to know (O’Sullivan & Igoe, 2005). This category is divided into four others sub-categories, as illustrated at Figure 1, composed by elements that sense, act, control and communicate. The behavior cards contain concepts considered important when designing how and when the system will perform the actions. The main motivation is to provide a common grammar of components and concepts to participants from different backgrounds and make possible the communication between people, including those with no prior knowledge of these issues.

In addition, during the workshops, a small amount of blank cards is always provided, in a way that participants can add features not included on the
card set. This is important since, on the one hand, the card set is supposed to inspire the imagination and the blank cards gives room for the unexpected; on the other hand the way participants use these blank cards inspires revisions and new versions.

Figure 1: 23 structure cards subdivided into 12 sensors (orange square), 7 actuators (purple square), 1 sensor/actuator (pink square), two communication devices (grey rectangles) and one microcontroller (top right rectangle).

<table>
<thead>
<tr>
<th>INTERACTION</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rules make people understand what’s happening and how it works. How people know what to do and how to proceed? Are these rules implicit or explicit?</td>
<td>Simplicity can lead to complexity. Put your concept above the technology. Take out everything that is not strictly necessary to achieve a simple result.</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>RULES</th>
<th>TECHNOLOGY</th>
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<tbody>
<tr>
<td>SENSES</td>
<td>NARRATIVES</td>
</tr>
<tr>
<td>Feedback makes people conscious that their actions affect the system. Which feedback do people get through their interaction?</td>
<td>Makers, clients, audience, environment – different participants play different roles during the creative process and on the real place. How are they connected and how do each of them contribute to the idea?</td>
</tr>
</tbody>
</table>

Figure 2: Front side (purple) and backside (white) from the 8 behavior cards, showing key issues for designing the interaction - Interaction, rules, senses, feedback, time, technology, narratives, and participants.

The way the cards are designed aims to hide unnecessary complexities at the same time that they play an informative role. Each card represents, as separate entities, one aspect from the behavior potential and the physical constrains of an interactive artifact. They allow participants to explore consistent ideas focusing on the design rather then limited by technical
constrains. During a creative workshop, the fact that users can point to, discuss with and pass around cards, supports communication and encourages social interaction. They can be applied in different contexts, as this paper will show.

Method, application and specific results

The strategy adopted to develop the i|o cards involved personal practical experience of programming sensors, actuators and microcontrollers, jointly with readings about the topic and the three workshops in which the cards were applied. From one workshop to the other, an evaluation was done with the aim to better understand and recognize latent possibilities and improvements regarding the overall activity, specific content and layout.

Since the beginning it was clear that both issues - structure and behavior - were essential. For the first version, the structural cards were based on specific literature about physical computing (O'Sullivan & Igoe, 2005) and the behavior cards content was firstly obtained from a tool called “Exchange Pieces” (Mongiat & Snook, 2007). The actual version, presented earlier in this article, derived from a general review made after the second workshop, when graphics and content were improved.

Three workshops already applied the tool and are analyzed in detail in this article. Two of them happened in the context of a design conference (workshop 1 and 3) and one time they were used to support the development of a specific project (workshop 2). They all consisted of controlled activities where groups of participants worked together with the goal to design concepts of interactive artifacts.

To summarize, in workshop 1 and 3, the participants were designers with different backgrounds. The goal was to make possible, in a short time, a grounded conceptual development of an interactive artifact, and the participants themselves decided the context and purpose of the designed object. Workshop 2 was part of a specific project and the activity had a defined task, to come up with possible sensors and behaviors to be implemented on an interactive environment, the main office of a design company. Table 1 shows a summary of the structure from all the workshops.

The approach to how data was collected varied according to the workshops’ contexts, although it kept significant common aspects. They all included photos from the activity and generated written documents containing participants’ feedbacks that were later coded and organized in order to gain insights about the tool and the activity.
To elucidate the workshops contributions to the cards development, the structure and achieved insights from each activity are described in detail. As different workshops have different organizations, this examination is also useful to support upcoming applications of the i|o cards.

**Workshop 1**

The first workshop, which happened during a design conference, was the main motivation for the cards creation. Twenty designers, within graphics, products, web and game, composed the participants; five of these were also involved in teaching activities. The activity lasted four hours and the task embraced two different techniques: the i|o cards to conceive and structure the object and the play-acting storyboard technique to illustrate...
and communicate the concept. Some of the final artifacts are illustrated at Figures 3, 4 and 5.

Figure 3: Storyboarding (left) and structure (right) of a device to assist deaf people. When the bell rings, the device shakes signaling that there’s someone at the door.

Figure 4: Storyboarding (left) and structure (right) of two pillows that triggers the smell of partners while they are living in different cities.

Figure 5: Storyboarding (left) and structure (right) of a wearable device used to communicate simple and predefined messages between co-workers, such as “I’m done” and “Stop for a coffee?” through light and vibration.

At the end, the participants were asked to answer a questionnaire to provide feedback regarding the overall activity and the cards. Generally the activity was very satisfactory and people felt that they’ve learned new content while doing it. They mentioned that the workshop was helpful to better understand the principles behind the digital technology. It introduced
the topic to novices at the same time as it contributed to a deeper understanding by those who were already familiar with it.

To get in touch and discuss about the structure of such artifact lead the participants to better understand the complexities that lie behind the development of this kind of object. They highlighted the importance to think about the object not as a single entity, but to think about it as a physical interface between the user and a bigger and connected system. With the activity, some realized that time and social interactions are the key issues while designing these artifacts. The overall difficulties regarded mainly the technical aspects, which can be attributed to the lack of experience with physical computing principles from most of the participants.

Regarding specifically the part of the activity when i/o cards were applied, the results were also satisfactory, with a lot of input for further improvement. According to the participants, the cards helped them to understand the basic concepts of physical computing. The support provided by the cards was compared to the development of a flow chart, a graphic representation, using symbols interconnected with lines to describe a system. Its informative design also led one participant to comment about its potential application on teaching activities.

As expected, since this was the first time the cards were used, the results indicated a lot of improvement opportunities. About the initial explanation, some participants pointed the importance of illustrating every component with examples or even bring a real functioning microcontroller to support the descriptions. Regarding the way the activity was conducted, they suggested that it could be a good strategy to start first with the concepts and later define the structure.

Concerning the cards content, the most criticized group was the structure one. The participants suggested several other components, some very specific, such as smell and heat actuators, and others that are essential, such as communication devices. They pointed that the input and output icons, logic and differentiation was confusing and that maybe it could be a good idea to include descriptive texts on these cards.

Workshop 2

The second workshop where the cards were adopted consisted of a project-specific set. The workshop was part of the development of an interactive space designed to be the office of a digital producer, a company that works together with advertisement agencies to produce web sites and applications. It was an essential part of the process for two reasons; on the one hand it supported the architects to come up with solutions grounded on the real needs and expectations from clients and
users, on the other hand, it improved the understanding of the potentialities that lies behind this kind of innovative space.

The goal was to promote a collaborative activity to come up with ideas to one specific part of the project, that is, the type and location of sensors and the interactions that would happen in the space. Ten people participated on the activity: 2 clients/users, 2 users, 3 architects, 1 electrical engineer, 2 researchers on architecture and digital technology. Just part of the i|o cards were adopted – sensors and concepts – together with the drawing of the space plan as a support material.

In this case, the order in which the groups received the cards was alternated as shown on Table 4. The data for further evaluation was gathered through pictures and movies taken during the activity, the transcription of the final presentations and e-mails sent by the participants evaluating the activity. Regarding the i|o cards, the activity validated their utility at the same time that it provided a context for its further improvement. Within the project context, the workshop was essential for its development, as earlier explored by Carneiro, Barros and Costa (2011).

The comments regarding the overall activity highlighted the value of collaboration and also the presence of participants from outside of the project - in this case they were mentioning the invited researchers. Participants recognized the workshop as an important opportunity to enhance the empathy between clients and service providers. In order to make it work, they also pointed out the importance of immersion during a controlled activity.

One of the main overall achievements was to provide an environment where all the participants were able to better understand the proposal. The support material – i|o cards and floor plans – were essential to mediate the process of having ideas and organizing them within a group activity. Since the interactive system can be reprogrammed and reconnected by the users in the future, the workshop was also an exercise where the participants were able to have “ideas for other ideas”.

Regarding the i|o cards one main consensus was observed between the groups: the order in which the cards arrive is important and, more than that, the behavior cards should always come first. The groups stated that talking about the content of the interaction was, for sure, the first natural issue that came into the conversation. The group that later got the behavior cards used them just as a checklist, demonstrating that even without them they had already covered their topics. The only recommendation was to better develop the transition between the cards.
Figure 6: Group 1 – the discussions were summarized on a personal notebook instead of relying on the support material (left). Their focus was mainly on the concepts; the structure cards were used more as a silence breaker (middle and right).

Figure 7: Group 2 – all support material was widely used, during the discussion and also at the final presentation. In addition to the floor plan, they also sketched the light wall to support the discussions (middle). At the end they organized all ideas on the floor plan (right) and used it during the presentation.

Group 1 (Figure 6) adopted the cards mainly as a stimulus to when conversation slows down. Participants stated that they were useful more to guide the discussions that to deeply determine their content. For example, even with the existence of the structure cards, discussions never deeply touched technical issues. Group 2 (Figure 7) emphasized the role played by the support material. They used the cards and floor plan together during the whole development process and also at the final explanation, structuring and illustrating their ideas.

Workshop 3

The last workshop where the cards were applied was also a design conference, this time with six participants from different parts of the world. Two of them were studying interactive product design and the others were also designers but without previous knowledge of physical computing techniques. For this activity, the cards were slightly modified, according to the inputs received on the previous workshops. The cards used on this workshop are the actual ones, described in the beginning of this article.

The assignment comprehended the design of an interactive object using as a support material the i/o cards and a cardboard box. As presented at Table 4, this time both teams first designed the concept and behavior, to later think about and develop the structure. The final ideas are illustrated at Figures 8 and 9.
Gabriela CARNEIRO, Gil BARROS and Carlos Zibel COSTA

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Figure 8: Sketches and cardboard prototype from group one - a teddy bear that enhances the relationship between child and parents. It gathers abstract data during the child’s day, such as movement, squeezing and sound, and gives it back at night when the bear is put to sleep.

Figure 9: Sketches and cardboard prototype from group two - an artifact that remixes glimpses of memories, composed of two parts that collect information along the day. One person carries one part and records images, the other records sounds. When they touch each other, the contents are mixed into one single collective memory.

The participants were asked to answer a questionnaire about the activity and the ijo cards. One big difference from this workshop when compared to the previous ones is the presence of participants with previous knowledge on physical computing, both stated that the content from the initial explanation has to be prepared according to the workshop audience. This has notably been a challenge; to define the amount of information to be given to mixed audience in order to keep it simple and informative.

The participants also stated that they prefer to spend more time first discussing the idea before structuring it. In a group context, it would also be a good idea to allow initial individual thinking before discussing the ideas with the partners. This could open up more ideas opportunities and would avoid that only one group member leads the decisions.

It was marked that the cardboard box was a useful tool, but maybe there could be more than one option to better suit the ideas. It was also noted that in a way, the cardboard also limits other important aspects such as colors, textures and shapes. It is the good and limiting aspects of the same solution.

The review done on the structure cards had a positive impact. Some content suggestions – display and speaker – were accompanied with an interesting critique. That the next development could focus on different levels of abstraction, to be applied according to the context and audience. On a higher level the solution would be to treat aspects such as movement
instead of motor, for example. When the design gets refined, lower levels defining the technical solutions would then be used.

For the first time, maybe because the structure cards reached a good development level, the main focus of critiques were the behavior cards, particularly regarding the guidance about their use and manipulation. One idea was to specifically ask participants to arrange them on a sheet of paper with connections and importance. It was clear that the way this group is introduced needs more attention.

**General Results and Discussion**

It was clear, during the workshops, that the i/o cards positively supported the teams to complete the proposed tasks. To take more advantage of this observation, it is important to systematize and discuss these contributions. The employment of the cards within the described contexts lead to the recognition of four ways in which they can support the design process of interactive artifacts:

1. **The i/o cards introduce a common vocabulary within participants from different backgrounds.** When teams are composed by designers with different backgrounds, professionals from varied disciplines, or even include clients and users, the i/o cards provides a common vocabulary to be used as a bridge between participants during the design process. The participants pointed that the tool allowed the development of a fast and concise idea, even between groups of people who have never met each other and came from diverse fields.

2. **The i/o cards are valuable resources to trigger conversations.** At the beginning of the design process or when the group runs out of ideas, the cards can be used to stimulate conversation and open up new design possibilities. As suggested by one of the participants, the cards could also be used privately to support individual projects.

3. **The i/o cards help participants understand and refine the structure of the artifact.** Vague ideas become clearer by the process and the cards facilitate the detailed structuring of the artifact. As participants understand the pieces, the resulting idea is always well grounded within real possibilities.

4. **The i/o cards support ideas visualization and communication.** At the end of each workshop, groups were asked to present the artifact they developed. The cards, together with the support material, were key elements to guide the presentations.

Even not being the main focus, the process of preparing the workshops stimulated several thoughts and understandings regarding the setup of
controlled creative activities. It showed that the activity itself consists on a
design problem and the same effort a designer usually spends on
designing an object should also be applied to create a collaborative
workshop. Thinking this way, a creative workshop would fit into the same
category of designing creative experiences. But this is a subject that
deserves another paper.

One of the limitations that can be found on the method applied to develop
the i|o cards is that the same problem was never done twice, for example
with and without the cards. By the other side, thinking about doing the
same workshop without the cards would lead to a complete review of the
whole activity. At the end, it would be a completely different context, with
no parameters for comparison.

These results do not represent the full reality. If, on the one hand, the i|o
cards can be used to trigger and stimulate ideas, on the other hand side
they also present noticeable limitations. There are a lot of features that are
not covered by the representations. Anyhow, the workshops elucidated an
interesting spectrum in which the i|o cards can be of great utility.

Conclusion

What was first created as a support material to one specific workshop is
now a tool with great potential. The i|o cards are suitable to support the
design process of different kinds of interactive systems, not only
interactive artifacts. A new version is currently being developed as an
outcome of the workshops described and analyzed in this paper.

Further improvement will be done concerning the organization of different
layers of abstraction. The idea is to develop a tool with different levels of
abstraction that ranges from specific technical constrains to general and
abstract features. The way this is going to happen is still open, but one of
the ideas is to link the cards with online content. The goal is to create not
just a tool, but also a system of tools to support the design of interactive
artifacts.

References


Assessment and Design of Disposable Medical and Adaptive Apparel

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Abstract
This study discussed the design of functional clothing for patients who suffer from spinal cord injury-induced lower-limb disabilities caused by car accidents or illness. Recycled fibers were used as the basic material, and digital printing technology used to create different color combinations. Ready-made clothes in Taiwan are not suitable for physical disable patients or those with urine drainage bags. The fabric is not antibacterial, and the designs are dull. The study surveyed physicians and patients in order to gain an in-depth understanding of patients’ actual needs. This study included four parts: 1) questionnaire survey and interviews with four physical therapists, on-site observation on the lifestyles of eight patients with lower-limb injuries, in order to summarize the design elements of adaptive apparel and to design four types of pants; 2) antibacterial fabric made of recycled fibers was used to reduce the possibility of bacterial infection; 3) digital printing system was used to design individualized apparel; 4) different fillings and a pressure measurement system used to measure the amount of pressure in pressure-free pants to ensure their effectiveness and to improve comfort. This study reached three conclusions. First, the assessment and design of disposable medical and adaptive apparel were characterized by the following three features: 1) comfort and convenience are important factors affecting patients’ intention to use such apparel; 2) the patients showed a high level of acceptance for disposable recycled fabrics; 3) the provision of individualized style and color combinations could significantly increase patients’ satisfaction. Second, the design functions for patients of different ages could be used to establish complete individualized design samples. Third, the use of recyclable materials and color combinations should be subject to the characteristics of the materials and patients’ preferences, to ensure the function and design quality and to increase patients’ physical comfort and psychological satisfaction.

Keyword: functional apparel design, recycled fiber, patients with lower-limb injuries
Introduction

With the progress and advancement of medical technology, people have aggressively sought for various medical approaches to enable patients with lower-limb injuries to rehabilitate. Moreover, improvements have been made to medical aids and functional apparel in order to improve patients’ quality of life. For patients suffering from limb injuries, those with physical disabilities or those using urine drainage bags, the ready-made clothes available in the market only consider the styling or decorative needs of healthy people. Moreover, because patients often need to bring medical aids with them, the sizes of ready-made clothes are usually unsuitable and can make the patients feel uncomfortable. It is thus important to provide patients with convenient and disposable apparel that have a functional design and is made of antibacterial materials to reduce the possibility of bacterial infection. It is also important to provide patients with apparel that has individualized design and color combinations to meet their psychological needs, in order to improve their overall level of comfort. Thus, this study attempted to design and improve disposable medical and adaptive apparel according to the physical needs of patients with lower-limb injuries. The design was aimed to enhance the patients’ psychological satisfaction, allow them to choose a variety of color combinations, and enable patients who use urine drainage bags to hide them inside the pants. Based on the above, the three purposes of this study are as follows:

(1) To summarize the meaning of the applying universal design elements on adaptive apparel based on the literature review and analysis, primarily on color difference analysis.

(2) To understand the needs of patients with lower-limb disabilities and their acceptance of functional apparel made with recycled fabrics through in-depth interviews and on-site observations.

(3) To establish complete design samples of individualized medical and adaptive apparel, and to provide these information as a reference for related industries to apply recycled fabrics in medical designs and products.

Literature Review

To understand the needs of patients with lower-limb disabilities and the theoretical foundation of the application of color combinations, this study reviewed and investigated the theories concerning spinal cord injuries and perceptual consumption. The effects of spinal cord injuries vary with the impact force and the position of the injury. Mild bone fractures can be cured simply by immobilizing the bone with plaster or a brace. However, severe bone fractures may result in paralysis of the lower limbs or permanent disability, requiring a wheel chair and a urine drainage bag. In addition to becoming a burden to families and increasing social costs, such a disability is an endless source of trouble for patients, and they may suffer from various complications such as respiratory tract infections, gastrointestinal tract infections, urinary tract infections, and skeletal and muscular system problems. The most common complications are bacterial infections of the urinary tract (Note 2). Vesicoureteral reflux is caused by low bladder adaptability and high bladder pressure. If such a situation is not adequately handled, urine reflux may occur after any instance of urination. The urine drainage bag should be placed lower than the bladder to prevent urine reflux; however, it should not be placed on the ground. Therefore, a hidden pocket for the urine drainage bag should be designed at a position near the calf (Lai, 2004). The daily urine output of an individual is at least 1,500 cc. To prevent infections and urinary tract obstructions, the urine drainage bag should be
emptied every eight hours, or when more than 700 cc of urine has been collected, as it is not acceptable to store an excessive volume of urine. The urine drainage bag outlet should be protected against contamination when emptying the bag. As a result, there is a need to notice whether the size of the interior hidden pocket applies to the volume of the urine drainage bag, when designing the hidden pocket for placement of the urine drainage bag. The zipper for emptying the urine should also be designed at a position near the lap, to prevent urine reflux and infection. When handling the sequela caused by the urinary systems of patients with spinal cord injuries, it is necessary to take the following design elements into consideration: safety for patients when handling their own urination, convenience for in-home caregivers, convenience for replacing diapers, and design for the prevention of urine leakage. Bedsores are caused by the long-term physical disability of patients, and they are frequently experienced by patients with spinal cord injuries. Bedsores usually occur on the buttocks, the ischium, the sacrum and the heels of patients, as shown in Figure 1. Consequently, apparel design should take into account the reduction and prevention of bedsores.

![Figure 1 Sites where bedsores frequently occur in patients with spinal cord injuries](image)

**Table 1 High Frequency of Bedsores in Patients with Spinal Cord Injuries**

**Source:** Taking Care of Pressure Sores, Maintaining Healthy Skin - Part 1 - Part 2, “Physical and Mental Rehabilitation Manual,” Department of Nursing/Bedsore Prevention Health Education Data, Chang Gung Memorial Hospital

The study of different lifestyles in the design field is to result in differentiation of product designs. Moreover, the understanding of the medical needs in design is also to identify the characteristics and perspectives of patients, so that the design elements could be realized in the medical and adaptive apparel. The concept of lifestyles was originated from the fields of psychology and sociology. Based on the theory of personal constructs proposed by George Kelly, lifestyle is regarded as a cognitive structure system, and lifestyles vary with individual cognition. A group of homogenous consumers will share the same model when spending time and money. Designers create products that move consumers according to their psychological, behavioral, and visual values (E-LCP 2003 Consumer Marketing Database).

The term “lifestyle” was widely used from the late 1960s to the 1970s, and the concept was applied in the field of marketing (Wells 1985). However, companies were uncertain
as to how to depict consumers’ characteristics and their inward feelings, such as consumer attitudes and values that really affect their behaviors. Therefore, Wells suggested that studies on lifestyle should use precise market segmentation. Green design and green life has become a popular lifestyle in the new century, and is a tremendous value system that includes the concept of environmental protection. It is also an important future trend. Numerous studies have found that, in addition to the rational aspect, the perceptual aspect also affects consumers’ purchase motivation. Moreover, the science of perceptual consumption is the science of investigating the rational and perceptual aspects of human consumer behavior as well as consumers’ personalities, preferences and emotional aspects, and how consumers choose products and brands (Sakai) according to individual’s emotional style. It has been found that human beings are characterized by two aspects, the rational aspect and the perceptual aspect. The rational aspect refers to thinking and reasoning, while the perceptual aspect refers to the five senses and sensation. The meaning of sense is a situation in which a person is moved in some way, and nature originally referred to the personality and character of a person. Sensibility refers to the inward ideological values, personality, preferences, emotional aspects, and other items that touch an individual’s heart (Chen). The perceptual tendency of consumers for food, clothing, housing, transportation, education and entertainment are mutually correlated. The differences in perceptual style originate from lifestyle differences.

An investigation of different groups, such as the target customers of a private product, can help summarize the important factors affecting product design and satisfy the people who fully grasp the target (Donald A. Norman). Owing to the growing concepts concerning global environment, society, and individual environmental awareness, environmentally-friendly processed materials have gradually attracted consumer attention. Environmentally-friendly materials that reduce pollution during the manufacturing process will become the main materials to dominate the industrial market in the 21st century (Organic Exchange, 2007). Enterprises around the world have gradually replaced their views of product development with the 5R principle of environmental protection for consumption, namely: reduce, reevaluate, reuse, recycle, and rescue.

Study Design

Research subjects

The main research subjects of this study were patients with spinal cord injuries, patients with bedsores, physical therapists, operators of medical and health products, and product designers.

Research method

1) Literature analysis: it is a research method used in historical studies. It focuses on describing the contents of the literature and re-arranging the literature in chronological order, to facilitate the understanding of the literature. This study investigated the causes of limb injuries and analyzed patients’ lifestyles, individualized product designs and color combination theory based on the collection of data from the literature.

2) Field investigation: this study used two field investigation methods, namely interviews and records, to observe the lifestyles of eight patients with lower-limb injuries. In-depth interviews were conducted with four physical therapists to record the interview contents and study the process, in order to understand the patients’ needs and clarify problems, investigate their need for disposable medical and adaptive apparel, and identify their acceptance for color combinations and recycled antibacterial fabrics. It was hoped that the use of this method could collect more objective and authentic data.
3) Experiment: this study asked the patients to try on the apparel, record the process using a camera, and evaluated the feasibility of the functional apparel. The subjects were patients with lower-limb injuries.

**Research procedures**

The design process of functional apparel is restricted by materials, designs, and manufacturing procedures. The research procedures of this study were divided into three stages in order to investigate whether disposable and adaptive apparel are beneficial to patients with lower-limb injuries. Stage 1 was the investigation on product needs, and literature review was conducted to establish a theoretical foundation. Stage 2 included the concept design, sample production, and field investigation. Stage 3 was data analysis for product evaluation and mass production, and conducted a feasible model.

In Stage 1, the product needs of patients with lower-limb injuries were discussed. During new product design, the problems encountered by patients were investigated, the causes were analyzed, and design elements were applied to the product design. The concept design in Stage 2 was to generalize the apparel styles and needs of patients based on the questionnaire survey. This study modified the design concept based on the comfort level of patients, their acceptance of disposable recycled fabrics, and their color preferences, in order to proceed to the design and pattern drawing stage. In Stage 3, this study evaluated the products and the feasibility of mass production through interviews.

![Figure 2 Framework of Research Procedures](image)

**Results and Discussion**

This study investigated patients’ needs and design elements based on literature review. The needs of patients with lower-limb injuries were analyzed through field investigation, on-site observations, in-depth interviews, and experiment. The design elements for
disposable and adaptive apparel were summarized according to: 1) the patients’ physiological factors; 2) the need for functional fabrics that are free from odor and bacteria; 3) the size of interior hidden pockets for placement of the urine drainage bag; 4) partial pressure-release design; and 5) wearing convenience.

**Correlation between style and functionality**

This study designed various styles of apparel according to the different needs and body shapes of male and female patients. The styles, applications of functional design, and results of the response evaluation are shown in Table 1.

<table>
<thead>
<tr>
<th>Style No.</th>
<th>Lady01</th>
<th>Man01</th>
<th>Lady02</th>
<th>Man02</th>
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<tbody>
<tr>
<td>Styles</td>
<td><img src="image1" alt="Lady01" /></td>
<td><img src="image2" alt="Man01" /></td>
<td><img src="image3" alt="Lady02" /></td>
<td><img src="image4" alt="Man02" /></td>
<td><img src="image5" alt="Lady03" /></td>
</tr>
<tr>
<td>Functionality</td>
<td>1. Pants with interior hidden pocket for placement of urine drainage bag. 2. For use by male and female patients with a urine drainage bag. 3. Interior hidden urine drainage bag 4. Urine leakage and exclusion are not restricted.</td>
<td>1. Pants with exterior hidden pocket for placement of urine drainage bag. 2. For use by male and female patients with a urine drainage bag. 3. Psychological satisfaction</td>
<td>1. For use by female patients with a urine drainage bag 2. To hide the urine drainage bag. 3. For outdoor use. A product with both medical and leisure functions.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response evaluation</td>
<td>Good The product can help effectively hide the urine drainage bag. It is convenient to empty the urine drainage bag. Urine drainage bag can be hidden securely. High patient satisfaction</td>
<td>Good The product can help effectively hide the urine drainage bag. It is convenient to empty the urine drainage bag. Urine drainage bag can be hidden securely. High patient satisfaction</td>
<td>Excellent The product can help effectively hide the urine drainage bag. It is convenient to empty the urine drainage bag. Urine drainage bag can be hidden securely. Highest female patient satisfaction</td>
<td></td>
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</tr>
</tbody>
</table>
Correlation between style and design elements

This study designed various styles according to the differences between male and female patients. Design elements, such as lines, were mainly used to design products with a sense of leisure that could make patients look slender. The introduction and application of styles and design elements, and the results of the response evaluation are shown in Table 2.

Table 2 Analysis on styles and design elements

<table>
<thead>
<tr>
<th>Style No.</th>
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<td><img src="image4" alt="Man02 Style" /></td>
<td><img src="image5" alt="Lady03 Style" /></td>
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<tr>
<td></td>
<td>2. The product can help hide the urine drainage bag as outdoor clothing.</td>
<td>2. The product can help hide the urine drainage bag as outdoor clothing.</td>
<td>2. The product can help hide the urine drainage bag as outdoor clothing.</td>
<td>2. The product can help hide the urine drainage bag as outdoor clothing.</td>
<td>2. The product can help hide the urine drainage bag as outdoor clothing.</td>
</tr>
<tr>
<td>Response evaluation</td>
<td>Good</td>
<td>Acceptable</td>
<td>Good</td>
<td>Acceptable</td>
<td>Excellent</td>
</tr>
<tr>
<td></td>
<td>Like it very much</td>
<td>Like it</td>
<td>Like it</td>
<td>Highest female patient satisfaction.</td>
<td>No significant difference</td>
</tr>
</tbody>
</table>

Analysis on the use of recycled fabrics and acceptance

According to the design concept of disposable and recyclable products, this study used fabrics reproduced from recycled plastic bottles to design products. A water repellent treatment was applied to the exterior cloth for the prevention of urine stains. An antibacterial deodorizing treatment was applied to the interior fabric in order to reduce the possibility of bacterial infection and increase ventilation. Breathable wicking fabrics made of recycled materials were used to produce adaptive apparel. The patients’ acceptance for such products and the results of the response evaluation are shown in Table 3.
Table 3 Analysis on the use of recycled fabrics and acceptance

<table>
<thead>
<tr>
<th>Style No.</th>
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<tbody>
<tr>
<td>Styles</td>
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<td><img src="image3.png" alt="Image" /></td>
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</tr>
<tr>
<td>Fabrics</td>
<td>1. Exterior: 100% Polyester 75d fabric made of recycled plastic bottles. A water repellent treatment is applied to the cloth for the prevention of urine stains.</td>
<td>1. Exterior: 100% Polyester 75d fabric made of recycled plastic bottles. A water repellent treatment is applied to the cloth for the prevention of urine stains.</td>
<td>1. Exterior: 100% Polyester 300d fabric made of recycled plastic bottles. A water repellent treatment is applied to the cloth for the prevention of urine stains.</td>
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<tr>
<td></td>
<td>3. Interior: 100% Polyester 40 mesh. An antibacterial deodorizing treatment is applied to the cloth to reduce the possibility of bacterial infection and increase ventilation.</td>
<td>3. Interior: 100% Polyester 30 mesh. An antibacterial deodorizing treatment is applied to the cloth to reduce the possibility of bacterial infection and increase ventilation.</td>
<td>3. Interior: 100% Polyester 60 mesh. An antibacterial deodorizing treatment is applied to the cloth to reduce the possibility of bacterial infection and increase ventilation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response evaluation</td>
<td>Excellent Odor free, easy to clean Breathable fabrics</td>
<td>Excellent Odor free, easy to clean Breathable fabrics</td>
<td>Excellent Odor free, easy to clean Breathable fabrics, no sense of itching</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Analysis on color combinations

The research results of this study on disposable medical and adaptive apparel included three aspects: a) the selection and design of the optimal material; b) patients’ psychological factors and color preferences; and c) consideration of the overall style and overall sense of color. During the interviews, the patients mainly wore apparel with dark colors, as the patients with lower-limb injuries were afraid of urine leakage, which would lead to urine stains on the clothing. Another reason was that patients had limited choices and could only accept the current status. Therefore, the analysis on the response evaluation showed that the male patients’ acceptance of dark colors, such as black and deep blue, was the highest. As for light colors, their acceptance of khaki was the highest. The female patients’ acceptance of dark colors, such as brown and black, was the highest. As for light colors, their acceptance of gray was the highest. The analysis on color combinations and the results of the response evaluation are shown in Table 4.
Conclusions

This study reached three conclusions:

1) A total of eight patients with lower-limb injuries participated in this study. The patients’ physical and psychological needs were taken into account to develop and design new products. This study also developed effective procedures for new product design, including data analysis, summarization and comparison, problem analysis and problem solving. The procedures could help designers fully understand the design parameters concerning patients, human nature, and medical behavior during the design of relevant products. Moreover, the procedures could also help develop adaptive products that meet the needs for practicability, safety, convenience, and aesthetic appearance.

2) The response evaluation on the use of disposable medical and adaptive apparel showed that the patients were highly satisfied with the use of pants and skirts with hidden pockets for placement of the urine drainage bag. The design of a hidden pocket helped hide the urine drainage bag and resolved the difficulty using the toilet outdoors. The interior zipper design made it easy to replace the urine drainage bag or to empty the urine in the bag, thus increasing the convenience for caregivers. The caregivers’ satisfaction with the design was also high.

3) The evaluation on the use of disposable recycled materials revealed that recycled fabrics are widely applied to environmentally friendly designs. Such a concept further complies with the idea emphasizing lifestyle and sustainable operations. The main objective of sustainable operations is to develop multiple values and consider product recycling and waste reduction, increase the durability and appropriateness of materials,
and select materials and manufacturing processes with the minimum amount of pollution. This study used a 100% polyester waterproof material to design functional apparel in order to prevent stains and odor caused by urine leakage. A breathable wicking mesh was used to make the lining. The patients with lower-limb injuries were highly satisfied with the use of disposable recycled fabrics. Moreover, it was convenient for them to use such products while travelling.

4) Regarding color combinations, the patients mainly cared about wearing convenience. The research results showed that they prefer dark colors, including black and deep blue. As for light colors, they mainly prefer khaki and gray.

Reference


Best Practices in PET Recycling - Overview of the PET Plastic Recycling


Revolve Brand- www.revolve-phil.com/products.shtml


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Shaping a Case in Cultural Product Design for City Marketing: Product storytelling for the former Tainan State Magistrate

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\textsuperscript{a}National Yunlin University of Science and Technology
\textsuperscript{b}National University of Tainan
\textsuperscript{c}Southern Taiwan University

Abstract

Promoting tourism by attracting the interest of people to the local culture, particularly through consuming experiences of cultural products, is a current trend in urban competitiveness. Cultural products are popular instruments representing local culture. They translate messages, narrate memories and historical events, and establish an emotional connection with people. The present paper explores the possibility of using cultural products as a city marketing strategy for the former Tainan State Magistrate Residence, which can be integrated with other cultural zones to represent Tainan City. The Tainan City government registered it as a city-level historical heritage site and completed its restoration and reuse plan in 2000. However, no practical marketing strategy has been formulated to promote the site and to raise cultural awareness among both locals and tourists. The present study adopts an empirical case generated from an outing course: a one-day cultural learning tour involving 61 student participants in the former Tainan State Magistrate Residence. Many rich identifiable cultural features were derived from the experience of the participants, which were transformed into unique and irreplaceable cultural product ideations. The findings of the case study provide a clear understanding of the dynamic relationship among cultural products, city heritage, and city marketing, which strengthens the potential of cultural storytelling through the design of cultural products for city image promotion and urban regeneration. They provide practical designers, urban planners, and policy makers a view of the importance of cultural communication media through products.

Keywords: cultural product, storytelling marketing, historic heritage, cultural-product industries, design prototype testing
Introduction

The development of cultural-product industries is a dominant issue in local economic policy. Cultural products, which are embedded in the local culture and in historical heritage, possess authentic characteristics and reflect traditional culture.

According to the benefits of cultural products, the present study explores the potential effects of developing cultural products in a case study of the former Tainan State Magistrate Residence. So far, there has been less awareness on its image/branding development until now. Therefore, the present study aims to develop an empirical design project with the concept of storytelling marketing for the former Residence.

The research methods used in the present study are based on the case study, including literature review, field survey, data collection, and content analysis of the experience of the participants. The case study involved 61 potential visitors and a design prototype test examined with the storytelling narratives of the 25 potential visitors.

The results indicate that cultural products are emotional and commercial tools that combine cultural features and creative design ideas to appeal to the interest of visitors. The present work explains the role of cultural and historical heritage in city-image visualization development by focusing on products with storytelling capability and by making them a part of a marketing strategy for the former Tainan State Magistrate Residence.

Theoretical Basis: Cultural Experience in Design

Culture and cultural product

The styles provided in this template are defined in numerous ways. Broadly, culture is the way people express themselves verbally and in their manner of clothing, lifestyle, beliefs, and practices (Crocombe, 1983). The customs of a society, the self image of its members, and the things that distinguish it from other societies constitute its culture (Fincham and Rhodes, 1994). Thus, the value of culture lies not only in the fact that it allows the members of a society to recognize themselves. The non-members of a society can also use culture to differentiate one group from others.

Culture is a dynamic construct activated in response to human life; it affects every aspect of life. Different types of geographical and cultural heritage produce valuable and intangible assets. In a borderless world, local culture and traditional values become more important in globalization. People gradually understand that embracing their own culture is important.

In the past, people produced tools for their domestic needs. Today, designers observe the needs of users and create products they can use for their daily needs. Design is firmly embedded in culture. Design satisfies the needs of people. The present paper emphasizes the UNESCO definition of “cultural products,” which states “the specificity of cultural goods and services, which, as vectors of identity, values, and meaning, must not be treated as mere commodities or consumer goods” (UNESCO, 2011).

The cultural factors in design make life convenient and make better use of culture as a source of innovation (Moalosi, Popovic, Hudson, and Kumar, 2005). More than ever, cultural factors provide stories for creating cultural emotional experiences. Hence, cultural image, identity, and meanings are embedded in the minds of individuals. These offer an opportunity for designers to create a certain emotional connection between cultural
commodities and users/customers. Thus, the present paper uses cultural products to explore their influences on the cultural marketing of a city.

**Illuminating cultural stories through PRODUCTS**

Storytelling creates culture, and rich cultural resources generate stories. Cultural practices shape the attitude and behavior of people into interactions in a cultural context. Hence, cultural image, identity, and meanings are in a form that delivers cultural intrinsic features and that communicate with people for generation inheritance. Rich folklores and stories often have appealing features that assist people to understand their culture better. The appealing and intangible features are interpreted into a redesigning process as a tangible product for consumption. Consequently, their significance offers an opportunity for designers to create a certain emotional connection for customers to appreciate culture. Ultimately, the products are reproduced and repackaged for commercial purposes to highlight local characteristics versus globalization in an increasingly homogeneous market.

According to Chang and Chung (2011), cultural emotions and ideas generate cultural products, which follow a story format. When stories are interpreted and redesigned into a cultural product, such product can represent the local culture. Culture also provides creative and unique ideas for product design. “Design is a kind of expression of culture” (Chen et al., 2009, p.337). Therefore, in the connection between culture and product, design is an aesthetic packaging for cultural promotion, and its strength is in the capability of storytelling to communicate emotionally with people.

**Cultural heritage and city marketing**

Kotler, Haider, and Rein (1993), who conducted an empirical study on inter-city competitions worldwide, propose a “place marketing” strategy. This strategy suggests the examination of a city as a market-oriented business and then the introduction of the marketing concept in city governance. In relation to this, the present study hopes to promote city development and hence its competitiveness. Paddison (1999) states that marketing enhances the competitiveness of a city, attracts inward investments, and promotes the welfare of the people. Further, Ashworth and Voodg (1990) indicate that city marketing might design local activities into consumer-related needs and benefits, maximize social and economic efficiency, and meet local development goals. In summary, Kotler, Haider, and Rein (1993) view a city as an industry, with its future as its product. Kotler, Haider, and Rein (1993) identify the four key elements of the cultural marketing strategy as (1) the image of a city, (2) local characteristics, (3) infrastructure construction, and (4) marketing using a celebrity.

According to the concepts of place marketing depicted above, the present paper suggests the use of historical heritage to construct an important cultural image of the city. Cultural and heritage images in the current paper refer to buildings embedded with identifiable images and the tool that conveys their core values. The identity of buildings lies in their complex spatial patterns and socio-cultural values. The cultural products in the present research synthesize various attributes and transform them into a unique and irreplaceable product identity for marketing.

**A case study: the former Tainan State Magistrate Residence**
The current research establishes the understanding among cultural heritage, cultural products, and city marketing. The literature depicts “cultural product design” as a creative process that involves the practices of cultural deconstruction, construction, and reproduction. To focus on the understanding of the dynamic relationship among heritage, cultural products, and city marketing, the present paper conducts an empirical case study of the historical heritage of the former Tainan State Magistrate Residence in Tainan City, the fifth largest city after New Taipei, Kaohsiung, Taichung, and Taipei. The research follows four processes: (1) defining the research questions, (2) developing the research methods, (3) collecting the data and analyzing them, and (4) developing a cultural product design project and prototype testing. The results show the importance of developing cultural products as an effective marketing strategy for a city.

Selecting a case

The former Tainan State Magistrate Residence is located in Tatiana City. It is near the city center and is accessible through convenient means of transportation. The area is bustling with economic activities as well. The location is a city-level historical heritage site that has completed restoration and reuse plans. However, no practical marketing strategy has been formulated to promote the site and to raise cultural awareness among residents and tourists.

In 1994, the Council of Cultural Affairs started working on the construction of central government-funded local software and hardware cultural facilities. According to currently funded projects (Hwang, 2002; Lu, 2006), the Tainan City government will market the place as the “Tainan Magistrate Residence Cultural Zone” in the near future. This area was chosen as the subject of the current study in order to discover its cultural features and its potential economic opportunity in terms of local tourism, city marketing, and branding.

Entry into the field

The current work uses an empirical case in developing an understanding of the dynamic relationship between heritage and cultural products to discover city marketing potential through the design of cultural products. The primary research methods used at this early stage of the current study include a review of the existing literature, field survey, collection and content analysis of old photos, and panel discussion with scholars, government officials, professionals, and local residents.

The understanding of the former Tainan State Magistrate Residence requires backtracking to the Japanese colonial period (1895 to 1945). During this time, the Japanese government implemented an industrial policy and infrastructure construction in Taiwan, and many settlements became prosperous cities. Inasmuch as the Japanese government was Westernized during the Meiji period, Western urban planning was introduced into Taiwan. Especially in 1920 (Da-Cheng’s ninth year), the Japanese government used the City-Block Improvement Plan (city planning) and redelineated five states, with Tainan City as the administrative center of the entire Tainan State. The former Tainan State Hall and the former Tainan State Magistrate Residence were then built. The former Tainan State Magistrate Residence was constructed in 1900 (Meiji’s 33rd year). It included two buildings. One was Western and had two floors, red brick walls, and many beautiful arched corridors. The building earned the name “Bell Tower.” The other was a Japanese-type structure. It was a Japanese–Western mixed style of architecture seldom seen during that time. It is a precious building from the Japanese colonial period that has been preserved up to the present. The building has three unique symbolic attributes, which can also be the source of the image and brand of the city. These symbolic meanings are presented as follows:
1. The first building is Western type with red bricked walls and many beautiful arched corridors, an eight-angled shape facade between its center, and two sides. The locals call it “The House of Arched Corridors.” It was the highest and the largest building in Tainan in historical times. It was also the residence of the highest Japanese official in southern Taiwan.

2. Dong-Cha (munahuda, one wooden board is nailed on the main beam or center of the house, which serves to send good wishes for the house owner) is the earliest form of Japanese architecture in all Taiwan at present. It should be preserved and considered a national treasure.

3. It was a bomb shelter that survived during the Japanese period and is the largest in Tainan City.

**Shaping the case**

According to field notes and related data, the current research conducted a one-day cultural learning tour at the former Tainan State Magistrate Residence. Case study research as a research strategy consists of a detailed investigation associated with multiple methods to collect data of phenomena within their context over a period of time (Hartley, 2004). The present study adopted the case study strategy because it ideally explores an issue in depth and follows leads that focus on new areas or new constructions of theory based on how much the case study participants reflect on issues.

The previous study was followed by an empirical design project as a case study with student participants. A total of 61 students aged 20 to 25 years old participated, who were selected because of several reasons. First (1), these young students had high potential to serve as site tourists. Second (2), these students selected are also local residents, who did not have much knowledge of their cultural heritage. Third (3), the site is located near the city center and is bustling with economic activities; it is near shopping districts where young tourists like to frequent. The participation of the students enables the current research to understand the interest of the younger generation in terms of city image and culture.
Figure 1 illustrates the current research framework. The focus of the process is to collect the ideas of the participants about cultural heritage and to observe their experiences in the actual site. The selection of cultural features based on participant impressions and preferences revealed that the heritage of the former Tainan State Magistrate Residence embedded Tainan history. It is not only part of history but is also one of the city’s symbols. When generating ideas about how to design appropriate cultural products for city promotion in Tainan, the present study started modeling what the participants like in products and testing their acceptance in the market. Through retesting and redesigning of products, the design process of cultural products, which are generated by the cultural features of the former Tainan State Magistrate Residence, describe the image of the dynamic relationship among cultural heritage, cultural products, and city promotion.

Analyzing data and searching for cross-case patterns

The analysis of data comprises the heart of building the understanding of the case study. Coding and decoding methods describe the thoughts of the respondents. The synthesis of the findings filtered out the distinct cultural features of the site. The interpreted data developed a design model for cultural products to represent cultural residences. The focus of the present paper emerged from an intensive research project that used qualitative methods, namely, onsite field survey, observations in the cultural learning tour, interviews of the participants after their site visit, and group discussion for the design of possible products.

Cultural features for design inspiration

According to Vanolo (2008), the analysis of the symbolic construction of a city image comes from two different perspectives, namely, internal and external. An internal image is more concrete and more easily identified through local sceneries and landmarks. By contrast, external image is relatively vague and has an abstract and simplistic value (including positive or negative values) in unfamiliar and unexplored cities. Based on Vanolo (2008), the former Tainan State Magistrate Residence is a cultural and historical heritage that is a landmark of Tainan. From historical links with Tainan, the Residence reflects the lifestyle of the Japanese imperial family and its elegant aura of nobility. From its architectural style to the building materials used, it is an accurate record of Tainan history. Figure 2 lists the internal and external images of Tainan City and attempts to structure the impressive image of the city.

City Image Symbolization and Cultural Product Visualization

Figure 2

Methods of analyzing Tainan City through an image interpretation process and a city marketing strategy
Three distinct images of the site often emerged in the discussions with the 61 student participants, namely, (1) Dong-Cha amulet, (2) clock tower, and (3) historical events that happened in the site, especially the Song Jiang Battle. Therefore, the present study generates first these three distinct products to understand the connection between city images and cultural heritage. The reason for conducting this process is to determine whether or not these cultural features of local heritage have a substantial effect on the promotion of city image via products, which have an inherent storytelling capability that presents regional culture. The current study organized a designer group, including four design students who are familiar with the site background. They referred to the outcomes of Figure 5 and conducted a brainstorming process to generate the ideations of the potential products. The ideas of the cultural products are from three distinct objects as seen in Figure 2, which were easy to connect with their representative. Thus, three product prototypes were developed.

The current work created other prototypes relative to the three objects, namely, (1) a bookmark formed using Dong-Cha style, (2) an alarm clock with a clock tower look, and (3) toy figures depicting the Song Jiang Battle in order to understand whether the usability of these cultural products was important. Product usability was hypothesized to attract visitors to buy something useful. Therefore, a product test was conducted to collect participant responses about the connection between cultural products and city marketing. In showing how to apply image symbolism and historical meaning transformation, Figure 3 uses symbols or signifiers to interpret the concept of the former Tainan State Magistrate Residence. In this case, considering the time limitation, three prototypes for testing the potential youth tourists were prepared. A suggestion for future research is to use more prototypes to interpret different cultural contents and hence develop an appropriate product style associated with city images.

**Figure 3**
Image identification and cultural product design of the former Tainan State Magistrate Residence. Three products are aesthetic oriented, whereas three others are concerned with how to approach customers.

**Coding the values of culture-driven product design for regional development**

Through the prototype testing, the present study collected 25 participant responses via semi-structured questionnaires. The participants were potential youth tourists, and they had visited the site before. From their responses, the current research obtained their understanding of cultural products and their appreciation of these products as cultural representatives of a place. According to Table 1, the four artifacts in the creation of the value of a cultural product are as follows: (1) telling local stories and creating tourist memories, (2) increasing tourist interest to promote local tourism, (3) applying product
consumption to create local economic value, and (4) structuring cultural images and identity to develop regional awareness and recognition. There are sub-attributes to illustrate each artifact. For example, “telling local stories and creating tourist memories” is derived from the collection of memories, local cultural promotion, extension of visit, reserve the memory when visiting the pace, creation of long-lasting impressions, and promotion of the place’s attributes. Each feature is decoded and supported by participant responses.

![Table 1](image_url)

Table 1 presents the thoughts and ideas of the potential young tourists on the cultural products. Note that the questionnaire also generated negative responses, such as “It is too commercial to use cultural products to promote a place” (Respondent 5); “The Residence is not that famous, I am not interested in its products” (Respondent 19); “I visit the area because the building is a well-known heritage in Tainan; I do not think it needs to be overcommercialized” (Respondent 21); and “Why are cultural products necessary? I like to visit a place for fun, not for shopping” (Respondent 24). Significantly, few of the participants had negative views of cultural products, and in fact, 21 respondents gave positive feedback as regards the use of cultural products for city marketing their value in local branding and tourism economics. Future research can examine the balance between commercial purpose and cultural reservation in design activity.

### Cultural products integrated with storytelling for city marketing

In the context of the participant responses, most people are aware that Tainan is one of the oldest cities in Taiwan and is teeming with folk culture and tradition. They are interested to know more about its cultural stories and to take home something to record their visit. For example, some respondents expressed, “After visiting the former Tainan State Magistrate Residence, I would like to have a postcard or something with its image on it; I like to have a souvenir of the place to record my own travel” (by Respondent 3),
and “It could be good to have a representative product of the place in order to deepen my impression about the place” (by Respondent 8). Further, the testing of product prototypes with the respondents gave feedback that reflected their interests in the stories or specific meanings of products.

The former Tainan State Magistrate Residence presents an elegant air of Japanese nobility in the past. Today, it has great potential of becoming a representative Tainan site. The unique symbolic heritage of the former Tainan State Magistrate Residence is concretely highlighted by its Western-style building with red bricked walls, the Dong-Cha, and the bomb shelter during the Japanese period, which are all internal images. The external images of the historical rerecording of life in the official residence and the elegant air of nobility comprise the structure of past residents’ values, beliefs, behavior, and attitude, creating a proper city branding strategy for marketing.

Inasmuch as the former Tainan State Magistrate Residence does not belong to any cultural zone of Tainan City, its cultural products are potentially more novel to visitors. The current study proposes to design a set of cultural tourism schedules, which can integrate the former Tainan State Magistrate Residence and other cultural zones to represent Tainan City.

**Competitive functions of cultural products**

Cultural analysis and the creative design of a product for daily use can support business marketing for the regional culture. Carmichael (2002:313) said that the competitiveness of cultural products relies on attributes such as their originality, uniqueness, and creativity. In the case of the present study, the cultural products, namely, the Dong-Cha amulet, the clock tower, and the toy figures that depict the historical events in the site, successfully transform cultural symbolism and represent a part of the history of Tainan City. Cultural products are not just ordinary products. Although they are prototypes, they still possess the originality and distinctiveness of their cultural features, which gained recognition from the respondents. For example, Respondent 2 said, “It draws my attention to the cultural connection with local history; it present cultural uniqueness.”

The use of cultural products is not always necessary, but purchase interest abounds. As Respondent 7 said, “If this product is functional, I will be more interested to buy it because it is usable and useful.” Respondent 9 has another opinion: “A cultural product has functions; it makes people want to buy because it is not useless or is just for fun. It looks interesting, and it still makes me want to buy.” There are pros and cons as regards the functionalism of cultural products. Usable cultural products attract the interest of people as the products do not just look nice but are useful as well. “Functionality” is an easy way to make cultural products more customer friendly.

**Conclusion**

A successful city image, which is a key reference for its residents and represents a sense of regional identity and belongingness, develops a positive attitude and feeling toward one’s environment. It also serves as a means for tourists to form a concrete idea of the city in their minds, encouraging them to visit the city again. This image can help maintain a sustainable tourism industry. The present study used the case study approach, with the participation of young local students who shared their cultural experiences and who contributed designs. The case study aimed to lead the youth in understanding their culture and to participate in city image development. To impress culture on the youth, the present study needed to develop cultural products which helped create a marketing strategy for the former Tainan State Magistrate Residence.
This process shows that culture and cultural values can be traced back into all aspects of living and is knitted in all kinds of historical records. The present paper reidentifies a neglected historical heritage and links its cultural features with city images. Cultural products play an influential role in strengthening the course of cultural rendering to bestow power for the construction of the symbolic features of the Residence and of Tainan City. The emphasis on the elegant lifestyle of formal residency living and that of the nobility through creative design and image making can expand the Residence’s public appeal. Character and tradition define the distinctiveness of the Residence, especially how it is used spatially and socially, as well as how it is embedded within the context of the local culture. Overall, the results of the case study provide practical designers, urban planners, and policy makers a view of the importance of cultural communication media through products. The findings illustrate that cultural products are emotional and commercial tools that combine cultural features and creative design ideas in order to appeal to visitors. They also play significant roles in cultural and historical heritage in city image visualization development, with storytelling capability as a city marketing strategy.

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References


Workshop Process for Design Education by Using AEIOU Approach to Wayfinding Application

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Abstract
The wayfinding application of AEIOU approach design workshop is an operationalism oriented design methodology in which design college students worked together to find the real world wayfinding problems and then analyze, represent, test, and finally design a problem solving product or service. The AEIOU approach is articulated to A (activity), E (environment), I (individual), O (objects), and U (understanding). It was designed based on the Situation-Framework-Solution Mode that consisted with Situation-problem (analysis), Framework-lenses (evaluation), and Solution-prototype (synthesis), the evidence-based design process. The most important concept to be learned is the attitude of “empathy” and “reflection-in-action”.

The workshop process was operated based on the following steps: (1) Define situation-problem; (2) Select framework to analyze; (3) Represent Lynch’s framework; (4) Use Lynch’s analysis method; (5) Analyze representation; (6) Evaluate the collected and represented data; (7) Develop representations of the evaluation (seeing & imaging drawings); (8) Synthesize the requirements or opportunities into beta solution method; (9) Prototype imagining drawings; (10) Evaluate the solutions-synthesis against the problem situation and test; (11) Repeat (iterate) steps 1-10 until the cost-benefit is negative.

The conclusions and feedbacks generated from the workshop were three pedagogical evaluation contents: (1) The website sharing and information presentation are helpful to the workshop pedagogical method. (2) Most of the students felt “freedom but serious” in the overall process control. With the satisfaction feedback, the students revealed high positive attitude about their final design works and their work performance. (3) The most impressive part of the workshop process was “prototype testing”. According to the opinions of students, most of them were first time to make prototype testing with the real users.

Keywords: design process, design workshop, aeiou approach, wayfinding application
Introduction

The wayfinding application of AEIOU approach design workshop is an operationalism oriented design methodology in which design college students worked together to find the real world wayfinding problems and then analyze, represent, test, and finally design a problem solving product or service. It was designed based on the Situation-Framework-Solution Model, which consisted of Situation-problem (analysis), Framework-lenses (evaluation), and Solution-prototype (synthesis), the evidence-based design process. The workshop was held in summer of 2011 in Taiwan. There were 27 student participants in the workshop, divided into six groups and worked together for two weeks. According to Cross (2011) in “Design Thinking”, three key strategic aspects of design thinking appear to be common: (1) Taking a broad systems approach to the problem; (2) Framing the problem in a distinctive and sometimes rather personal way; and (3) Designing from ‘first principles’, the designers appear to explore the problem in a way that stimulates and pre-structures the emergence of design concepts. In this workshop, the methodological goals were set for young design students, which concluded the “empathy thinking” with users and team members, and the “reflection on action” about their user behavior observation and design solution testing observation.

The AEIOU approach is articulated to A (activity), E (environment), I (individual), O (objects), and U (understanding). It was an evidence-based design process. The most important concept to be learned is the attitude of “empathy” and “reflection-in-action”. The concept of “empathy” is to understand people’s needs by getting out in the “wild” and observing what they do, and make and listen to what they say. The idea is to collect data that could potentially identify opportunities and user needs. The idea of “reflection” is to evaluate by “reflecting” on each decision that is made during the design process (Schon, 1983). The concept offers a designerly way of thinking and a strategy for the design process. The AEIOU frameworks (see Figure 1) represent not only design experience but also evidence-based knowledge to support the design process. Representations are different forms of communication and are used to think and communicate what they are imagining in their minds.

There are five teaching goals in the workshop. (1) Learn that the user is important and should be part of the design process; (2) Learn specific knowledge, literature and language to help students become a better designer; (3) Learn to work in teams, and learn leadership and communication skills; (4) Learn to apply current, appropriate design methods; (5) Incorporate research on the real world environment with design thinking.

![Figure 1 Situation-Framework-Solution Model](Adopted from Branham (2011))
The A-E-I-O-U Approach

The A-E-I-O-U onion model is based on a situation frame that offers a contextual systematic view for analyzing and evaluating a human-centered situation or problem (see Figure 2). It could have also used the wording 'context-based design' because the idea of 'situation-based design' is based on a series of nested systems beginning with the (1) individual or group (I), then (2) activities (A) of the individual or group, then the (3) objects (O) that they interact with in a specific 'place' or (4) environment (E) called a behavior setting at a small scale. These behavior settings are collected together to form an activity system of a larger scale. All these nested systems are influenced by the largest scale or system consisting of political, economic, sociocultural and technological systems; and the (5) understanding (U), in context, the relationships between individuals, activities, objects and environment where the relationships take place. Figure 2 shows the framework of the AEIOU relationship. Spradley (1980) had defined the main ideas of the content, see the Table 1.

![Figure 2 A-E-I-O-U Circle](Adopted from Branham (2011))

### Table 1 Brief definition of AEIOU

<table>
<thead>
<tr>
<th>Title</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual</td>
<td>The goals people trying to accomplish, the activity or community people involved in and feeling expressed</td>
</tr>
<tr>
<td>Activity</td>
<td>Single, set of action people do, and carry out the event over time</td>
</tr>
<tr>
<td>Object</td>
<td>The physical things that are present</td>
</tr>
<tr>
<td>Environment</td>
<td>The physical place or places</td>
</tr>
<tr>
<td>Understanding</td>
<td>Understanding the relationship from individual to environment</td>
</tr>
</tbody>
</table>

**Individual**

Individual is the human at the very center of the situational frame. It reinforces the concept of human-centered design. The individual must be studied in context of other individuals (work, social, or play group), activities they perform in relation with--others, objects and their immediate environment. Individuals can be studied in context of three main topics which concluded five levels: (1) Embodied cognition (brain), which refers to the embeddedness of the brain in the body (the functional integration of action, perception, and cognition that flow from it) (Wilson, 2002); (2) Situated cognition (body), which refers to the embeddedness of the brain-body complex in the environment. Also, off-loading cognitive work onto the environment (Lave &Wenger, 1991; Suchman, 1987),
and focused on psychological (mind, body and place, cognitive psychology); (3) Distributed cognition (world), in certain cases, collectives (or networks of situated brains) process information co-jointly (Hutchins, 1995), which concluded with social and cultural context.

**Activity**

It is based on the assumptions that the ‘activity’ is the basic unit of analysis and artifacts or tools mediate the relationship between subjects and object (Robertson, 2008). Robertson (2008) addressed interactions that occur when two activity systems come together and incorporate the idea of boundary objects, see the Figure 3. Where two (or more) activity systems come into contact, there may be contradictions and tensions through which expansive learning is possible.

![Figure 3 Third generation activity theory](image)

**Object**

Physical things and artifacts present in the environment that the individual interacts and manipulates. Properties of an object are the attributes of it that can be experienced by our senses (e.g., its color, size, weight, smell, taste, and location). Objects manifest themselves as clusters of their properties occupying the space (Wikipedia, 2011). An object possesses a material shape which can be distinguished from other shapes and perceived as having meaning. Related with symbolic Interactionism (Blumer, 1969), which rested on three simple premises: (1) The basis of the meanings of things human beings act with; (2) The meaning of such things is derived from, or arises out of, the social interaction; (3) These meanings are handle in and modified with interpretative process by the person who dealing with things.

**Environment**

The environment includes small-scale and medium-scale physical places in context, which could be interpreted small-scale with “behavior setting” (Barker, 1968), and the medium-scale with “activity system” (Lang, 1987). Behavior setting explains the relationship of the individual and the social environment. It consists of the combination of activity and place, in a specific time frame (Barker, 1968). Baker (1968) describes the activity as "a standing pattern of behavior that involves interpersonal interaction or the manipulation of objects and the physical environment as the place." The behavior-place relationship is referred to as the synomorphy. The environment consists of a hierarchy of behavior settings linked together to form activity systems. People's activity systems reflect their motivations, attitudes, and knowledge about (or images of) the world within the constraints of their incomes, competencies, and cultural norms (Chapin & Brail, 1969).

**Understanding**

Understand the relationships from individual to environment. In the operation process of A-E-I-O-U framework, students must realize what the content in the environment real
users will be encountered, and observe the situation in honestly, recoding the detail and well analyzing with the A-E-I-O-U framework.

**Wayfinding Workshop**

Wayfinding encompasses the information-gathering and decision-making processes that people use to orient and navigate through space, or how people get from one location to another. There are five principles that wayfinding questions can address: What is my destination? How do I find where I am in the environment? How do I find the route to my destination? How do I recognize my destination when I arrive there? How do I find my way back to my starting point?

Lynch (1960) coined the term “wayfinding” to describe his concept of environmental legibility. He identified the skeletal elements of city form: (1) Paths: Familiar routes followed such as streets, walkways, subway routes; (2) Edges: there are boundaries between two phases, linear breaks in continuity. The physical barriers concluded of walls, fences, rivers, or shorelines; (3) Districts: areas with perceived internal homogeneity such as midtown, residential areas, industrial areas, suburbs, college campuses etc.; (4) Nodes: centers of attraction that you can enter. Major intersection or meeting places, such as New York’s Grand Central Terminal; (5) Landmarks: point of reference such as building, sign, store, or mountain.

The workshop process was conducted based on the following steps: (1) Define situation-problem; (2) Select A-E-I-O-U framework to analyze; (3) Represent Lynch’s framework; (4) Use Lynch’s analysis method; (5) Analyze representation; (6) Evaluate the data collected and represented; (7) Develop representations of the evaluation (seeing and imaging drawings ); (8) Synthesize the requirements or opportunities into beta solution method; (9) Prototype the image drawings; (10) Evaluate the solutions-synthesis against the problem situation and test; (11) Repeat (iterate) steps 1-10 until the cost-benefit is negative. The following explanations were integrated into five dimensions to combine the above-mentioned 11 steps with the workshop destination on campus. Alexander, Ishikawa, and Silverstein (1977) mentioned the pattern language of towns and buildings, and “each pattern represents our current best guess as to what arrangement of the physical environment will work to solve the problem presented.” Alexander et al. (1977) suggested that the pattern language for your own project you choose, that should be most helpful to solve the situation problems and connect the different scale patterns in the environment. With the concept of city image (Lynch, 1960) and pattern language (Alexander et al., 1977), the A-E-I-O-U framework was created based on an easier way to access wayfinding projects for young students to understand and analyze the environment.

**Workshop process**

**Think and Determine**

Think and determine a situation on campus that could be improved by providing a better wayfinding system, for example find a ‘place’ on campus that is hard for the visitors to find or navigate to and through. Why and how did you choose your situation? Figure 4 is the primary analysis of the chosen environment of group-3.
Make a Representation

Make a representation of the situation you selected. Define the ‘unit of analysis’ (scale). What is the place included in the situation - city, campus, parking lot, building or room? Determine what type(s) of representations would be the most appropriate - sketches, plans, photos, and video, etc. Begin by representing the environment; next define the individuals, activities and objects in the environment in your situation, see the Figure 5 which showed the A-E-I-O-U analysis of school library by group-3.

Think about how to Analyze and Represent

Collect, evaluate and represent the information of the environment in this step. Lynch (1960) mentioned ‘imageability’ to show the potential of city guide and evaluation. In Lynch’s concept of city image, there are five elements which had been defined as paths, edges, districts, nodes, and landmarks. These elements are basic concepts and are connected to each other with interrelation and formed the city image flexible and free. As the Figure 6 showed, group-2 made their environment situation images from complex to brief representation with design shifting from their refined images and user responses.
Prototype Making and Testing

Make design solutions, prototypes, signs or maps (representations) based on the evidence gathered in the previous steps. Kosslyn (2006) suggested that good graphic should allow a designer to “connect with his/her audience”, “direct the reader’s attention through the display” and “promote understanding and memory.” In Figure 7, young designers tried to make replaceable interface stimulated for the mobile device and test it in the Taipei main station. Before they made the final design solution, the prototype testing could let young designers observe the situation of user operation with suggestions from Kosslyn (2006). Prototype making is one of the most important parts in the evidence-based design workshop. The goals of prototype making are to learn how to represent designers’ ideas and how to integrate the members’ design abilities with suitable communication. Think and formulate a testing plan to test solutions in the real environment using real users. Carry out the testing quickly, collect and analyze the data, document, and communicate the results to your class.

Re-make and Re-think

Re-make and re-think the steps 1 to 4 mentioned above. In other words, collecting and observing the situation of real users’ response to the solutions design iteratively.

Workshop Outcomes

There are six groups in this workshop. Each group chose their destinations and found the problems they want to solve. After several times of prototype testing with real users in the environment, young designers made their final design and set it in the real environment. The Figure 8 explained that group-1 made their prototype testing and final design testing in NTU campus. They found some users to follow their design walked on the campus,
and collected their opinions. The other time, they just stayed there and observed people on the campus if they were watching their design or not. Another project set in the school library, and the group-3 designed the product with cloud computing concept to help people find book they want (see Figure 9). There are different situations with different environmental concerns, and the students generated their ideas and solutions with their innovative design abilities.

Figure 8 Prototype and final design testing of group-1

![Prototype testing and Final Design testing](image)

Figure 9 Book searching concept of group-3

Multi-Media Usage

In this workshop, students used different representation tools such as multi-media (Flash video), social media (Facebook), Android OS, etc for their designs. One of the most impressive ways is the vote function on Facebook. Young designers made their color decision by voting on Facebook and collected 204 friends’ opinions to help decide their signs color (orange) for restaurant destination. In Figure 10, one of the final project designs was created for the information and operation interface on tablet, the Android OS system.

Figure 10 Application design on tablet by group-4
Feedback from Students

In this workshop, the methodological goals was set for young design students, which included the “empathy thinking” with users and team members, and the “reflection on action” (Schon, 1983) pertaining to their user behavior observation and design solution testing observation.

Empathy

Perspective Differences between Designers and Users

This project of wayfinding in the real environment let young designers focus on the perspective of users' point of views. There are problem-solution gaps between young designers and experienced users. One student had said:

“The designers' way of finding a problem is different from users, even when I am a junior student, have been learning how to do design for a while. If there is a variety of user with different background, I think more gaps can be existed. So I found that more users testing with different situations will be much helpful for me to find the true and meaningful problems of the situation or in the environment.”

Reflection on Action

Respect, Integrate and Test

Respect, integrate and test different ideas. Learning how to respect team members' different ideas, if we could not make a final decision about the best solution, we make prototypes to show to the users and test, evaluate users’ response regarding potential solutions.

Observation

Observing the problems that users encountered and the solutions designed. Learning how to observe users behavior and the problems users encountered. After analyzing the design ideas generated and observing the solution tested with users, a document will be created for record.

First time teamwork

First time teamwork, first time learn to work as a team and work together with others. Around 75% students in the workshop are the first time to participate in a team. The A-E-I-O-U framework and design process let students work together fast and correctly under an intense time load of two weeks. How to communicate with each other in the team is the most important part regarding students’ teamwork. One student said:

“It’s our first time to do the teamwork design project, and compare to our school programs, it’s really different and interesting. We have lots of ideas to make idea storming with 4-5 team members, and we found everyone had different thoughts. We kept communicating and trying to convince group members with our own ideas by explaining how great and helpful my idea was. We also tried to respect team members’ ideas and gave positive suggestions. It's hard but learnable and interesting during the first time to join a team work.”
Website Blog

There is a website (see Figure 11) built for the weekly review purpose and students must upload the weekly content to the website for sharing with other groups. The website review was helpful to young students for their work process of the incoming week. One student said:

“Although I was not familiar with interacting with the blog, but the information on the website regarding each group works and process let me feel some pressure and encourage us to do better than the previous week. Because we were asked to post our team information on the blog, our team members had a chance to integrate our data and pictures from the previous week, and arrange the information to post. I thought that will be helpful for us to make our next step of design and data collection.”

Process Control

In the process, the six groups must discuss with the instructor more than two times a day, and performed short presentation 2-3 times per week in the classroom. In the free time, they can go to anywhere searching for more details and materials about their works. There are three teaching assistants worked together in this workshop, and kept interaction with students.

Conclusion

The results generated from the workshop included three pedagogical evaluation contents.

Website Blog for Information Sharing

The researchers had created “website blog” for the six groups to present their weekly research contents and work process, which included their feedbacks. Students can re-organized their weekly works with the workshop steps and review other groups’ works on the blog. According to the students’ feedback, “the website sharing and information presentation are much helpful” to the workshop pedagogical method.

Well Workshop Process Control

In the process, the six groups must discuss with the instructor more than two times per day, and had short presentation 2-3 times per week in the classroom. During the free time, they can go to anywhere looking for more details and materials about their works. The workshop was held for two weeks, and the design process was well controlled from...
divergent to convergent process. According to the students’ feedbacks, most of the students felt “freedom but serious” to the process control. With the satisfaction feedback, the students gave the high positive attitude about their final design works and their work performance.

**Prototype Making and Testing with Real Users**

The most impressive part of the workshop process was “prototype testing”. According to the students' opinions, most of them were the first time to make prototype testing with the real users. In the real world wayfinding situation, students must find the real users to test their destinations, and convince them to accept the prototype testing. Students had to make the users testing again and again if they had new design solutions better than the previous ones.

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**References**


Shaping and Expressing of Happiness Image in Products

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Abstract

Happiness is humans' constant and eternal pursuit. The aspiration for happiness is also directly reflected in presentation of products. Spiritual value of products can be shaped by design conversion. Compared with emotional products, products with image of happiness are much closer to aspiration deep in people's heart and play the role of enlightening and nourishing people's spirit. It's shown by literature analysis that the sense of happiness emerges from satisfaction to feeling, perception and sensation. Besides function and sense of beauty, the sensation of "bring happiness to people" should also be taken into consideration in products' connotation. This study is done from exploration on a spiritual level to discuss design development of products with image of happiness. In addition, it also makes a further discussion based on focus method targeting explicit factors and implicit factors to summarize formal characteristics and connotation factors of products with happiness image and develop design presentation modes of them. According to the study, expression of happiness in products should combine external and internal characteristics together which is also directly related to people's sensory intuition, cultural experience, belonging of love and desire for achievement. This study made contributions as follows: 1. direct new orientation of product design thinking by discussing characteristics of products with happiness image; 2. provide reference for designing and planning practice of relevant industries.

Keywords: happiness image, product experience, spiritual value
Introduction

Research Background and Motivation

Happiness study began in late 1950’s to indicate the quality of of life (Keyes, Shmotkin, & Ryff, 2002). In recent years, with the development of positive psychology the optimal human functioning and a better quality life get more attentions. (eg, Keyes, et al., 2002; King, Eells & Burton, 2004; Rathunde, 2001; Ryan & Deci, 2001). To create a better life for human-being is as important as to solve people's psychological problems. (Keyes, & Haidt, 2003; Linley & Joseph, 2004). This is exactly like what the Greek philosopher Epicurus(n.d) said, happiness is the highest of all goods; it is that which all men strive to achieve. As an ethical guideline, Epicurus emphasized minimizing harm and maximizing happiness of oneself and others. From ancient times till now, humans’ aspiration for happiness has never changed and moral principles of happiness advocated by philosophers even predict the orientation of our effort whose viewpoints and purposes are in accordance with the designing principles today. Design is done aimed at seeking common well-being for human being. Therefore, “design happiness” becomes designers' mission in its nature and expression of happiness image in products just responds to this ambition. Products are made because people need them. When products for daily use are adequate enough, people will gradually learn about that products should satisfy not only their rational requirement based on their practical function but also their emotional requirement by pleasing them. Especially in such a busy modern society full of high pressure, the sense of restlessness and disturbance always makes people lack of rich emotions. In this condition, products just play a key role. Fiske (2001) in his book Understand Popular Culture stated modern products have more spiritual contents expressed than material ones with the function of consolation. In Gobe (2002)'s opinion, products echoing with people's internal emotion are inspiring and able to meet requirement and desire which can't be satisfied temporarily. Norman (2004) proposed the concept of emotion designing, emphasizing that emotion will change users' cognition and thinking mode from rational one to perceptual. Pink (2008) thought what products' image expresses is special information which can satisfy a certain emotional requirement deep inside peoples' heart.

Products have influential energy which should be applied to create the sense of happiness. To achieve this purpose, products must have more considerate design to make them not only touching but impressive, meeting both sensory and spiritual requirement. Sensory and spiritual experience brought by products is used to induce the sense of happiness from users. It's a method of endowing products with spirituality, the idea of which is similar to that of emotional design nowadays in terms of modern design. However, products under this method are endowed with the function of inspiration and illumination. Today, when we see a lot of commodities with the sense of visual beauty, we may feel curious and find them interesting but may not be willing to buy them. However, when we see a commodity which arouses the sense of happiness and emotion from us,
we may want to buy them to enhance our energy. Products with happiness image are suggestive and comforting which are a kind of inspirational product. Meeting peoples’ potential requirement is the key to realize products’ value. With more and more focus put on sensory and cultural experience, happiness image presents a new design angle, which makes people have a new understanding of products.

New life style in modern times has changed relationship between people and products and increasing emotional interaction between them will definitely become the trend of future design. How to make products arouse happiness from people? What design factors should be included in happy products? This study will discuss potential factors constituting happiness image of products based on analyses of relevant researches, expecting to have information expressed by products take root in users' heart through communication of happiness image so as to increase products' spiritual value.

Relevant Researches

The Definition of Happiness Image

It should be known of the word Eudaimonia to understand the concept of "happiness". "ευδαιμονια" a word in Greek, which consist of "eu"(good) and "daimon"(genius), basically refers to the perfect realization of human potential characteristics particularly the excellent ability of rational thinking. Aristotle (n.d) clarified the aim and theme from the very beginning of book "Eudemian Ethics", "Happiness is the most beautiful, the best and the most pleasant thing in the world." It is the ultimate goal of the whole life for completion and self sufficiency (Woods, 1992). Darrin McMahon (2005) in the Book History of Happiness concluded outlook on happiness made from ancient Greek till now in western countries that, happiness means good luck in Homer; philosophers from ancient Greek think happiness equals to wisdom and virtue. During the period of enlightenment, happiness is carpe diem. Happiness comes into being from experience and share in life with strong moral consciousness in it and emphasizes common growth and prosperity. Modern psychology has mentioned the phrase of “subjective well-being” which emphasizes that happiness is the status of joy in heart and an attitude towards life basically composed by cognition and emotion (Diener, 2000). Father of positive psychology Martin (2003) believed happiness is aimed at realizing a flourishing life which can be concluded as joy + participation + intention=happiness. Hunter Institute of Mental Health (2010) proposes a “power” indicator targeting modern peoples’ psychological health and happiness indicating five components of happiness-activeness, optimism, manhood, enjoyment of life and recovery flexibility. The sense of happiness comes from good interaction between man and himself, between man and man and between man and society, all of which can intensify the sense of happiness.

Happiness is to experience optimum function and experience which constitutes a good life and includes pleasure and significance (Ryan & Deci, 2001). The sense of happiness should be achieved by satisfying both instinct of human being in its nature.
Maslow (1943)'s Theory on Hierarchy of Needs shows that humans' motivation and desire constitute a hierarchy of needs. The needs develop at a periodical process that higher needs are satisfied after basic needs are firstly met. Humans' pursuit to happiness also follows this process that they first pursue physiological needs at a lower phase and then the spiritual needs as a higher phase, during which the sense of happiness gets stronger gradually. Jorgensen and Nafstad (2004) think a wonderful life develops from simplicity to complexity at four levels including the pleasant life, the good life, the meaningful life and the full life. The sense of happiness also enhances at a periodical process from physical and psychological satisfaction to the spiritual satisfaction at peak. At the end of 19th century, the seblstverwirklichung specially emphasized by German philosopher Paulsen (1895) indicated that realizing one's own value by pursuing beauty and virtue is an important source of the sense of happiness. Therefore, happiness is forward mood with strong motivation which is strong enough to induce realization of humans' potential. Fredrickson proposed that forward mood impacts peoples' viewpoint and behavior, promotes increase of personal potential and helps establish ones' own psychological, social and physical resource(Fredrickson, 1998; Fredrickson & Joiner, 2002). In Csikszentmihályi (1990) 's opinion, human beings’ sense of happiness comes from top experience which is a flow state owned by people fully devoted to doing one thing. He explained happiness as a self-realization. Veenhoven (1996) described happiness as “degree of satisfaction in life” and pointed out that mood status in life is more important than subjective cognition and mental feeling at that time should be focused. In a word, the sense of happiness can be built based on physical, psychological and spiritual experience, spiritual experience in particular, in which the physical experience refers to sensory comfort, a sort of material satisfaction, psychological experience comes from a perceptually touching feeling, a kind of emotional satisfaction and spiritual experience lies in significance of existence, a type of spiritual satisfaction. The sense of happiness enhances gradually along with increase of levels and contributes to a rich and colorful life. (Figure 1)

![Figure 1](image-url)

**Figure 1**

Three Levels of Happiness Image
Design Happiness for Products

Modern definition on products has changed that they should serve more as the medium conveying information and expressing emotion than just tools. In 21st century, design should be characterized by people oriented with its core value developing from meeting functional and physiological requirement to mental and spiritual requirement. Junginger (2008) considered that design of commodities must have development which should be made centering on users. Fiske (2001) thought that spiritual level within products have already surpassed material level. Increasing spiritual value of products contributes to improvement of relationship between people and objects and makes them have talk to each other. Products with happiness image are aimed at combining material happiness with spiritual happiness together and increasing products’ spiritual value based on physical and mental interaction.

Today’s products combine both sensation and emotion together but they fail to express spirit. Spirit should be created with the method of surpassing emotion. Happiness image has functions of comforting and inspiring people, making them feel happiness and learn happiness. Products are the best medium to express spirit and design of happiness image is aimed at “touching” people. There are not only users’ one-way emotional preference to products but also two-way spirit and mutual communication brought by products.

Explicit Factors of Happiness Image

From Pink (2008)’s viewpoint, besides owning basic functions and aesthetic requirements, products should also pay attention to sensory image and satisfactory of information created by products to people’s mental requirement. Sensory image is mainly made by products’ color, shape and material. Impacted by users’ innate intuition and acquired experience, different subjective feeling will be produced. Burchett (1991) made an exploration of people’s preference to colors based on color psychology and found that “intuitive emotion” is main factor of color preference. McKellar (1965) in his research indicated that psychological image will be produced due to stimulation for 76% of people. Crozier (1994) stated information or symbol revealed by product shaping is relevant to the sense of pleasure they produce. Products’ three explicit characteristics of color, material and shaping play a key role in impacting visual beauty and mental image.

Implicit factors of happiness image

Analyzing formation of happiness image from its three levels has been made in some literatures. The first is personalization. Douglas & Isherwood (1996) thought people buy products out of three reasons: material happiness, spiritual happiness and self awarding. In Gobe (2002)’ s opinion, today’s customers choose products in accordance with personal life style and emotion to satisfy their requirement and desire. The second is familiarity. Desmet and Hekkert (2007) pointed out that interaction between people and products is mainly composed by beauty appreciation experience, significance experience
and emotional experience. Debra Lilley (2009) believed taking people’s idea, viewpoint and habit into consideration of design can enhance sustainable value of products. The third is the sense of belonging. Mugge (2008) propose four determinants of product attachment: self-expression, group affiliation, pleasure, memories. Product design should include experience on happiness in life into patterns of products, which not only increases attachment between people and products but also promotes strengthening of products’ happiness impression. The fourth is moral and sentiment. Jordan (2000) classified pleasure into physio-pleasure, psycho-pleasure, socio-pleasure and ideo-pleasure based on Maslow (1943) and Tiger’s (1992) theories, in which ideo-pleasure contains strong social consciousness and an expectation of common prosperity. The fifth is recollection emotion. D.J. Huppatz (2009) thought peoples’ emotion of recollection is their instinct when they are faced with indeterminacy of future. They weaken their worry about future by memorizing value of the past. From C.Rapaille (2007) ’s point of view, cultural symbols will touch customers’ old memory and cause response in mood. Products endowed with meaning play their role in users’ sub consciousness and arouse their same feeling. The sixth is self-realization. Lu (2007) indicated that products with sustainable design are helpful in realizing oneself. To have customers lead creation of products around themselves does good to increase spiritual value of products.

In summary, happiness image design focuses on exploration at a spiritual level. Together with factors adequately to trigger mental energy, they will make products around have forward function on people’s mind characterized by stability, inspiration and enlightening. It’s a challenge for design of future products which will lead product design into a brand-new area.

## Research design

To deeply investigate the key to design of product happiness image, this study is carried out through two stages by means of focus group. Focus group is used for investigating key points in the design of happiness image of product. Focus group is a qualitative research method adopting group interview to collect information about group members’ recognition, attitude, behavior, etc toward research subject; it is not only an exploratory way of data collection but also an important tool for idea confirmation. In this study, focus group comprises five experts, all possessing over-four-year experiences of design practice. To obtain comprehensive research results, the study is carried out through two stages. The first stage uses dinner plate as test sample, thus to find out formal elements and explicit characteristics of happiness image; the second stage collects experts’ opinions on design techniques of happiness-image products, so as to get inherent elements and implicit features of these products.

### Explicit Elements

Firstly, the standard of selecting 50 plate samples randomly from the market is meeting requirements of outstanding features. The process is as following:
1. Ask five experts to make a brief description of 50 pieces of dinner plates, which are randomly coded, according to three formal feature-shape, color and texture.

2. Based on above descriptions, from these 50 plates, five experts (coded as A, B, C, D, E) pick out pieces featuring shapes, colors and textures that provide sense of being happy and unhappy. In this way, samples accepted by all experts are chosen. (Table 1)

<table>
<thead>
<tr>
<th>form</th>
<th>shape</th>
<th>color</th>
<th>texture</th>
<th>shape</th>
<th>color</th>
<th>texture</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>02. 06. 09. 11. 32. 36. 41. 42. 45. 48</td>
<td>01. 04. 07. 11. 13. 21. 25. 27. 37. 41. 49</td>
<td>00. 13. 15. 22. 28. 33. 48. 44. 46. 48</td>
<td>06. 08. 10. 26. 22. 23. 30. 38. 44. 50</td>
<td>08. 14. 15. 18. 19. 28. 34. 40. 50</td>
<td>06. 10. 11. 17. 23. 31. 38. 44. 50</td>
</tr>
<tr>
<td>B</td>
<td>03. 05. 09. 14. 22. 28. 32. 35. 41. 42. 49</td>
<td>01. 05. 07. 11. 13. 21. 25. 31. 36. 41. 49</td>
<td>03. 05. 13. 21. 25. 29. 33. 43. 44. 45. 46. 47. 48</td>
<td>04. 10. 14. 15. 16. 18. 19. 20. 28. 30. 50</td>
<td>04. 08. 14. 15. 18. 19. 23. 26. 34. 38. 40. 42. 50</td>
<td>06. 09. 11. 14. 15. 16. 17. 18. 31. 34. 38</td>
</tr>
<tr>
<td>C</td>
<td>09. 14. 25. 27. 32. 33. 37. 41. 42. 43. 48</td>
<td>02. 05. 06. 09. 11. 13. 21. 25. 31. 36. 41. 49</td>
<td>00. 13. 22. 23. 28. 29. 33. 43. 44. 45. 46. 47. 49</td>
<td>02. 07. 10. 12. 15. 16. 17. 17. 22. 28. 30. 38. 50</td>
<td>07. 14. 17. 18. 19. 26. 28. 37. 41. 42. 50</td>
<td>06. 10. 11. 17. 23. 31. 35. 38. 42. 44. 50</td>
</tr>
<tr>
<td>D</td>
<td>02. 06. 09. 10. 27. 30. 32. 33. 41. 42. 45. 48</td>
<td>05. 10. 12. 13. 21. 24. 25. 32. 35. 41. 45. 47. 49</td>
<td>01. 05. 09. 13. 21. 25. 29. 33. 33. 33. 43. 44. 45. 46. 49</td>
<td>05. 10. 11. 13. 16. 17. 18. 19. 20. 26. 30. 50</td>
<td>06. 14. 15. 18. 19. 22. 30. 34. 40. 50</td>
<td>06. 10. 11. 17. 23. 31. 38. 40. 50</td>
</tr>
<tr>
<td>E</td>
<td>05. 09. 11. 28. 29. 32. 34. 38. 41. 42. 44</td>
<td>13. 21. 22. 25. 29. 33. 41. 44. 45. 46. 49</td>
<td>04. 13. 18. 27. 28. 33. 34. 40. 41. 44. 46</td>
<td>03. 04. 07. 10. 14. 15. 16. 30. 50</td>
<td>04. 08. 14. 18. 19. 23. 40. 50</td>
<td>01. 04. 06. 11. 14. 15. 21. 23. 31. 38. 42</td>
</tr>
<tr>
<td>Ω</td>
<td>9. 32. 41. 42</td>
<td>13. 21. 25. 41. 49</td>
<td>13. 29. 33. 44. 46</td>
<td>10. 16. 30. 50</td>
<td>14. 18. 19. 40. 50</td>
<td>6. 11. 31. 38</td>
</tr>
</tbody>
</table>

Table 1
Sample record

3. The chosen samples are named according to above descriptions, and contrast results of formal characteristics of happiness image are as below (Table 2):

<table>
<thead>
<tr>
<th>Sample of happiness</th>
<th>Form</th>
<th>Sample of unhappiness</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image 1" /></td>
<td><img src="image2.png" alt="Image 2" /></td>
<td><img src="image3.png" alt="Image 3" /></td>
</tr>
<tr>
<td><img src="image4.png" alt="Image 4" /></td>
<td><img src="image5.png" alt="Image 5" /></td>
<td><img src="image6.png" alt="Image 6" /></td>
</tr>
<tr>
<td>Complete</td>
<td>shape</td>
<td>Split</td>
</tr>
<tr>
<td>Organic</td>
<td></td>
<td>Geometric</td>
</tr>
</tbody>
</table>
Analyses results show complete organic forms provide stronger sense of happiness than split or geometric forms; happiness feeling of warm and bright colors is greater than that of cool and gloomy colors; pliable natural texture general stronger happiness sense than rigid man-made texture. Products with above features are repeatedly shown in above table.

**Implicit Elements**

This study conceives some questions according to literature analysis results, and invites experts to propose viewpoints and opinions on the design of happiness-image products. Main shaft 1: how to express happiness image through design connotations of product? Main shaft 2: among previous product design experiences, which technique can resonate happily in consumers? Five experts (coded as A, B, C, D, E) are asked to propose viewpoints and opinions on the design of happiness-image products. Content of verbatim transcription is classified, coded and named as below (Table 3):

<table>
<thead>
<tr>
<th>Names of main shaft</th>
<th>Excerpt from verbatim transcription</th>
<th>Data resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialty</td>
<td>Each time I see product featuring self personality, I have a feeling of being different from others.</td>
<td>A-03</td>
</tr>
<tr>
<td></td>
<td>Own a rare product.</td>
<td>C-04</td>
</tr>
<tr>
<td></td>
<td>Consumer’s feeling of being exclusive and unique.</td>
<td>D-03</td>
</tr>
<tr>
<td>Sharing</td>
<td>Value its atmosphere of sharing and emphasize design that possesses a sense of wholeness.</td>
<td>A-01</td>
</tr>
<tr>
<td>---------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>-----</td>
</tr>
<tr>
<td></td>
<td>This product must be possessed or shared by all people.</td>
<td>A-02</td>
</tr>
<tr>
<td></td>
<td>Be able to present a re-union or satisfactory image.</td>
<td>E-02</td>
</tr>
<tr>
<td>Symbol</td>
<td>The integration with auspicious ornamental patterns resembles ancient blue and white porcelain.</td>
<td>A-04</td>
</tr>
<tr>
<td></td>
<td>Introduce traditional figures to create an impression of happy and harmonious family.</td>
<td>B-02</td>
</tr>
<tr>
<td></td>
<td>Add globally used pictures and languages representing happy sense, e.g. the shape of &quot;heart&quot;.</td>
<td>D-02</td>
</tr>
<tr>
<td></td>
<td>Use symbolic meaning of cultural code to express happiness idea.</td>
<td>E-01</td>
</tr>
<tr>
<td>Memory</td>
<td>Mental interactions between people presenting product and the product user.</td>
<td>B-01</td>
</tr>
<tr>
<td></td>
<td>Nostalgic emotion driven by long-term national memories of ceramic culture.</td>
<td>C-03</td>
</tr>
<tr>
<td></td>
<td>Smell or trace that can stimulate happy memories.</td>
<td>D-01</td>
</tr>
<tr>
<td>Health</td>
<td>Natural products are preferable, such as pottery and wood-made things.</td>
<td>A-05</td>
</tr>
<tr>
<td></td>
<td>Product materials should be nontoxic and safe.</td>
<td>B-03</td>
</tr>
<tr>
<td></td>
<td>Whether the components of product are healthy and organic.</td>
<td>C-01</td>
</tr>
<tr>
<td></td>
<td>Health image of product also matters.</td>
<td>E-03</td>
</tr>
<tr>
<td>Participation</td>
<td>Modification can be made in accordance with consumer's preferences; flexible design that satisfies desire for achievement.</td>
<td>B-04</td>
</tr>
<tr>
<td></td>
<td>Make the product has diversified appearances, which can be integrated into different life contexts depending on user's preference.</td>
<td>C-02</td>
</tr>
<tr>
<td></td>
<td>A part of user's efforts are contained in the product.</td>
<td>E-04</td>
</tr>
</tbody>
</table>

Table 3

<table>
<thead>
<tr>
<th>Codes for main shaft of implicit features of happiness image</th>
</tr>
</thead>
</table>

After several rounds of discussions, following conclusions are drawn:

1. Uniqueness-to make products personalized and distinctive from others. For instance, individualized commodities let user express self and thus emotionally depend on the product (Douglas & Isherwood, 1996; Gobe, 2002).

2. Share-product is designed for being possessed and shared by many people, e.g. paired or combined design that generates a sense of belonging to a group through sharing (Mugge, 2008).

3. Addition of symbolic totem or mark or traditional expressing technique brings happiness-image product an effect of culture identity (Dewey, 1980; Oliver & Winer, 1987; C.Rapaille, 2007).
4. Memory-utilize symbol or memory to evoke nostalgia. Symbols like auspicious objects and patterns as well as memories such as friend’s stamp and signature can affect people due to recognition and memory; possessing the product means receiving blessings (D.J. Huppatz. 2009).

5. Health—a feeling of co-existing with the nature harmoniously. For example, a product designed by natural and environmental technique makes people comfortable, relieved and also proud of making contribution to environment protection (Jordan. 2000).

6. Participation—make users partially participate in design of product. If subsequent processing of product is conducted in accordance with users’ personal customs, the product will embody a part of users’ efforts and thus strength their confidence and sense of achievement (Lu, 2007).

**Conclusions**

We map constituent elements of happiness-image product into three levels of happiness image (figure 1). From viewpoint of sensation, people's initial happy experience of product originates from external form of product. Complete and organic shapes, warm and bright colors as well as pliable and natural texture are easily to cause feeling of happiness, and this is because people pursue nice, satisfactory, natural and healthy life. Regarding perception, no matter sharing common memories, perceiving cultural code or recalling past affairs, people’s emotional instinct will result in a series of warm and happy feelings of being moved. In terms of affection, human needs levels are reflected by product image. If the instinct of pursuing self actualization can be satisfied through product, the product will feature a power of inspiring and affecting people. Through exclusive feeling of self identity, achievement sense of participation in product production, and moral feeling of contribution to the environment, product spirituality makes beauty and goodness of human nature explicit.

Based on above results, this study will develop products with happiness image to conduct consumer test in the future. Major contributions of this study include following two points:

1. Direct new orientation of product design thinking by discussing characteristics of products with happiness image;

2. Provide reference for designing and planning practice of relevant industries.

**References**


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Predicting Affective Responses to Green Technology Vehicles Using Support Vector Regression

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\textsuperscript{c} Southern Taiwan University

\textbf{Abstract}

Car styling and features play an important role in an automobile’s design and how consumers perceive it. The goal of this study is to propose a methodology to assist automotive designers in understanding consumers’ affective responses to green vehicles’ form design, in order to further develop the shape and styling of green cars. Given the increase of environmental awareness among consumers and the current fierce competition in the automotive industry, it is very important for automobile makers to effectively consider consumer desires for the form features of green vehicles. To achieve this, we performed Support Vector Regression (SVR) to incorporate the psychological response of customers into the design of shape variables and to establish prediction models to fulfill customers’ demands for green cars. In this paper, a systematic evaluation method is presented as follows. First, semantic differential (SD) evaluation was used to measure the feeling associated with certain adjectives describing green vehicle design to obtain customers’ baseline attitudes, and factor analysis (FA) was used to extract representative affective dimensions. Next, automotive form features were determined by a numerical definition-based system approach (NDSA). Finally, a SVR-based model was constructed for predicting customer’s affective responses. The results of this experiment can provide a basis for future green technology vehicle design to support automotive makers in bringing visual expectations of automotive styling to life, therefore satisfying consumer needs.

\textbf{Keywords:} form features, semantic differential (SD), factor analysis (FA), numerical definition-based system approach (NDSA), support vector regression (SVR)
Introduction

Developing attractive vehicles to increase sales has become a primary objective among automobile manufacturers. Vehicle appearance is one of the key factors affecting a consumer's purchasing decisions, once the functional and operational utilities of automobiles have fulfilled customer needs (Moulson & Sproles, 2000). In general, a vehicle's design initially develops from the current designers' experience and innovation, which tend to rapidly differentiate an automobile's shape from that of the competitor's vehicles. However, designers can never guarantee the market success of their distinguished designs. A widespread problem is that designers fail to objectively consider customer satisfaction and to reliably meet customer demands with an automobile's design. One must consider the prominence of customer-oriented marketing, whose purpose is to satisfy customers by identifying potential expectations. Therefore, it is essential to improve designers' understanding of customer affective responses so they can develop and systematically guide vehicle form design to best meet consumers' actual and potential desires.

Several studies of product design have been run to gain more insight into customers' affective responses in order to develop appealing and successful products (Hong, Han, & Kim, 2008; Hsiao, Chiu, & Lu, 2010; Lai, Chang, & Chang, 2005; Zhai, Khoo, & Zhong, 2009). The Kansei Engineering (KE) method is significant because it first introduced a cause and effect assumption in product design that systematically translated customer feelings and demands into design elements (Nagamachi, 1995). The purpose of the KE method is to provide designers with an explicit evaluation method for product design by examining and clarifying the relationship between affective factors in consumers and design variables. However, in order to optimize a customer's satisfaction with a product, researchers will confront the design problems systematically organized procedure information to determine a suitable KE methodology.

In this paper, we aim to provide a method for adopting Support Vector Regression (SVR) to evaluate affective responses to green technology cars, in order to determine consumer preferences and to promote further understanding among designers of the psychological consumer needs that should be fulfilled by a product. The paper is structured as follows: Section 2 consists of a related literature review of the current KE method. Section 3 includes a proposal for construction of a method based on the SVR prediction model. Section 4 highlights the experimental results by analyzing samples collected from the market, using green technology cars as examples. Finally, Section 5 offers conclusions and suggestions for future study.

Overview of Previous Works

The KE method introduces several useful applications for product design and provides a potential advantage for product development. Nagamachi (1993) first suggested a KE approach should contain the following steps: target product selection, adjective collection, adjective definition understanding, emotional assessment, statistical analysis, and expert system establishment. Based on previous KE studies, Schutte, Eklund, Axelsson, and Nagamachi (2004) point out the procedures common to past KE studies, which include choosing the product domain, surveying the semantic and other properties of a product, and synthesizing these elements.

A product's physical features play a very important role in a consumer's impression of how appealing a product is and how well it satisfies their needs. Accordingly, many researchers in the field of product design have explored the feasibility of developing
various approaches to representative product features analysis as utilized in KE studies. Previous KE studies have employed a qualitative description for product features to simplify product form definition. Hsiao and Chen (1997) broke down an office chair into its individual design elements: the seat, back, armrests, back support, base, etc. These isolated components represent this product's basic design features, and then a parametric definition can be easily obtained from typical curvature or representative form features. While this approach is a fairly straightforward way to represent product form features, it is quite difficult to uniformly apply to all product types. Therefore, an extensive method of product form features analysis was conducted to establish the feature elements relevant to each product. Kwahk and Han (2002) proposed an advanced method based on a class-subclass concept, which introduces a more objective and effective metric for representing more complex product samples. Moreover, a conceptual approach of product design can also be applied to the level-based structural framework to describe a product's style (Chen & Owen, 1998). However, qualitative approaches in the past were based on experts and focus group opinions, which share the drawback of drawing from a small selection of available experts whose opinions weren't objective. Recent product form research has attempted to use numerical definition-based descriptions to overcome the disadvantages of over-reliance on such expert subjective conjecture. In order to remedy the subjective nature of qualitative approaches, Chang and Chen (2008) employed a numerical definition-based system approach (NDSA) to synthesize various explicit shape variables for product form design. Research by You and Lin (1997) also applied a similar concept to the 2D profiles definition of automobile design.

In a typical affective assessment, customer affective responses are measured by their grading of various researcher-provided adjectives in describing product samples, and then accompanied by a semantic differential (SD) survey to evaluate them (Osgood, Suci, & Tannenbaum, 1957). Factor analysis (FA) was often employed to examine the evaluation scores on the SD questionnaire to understand the subject's feelings. In order to reveal the difference in perception of product appearance between designers and users, Hsu, Chuang, and Chang (2000) apply the FA technique to explore the designers' and users' perception space toward the form elements of telephone samples. According to the customers' perception of a product, FA can combine similar or identical meanings of adjectives to determine the factor loadings on the common factors that can help designers once they have interpreted the effect of such adjectives. Several studies have further investigated the underlying dimensions of customer affective responses to various product form designs (Chuang, Chang, & Hsu, 2001; You, Ryu, Oh, Yun, & Kim, 2006).

A key component of the KE method is the construction of a prediction model to determine the existing cause and effect relationship between affective factors and design variables, in order to enhance product evaluations (Han & Hong, 2003). Therefore, a Kansei model developed for predicting product form design was also utilized in our study to evaluate the regression issue. Some KE studies have used common analysis approaches related to product design, for example quantification theory type I (QT1; Lai, Lin, Yeh, & Wei, 2006), multiple linear regression (MLR; Han, Kim, Yun, & Hong, 2004), and partial least squares regression (PLSR; MacKay, 2006). These studies mostly conform to an assumption of linearity. However, many practical product design problems often lead to more complex nonlinear relationships between variables. For this reason, the specific type of nonlinear relationship cannot be inferred accurately, and these techniques cannot be used.

In order to solve the issue surrounding nonlinear variables, Nagamachi was the first to present a model based on artificial neural networks (NN) to establish relationships between consumer preferences and form features in automobile design (Nagamachi, 1995). A NN model is capable of processing nonlinear input-output maps of variables (Hsiao & Huang, 2002), which is why this model is considered to be a suitable method for
constructing prediction models. Some previous NN studies relevant to product design yielded significant results. For example, a comparison of models based on NN and grey relational analysis (GRA) was presented by Lai et al. (2005), and demonstrated that NN is the better method for predicting effective product form feature combinations. However, there are disadvantages with the NN models. Most importantly, they are limited by the large quantity of parameters that must be estimated, and they lack a transparent framework for finding an appropriate solution for a generalization performance (Chan, Kwong, Dillon, & Fung, 2010).

Support vector machines (SVM), a new type of NN algorithm proposed by Vapnik (1995), have been adapted to minimize structural risk instead of minimizing training errors that can occur in the NN models, in order to achieve good generalized performance on a limited number of samples. Structural risk minimization principle mainly seeks to minimize empirical risk and confidence intervals. SVM have been shown to provide better performance than traditional training methods and successfully applied in many circumstances and fields (Burges, 1998; Wang, Huang, Tian, & Xu, 2010; Tanoori, Azimifar, Shakibafar, & Katebi, 2011). In product design fields, the appearance of a product is directly correlated to customer satisfaction, and product form attributes are highly correlated with each other. (Han, Kim, Yun, & Hong, 2004). In order to address problems arising due to the nonlinear nature of variables, SVM was initially introduced to take advantage of the kernel technique for carrying out a nonlinear mapping in a high dimensional feature space to solve classification problems. In recent studies, SVM have also been applied to deal with nonlinear classification tasks in stylistic applications of product design. For example, Shieh and Yang (2010) proposed a classification method based on fuzzy SVM to predict the classifications of different product form attributes according to customer perceptions. By adopting an appropriate loss function, the SVM method has further been extended into SVR to handle the domain of nonlinear estimation problems. Yang and Shieh (2010) demonstrated a high performing SVR method to build a model for predicting consumer feelings towards mobile phones. Despite SVR’s many attractive properties that make it a valuable choice as an evaluation method, SVR has yet to be widely applied in the design field of green vehicles.

At present, the automobile industry is facing fierce competition. To reduce the environmental impact of conventional vehicles, automobile manufacturers have continuously introduced green vehicles and tried to improve the visual appeal of green car design in order to attract more consumers. However, their efforts are hindered by a lack of ability to measure and comprehend consumer preferences concerning stylistic designs. Zafarmand, Sugiyama, and Watanabe (2003) suggest that a green design should demonstrate that the product is consistent with the environment. The aesthetic message conveyed by the appearance of a product can also influence consumer preferences (Pernot, Falcidieno, Giannini, & Leon, 2008). The intensity of a consumer’s visual perception of a product is also related to the influence of the form features (Lai, Lin, & Yeh, 2005). Therefore, product features can be used as design specifications for consumer preferences (Nagamachi, 1995). The impact of the physical features of green technology vehicles, which shape consumers’ decisions on whether to purchase such green vehicles, can be assessed by a quantitative process. Datschefski (2001) described an assessment scheme for developing green design products based on quantitative evaluations of each aspect necessary to consider for product success.

Method

This study proposes a method based on the SVR prediction model for product form design of green technology vehicles. Firstly, samples vehicle, including concept cars, were collected from the marketplace. With regards to the side view of the vehicles, the
numerical-based profile curves proposed by Chang and Chen (2008) were defined by a set of control points and also adopted in our study. Secondly, adjectives were compiled which could be used to measure participant affective responses to the vehicle form design. Thirdly, the representative affective dimensions were screened by FA. The SD evaluation data of participants were collected using questionnaires. Finally, SVR prediction models based on different adjectives were created using the control point coordinates of the vehicle profiles as input data and the evaluated SD scores as the output value. Optimal training parameters of the SVR model were determined using a grid search of cross-validation.

Preparing numerical definition-based form samples of green cars

The proposed method first collected the green car samples from car magazines, catalogs, and photos taken from the Internet. The background of car samples was initially removed from the original images, and the contours of the car were described from non-uniform rational basis spline (NURBS) curves using vector graphics. In order to further establish mutual relationships between affective responses and form variables, vehicle profiles were adopted to explore the possibility of existing distinctions between different automobiles due to consumer perceptions of quality, so that we would be able to take feasible market strategies to automobile manufacturers. The form features of other views from a different perspective given by consumer impressions will be required for future investigations into improving vehicle styling.

A significant characteristic of a car appealing customers is mainly judged on its form features. The data of default dimensions of vehicle samples were collected for the reduced scale experiments on customer perception. As shown in Figure 1, the investigation of automobile form was based on the numerical definition-based profile shape of green technology vehicles. The main structure of the vehicle’s form features were defined using ten NURBS curves, and constructed using a total of 35 control points, as shown in Table 1. Note that control point P 33, which was located at the lower edge of the front bumper curve, was specified as the origin (0, 0) of the coordinate system used to define the location of each control point (x, y) in the overall vehicle form. There were 63 sample vehicles used in this study, however only fifteen have been listed in Figure 2. In order to reduce instances of perceived differences caused by the materials and textures of the car samples, the car shapes were overlaid with an identical gray color with uniform luminance. Moreover, the shape features of automobile rim were not included in this investigation.

Figure 1  The form feature definition of a green technology vehicle.
Affective response dimension extraction using factor analysis

In order to evaluate customer affective responses towards green technology vehicles, adjectives which might be suitable for describing the vehicle form design were first collected from car magazines, newspapers and books, and further improve the participants' mental consistency and obtain consumer subjective perception in questionnaire evaluation, by screening similar and redundant adjectives, a total of 18 adjectives were used as the initial set of affective dimensions (Table 2). To select the most representative adjectives, 25 participants, 13 males and 12 females, were asked to evaluate 20 representative product samples using the initial set of affective dimensions in SD experiment (see Figure 3). A user-friendly questionnaire interface was also used to collect the evaluation data in a more effective way. The scores of SD evaluation for each product sample were averaged. The SD evaluation scores were then evaluated using FA. Two criteria, the eigenvalues and the percentage of variance explained for all extracted factors, were used to determine the number of factors. A simple and intuitive way to select representative adjectives was to include the adjectives with the largest absolute factor loadings in each factor.

Table 2  Eighteen initial affective dimensions for describing the product form design of a green technology vehicle

<table>
<thead>
<tr>
<th></th>
<th>Natural</th>
<th>7</th>
<th>Neat</th>
<th>13</th>
<th>Vigor</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Peace</td>
<td>8</td>
<td>Friendly</td>
<td>14</td>
<td>Environmental</td>
</tr>
<tr>
<td>3</td>
<td>Life</td>
<td>9</td>
<td>Safe</td>
<td>15</td>
<td>Balanced</td>
</tr>
<tr>
<td>4</td>
<td>Healthy</td>
<td>10</td>
<td>Hopeful</td>
<td>16</td>
<td>Coordinated</td>
</tr>
<tr>
<td>5</td>
<td>Fresh</td>
<td>11</td>
<td>Pure</td>
<td>17</td>
<td>Precise</td>
</tr>
<tr>
<td>6</td>
<td>Young</td>
<td>12</td>
<td>Vital</td>
<td>18</td>
<td>Advanced</td>
</tr>
</tbody>
</table>

CHIU Chun-Hui, FAN Kuo-Kuang and YANG Chih-Chieh
Questionnaire surveys for adjective evaluation

To collect the affective response data for automobile form design, 35 participants, 20 males and 15 females, were asked to evaluate 63 vehicle samples using a score from 0 to 1, with intervals of 0.1, using the representative adjectives. Images of the vehicle samples were presented to the participants in the format of a questionnaire. The presentation order of the vehicle samples was randomized to avoid any systematic effects. The adjective data of all the participants was averaged to reach a final utility score and applied as the output values in the SVR prediction models.

SVR-based prediction models construction

SVR was used to construct the prediction model based on the control points of car profiles and the average adjective ratings obtained from the questionnaire. SVR can only deal with one output value at a time, thus a separate prediction model must be built for each representative adjective. The training scheme of a single SVR model is shown in Figure 4. Firstly, the vehicle samples, which consist of a series of control points as input vectors, are fed into the training model. These input vectors are mapped into feature space by a map function $\Phi$. Instead of directly calculating the mapping $\Phi$, the kernel function $K$ is used to compute the inner product of two vectors $x_i$ and $x_j$ in the feature space $\Phi(x_i)$ and $\Phi(x_j)$, that is, $K(x_i, x_j) = \Phi(x_i) \cdot \Phi(x_j)$. SVR is known for its elegance in solving the nonlinear problem with the kernel function which automatically applies nonlinear mapping to a feature space. In this study, the Gaussian kernel function was adopted as follows:

$$K(x_i, x_j) = \exp(- \frac{||x_i - x_j||^2}{2\sigma^2})$$

where $\sigma$ is the spread parameter determining the influence of squared distance between $X_i$ and $X_j$ to the kernel value. Using the Gaussian kernel function, dot products were computed with the output values of the training vehicle samples under the map $\Phi$. The weights in the SVR model represent the knowledge acquired from the
vehicle samples. Finally, the dot products were summed using the weights terms of Lagrange multipliers, $\alpha_i$ and $\alpha_i^*$. This, plus a constant term $b$, yields the final predictive output value as follows:

$$y = f(x) = \sum_{i=1}^{l} (\alpha_i - \alpha_i^*)K(x, x_i) + b$$  \hspace{1cm} (2)

The following procedure was used to train the vehicle samples:

1. Convert the data to the input of SVR format;
2. Normalize the coordinates of the control points linearly to the range $[0, 1]$;
3. Conduct a grid search with 20-fold cross-validation to optimize the best parameter $C$, $\varepsilon$ and the spread width $\sigma$ of the Gaussian kernel function;
4. Use the best parameter set to train the remaining training set.

![Training scheme of the SVR model](image)

**Experimental Results**

**Results of selected affective dimensions**

Factor analysis as a feature extraction method was used to merge similar adjectives from the initial 18 groups and to form new groups by choosing a suitable number of factors. The results of the factor loading using three factors are shown in Table 3. The extracted three factors account for 42.3%, 25.3% and 12.1% of the explained variance respectively. The total cumulative percentage of variances is 79.7%, indicating that the result of the factor analysis using the three factors is acceptable. The adjectives with larger absolute factor loadings in each factor are regarded as more important, thus they were selected as representative adjectives. The selected adjectives for the three factors were adj1 (natural), adj18 (advanced), and adj12 (vital). These three selected adjectives were used in the adjective evaluation experiment.

**Table 3 The factor loadings of the 18 adjectives using three factors**

<table>
<thead>
<tr>
<th>Adjectives</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Natural</td>
<td>0.906</td>
<td>-0.070</td>
<td>0.280</td>
</tr>
<tr>
<td>15 Balanced</td>
<td>0.876</td>
<td>0.062</td>
<td>-0.163</td>
</tr>
<tr>
<td>16 Coordinated</td>
<td>0.850</td>
<td>0.244</td>
<td>-0.143</td>
</tr>
<tr>
<td>2 Peace</td>
<td>0.766</td>
<td>-0.338</td>
<td>0.310</td>
</tr>
</tbody>
</table>
Predicting Affective Responses to Green Technology Vehicles Using Support Vector Regression

<table>
<thead>
<tr>
<th></th>
<th>Pure</th>
<th>0.724</th>
<th>-0.193</th>
<th>0.555</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Neat</td>
<td>0.714</td>
<td>0.437</td>
<td>0.209</td>
</tr>
<tr>
<td>4</td>
<td>Healthy</td>
<td>0.702</td>
<td>-0.254</td>
<td>0.253</td>
</tr>
<tr>
<td>8</td>
<td>Friendly</td>
<td>0.690</td>
<td>-0.342</td>
<td>0.516</td>
</tr>
<tr>
<td>9</td>
<td>Safe</td>
<td>0.679</td>
<td>-0.631</td>
<td>0.008</td>
</tr>
<tr>
<td>18</td>
<td>Advanced</td>
<td>-0.180</td>
<td>0.903</td>
<td>0.130</td>
</tr>
<tr>
<td>17</td>
<td>Precise</td>
<td>-0.070</td>
<td>0.889</td>
<td>-0.234</td>
</tr>
<tr>
<td>6</td>
<td>Young</td>
<td>0.136</td>
<td>0.864</td>
<td>0.307</td>
</tr>
<tr>
<td>16</td>
<td>Vigor</td>
<td>0.044</td>
<td>0.847</td>
<td>0.381</td>
</tr>
<tr>
<td>12</td>
<td>Vital</td>
<td>0.016</td>
<td>0.203</td>
<td>0.854</td>
</tr>
<tr>
<td>5</td>
<td>Fresh</td>
<td>-0.114</td>
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</tr>
<tr>
<td>10</td>
<td>Hopeful</td>
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<td>0.691</td>
</tr>
<tr>
<td>3</td>
<td>Life</td>
<td>0.449</td>
<td>0.213</td>
<td>0.632</td>
</tr>
</tbody>
</table>

**Final statistics**

<table>
<thead>
<tr>
<th></th>
<th>Eigenvalue</th>
<th>7.6</th>
<th>4.6</th>
<th>2.2</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Percentage of variance</td>
<td>42.3</td>
<td>25.3</td>
<td>12.1</td>
</tr>
<tr>
<td></td>
<td>Cumulative percentage</td>
<td>42.3</td>
<td>67.6</td>
<td>79.7</td>
</tr>
</tbody>
</table>

The bold underlined numbers indicate the groups of adjectives associated with factors 1-3.

**Predictive performance of SVR model**

In order to obtain the best performance and reduce any over-fitting of the SVR training model, a grid search of 20-fold cross-validation was taken using the following sets of values: $C = \{10^{-5}, 10^{-4}, ..., 10^{1}\}$, $\varepsilon = \{10^{-5}, 10^{-4}, ..., 10^{1}\}$, $\sigma^2 = \{10^{-5}, 10^{-4}, ..., 10^{1}\}$ . Thus we utilized 1,331 combinations of parameters ($11 \times 11 \times 11 = 1331$). An optimum $(C,\varepsilon,\sigma^2)$ was selected from the grid search and used to construct the prediction model for each adjective. The optimized parameter set $(C,\varepsilon,\sigma^2)$ for the adjectives “natural”, “advanced”, and “vital” were $(1,0.001,100)$, $(100,1.00E-05,1.00E+5)$, and $(0.1,0.01,1.00E+5)$ respectively. Figure 5 shows the predictive performance of the constructed models. The blue solid lines are the original adjective scores of the product samples while the red dashed lines are the predictive scores. The root mean square error (RMSE) values of the three prediction models were 0.103, 0.102, and 0.078 respectively. RMSE reflects an accuracy evaluation, by comparing measures between values predicted by a model and the values actually observed. Since the predictive adjective scores fit well to the original adjective scores, the SVR models are capable of predicting the affective response of the product form design for the green technology vehicles.
Predicting Affective Responses to Green Technology Vehicles Using Support Vector Regression

<table>
<thead>
<tr>
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<th>PA</th>
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Figure 5 Predictive performance of SVR models of the adjectives (a) natural, (b) advanced, and (c) vital.

Conclusions/Summary

This paper has proposed a methodology based on SVR model for predicting the form design of green technology vehicles. NDSA profile curves of the vehicle side view were
applied to the form design of green representative cars. FA was adopted to extract consumer affective responses to construct the prediction model. Consumer affective responses toward the form design of green technology vehicles were described using a set of 18 adjectives. Three typical adjectives "natural", "advanced", and "vital" were acquired by FA. The SD data of these adjectives for the 63 product form samples were collected using questionnaires. Finally, SVR prediction models based on different adjectives were constructed using the coordinates of the control points as input data and the adjective evaluated scores as the output value. The experimental results of the SVR models of the three adjectives have provided great predictive performance, and yield low RMSE values of 0.103, 0.102, and 0.078 respectively. However, the analysis of the vehicle form study is only based on the contour lines of the side view, which is not a complete view. A more comprehensive study should include a detailed decomposition of the vehicle form design in order to verify the effectiveness of the proposed method.

References


Reshaping the Image of the Chinese Scholar in Modern Shanghai

CHU Lung Hsing
Southern Branch of the National Palace Museum
The Design College of Chung-Yuan Christian University

Abstract
Establishing a strong identity is always a critical strategy in commercial graphic design. To achieve a sympathetic response from consumers by building an identity figure in advertising is the goal of each graphic designer. From the perspective of the history of Chinese graphic arts, the scholar occupies a significant position in this area. On the one hand, paintings by Chinese scholars established a style of Chinese painting called “Scholar Painting” (Wen-ren Hua 文人畫). On the other hand, these scholars frequently were present in or presented themselves in Chinese visual arts. Indeed, building the image of Chinese scholars has been a primary issue for pictorial designers in China for thousands of years. In the crucial year of 1843, Shanghai opened her harbor to the world, which meant that Chinese scholars then faced a variety of visual cultures from the West. In addition, the impact of the West forced Chinese scholars to rethink their image, as well as their attitude toward the public, especially after the May 4th Movement.

This paper starts with a style analysis and uses iconographic studies methods to investigate the graphic design of the Chinese scholars’ image in painting and print media, such as books, magazines, and newspapers. Taking into account the communication and interaction between the West and the East, and tradition versus modernity, the graphic designers in Shanghai have reshaped a diverse image to depict the new Chinese scholar. All in all, this paper will draw attention to the issue of how the image of the Chinese scholar has been reshaped or is represented in modern Shanghai; it also attempts to demonstrate the deep relationship between design and culture from the past to the modern times in China.

Keywords: iconography, image, Chinese scholar, modern Shanghai
1. Introduction

Establishing a clear identity is always a key strategy in commercial graphic design. To achieve a sympathetic response from consumers by building an identity figure in advertising is the goal of each graphic designer. In comparing two commercial advertisements for two brands, Timberland and Hugo Boss (Fig. 1), one can see that graphic designers have created different styles not only by the use of interior or outdoor scenes but also by managing dresses, bags and gestures to convey different atmospheres (Bremmer, J. N., & Roodenburg, H., 1991). Similarly, when we compare the model in the Timberland advertisement with the scholar in the album of playing Chinese zither (Fig. 2), it obviously reveals that the Chinese painter also faced the problem of how Chinese painters visualize the image of a Chinese scholar. From the perspective of the history of Chinese graphic arts, the scholar occupies a significant position in this area. On the one hand, paintings by Chinese scholars established a style of Chinese painting called “Scholar Painting” (Wen-ren Hua 文人畫). On the other hand, these scholars frequently were presented in or presented themselves in Chinese visual arts. That is to say, creating an image of the Chinese scholar occupies a significant place in the history of Chinese graphic arts.

Fig. 1.

| Left: Timberland Advertisement | Right: Hugo Boss Advertisement |

Fig. 2.

playing Chinese zither
Focusing on the image of the Chinese scholar as it has changed from the past to the present as an example, this paper discusses pictorial culture in modern Shanghai and demonstrates that the 1930s in Shanghai was a turning point for reshaping the image of the traditional Chinese scholar to a modern intellectual. Although studies of the visual culture of modern Shanghai have produced great achievements so far, still however, some specific iconographic studies, such as the motif of the Chinese scholar in modern Shanghai, have not been discussed (Zito, A., & Barlow, T. E., 1994; 上海书画出版社, 2001). This paper will focus on some particular aspects of how Chinese scholars and intellectuals have built their images from the past to the modern times in Shanghai.

This research begins with a style analysis and uses iconographic studies methods to investigate the graphic design of the Chinese scholars’ image in painting and print media, such as books, magazines, and newspapers. Taking into account the communication and interaction between the West and the East, and tradition versus modernity, the graphic designers in Shanghai have reshaped a diverse image for the new Chinese scholar. All in all, this paper draws attention to the issue of how the image of the Chinese scholar has been reshaped or represented in modern Shanghai; it also attempts to demonstrate the deep relationship between design and culture from the past to the modern times in China.

2. Approach and Methods

This paper focuses on Chinese scholars in modern Shanghai. The materials studied include traditional Chinese painting and prints, and mass
publications such as newspapers and magazines. Therefore, the approach in this paper goes beyond mere art history and its methods and crosses over to the field of material culture or design history. However, it is undeniably true that this approach is derived substantially from art history’s methods (Craig Clunas, 2006). Take the iconology method as an example—this method was established by Warburg at the beginning of the last century, and its development was furthered by Panofsky and Gombrich (Cassidy, B., 1993). Its development after World War II greatly benefitted the study of material culture. At this time, the method has undergone much debate and has been modified to a proper approach within some discourses, such as the post-structuralist. The most striking example is the study conducted by Peter Burke. In Eyewitnessing: The Uses of Images as Historical Evidence (2001), Burke stresses the use of "traces" rather than "sources" to understand the past; he also argues that visual documents provide invaluable evidence for historians. This approach continues the “pictorial turn” from the 1980s pioneered by William Mitchell. The Fabrication of Louis XIV, published in 1994, can be considered representative of the use of images as historical evidence. In this book, Burke uses oil paintings, engravings, and the like to illustrate how Louis XIV built his own image in France.

From the perspective of the history of Chinese painting, the scholar occupies a significant position in this area (Yen, S., 2010). That makes the visual culture in China is differentiated from that of other areas. Furthermore, the Chinese scholar may be considered the representative image of Chinese. The question of how to establish and portray the image of Chinese scholars was a primary issue for pictorial designers in China for thousands of years. With respect to the figure images as the main subject in this research, as many scholars have emphasized, the postures and gestures of the people, and the accessories or objects shown in their vicinity, follow a pattern and are often loaded with symbolic meaning. In that sense, a portrait is a symbolic form (Brilliant, R., 1991). The significant places behind the figure images not only reveal the style connection between traditional and modern but also tell about the differences in material culture between the West and the East.

3. Reshaping: Crossing the Boundaries of Gender and Class

Among Chinese graphic arts about scholar images, The Eighteen Scholars (Fig. 3), four hanging scroll paintings collected in the National Palace
Museum, are authentic and classic Chinese scholar images of the past. These four paintings illustrate activities including chess, music, calligraphy, and painting being done by Chinese scholars, and through these events, the work establishes and unfolds the iconography of the image of Chinese scholars in the past. Indeed, writing, reading, chess, and playing music were all the boundaries drawn by Chinese scholars to build a frontier from the outside. To some extent, regarding the motif of Chinese scholars, reading, writing, and antique appreciation played a significant role in creating the image of Chinese scholars.

Fig. 3. The Eighteen Scholars

Among activities of Chinese scholars, reading held a primary significance in shaping the image of Chinese scholars. Considering the term du shu ren (讀書人, Reading-Men), which appears in many Chinese novels, take The Scholars (儒林外史) for example, it actually refers to the scholar in China. Cui Zizhong’s Entertaining a Guest in the Apricot Garden (Fig. 4) provides a good example to let people recognize the fact that portrayals of people holding a handscroll for reading indicated scholars.

In investigating the images of reading-men printed in mass media like newspapers and magazines in 1930s Shanghai, the most striking difference between the traditional and modern periods is that the images of reading-men were no longer confined to men but focused also on women. As mentioned above, in the past, activities such as reading or writing appeared only in depictions of gentlemen’s gatherings. These seemingly easy and cozy meetings actually had major cultural significance behind them—the fact that knowledge of writing and reading was restricted to men. As to women, the old saying that “it is virtue without knowledge for women” (女子無才便是德) was
obeyed for thousands of years. Therefore, it is striking that the images of reading-women were shown in print media frequently after 1930. Take *Liang-you Pictorial Magazine* (良友畫報) as an example; before 1930, the cover girls were doing nothing but just striking a flirting pose (Fig. 5, Laing, E. J., 2004); however, afterward, many issues emphasized the cover girls showing their intelligence by holding books (Figs. 6-1 and 6-2). Furthermore, reading-women became visible in public spaces like libraries and were depicted repeatedly in mass media (Fig. 7). This does not mean that Chinese females were innocent in the past, but the noteworthiness here is that the reading women were not always shown in a private place, as Chen Hon Shou has described (Fig. 8); rather, they were also pictured in public places. All these points support the argument that the borderline established for the traditional Chinese scholar had collapsed after 1930.

---

*Fig. 4. Entertaining a Guest in the Apricot Garden*

Ming Dynasty, Cui Zizhong, hanging scroll, ink and color on silk,

Nicholas Cahill Collection
Fig. 5. Liang-you Pictorial Magazine,
Left: Issue 1928–30; Right: Issue 1929–40

Fig. 6-1. Liang-you Pictorial Magazine
Left: Issue 1932–71; Right Issue1933–74
Fig. 6-2. Liang-you Pictorial Magazine
Left: Issue 1933–82; Right: Issue 1934–95

Fig. 7. Liang-you Pictorial Magazine
Left: Issue 1930–49; Right: Issue 1936–118
In modern Shanghai, not only did women become the subjects of reading images but the blue-collar worker was also illustrated as a class capable of possessing reading skills. As the publishing industry thrived between the wars, the labor class had more and more opportunities to access literature as well as art in modern Shanghai. A photo taken in 1935 demonstrates that the graphic arts did reach the public on the streets of Shanghai (Fig. 9). This shows that the activities engaged in by scholars of the past no longer entailed a specific knowledge limited to scholars. Rather, scholarly activities such as reading were expected to occur among the labor class as well. If we extend the issue of the diffusion of knowledge, it is easy to observe that not only were images of the elite published but the labor class also received much attention. Feng Zikai (1898-1975), a very famous Chinese painter and cartoonist in Shanghai, addressed the situation by illustrating that the rickshaw man also enjoyed the activity of reading as much as a traditional Chinese scholar did in the past (Fig. 10).
Reading by Tsui Yin-yin

Ming Dynasty, Chen Hon Shou, Illustration for the novel West Chamber

In modern Shanghai, not only did women become the subjects of reading images but the blue-collar worker was also illustrated as a class capable of possessing reading skills. As the publishing industry thrived between the wars, the labor class had more and more opportunities to access literature as well as art in modern Shanghai. A photo taken in 1935 demonstrates that the graphic arts did reach the public on the streets of Shanghai (Fig. 9). This shows that the activities engaged in by scholars of the past no longer entailed a specific knowledge limited to scholars. Rather, scholarly activities such as reading were expected to occur among the labor class as well. If we extend the issue of the diffusion of knowledge, it is easy to observe that not only were images of the elite published but the labor class also received much attention. Feng Zikai (1898-1975), a very famous Chinese painter and cartoonist in Shanghai, addressed the situation by illustrating that the rickshaw man also enjoyed the activity of reading as much as a traditional Chinese scholar did in the past (Fig. 10).
4. Transforming the Accoutrements of the Scholar

In addition to reading activity in regard to being a scholar, certain other elements certainly are crucial in designing an image to represent scholars. In general, images of the so-called “four treasures of the scholar house”—brush, ink, paper, and inkstone—typically accompanied scholars in delineations of the image of the Chinese scholar. Strictly speaking, reading, writing, and antique appreciation were all activities engaged in by people who possessed a particular knowledge, which separated the scholar class from others.

How can writing distinguish scholars from others? Gu Kaizhi’s *Admonitions Scroll* (Fig. 11) is a good example from the early ages (McCausland, S., & Gu, K., 2003). At the end of the hand scroll, the lady faces the opposite side of the others and holds a writing brush as she writes. The text beside her reads:

> Thus has the Instructress, charged with the duty of admonition,  
> Thought good to speak to the ladies of the palace harem.

The pictorial designer distinguishes the instructress from the ladies in the palace by giving the instructress a writing gesture. The use of writing to characterize the scholar class is also displayed in *Scholar Gathering*. It is easy to grasp the content of the painting immediately from the title. The painting depicts four gentlemen gathered in a courtyard; the man on the right side holds a brush and meditates for writing (Fig. 12). Like the example in the *Admonitions Scroll*, this writing gesture with a brush reveals another standard feature of a Chinese scholar. In modern Shanghai, females not only engage in reading activity but they also understand how to hold a pen in writing, shown in front of the public. One illustration printed in *Liang-you Pictorial Magazine* since 1926 depicts two women sitting at the desk (Fig. 13). The left one is holding a pen rather a brush. On the desk we see, not a traditional Chinese inkstone, but instead a Western-style ink bottle that was made of glass. The painting hanging on the wall is not a hanging scroll of a Chinese painting depicting the interior world of a scholar, but rather it is a map, indicating a stronger attitude toward the outside world.
In addition to writing with a pen, antique appreciation was another main activity of scholars. A book titled *Essays for the Antiques Connoisseur* (格古要論) was written for scholars to offer them knowledge about antique appreciation. As to pictorial images, Du Jin’s *Antiques* (Fig. 14) is a good example of how the image of scholars was established in another way. Even after hundreds of years, the Emperor Qianlong represented himself as a scholar by surrounding himself with antiques and books. Obviously, this painting comes from an album describing a scholar of the Sung Dynasty (Fig. 15). It is interesting that all antique appreciation in the past was carried out only by men. Gu Ming’s *Yunxi Teaching Buddhist Scripture* (Fig. 16) is a typical...
authentic painting that supports this fact. Only the male side displayed antiques in order to show that he is the only one to enjoy this scholarly activity, and by doing so, it reveals the identity of the man as being a scholar. In modern Shanghai, not only have the gender lines become blurred but also the accessories of a scholar have been transformed from Chinese style to Western style. A photograph taken in 1912 shows a woman sitting behind a desk (Fig. 17). It is quite common for certain artifacts, such as the Chinese zither, to appear in Chinese paintings that illustrate a Chinese scholar. Interestingly, however, a Western-style clock also comes into view, and this shows that the image of traditional Chinese scholars has also been transformed by influences from the West.

Fig. 14. Du Jin’s Antiques
Reshaping the Image of the Chinese Scholar in Modern Shanghai

Only the male side displayed antiques in order to show that he is the only one to enjoy this scholarly activity, and by doing so, it reveals the identity of the man as being a scholar. In modern Shanghai, not only have the gender lines become blurred but also the accessories of a scholar have been transformed from Chinese style to Western style. A photograph taken in 1912 shows a woman sitting behind a desk (Fig. 17). It is quite common for certain artifacts, such as the Chinese zither, to appear in Chinese paintings that illustrate a Chinese scholar. Interestingly, however, a Western-style clock also comes into view, and this shows that the image of traditional Chinese scholars has also been transformed by influences from the West.

Fig. 15.
Left: scholar of the Sung Dynasty; Right: Portraiture of Emperor Qianlong

Fig. 16. Gu Ming, Yunxi Teaching Buddhist Scripture
5. Conclusion

As shown throughout this paper, images showing reading, writing, and antique appreciation were all symbols used to define the image of the Chinese scholar in pre-modern Shanghai. Because of the involvement of women and the labor class, however, the image of reading as an activity that was initially dominated by scholars in the past was gradually blurred and then disappeared. Nevertheless, it also revealed the true face of visual culture in modern Shanghai (Mirzoeff, N., 2009).

What distinguished visual culture in 1930s Shanghai from that of the past was impacted not only from the outside; rather, it came as a response from the intellectuals themselves on the inside. As mentioned previously, the intellectuals in modern Shanghai were not concerned only with themselves, but they paid attention to the labor class as well. For example, Feng Zi-kai had
illustrated pictorial images showing his expectation that rickshaw drivers would have reading skills in the future. Some intellectuals, such as Zheng Jin-wen, shared his collections with the public. Not only does the photo he had taken in front of his collection (Fig. 18) show that he was obviously very proud of the exhibition, but also it becomes a portrait of all intellectuals in modern Shanghai. The facts set forth in this article demonstrate the transformation in Chinese art from the traditional scholar to the modern intellectual.

Fig. 18. Cheng Chin-wen of the Ta-tung Musical Society who has made 163 kinds of ancient musical instruments

References
Next Innovation Playground: A cultural-oriented product design model

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Abstract
The emergence of cultural pluralism in today’s markets presents unlimited economic opportunities and challenges in terms of industrial competition. Through effective designs, intangible cultural features transform into tangible products with economic values. Moreover, through the success of ethnic target marketing, products with cultural symbols or traditions have differentiated themselves from other industrial products in the increasingly homogeneous market. Embedding cultural relevance into product design does not only tap into the regional feelings of potential consumers but also creates original contexts for innovation. Thus, developing soft and emotional power through individual cultural artifacts in industries that function as symbolic identities and meanings with origin is crucial. The current study intends to generate the essential concepts of cultural products to structure the potential development of design innovation. In the current work, we review the related literature and existing design principles of cultural products. We then conduct a series of empirical studies through an expert focus group. In addition, we perform a peer review with card-sorting analysis, which examines 40 selected images of individual products. Finally, we use expert interviews in examining the outcomes. The triangulation concept is also used throughout the entire investigation process for validation and verification. Based on the findings, a design model for a culture-oriented product as a concentric circle is developed to provide designers with a culture-oriented product design model when designing cultural contexts for consumers.

Keywords: innovation, cultural-oriented product, design model, focus group
Research background

Culture is intrinsic in human life, as demonstrated through value, belief, and education. Culture continually evolves in human being activities. Creativity for innovation is originally rooted in cultural generation. Since the birth of creative industries as policy and discourse in the late 1990s, there has been a series of increasingly passionate attempts to link cultural ground to innovation policy (Cox, 2005; Cunningham, 2006; NESTA, 2006; and Oakley, 2009). Many countries consider the reflection and review on the cultural features contained in the mass production of design products as facing the force of globalization and homogenization in people’s lives through standardized products. In the reaction to globally standardized products, an opposite trend emerges to reawaken the regional awareness of local identity and tradition though the localization of product design (Moalos et al., 2010; Lee, 2009; Chen et al., 2009). As a facet of product design, cultural features can create unique and original product characteristics, enabling the creation of value-added products in the globalized market. In the rapid production in the manufacturing sector, local culture provides a self-promotion channel towards product innovation, encouraging designers to rethink the value of their own culture.

When considering the growing force of cultural sustainability and product innovation, the current research intends to generate a design model for cultural-oriented products to structure the potential development of design innovation. The purpose of the study is to determine a systematic approach to develop the understanding of the essence of cultural products and to reawaken designers’ awareness in performing cultural differences in products, which drives the effort toward product innovation and national identity construction to face the competitive global market.

Literature review

Culture and Design

Culture is a dynamic construct activated in response to human life. With continually evolving tradition and convention, culture is rooted in society, ethnicity, and heritage accumulating in the lifestyle. Culture affects every aspect of life. Different types of geographical and cultural heritage produce valuable and intangible assets. In a borderless world, local culture and traditional values become more important in the accelerated process of globalization. People gradually understand that embracing their own culture is important: culture creates a unique national image and profits.

“Design is a kind of expression of culture” (Chen et. al, 2009). Culture filled with life assets is the basis to inspire a designer’s creative thinking. Cultural factors in design, using appropriate technologies in a social context, do not only make life convenient but also make better use of culture as a source of innovation (Moalosi et al., 2005). More than ever, cultural factors provide stories for creating cultural emotional experiences in which people can engage. Cultural practices shape people’s attitudes and behaviors into interactions in a cultural context, such as communication, understanding, memories, and learning. Hence, cultural image, identity, and meanings are embedded in an individual’s norms and manners. Consequently, their significances offer an opportunity for designers to create a certain emotional connection between cultural products and users/customers, which is currently applied in many commercial purposes. Through design techniques, culture can be transformed into diverse forms, as commercialization results in the creation of economic values.

Cultural and creative products
Design is firmly embedded in culture. Through design, people’s needs are satisfied. Design with a cultural context can be extended to an internal link to reawaken public cognition in a region and to an external link to deliver culture and spread regional features to the world. “Cultural products,” as defined by the UNESCO, is “the specificity of cultural goods and services, which, as vectors of identity, values, and meaning, must not be treated as mere products or consumer goods” (UNESCO, 2011). According to Sandin (2005), who referred to Sardar and Von Loon (2000, p.16), cultural products are different from other products because they contain meaning, values, and ideas, which are a form of communication. Therefore, we assume a cultural product as a communication vehicle for the delivery of culture and presentation of cultural identity and images.

Lee (2009) pointed out that a cultural design product is composed of tangible and intangible substances inherited from culture that present cultural individuality, market competitiveness, and industrial productive efficacy, such as ordinary provisions, global sightseeing items, public design articles, and cultural festivals and events. Cultural products emphasize how products contain part of or all cultural archetypes to identify cultural images, preserve cultural connections, and promote regional economics. Design aims to improve life quality, but cultural design intends to incorporate the artistic performance of culture and foster the uniqueness of a local culture in the global market. Designing culture into products will become a design tendency in a cross-cultural issue in the global market, which is called the “global-market-local design era” (Lin, 2007). In the current research, we attempt to collect cultural features from the professional experiences of designer experts and the current cultural products in the market to define how these products present the local culture in Taiwan and outline their relevance. Finally, we conclude the outcomes into a guideline for developing a cultural product.

**Design innovation from cultural inspiration**

Customers/users around the world are no longer willing to settle for one-size-fits-all products with standardized designs (Delaney et al., 2002). A designer’s creativity has been challenged by the shift in customer/user needs and desires in the modern society. Bourges-Waldegg (2000) says, “...Design changes culture and at the same time is shaped by it. In the same way, globalization is a social phenomenon both influencing and influenced by design, and therefore by culture..., both globalization and technology have an effect on culture, and play a role in shaping them.” The relationship between design and culture has many twists, with design and culture both affecting each other and steering civilization to grow based on how they use life experiences to perform.

Cultural values can be incorporated into products by designing appropriate signs or features representing these values (Moalosi et al., 2010, p.176). Designing a cultural product represents a process of rethinking or reviewing cultural features and then redefining them into a new product to meet the social trends and provide satisfaction in user experience and consumer expectation (Ho et al., 1996). Therefore, a designer’s creativity and culture mutually support each other in the increasingly homogeneous market. Creativity alone is vulnerable to imitation, and culture alone is not suitable to manifest its uniqueness and style. Thus, the current study takes the initiative in considering the correlation between culture and design to enable value-added designing with culture and creativity generate innovative values. Designing products by viewing culture uniquely to identify its distinct nature and features can increase the potential of product innovation.

**Summary**

As “culture” is abstract, designers should design cultural products strategically. They should understand the nature of cultural products and further employ creative design
languages to incorporate the cultural tales into the merchandise, enabling the spiritual concepts of culture to combine the tastes of contemporary life to achieve real economic value. As the concept of cultural products is different from that of common merchandise in design, the opportunities of innovation of products by adding value culturally also provide consumers with different cultural views, as well as create a new blue ocean, in the competitive market. Hence, the current study aims to construct a process of assisting designers to understand systematically the design of cultural products in the hope of advancing culture through creativity of design to develop further the possibilities of innovative designs.

Methodology

Research design

The current project is mainly an exploratory research. Exploration is treated as an important process throughout this research project to develop an accurate picture of the research objective. The present research is not hypothesis driven but is rather focused on generating an understanding about how to develop a cultural product with creative context through tangible heritage and intangible cultural features. Mostly, this study is grounded on the qualitative concept of investigator triangulation using three kinds of studies: 1) conducting a focus group with design experts about their professional experience on cultural products; 2) conducting a peer review regarding the opinions about cultural features in design for analyzing cultural products and establishing a design model; and 3) conducting an in-depth interview with design experts to review the content of the design model. Design experts and participants are selected through the purposive sampling strategy. Purposive sampling indicates that the sampling is conducted in deliberately with specific purposes or focuses (Punch, 1998:193).

This sampling is applied to “those situations where the researcher already knows something about the specific people or events and deliberately selects particular ones because they are seen as instances that are likely to produce the most valuable data” (Denscombe, 2003:15). Thus, purposive sampling can provide researchers with a suitable strategy for locating samples composed of information-rich informants (Punch, 1998:193). Therefore, the purposive sampling strategy is set up in this research project. The current research is used to collect designers’ perceptions, perspectives, and ideas. The flexibility of the method makes it commonly used to obtain specialists’ viewpoints, and its application reduces the time demand of data collection.

All research activities are based on an exploratory research strategy to create an intensive discussion with which to learn more about the perspectives of design professionals. The discussion will ultimately lead to the development of an informative toolkit to support future product design activities (Figure 1).

<table>
<thead>
<tr>
<th>Phase of study</th>
<th>Participant</th>
<th>Method</th>
<th>Sampling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase one-Designers’ experience</td>
<td>5 designers</td>
<td>Focus group discussion KJ method</td>
<td>Purposive</td>
</tr>
<tr>
<td>Phase two-Peer review</td>
<td>4 designers</td>
<td>Focus group discussion KJ method</td>
<td>Purposive</td>
</tr>
<tr>
<td>Phase three-Designers &amp; researchers’ review of the development of a design model of product design</td>
<td>5 designer</td>
<td>Open-ended interview Card-sorting practice</td>
<td>Purposive</td>
</tr>
<tr>
<td></td>
<td>2 designers &amp; 3 researchers</td>
<td>Semi-structured interview</td>
<td>Purposive</td>
</tr>
</tbody>
</table>

Figure 1. List of the type of sampling and the number of participants involved.
Research method

The current study is divided into three stages. In stage one, by conducting a focused group interview, five industrial experts are invited to gather keywords of cultural product design. The KJ method is employed next to classify and group the resultant keywords to build the underlying framework. In stage two, through a peer review, five design researchers who have more than five years of experience in design learning are invited to sort 40 pictures of cultural products that remained after multi-screening the research framework in stage one. This step is conducted to examine whether each aspect of the framework is complete and to revise the group names, obtaining a more perfect framework of cultural product design. In stage three, by conducting an in-depth expert interview, the opinions of experts based on their experience are used to make perfect constructs. Thus, the current study presents a design model for the construct of cultural product design. Fig. 2 shows the entire research process.

![Figure 2. The entire research process](image)

Methods

This study employed investigator triangulation and different researchers to analyze data under the same topic. In accordance with the research objectives, expert focus group interview, KJ method, peer review, and in-depth expert interview were used to build the structural model for cultural product design.

KJ method

The KJ method originated from the data process used by Japanese anthropologist Kawakita Jiro in his field study. It includes the generalized KJ method and the narrow KJ method (Kawakita, 1975). The KJ method enables the classification and grouping of diverse and unbalanced data, integrating them in a top-down, step-by-step manner. The KJ method herein was divided in three steps. First, “data gathering” aims to capture the analytic contents related to the research subject, which can be derived from documentary data, information, or quantified data. Second, “card making” catalogues the data obtained from slips of paper. Third, “organizing” uses grouping in a bottom-up-tiered organization to sort gradually the cards into small groups, medium groups, large groups, and even extra large groups, which are all given names written on “name cards.” This KJ method is simple, as the process is completed immediately when the KJ method is used to classify the data until grouping is done (Ohiwa et al., 1990). The resulting large number of keywords of cultural product design was sorted by the KJ method to classify and group them effectively, as well as to build the foundation. For the same purpose, another examination was conducted through peer review and expert interview to establish a sound structural model for cultural product design.

Focus group: Experts are influential

This study used the expert focus group method, with its property of interacting between members of the focus group during the process, to gather the keywords related to cultural product design. The KJ method was also used to conduct the subsequent data convergence. Members were selected through the homogeneity principle, which makes them feel open to express their individual ideas because of their similar occupations and experience backgrounds, and to be willing to interact and communicate. Thus, through
the recommendation of design experts, nine experts in the field of cultural and creative industries were invited to conduct the interview. Five experts were involved in the first interview, and the remaining four experts participated in the second interview to collect new keywords until the theoretical saturation was met at this stage. The elements of cultural products design were investigated and gathered in an open manner.

The interview processes were designed to determine and follow up the gathering of keywords of cultural product design. Each process began with a 20-minute period for the participating experts to write down their keywords of cultural product design, while the host created a relaxing atmosphere and guided them in writing intuitively. This process was followed by an explanation of the contents based on their individual experiences to invoke more ideas from other participants as well as more keywords. The host also inquired about these contents. As the experts shared their experiences during the sharing and interview portions, the keywords for cultural products design were determined. The resultant vocabulary was then grouped according to the KJ method and naming.

Peer review

A peer is a person in equivalent status in the same field. Peer review evaluates an issue made by persons in the same field. Through peer review, singling out the flaws with a similar background of learning and experiences, and offering pertinent corrections are possible. To conduct a peer review, this study invited five design researchers who had over five years of learning experience in design to examine the constructs for cultural products. These design researchers, as peers having related experience in design learning, are acquainted with the field of cultural product designing. Hence, these peers were able to understand quickly the context of the whole research and present insights to enable the modification of the framework and to verify the completeness and appropriateness of the cultural products.

Analysis and Discussions

Stage-one Analysis: Gathering and Sorting the Keywords of Cultural Product Design

The current study analyzed the design constructs of cultural products. To obtain analytic data of cultural product design, the recommendations of design experts were used. Five experts with experience in the culture and creativity field were invited to sit in a focus group interview and intuitively share their individual experience in a 20-minute session, writing down their keywords for “cultural product” design. They shared their own concepts and added more keywords while the other participants made their presentations. Fig. 3 presents the keywords that were gathered and sorted.

As shown in Fig.3, among all the keyword cards obtained at this stage, two focus groups were disregarded because of redundant contents, resulting in 80 items and 42 items(Fig.3), which were also grouped using the KJ method and naming. The first grouping resulted in 19 groups, which were further classified by their correction. Upon inspection of the 19 groups, the groups of “price range in market” and “input of intellectual property” were disregarded because they belonged to the marketing and planning aspects, which this study does not address. Moreover, despite being relevant to the aspect of design, the group “creative design techniques” can be applied as well to other design constructs; thus, it was ruled out. This study then classified the remaining 16 groups by differences in the conceptual characteristics into five groups, i.e., material application, exterior shaping, technical functions, idea shift, and emotional symbol, which form the basic framework for the cultural product design elements(Fig. 4). However, do these keywords, which were gathered from the qualitative exploration of experts, include
all the cultural product design elements? Moreover, does such grouping actually convey all the implications we want to express? To answer these questions, the current study designed a second step to examine and modify the framework.

<table>
<thead>
<tr>
<th>Material application</th>
<th>Exterior shaping</th>
<th>Technical functions</th>
<th>Idea shift</th>
<th>Emotional symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>/Create using local materials/</td>
<td>/Use of landmark objects/</td>
<td>/Rendering abstract concepts/</td>
<td>/Embodying abstract concepts/</td>
<td>/Meaning of colors to represent locality/</td>
</tr>
<tr>
<td>/Use of composite media/</td>
<td>/Use of local visualized symbols/</td>
<td>/Combining traditional wisdom in life/</td>
<td>/Extending and converting word meanings/</td>
<td>/Story-like expression and association/</td>
</tr>
<tr>
<td>/Replication and simulation of materials/</td>
<td>/Use of cultural totems/</td>
<td>/Combining traditional crafts and modern design/</td>
<td>/Visualizing traditional customs/</td>
<td></td>
</tr>
<tr>
<td></td>
<td>/Authorized use of archived digital images/</td>
<td>/Exhibiting traditional arts through products/</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>/Use of traditional/</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Stage-two Analysis: Examining the Completeness of the Framework through Peer Review

To determine whether the design framework proposed in stage one was complete enough to depict the cultural products available in market, this study employed peer
review and examined the graphs of cultural products through classification. To begin, this study selected from among the items on sale in “Bravo Taiwan Good Design Shop,” a Web site set up by the Council for Cultural Affairs, as the source of samples, as a variety of cultural products has emerged from the government’s fervent promotion of culture and creativity industries in recent years. As a selling platform offering many samples, this Web site holds a collection of cultural products from many firms. As the Web site holds thousands of items, this study screened and selected only those carrying cultural contents and disregarded redundant or similar ones. Considering the time and energy of the subjects, 40 cultural products were selected as samples for the graph classification.

The purpose of the graph classification is to enable the subjects to study the groups using the classification of cultural products. The researchers recorded and selected the appropriate subjects to present their opinions better, i.e., to determine if anything was missing from the groups or could be described more appropriately. Hence, five design researchers who had over five years of experience in design learning were invited to classify, group by group, the sample pictures of preselected cultural products. Peers with related experience in design learning quickly understood the context of the whole research and presented insights and recommendations, verifying the constructs for completeness and appropriateness.

When the process of graph classification was complete (Fig. 5), this study sorted the opinions the subjects gave in the groups to modify the framework. This step transformed the previous 16 subgroups in 5 groups to 15 subgroups in 5 groups, in which the construct of “exterior shaping” was reduced from having 5 items to 3 items after the discussion. Thus, the overall framework became more specific.

<table>
<thead>
<tr>
<th>Group</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material application</td>
<td>Create with local materials</td>
</tr>
<tr>
<td></td>
<td>Use of composite media</td>
</tr>
<tr>
<td></td>
<td>Replication and simulation of materials</td>
</tr>
<tr>
<td>Exterior shaping</td>
<td>Resizing traditional cultural items</td>
</tr>
<tr>
<td></td>
<td>Direct use of traditional images</td>
</tr>
<tr>
<td></td>
<td>Shaping with common vocabulary</td>
</tr>
<tr>
<td>Technical functions</td>
<td>Application of traditional techniques in new shaping</td>
</tr>
<tr>
<td></td>
<td>Combine tradition crafts and modern designing</td>
</tr>
<tr>
<td></td>
<td>Present traditional arts in products</td>
</tr>
<tr>
<td>Idea contents</td>
<td>Embody abstract concepts</td>
</tr>
<tr>
<td></td>
<td>Embody symbols</td>
</tr>
<tr>
<td></td>
<td>Visualizing traditional customs</td>
</tr>
<tr>
<td>Emotional symbol</td>
<td>Representativeness of colors for locality</td>
</tr>
<tr>
<td></td>
<td>Representativeness of story in the contents</td>
</tr>
<tr>
<td></td>
<td>Capability of evoking emotional resonance</td>
</tr>
</tbody>
</table>

Figure.5. Subjects sorting the graphs

Table.1. List of preliminary investigations on cultural product design (based on the current study)
At this stage, peer review was used to study the cultural products available in the market against the groups to determine if the framework was complete, resulting in the preliminary framework for design elements of cultural products (Table 1). To be thorough, this study conducted an in-depth expert interview on such framework and incorporated them into the discussion on the proposed contents.

**Stage-three Analysis: Establishing the Model for the Design of Cultural Products**

With the view of constructing a model for cultural product design that meets the requirements of industrial operation, the current study gathered and rearranged data using multiple methods. To verify whether the results of the previous stage were appropriate, five experts in the industry were invited for an in-depth interview, in which the results of stage two were discussed and modified one by one.

**Group name revision**

The results of stage two involved 15 items in 5 groups: material application, exterior shaping, technical functions, idea shift, and emotional symbol (Table 1). The expert interview was revised as follows. “Exterior shaping” verbatim was interpreted as 3-D shaping, and it did not include the expression for 2-D images, such as totems and graphics. Thus, it was changed to “shape pattern.” “Idea contents” and “emotional symbol” were merged to become “cultural emotion and ideas,” as they were considered in the experts’ discussion to address the same property. “Functional techniques” was broken down into “manufacturing techniques” and “product functions,” allowing for a more thorough consideration of the construct of the design of cultural products. With the experts’ opinions organized, the number of design constructs of cultural products increased from 15 items to 18 items in 5 groups (Table 2).

<table>
<thead>
<tr>
<th>Group</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material application</td>
<td>Create with local materials</td>
</tr>
<tr>
<td></td>
<td>Select materials for their functions</td>
</tr>
<tr>
<td></td>
<td>Replication and simulation of materials</td>
</tr>
<tr>
<td>Shape pattern</td>
<td>Employment of tangible cultural items</td>
</tr>
<tr>
<td></td>
<td>Employment of shapes of words</td>
</tr>
<tr>
<td></td>
<td>Employment of cultural totems</td>
</tr>
<tr>
<td></td>
<td>Authorized use of digital archived images</td>
</tr>
<tr>
<td>Manufacturing techniques</td>
<td>Pass on living wisdom</td>
</tr>
<tr>
<td></td>
<td>Render style and look of modern design</td>
</tr>
<tr>
<td></td>
<td>Combine modern technology</td>
</tr>
<tr>
<td></td>
<td>Exhibit traditional arts in the products</td>
</tr>
<tr>
<td>Product functions</td>
<td>Capable of practical use</td>
</tr>
<tr>
<td></td>
<td>More decorative effects than practical usage</td>
</tr>
<tr>
<td></td>
<td>Decoration purpose</td>
</tr>
<tr>
<td>Cultural emotion and ideas</td>
<td>Pass on custom in life</td>
</tr>
<tr>
<td></td>
<td>Specific images with locality recognition</td>
</tr>
<tr>
<td></td>
<td>Employment of historic tales</td>
</tr>
<tr>
<td></td>
<td>Meaning of colors to represent locality</td>
</tr>
</tbody>
</table>

Table 2. Constructs of cultural commodity design (based on the current study)
The model for cultural product design

Through the processes of expert focus group interview, data grouping by KJ method, peer review, and in-depth expert interview, the current study developed the constructs of cultural product design (Table 2). Based on the framework of cultural product design, this study explored and arrived at the elements of cultural product design and considered the independencies between them and the presented framework of the model (Fig. 6). The contents of each construct are described as follows. (1) Cultural emotion and ideas: cultural emotion and symbolic ideas can invoke ideas and stories, creating resonance between products and users, and suggesting the design of cultural products by considering the contents of the culture around the core of emotion. (2) Product functions: The approach taken should be from product functions. The usage of products should be combined with past life experiences, and how products with different orientations of functions could shorten the gap between culture and life should be considered, uplifting the level of product functions. (3) Material application: From the perspective of materials, consider which materials can support what cultures can offer. A part of the materials is historical emotion; it can create and activate the linkage to experiences. For example, bricks, which are a traditional building material, is not just a material but is also capable of bringing back memories and triggering a cultural association with its contents. (4) Manufacturing techniques: While creativity develops from constant living and the accumulation of culture throughout history, manufacturing techniques keep evolving as well. Designers can create cultural linkage through the connection and preservation of crafts and modern demands, as well as nostalgic retro and modern technologies; (5) Pattern, shape, and form: in presenting exterior patterns, aside from gathering and capturing cultural elements for creation, designers should also consider the differences between traditional materials and modern design and how to transform the former into the latter. However, as many shape patterns are diverse or vary, determining how to maintain a point of balance, which is appropriate for cultural contents, between changing and preserving cultural connections through designers’ experience and aesthetic views is possible. As presented in Fig. 6, designers can consider the relationships between each of the items, culture, and creativity using this framework to create possibilities in innovating cultural products.
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Figure 6. Framework of a cultural commodity design (based on the current study)

In this framework of creating an entire cultural product design (see Fig. 6), the cultural emotion and ideas is the core value of designing a cultural product, and the items extending outward, such as “pattern, shape, and form,” “manufacturing techniques,” “material application,” and “product functions,” are the elements of differentiation in appearance of cultural products from other average products. The relationship between the items can provide a systematic framework that enables the contemplation of the correlation between the constructs of cultural product design and the design process. As cultural products should be developed with cultural content, we should think outward from the aspect of cultural emotion and ideas as the core to the possibility of developing the items. The constructs link to each other to form a network, with each affecting the others. Developing each construct individually or expressing the design by linking various items, providing more possibilities for creative design, should be considered.

Conclusion

This current study attempts to create a model for cultural product design and explores the opportunities of innovation therein. Cultural products cover a vast scope. How is commodity design created based on culture by considering orientation and spurring creativities? Through the processes of expert focus group interview, KJ method, peer review, and in-depth expert interview, the current study develops the constructs of cultural product design. It also presents the creative thinking context for cultural products in five aspects: (1) Cultural Emotion and Ideas: create resonance between products and users, suggesting the design of cultural products by considering the contents of culture
around the core of emotion; (2) Product Functions: combine life experiences and functions, and shorten the gap between culture and life; (3) Material Application: consider the historic attachment to materials and their accumulation in life; (4) Manufacturing techniques: balance and exhibit both traditional techniques and modern technologies; and (5) Pattern, Shape, and Form: reach a point of balance in the expression of appearance between cultural tradition and contemporary innovation. The framework can also be used to determine whether the association and connection between the elements are completed during the design to generate the multiplied effects from culture and designing. This model can serve further as the basis for combining designers’ creation and creativity to realize their ideas. This model makes the products an important vehicle for preserving and propagating cultures and helps spark the creation of cultural product designs. It transforms intangible cultural contents into products that create economic value and enhance the opportunity of having sustainable cultural and regional development. The results of this study are expected to be used for establishing an efficient and feasible design strategy for the reference of relevant products to foster creativity in subsequent product innovations.

**Acknowledgments**

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**References**


Next Innovation Playground: A cultural-oriented product design model


An Overview of the Issues facing the Craft Industry and the Potential for Design, with a Case Study in Upper Northern Thailand

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Abstract
This paper presents initial findings from an ongoing research project that explores opportunities for design to contribute to a sustainable future for the craft industry. The research asks "Are there potential areas for design to make a positive contribution to the craft industry in upper northern Thailand to help ensure its viable future, and if so, in what areas can design best contribute?" The research consists of three main components: (i) background research into crafts; (ii) identification of a specific study site; (iii) investigation of craft practices, products and issues of concern in the context of the study site. Background research includes: persistence of crafts in a period of Mass Production; principles of craft today; genres of crafts; relationship of crafts with tradition and design. The upper northern region of Thailand is identified as a major craft production area, with historical, cultural and socio-economic significance. Craft in this region are classified and the challenges for design and design management are identified. It is found that there is a need to integrate: (i) ‘designers’ and ‘craft-makers’ in practice; and (ii) traditions in commercial craft-product design.

Keyword: design, craft, sustainability, Thailand
Introduction

Contemporary understandings of sustainability have long been linked to ‘the local’ and ideas of localization (Van der Ryn and Cowan, 1996, p.68; Scruton, 2012, p.36, p.71). In a time of globalized mass-production and product distribution, traditional crafts offer an example of long-standing ‘local’ approaches to material culture that are often socially, environmentally and economically reifying. However, around the world, traditional crafts, which are often located in rural areas, are in decline as younger people migrate to urban centres for work and the attraction of ‘modern’ lifestyles. Design researchers that are examining the relationship between design for sustainability and product design are increasingly looking towards traditional crafts, and their revitalization (Nugraha, 2012), as a way of manifesting functional and decorative goods that are: environmentally responsible; that provide skilled, satisfying employment opportunities i.e. ‘good work’ (Schumacher, 1980); that offer income opportunities in ways that inherently ‘internalize’ true costs (rather than externalizing costs as is often the case in today’s mass-production systems e.g. Nair, 2011, p.52); and which produce a material culture that is culturally significant and meaningful.

This paper presents the initial findings from an ongoing research project that explores opportunities for design to contribute to a sustainable future for the craft industry in upper northern Thailand. The key question is: “Are there potential areas for design to make a positive contribution to the craft industry in upper northern Thailand to help ensure its viable future, and if so, in what areas can design best contribute?” The research consists of three main components: (i) background research into crafts in general; (ii) identification of a specific study site; and (iii) investigation of craft practices, products and issues of concern in the context of the study site. The background research examines the persistence of crafts in a period of mass production and consumerism; principles of crafts in the twentieth-first century; classification of crafts into three main groups; and relationships of crafts with tradition, human intimacy and design. Major craft producers worldwide are identified and Thailand is addressed as a country with crafts in decline. However, the upper northern region is highlighted as a major craft-based production area in the country, with important roles in terms of it historical, cultural and socio-economic significance. This research provides information on craft classification in the region and the challenges to design for the development of craft enterprises. In conclusion, it is found that there is a need to integrate: (i) ‘designers’ and ‘craft-makers’ in practice; and (ii) traditions in commercial craft-product design. Further research into sustainability is needed, as crafts are claimed to be a key to sustainable development in the twentieth-first century, so as to make a strong connection between crafts and design for sustainability – from the past to the present.

Terms and Definitions in the Research Context

Craft(s)

‘Craft’, as a noun, means an activity involving skill in making things by hand. In the plural, ‘crafts’ refer to objects or artefacts. As a verb, ‘to craft’ means making or processing something by hand (Macmillan Dictionary, 2009; Oxford Dictionaries, 2012). Towards the end of the nineteenth century the term ‘craft’ began to be widely used to refer to handmade decorative arts; the Arts and Crafts movement and the writing of John Ruskin and William Morris, which critiqued the consequences of industrialization, were especially influential in these years (Shinner, ed. By Alfoldy, 2007, p.34).
Handicraft(s)

The term ‘handicraft’ has a similar meaning to craft(s); however, it is mostly used to refer to ‘decorative / beautiful’ objects (Macmillan Dictionary, 2009; Oxford Dictionaries, 2012). The United Nations Educational, Scientific and Cultural Organization (UNESCO) provides a definition of ‘handicrafts’ as follows:

“These can be defined as products, which are produced either completely by hand or with the help of tools. Mechanical tools may be used as long as the direct manual contribution of the artisan remains the most substantial component of the finished product. Handicrafts are made from raw materials and can be produced in unlimited numbers. Such products can be utilitarian, aesthetic, artistic, creative, culturally attached, decorative, functional, traditional, religiously and socially symbolic and significant.” (UNESCO, 2001, emphasis as per original)

In this research, the authors prefer the term ‘craft’, which is more generally used internationally, rather than ‘handicraft’. However, in the context of Thailand, the term ‘handicraft’, namely ‘Hat-Ta-kham’ or ‘Ngan-Fee-Mue’, is widely used because it conveys a set of words that bring ‘hand’ and ‘action or doing’ together; saying ‘craft’ sounds incomplete in the local vocabulary and usually articulates skill.

Design

‘Design’, as a noun, has various meanings: a drawing that shows what something will look like when it is made; a process of deciding how something will be made, will work and look like; a pattern that decorates something; a plan or idea; the study of how to make things, especially for shape and appearance (Macmillan Dictionary, 2009; Oxford Dictionaries, 2012). As a verb, ‘to design’ means: to decide upon the appearance and function of thing by making a detailed drawing of it (Oxford, 2012). Design practitioners generally describe ‘design’ as an idea and a process of how we think about users’ needs and wants that will become tangible – a concrete expression of design outcomes (Hunter, 2010; Walker, 2011, p.119) in various forms, e.g. packaging, home furnishings, websites and street furniture. In relation to crafts, this paper will use the term ‘design’ specifically to refer to the areas of industrial design or product design and design management.

Research Method

The project aims to deliver effective design management/strategies to contribute to a future for the craft industry that is in accord with the principles of sustainability. In the first stage, the research method is based primarily on a literature review supplemented by the acquisition of qualitative data from key informant interviews among crafts stakeholders including craft enterprise owners, craftspeople, retailers, customers and government and NGO representatives. This primary research data will be analyzed and coded to develop conclusions and recommendations for design and design management strategies.

BACKGROUND TO CRAFTS

The Perseverance of Crafts in the Era of Mass production,1 and Consumerism2

For over three centuries, it has been said that crafts are on the verge of extinction, affected by the legacy of the Industrial Revolution3, the ensuing development of mass-

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2The term “Consumerism” was first used in 1915.
3Industrial Revolution, ca. 1750-1900 (Walker, 2011a).
production technologies, and the disinterestedness of high modernists, particularly in Europe and North America, in, for example, traditional pottery, yardage weaving, basketry, and boat making, together with the end of the guilds (Mohanty, 1990; Alfoldy, 2007, p.3; Metcalf, ed. by Alfoldy, 2007, p.6). Particularly in the nineteenth century, manufacturing structures changed rapidly and significantly: (i) from domestic handwork for the family, to community-based and outwork production for others, and later to mechanized manufacture; (ii) from small- to large-scale production for greater quantities; (iii) a new emphasis on manufacturing goods for export and trade (Mohanty, 1990; Bowie, 1992; Walker, 2011a). Mass production stimulated the rise of consumerism, deliberately going beyond the basic needs for survival; factory-made products became abundant in the marketplace and consequently crafts, which were more time consuming and more costly to produce, declined sharply (Metcalf, ed. by Alfoldy, 2007, p.6). During the twentieth century, the expansion of this kind of industrialised production became problematic in terms of its social and environmental effects, including unemployment, urban migration, the overuse of natural resources, consumerism and disposal via landfill (Schumacher, 1993; Walker, 2011a). By the late twentieth century, achieving socio-economic justice and environmental responsibility had become major concerns (Schumacher, 1993; Walker, 2006, p.17). Ironically, crafts re-entered the marketplace in response to consumerist values, particularly gifts and home furnishings (Metcalf, ed. by Alfoldy, 2007, p.6).

Crafts in the Twenty-First Century – A Key to Sustainable Development

In the early years of the twenty-first century, the concept of sustainability – a way of living responsibly in terms of environmental issues, social justice and economic equity – has become generally and positively recognized by governments, business and society as a whole (Walker, 2006, p.17; Bhamra, 2007). Crafts are identified as a key strategy for sustainable development that can provide opportunities for employment, especially in rural communities, as well as contributing to economic growth and environmental stewardship (European Conference of Crafts and Small Businesses, 1994, 1997; UNIDO, 2007; UNCTAD, 2008). The European Conference of Crafts and Small Businesses (1994, 1997) also identified handicrafts as a feasible focal point for business ideas, market competition, innovation and economic growth.

Genres of Craft Consortiums from Past to Present

Crafts can be broadly classified into three main groups: 1. traditional (conventional), 2. contemporary and 3. modern (neo-) (Alfoldy, 2007). Traditional crafts have recorded multicultural history, especially of societies, in the form of objects (Metcalf, ed. by Alfoldy, 2007, p.6). Contemporary crafts are guided by art and/or design – a combination of aesthetics, individuality, function, customer service, problem-solving, rational analysis and technology (Ihatsu, ed. by Harrod, 1997, p.303). Modern crafts can be “characterized by decorative and vernacular attributes as well as maintaining the political badge of handmade” (Greenhalgh, cited in Alfoldy, 2007, Foreword).

Relationship between Crafts and Tradition

The power of tradition has been identified as a core component of the persistence of crafts (Harrod, 1997). Craft objects can be suggestive of what has been termed ‘traditions of medium specificity’, that is, the materials, skills and technologies that evolved before the advent of mass-production; these play a role in seamlessly connecting the past to the present (Metcalf, ed. by Alfoldy, 2007, pp.5, 19-20).
“Craft looks to the past for techniques, visual cues, meanings, and ideas. Even today, craft depends on the continuous revival of pre-industrial technologies. ...Craftspeople also look to historical production for reference and inspiration. ...Craft looks at society as a continuum, not a new invention. A firm connection to the past is both possible and desirable. ...To craft, tradition is not necessarily backward, corrupt, or a restraining force in civilization; it is not an anchor, but a rudder.” (Metcalfe, ed. by Alfoldy, 2007: 19-20, emphasis as per original)

Relationship between Crafts and Human Intimacy

William Morris, the English reformer, suggested that pre-industrial technologies, i.e. handmade objects, should be preserved for their social usefulness, essential humanity and nature (Harrod, 1997; Metcalf, ed. by Alfoldy, 2007, p.25). Crafts can create a sense of intimacy and personal value for their makers and users, especially through materials with functional use and bodily touch (IHatsu, ed. by Harrod, 1997, p.304; Walker, 2006; Neidderer & Townsend, 2010). Crafts always entail the properties of specific materials, either a single material such as wood, glass, metal, clay, paper, plastic or stone – or materials in combination. Materials are especially important to the appearance of crafts (Adamson, 2007, p.39; Bassett, 2010). Craft products that use different choices of materials include, for example, wool or silk scarves, willow or bamboo baskets, wicker or wooden furniture, glass or ceramic tableware etc. Miller (2009) suggests that crafts are able to influence social, cultural and philosophical values through a human relationship with materiality – either how craft workers make them or how people use those objects (in Neidderer & Townsend, 2010, p.5). With respect to environmental considerations, Walker (2006, pp.48-50) suggests that an object that is a deeply meaningful personal possession can be enduring – resulting in reductions in consumption and disposal via landfill.

Relationship between Craft and Design

Craft is situated between art and design (IHatsu, ed. by Harrod, 1997; Shiner, ed. by Alfoldy, 2007). In a changing world, traditional crafts have two potential directions for endurance, towards ‘industrial design’ and towards ‘fine art’ – hence the emergence of ‘craft-design’ and ‘art-craft’ in recent decades (IHatsu, ed. by Harrod, 1997, p.303). Four factors that bring these directions together are hand, material, mastery and use (Shiner, ed. by Alfoldy, 2007, p.39). Use (functions of objects, how objects serve users) is an area common to both industrial design and craft – more specifically, physiological needs – sitting, eating, warmth via clothing, and adornment (Shiner, ed. by Alfoldy, 2007, p.40). Craftspeople who include design in their process tend to call themselves ‘designer-craftsmen’ or ‘designer-makers’ (IHatsu, ed. by Harrod, 1997, p.302; Shiner, ed. by Alfoldy, 2007, p.41). Such craftspeople also tend to focus on exploring a particular area of materials, whereas conventional industrial designers consider any number of materials to solve problems (Shiner, ed. by Alfoldy, 2007, pp.39-40). With respect to the handmade factor, it is the only area within the three main ‘craft’ groups, mentioned above, where the use of other tools, for example CAD, CAM or fabrication teams, is considered acceptable for production (Shiner, ed. by Alfoldy, 2007, p.39).

IDENTIFYING THE STUDY SITE – WHERE CRAFTS EXIST

Major Craft Producers Worldwide

According to UNCTAD (2010, p.128), total exports of all art and craft goods reached US$ 32,323M in 2008, a rise from US$ 17,503M in 2002. A significant proportion of

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4 Domer, 1997; UNESCO Bangkok, 2001; Adamson, 2007; Bassett, 2010; Traidcraft, 2011.
exports come from developing countries, accounting for US$ 20,715M in 2008, approximately 1.8 times greater than for developed countries (UNCTAD, 2010, p.128). Crafts made in Asia have a leading position in the global market, dominated by China (UNCTAD, 2008, pp.116-117). Among developing economies, the top ten exporters in art and craft goods are China, Hong Kong, Turkey, Korea, India, Taiwan, Thailand, Vietnam, Egypt and Pakistan, in that order, whereas the leading exporters among developed economies are Belgium, US, Germany, Italy, France, Netherlands, the UK, Spain, Austria and Japan, respectively (UNCTAD, 2010, p.141, data available to 2008).

**Thailand – A Country with Crafts in Decline**

According to Cohen (2000, pp.9-10) and Wherry (2008), old Siam (the former name of Thailand) was known for its sumptuous ceremonies and ornate arts and crafts, this relates predominantly to tradition. In Thailand today, art and craft production is a visible industry contributing to the country’s national economic and social development (UNCTAD, 2008, p.110), and providing employment to over two million workers of whom half work full time (UNESCO, 2009, cited by Howkins, 2010, p.29). Over recent decades, globalization and trade have penetrated into Thailand via imports of manufactured goods and through tourism, resulting in changes in Thai cultural traditions, social practices and lifestyles – including the making of crafts (Cohen, 2000; Wherry, 2008). The decline of craft production is particularly severe in the central region, while it is less pervasive in the northern, north-eastern and southern regions (Cohen, 2000). In some isolated areas in these regions, craftspeople continue to produce items using the same techniques and designs as their ancestors, especially in the hill tribes of the north and in the north-east of the country. Nevertheless, some traditional crafts are in decline, for example basketry in Mae Hong Son and Chiang Mai provinces (Cohen, 2000). In addition, the situation of craft production and their markets, particularly commercial crafts, have been unstable due to a variety of changing conditions stemming from globalization. Change is found, especially, in the structure of production processes, in the way that components of the process, e.g. raw materials and techniques, are disassociated from traditional spatial, cultural and social connections to locality (Cohen, 2000, pp.20-21). Involvement with exports lead to radical “heterogenization” and to an absence of a relationship between the cultural background of the artisans and their craft products; thereby craft producers are dependent on or unfamiliar with constantly changing international contexts and demand for craft commodities, especially customer taste and preferences (Cohen, 2000, p.20). However, research in this specific area is lacking – “…only [a] few researchers conducted any systematic work on recent developments in Thai arts and crafts” (Cohen, 2000, p.1); some groups of Thais see crafts in commercialization as “an unretrievable debasement or corruption of Thai crafts, not worthy of serious attention” (Cohen, 2000, p.1). There is a critical need to integrate traditions in commercial craft-product design with design management (for examples, skills, materials, stakeholders, markets, retail, customers, etc.) in order to address sustainability agendas effectively. The relationship between design for sustainability and localization is critical – though this is neither well understood nor much emphasized in the field of commercial craft-product design.

**Upper Northern Region of Thailand – Specific Region for Study**

This region plays a significant role in terms of historical, cultural and socio-economic aspects. It includes eight provinces – Chiang Mai, Lamphang, Lamphun, Mae Hong Son, Chiang Rai, Phayao, Phrae and Nan. Historically, it used to constitute the Kingdom of Lanna, for more than seven hundred years from the thirteenth century, thereby establishing a unique identity of art and culture, known as Lanna (Lannaworld.com, 2006). Much of this identity has been retained through traditional ways of living, including the making and diversity of crafts, especially by ethnic groups and hill tribes, thus
INVESTIGATION INTO CRAFTS IN UPPER NORTHERN THAILAND

Classification of Crafts

This section poses the question: “What do the handicrafts in this region encompass?” This suggests different ways to look at crafts: (i) material experience; (ii) active skills; (iii) artwork (Adamson, 2007, p.4). Other ways of considering crafts appear in other sources of literature, and have emerged through initial interviews: These include: (iv) market value; and (v) market structure and customers. This section gathers information from a literature review on the classification of handicrafts and presents them as an inventory (see Table 1).

- **Materials** – these encompass animal-based materials such as silk worm; plant-based materials such as wood, bamboo, wicker, cotton and mulberry paper; ceramic and earthenware; gemstones; metals; and synthetics such as recycled plastic (DIP, 1999a; DIP, 1999b; NOHMEX, 2009; Bassett, 2010).

- **Skills & processes** – Sketching: drawing, pattern-making; Forming: casting, modelling, moulding, pottery-making, sculpting, turning; Decorating: carving, embossing, engraving, etching, printing, weaving, yarn colouring; Finishing: gilding, lacquering, painting, surface inlaying (Fine Arts Department, 2006; Department of the Ten Crafts, Maehongson, 2009).

- **Products** – beads, candles, Christmas decorations, furniture, games, gardenware, garments, gifts, home decoration, household, jewelry, lacquerware, miniatures, painting, potpourri, souvenirs, stationery, toilestries, toys, umbrellas (DIP, 1999a; DIP, 1999b; NOHMEX, 2009; Howkins, 2010; DITP, 2012).

- **Market Value**

Appearance, production and quality are key to justifying the value and types of crafts in the marketplace; the relationships between markets and products are identified as follows (UNIDO, 2007, p.29):

- ‘High-End Market’ and ‘Traditional Fine Crafts’

Fine crafts demonstrate ethnic, traditional and cultural heritage and are considered to be works of art. They are often produced as unique or one-off pieces and may be exhibited in museums or galleries, or purchased by collectors. In short, high-end crafts have high value but are produced in low numbers.

- ‘Medium-High Market’ and ‘Artisanal Crafts’

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In producing artisanal crafts, artisans may work with design consultants to adapt their work to meet market requirements. Historical background and ethnic appearance are retained through the use of traditional elements. Large-volume production may be possible if planned. Outlets include speciality stores, exhibitions and design centres.

- **‘Low-Medium Market’ and ‘Commercial Crafts’**

Commercial crafts are made in traditional ways, but adapted to suit buyers’ preferences with support from mainstream buyers or designers. Large volumes can be produced for mass markets. Outlets include speciality stores, exhibitions, design centres, lifestyle shops, importers, tourist shops and mainstream buyers.

- **‘Low Market’ and ‘Manufactured / Mass-Production Crafts’**

At the lower end, commercial so-called ‘crafts’ are mass produced in large quantities, using machines or large networks of artisans. They reflect trends, not traditions, though they retain some ethnic appearance. They are designed specifically to be distributed through outlets such as tourist shops, mainstream buyers and global chains. **Such mass-produced ‘crafts’ are excluded from the scope of this research because they are not true crafts.**

**Market Structure and Customers**

Considering the market structure of crafts, Sangkhawutthichaikul (2011) notes that three significant markets are local, tourist (sub-divided into local and foreign) and exports. Jutidharabongse (2012) advises consideration of consumer channels. In the larger context there are two main market channels – domestic and for export. Moreover, the export market is subdivided into indirect exports (tourist market) and direct exports (shipment to overseas customers). Crafts largely flourish in the tourism and leisure markets (Howkins, 2007; Wherry, 2008). However, Cohen (2000, p.20), after continuous research on commercial crafts for 20 years, suggests that the domestic market is the principal market for commercial craft products, especially Thai urban middle-class customers with a taste for 'traditional' craft products. Other domestic customers are tourists, middlemen and shopkeepers (Cohen, 2000, p.15). Foreign tourists prefer objects that are useful, decorative or otherwise suit their lifestyle, while being less concerned with authenticity or tradition (Cohen, 2000, p.20). Suriya (2007, pp.2, 4-5) notes that souvenir products are sold in significant numbers to foreign tourists in Thailand. Humphreys (1999, p.57) reveals that female expatriates in Bangkok are also primary supporters of craft organizations, especially Japanese, British and American. UNIDO (2007, p.32) reports that crafts continue to grow in global markets through exports. The largest craft-importing countries are those in the European Union, the USA and Japan. At the regional level, China, Singapore, Hong Kong and Malaysia are key importers (OSMEP, 2009).
### Table 1: Inventory of Crafts Classification in Upper Northern Thailand

<table>
<thead>
<tr>
<th>Materials</th>
<th>Skills &amp; Processes</th>
<th>Products</th>
<th>Market Value</th>
<th>Market Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal-based</td>
<td>Drawing</td>
<td>Beads</td>
<td>High-End</td>
<td>Customer Channels</td>
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<tr>
<td>Plant-based</td>
<td>Pattern-making</td>
<td>Candies</td>
<td>- Traditional Fine Crafts</td>
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<tr>
<td>Fabric / Textiles (silk &amp; cotton)</td>
<td>Forming</td>
<td>Christmas deco</td>
<td>- Artisanal Crafts</td>
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<tr>
<td>Bamboo &amp; wicker</td>
<td>Casting</td>
<td>Furniture</td>
<td>- Commercial Crafts</td>
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<td>Wood</td>
<td>Modelling</td>
<td>Games</td>
<td>- Mass Production</td>
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<tr>
<td>Mulberry paper</td>
<td>Pottery-making</td>
<td>Garden ware</td>
<td>crafts</td>
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<tr>
<td>Ceramic &amp; earthenware</td>
<td>Sculpting</td>
<td>Gifts</td>
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<td>Gem stones</td>
<td>Turning</td>
<td>Home decoration</td>
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<td>Metal</td>
<td>Decorative</td>
<td>Household</td>
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<td>Natural synthetics</td>
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<td>Jewelry</td>
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<td>Synthetics</td>
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### Challenges to Design in the Development of Craft Enterprises

- Shortages of Skilled Labour and a Need for Skills Development

Craft enterprises face a shortage of skilled labour (Howkins, 2010; SACICT, 2010; OSMEP, 2010). There has been a decline in the number of basket-makers in Maehongson and Chiang Mai (Cohen, 2000). Simultaneously, young women tend to leave local weaving and textile production because of: limited and unreliable markets; impatience with complex, time-consuming and repetitive procedures of production; seeking freedom and financial independence (Humphreys, 1999). For local textile production, it is vital that craft-based organizations run more marketing and design training programmes in order to develop new products from existing skills, as well as to find appropriate markets with lucrative income for the younger generation (Humphreys, 1999, p.62).Woodworking and painting skills will need to be improved in order to meet international standards (Creative Thailand, 2011, p.18). On the other hand, Thai artisans have high skills in welding, jewelry-making and dressmaking, winning many awards in international competitions for best practice (Creative Thailand, 2011, p18). However greater capacity building will be needed to maintain the exceptional level of skills required to compete in globalised markets, specifically in terms of free trade and technology (Laisatrulkai in Creative Thailand, 2011, p.5).

- Market Information, Customer Preferences, Product Design

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7 (DIP, 1999a; DIP, 1999b; NOHMEX, 2009; Bassett, 2010)
8 (Fine Arts Department, 2006; Department of the Ten Crafts Maehongson, 2009)
9 (DIP, 1999a; DIP, 1999b; NOHMEX, 2009; Howkins, 2010; DITP, 2012)
10 (UNIDO, 2007)
11 (Humphreys, 1999; Cohen, 2000; UNIDO, 2007; OSMEP, 2009; Sangkhawuttichaikul, 2011; Another informant, 2012)
Craft enterprises face a lack of knowledge and information about markets and buyers (Howkins, 2010; SACICT, 2010; OSMEP, 2010). Few companies know how to satisfy distributor or buyer demands, particularly in the tourist and export markets (Howkins, 2010, p.29). A classification of two distinct markets, “internal and external” [domestic and export], is insufficient; several kinds of “public” [markets], reached through export channels, have to be distinguished – for example, domestic tourists, foreign tourists and customer abroad (Cohen, 2000, p.20). There is a need to seek input from designers to help connect craft makers with customers through product design for particular markets (UNIDO, 2007, p.35). Ruskin and Morris initiated this kind of approach in the late nineteenth century, where the contributions of designers and makers become integrated in the development crafted works. However, designers and makers are often found to be separated in practice (Shinner, ed. by Alfoldy, 2007, p.34). In addition, a lack of clear direction in product design is a root cause of poor customer perceptions (Suriya et al., 2007). From a customer perspective, old-fashioned design, ubiquitous imitations, poor quality, impracticality, low price points and lack of creativity, uniqueness or identity can all contribute to a poor perception of crafts (SACICT, 2010; OSMEP, 2010). To improve the opportunities for enterprises to achieve upper-market value and/or increase their market share, they have been advised to compete on quality, not just on price, through product design (UNIDO, 2007, p.33, OSMEP, 2010; Howkins, 2010, p.40). Products advertised as environmentally friendly and fairly traded can also have an advantage (UNIDO, 2007, p.33). Generally, furniture, home decoration, gifts, toys, garments and jewelry have high market shares (UNIDO, 2007; Ministry of Culture, 2009; OSMEP, 2010). Jewelry and toys are frequently traded, with high volumes of export goods (UNCTAD, 2009, cited by Howkins, 2010, p.20). Carpets, celebration items, yarn products and wickerwork are considered to have have greater opportunities to enter global markets (UNCTAD, 2008, p.116).

### Production and Techniques in Attention for Design

The production of textiles and wooden furniture is suggested as having potential but in need of special attention for market and business development (UNIDO, 2007; Ministry of Culture, 2009; OSMEP, 2010; Howkins, 2010). Small-scale production gives designers and craft-producers greater flexibility to experiment in product innovation and/or material exploration (Bassett, 2010). A combination of production and distribution activities is very important for crafts if they are to be commercially successful in the market (UNIDO, 2007, p.17). Advanced technology may be introduced to production processes to enhance quality and expand choices of materials (Ryalie, 2009; Bassett, 2010). There are opportunities for ‘Original Equipment Manufacturers’ (OEMs) – manufacturers that produce products or parts for contracted companies or retailers under those contractors’ brand names or rights – to integrate design into their manufacturing processes and develop their own brands and own-designed products (Ryalie, 2009, p.20). This would be a paradigm-shift from OEMs to ODMs – ‘Original Design Manufacturers’.

### Conclusion and Recommendations

Three main findings concerning the challenges to design in the development of craft enterprises in Thailand ironically call for a need to integrate the contributions of ‘designers’ and ‘craft-makers’ in practice. In addition, there is a critical need to integrate traditions in commercial craft-product design with design management, for example, skills, materials, stakeholders, markets, retails and customers. On the other hand, as
crafts are mentioned as being key to sustainable development in this era, a strong connection between crafts with design and sustainability has not been made explicit – in this stage of the research. To address sustainability agendas effectively in the next stage, the relationship between design for sustainability and localization is critical and has been emphasized in the field of commercial craft-product design – so this is a focus for the next stage of the research. This may be pursued by asking: “How will producing what customers want act to preserve traditional ways of working and sustainable development?”

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Design Process in Retrieving the Local Wisdom and Communal Identity: A case study of Bangchaocha’s bamboo basketry crafts

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Abstract
This study aims to develop a method of retrieving indigenous knowledge, cultural identity, and artistic quality in local craft through design activities. Taking bamboo basketry product as the case study, this research selected Bangchaocha, a sub-district in Ang Thong province, as a representative of Thailand’s rich culture and established crafts village. The community has recently encountered a problem seen in many craft communities throughout Asia – one that sees the loss of their traditional craft identity due to foreign traders placing large orders for generic products that showcase neither indigenous craft knowledge nor traditional craftsmanship. This study aims to show how the design activities can help empower the Bangchaocha craft community to appreciate, utilize, and market their invaluable craftmaking skills.

Our research method grouped design students and professional designers into three teams - each with their own unique strategy. Each team was then assigned to collaborate with local craftspeople and craft “children” in testing three different design scenarios: (1) Master and Apprentice in old time craft scenario (2) User and Designer in co-creation scenario (3) Maker and Designer in current global crafts scenario. The methodology employed by each team was based on an anthropological approach. The activities involving locals were mostly conducted in a participatory and holistic manner.

The three teams started with the same preparatory method of learning basic Bangchaocha craft weaving skills from the locals. Naturally the different approaches adopted by each group produced uniquely different and valuable results. Thus, the research concluded that the 3 types of designer/craftspeople social relationships and design activities would greatly benefit Thailand’s crafts communities as efficient mechanisms for the retrieval of local know-how.

Keywords: retrieving local wisdom, communal identity, co-creation, design process
Background

As ASEAN has agreed to strengthen its competitive regional economy, one of the key features is to develop strategies to engage and enhance the competitiveness of small and medium enterprises (SMEs) in the region. The opening of the ASEAN Economic Community (AEC) therefore will tremendously benefit all its member countries in terms of economy, sovereignty, equality, and territorial integrity (ASEAN Secretariat, 2009). Nevertheless it has also stirred up in their citizens, especially in the SMEs craft product sector, a strong feeling of national identity, as they require a business strategy to maintain cultural uniqueness for their goods. In the past, borders in Southeast Asia region were fluid or indistinct and today many ASEAN countries are remained multi-cultural societies. A great variety of ethnicities, differences in religions and beliefs, the increasing and declining in migration, diplomacy, colonization and the global trading network, all have shaped each ASEAN society to develop its own cultural practices and indigenous knowledge (Owen et al, 2010). Alongside with the flourishing concept of Creative Economy, Thailand has recently embraced this progressive concept in its national policy and development scheme, in hope to generate economic growth and development, to foster income generation, job creation and export earnings while promoting social inclusion, cultural diversity and human development (UNCTAD, 2008). Arts and Crafts sector is one of Thailand's biggest “Creative Industries” who utilize their cultural creativity and intellectual capital as primary inputs to create, produce and distribute artistic goods and services. Still, the large majority of these SMEs craft producers find it difficult in rediscover their indigenous knowledge and cultural identity since some of the crafts, in someway, blurred in its geographical origin and even shared some distinctive characteristics with other crafts in their neighborhood region (Lisuwan, 1986).

Bangchaocha community, a sub-district in Ang Thong province, is one example of a crafts community who could not resist the temptation of being a part of the global crafts commodity business scene. They enthusiastically play their role as OEM for exported craft products to quite a few parts of the world: South East Asia, Japan and North America. To do so, the local identity on crafts and design, including some indigenous knowledge are somehow neglected in order to enhance the efficiency of their crafts production line. Consequently Bangchaocha craft producers have involuntarily ignored their long historical vernacular craftworks. Their indigenous knowledge in basketworks has evolved due to material availability, preferred usages, forms, and techniques, to meet the growing needs of modern living and trends.

Recently, Bangchaocha has relied on export markets such as Japan, whose traders have ordered mainly variations of colorful and refined ladies’ handbags to be carried with kimono dress. Apart from that, they supply much the same products (but with less quality) to domestic markets for local consumers who fancy traditional-inspired design. In comparison, unlike those fancy handicraft bags, the authentically vernacular bamboo craftworks, mostly utilitarian artifacts, such as Kra-bung or rice container are considered rare and not gaining popularity in the domestic mid-range market. Such a traditionally vernacular craftworks are then usually handed to the elderly who are physically incapable of pursuing fine crafts.

As Bangchaocha craft business has faced adversity in many ways, thrive in sustaining their indigenous knowledge, while constantly developing their local craft identity, to keep up with the markets. They also confronted with the drop in human capital and natural resources. Modernization phenomenon is common to most provincial areas in Thailand, including Bangchaocha. The consequential problems, including the relocation of the young generation to work in the bigger cities, the decline of the agricultural profession,
and the replacement of hand-made agricultural-related daily artifacts by mass-produced commodities, have contributed to change the local crafts production structure and eventually resulting in the loss of indigenous knowledge. With little demand from locals, the remaining Bangchaocha craftsmen have shifted to work for the outside markets, who dominate the types, styles, quality and price of the products. Therefore, this craft-making community has also adopted an outsourcing labors and workforce distribution strategy to their craft production line for efficiency as well as time and quality control. As a result, the transfer of indigenous knowledge has been disrupted because it is too time consuming to make crafts in the old way and actually there are not many of the younger generation want to pursue this career path (Poonpol, 2004).

The decreasing popularity of craft-based products among Thai consumers corresponds with the effects of globalization and capitalism. In other words, the phenomenon was a cultural evolution that has pushed the once dominant culture of domestic materialistic consumption into a residual culture, responding to the changing social, economic, technological, ideological and geographical contexts and conditions (Williams, 2005). Not long before, Thai villagers lived a completely self-sufficient economic life. People sustained families through multiple occupations, exchange, and sales. Artisans operated from a small workshop on a part-time basis. The villages were linked by markets, where people traded their crafted goods for items they could not themselves produce or that it was not worth their time to make (Owen et al, 2010). Once industrialization and international trade had permeated into the region, imported goods had replaced most of the local crafted products. Local consumers had developed new preferences for household and daily lifestyle products, which made Bangchaocha bamboo basketry, fall in its popularity.

This study therefore attempts (1) to find out the method of retrieving the indigenous knowledge and cultural and artistic identity in Bangchaocha bamboo craftworks through design thinking and activities, (2) to empower local craftsmen working in the dilemmic context of cultural-rich-yet-OEM-salable-products with an awareness of their own cultural roots through design activities, and (3) to build up the once residual culture of domestic materialistic consumption to be a dominant culture among the Thai community. The investigation also elaborates on how such village craftsmen see and approach their communal identity for the purpose of commercialization. Further, how the involved stakeholders, eg. locals and designers who are in contact with the crafts community for product development, value and utilize this local uniqueness.

**Theoretical Context and Methodology**

The local wisdom of basketry crafts of Bangchaocha lies in the process of craft making itself. This is what Michael Polanyi refers to as tacit knowledge, a type of knowledge which cannot be transferred or taught by words alone. Instead of formal descriptions, tacit knowledge can primarily be acquired by practical and personal contact between master and apprentice (Polanyi, 2002). Bangchaocha local SMEs thrive largely on generating revenue from their basis craft implicit knowledge, but there is a limit to which they would grow if they do not engage in knowledge exchange with other practitioners or organizations in the knowledge sphere.

Unlike modern or scientific knowledge that derives from the academic activities and research institutes, indigenous knowledge is a product of cultures, traditions, values and beliefs, generations of experiences, practices, and trial-and-error experiments that are unique to specific societies. Therefore, indigenous knowledge characteristically occurs in the form of tacit knowledge, which cannot be expected to serve as a basis for trade or
knowledge exchange at local or global level since it is not documented or codified (Agrawal, 1995).

Nonaka et al. (2001) explain the creation and conversion process of tacit and explicit (codified) knowledge in four continuous steps, namely 1) Socialization, 2) Externalization, 3) Combination and 4) Internationalization. “Socialization” promotes knowledge and experience exchange and sharing through engagement in social activities such as informal meetings, living together and interacting and discussing issues of concern. These activities generate empathy that would allow tacit knowledge to be learned and shared by observation, imitation and other informal means. The spread of tacit knowledge paves the way for its conceptualization, so that it can be codified and externalized if found to be of any socio-economic significance. “Externalization” is thus a process, which transforms tacit knowledge to explicit knowledge by creating concepts in forms that can be readily understood by and exchanged with others.

The next stage in the evolutionary process is “Combination”, the process that transforms explicit knowledge into more complex, but systemic, form, thus allowing explicit knowledge to be communicated, diffused and systemized. The effectiveness of this process would depend on the extent of the social network and connectedness among people for knowledge to be able to circulate widely. The last stage, the “Internalization” process ensures that explicit knowledge is embedded into tacit knowledge making it more complex and dynamical. This is akin to “cross-pollination” in the knowledge exchange process. It occurs, for example, through the vehicles of manuals, procedures and programs that are used in institutions as teaching materials in training courses. The diffusion and embodying processes of explicit knowledge have a potentially regenerative effect on tacit knowledge or knowhow that result in the development of the core competency of activities.

Human, cultural, social, and environmental capitals are all play vital roles in the sustainable development of Bangchaocha craft community. While original concept in sustainable development has established on the three pillars of environmental, social and economic sustainability, the IUCN Programme (2006), has demonstrated that the three objectives need to be better integrated, with action to restore the balance between dimensions of sustainability. With the recent argument on the biodiversity vision, cultural diversity is the fourth policy area of sustainable development, understood not simply in terms of economic growth, but also as a means to achieve a more satisfactory intellectual, emotional, moral and spiritual existence (UNESCO, 2001). Design activities that allow traditional bamboo-working communities greater participation in the production to the consumption chain can address the issue of sustainable development in a holistic manner, while simultaneously actualizing bamboo’s potential to allow for economically viable, culturally sensitive, socially equitable, and eco-friendly production (Reubens, 2010). The Craft Research Methods as a spiral model, “Village Incubatee” (later developed to a Raindrops model, a combination of multi-spiral models in random manner) by Prof. M.P. Ranjan (2008) at The Indian Institute of Crafts and Design (IICD) also suggested that several design activities between locals and outside designers are inseparable and should have several contact points to allow both parties in engage, empathize, share, collaborate, and incubate.

Also inspired by the notion of Dominant, Residual and Emergent Cultural Behaviors by Raymond William in Culture and Materialism (2005), Xiangyang Xin and Craig Vogel have suggested the relationship of those three in the form of Progression of Cultural Behaviors model (2006). While dominant cultural behaviors conform to institutional and mainstream ideologies, residual cultural behaviors are often rooted in the traditional and emergent cultural behaviors are continually generated new behaviors.
Within our study, crafts making is considered as a form of cultural activity, which also has its own path of evolution through a period of time, which seems to correspond with the Progression of Cultural Behaviors model. In search of possible retrieval mechanisms, we have set up our assumption on 3 indigenous knowledge stages we are going to explore: Dominant, Emergent and Residual based on the Progression of Cultural Behaviors model as follows:

Therefore this study is influenced by an anthropological approach, but a participatory design method is also utilized. The application of both methods, with the holistic approach aiming in development of Bangchaocha social capital, produced the three different design scenarios as the research tools that speak of the varied social relationships between Bangchaocha local craftsmen and the participant designers: (1) master and apprentice in the craft knowledge transfer of the old time, (2) the equal role of user and designer in the co-creation concept, and (3) maker and designer in the typical Thailand's OEM scenario. These preset design roles as the research strategy will beneficially articulate how and in which different levels access to indigenous knowledge can happen. Nevertheless, the collaborations mostly initiated by Thai government agencies, like in other developing countries, support the community in terms of product introduction, financial and group management advice, and make known the target market, but in the long run, the community needs to self-sustain its business by introducing and fostering in their young community members the value of their indigenous knowledge and wisdom.

The three groups of participant designers included two groups of young 4th year Industrial Design students and another group of professional designers. Each group was assigned the same mission: develop the new bamboo basketry-technique-based products that convey indigenous knowledge of Bangchaocha, involving creative
technique, form, community’s self-sufficient lifestyle, sustainability, or appropriate marketing approaches. The first group of design students imitated the role of apprentices, learning closely with the crafts master before starting to create their own designs. The second group of design students teamed up with 5th grade students from the local school in their co-creation project, as a senior friend who came in once a week to give them fun activities during the 8-week design project. The 5th grade students were risky, but appropriate subjects as they already possessed basic weaving skills provided in the local school’s cultural study course. The third group of professional designer pursued their role of outside designers working with the craft makers in the typical Thai OEM scenario.

![Figure 3: The Three Models in Retrieving Bangchaocha’s Indigenous Knowledge](source: Chuenruedeemol, W. (2011))

With the initial concept of how to preserve Bangchaocha craft indigenous knowledge and how to render a well-captured spirit of Bangchaocha identity into a commercially successful product, the three groups of designers participated in a village survey and museum visit to acquaint themselves with the community and for the community to get to know them. The first group of young industrial design students employed an ethnographic observation, a strong grounding in both verbal and visual domains of experience to provide empathy from immersion into a particular context. A preset circumstance of different intentions was organized between the young student designers and local craftsmen to create a mutual learning atmosphere. The students were required to slightly challenge the craftsmen in experimenting with materials, form and technique, which had varied influences on their design thinking.

The second group of young students who approached the 5th grade local school children had set up a series of edutainment workshop, mission of finding insight into the community and how the people perceive and think of their local wisdom. The friendliness of young design students, the informal style of the workshop, the fun, creative and easy activities, helped ease those local children in participating in the activities. While the
design students have exercised their learning with the locals, the third group of professional designers from different background have hopped in and out the village since they had limited time. This circumstance was already controlled to imitate the OEM relationship between the designers and locals, a one-way design interaction. The local craftsmen’s task here was only to produce prototypes according to the designers’ plans.

Results

1) Design Outcomes

The design outcomes of all three groups are quite varied in terms of design intention and marketing strategic planning. With the first group of industrial design students approaching the craftsmen following a master-apprentice model, they had first hand experience living with the villagers, which allowed them to understand and empathize with the villagers. Some students set their design intention, together with the assistance of the craftsmen, in expanding existing bamboo handbag product lines, which the craft group leader had seen the market potential for. Therefore the design output from the master-apprentice collaboration was a practical commercializable yet undifferentiated product. Some other students in the group had set their design intention in reviving the traditional bamboo crafts of Bangchaocha to fit with the current consumer lifestyle. By adapting the old rice and fish containers to be home decorative items, they altered the original functions, forms, and color scheme, but still maintained the significant weaving pattern. This resulted in an unexpected craft design familiar to consumers, which made them easily to become a popular line of products.

The design outcomes from the co-creation between the design students and local school children was inspired by the children’s imagination. Most of the finished works came from design activities in class: keeping diary, wish-list drawing, paper-model making, and story telling, all activities related to their daily life. Like most of the co-creation project, the young children participated as product users, helping the design students to form their initial design concept. Interactions between these two stakeholders were very spontaneous. The design students had experienced a slightly uncomfortable reaction as they felt they were not in-control of the whole design process, which most designers usually expect. However, they were pleased when they saw their younger friends relishing their beautiful child-friendly craft products.

The third group comprised professional designers from different backgrounds, including a branding strategic designer, a consumer product designer, an interior designer, and an architect. The design outcomes of this group reflected on individual designer’s expertise and personal interest. And as they were set as outside influencers, their craft designs were quite fresh and challenging since they had less preconception of the limitation of craft process. In result, some of their craft designs were not directly intended for retail sale, but rather as facilitating tools that would also appeal to craft-loving customers, for example a safety knife for slicing bamboo bark. While some craft products are designed to cater target customers, some designed crafts from this group are designed to benefit people of the community.
2) Lessons Learnt

For design students, participating in this study gave them opportunities to learn from the real world. Bringing together two groups of people with different backgrounds turned out to be an eye-opening experience and a source of powerful creativity through the synergy of ideas, and a mix and match working style with open-ended expectations, rather than goal-oriented solidified solution. In essence, design students explored contemporary product design theories with the craftsmen’s existing basketry techniques. The process was truly collaborative, one in which students were able to materialize their design intentions through a real understanding of craft materials and techniques while village craftsmen were encouraged to apply their skills to functions and forms made by the students that were outside of tradition and convention.
The project challenged the community in a constructive way. Craftsmen, local chief and officers, local children, all realized not only their creative potential, but also their invaluable local wisdom. While villagers need to prioritize their source of subsistence, they finally also realize the importance in sustaining their valuable craft wisdom. Therefore, community craft product development should balance between the aim to creatively commercialize and to effectively preserve their local wisdom. The village craftsmen also mentioned that they had absorbed some design knowledge during the project. They learned that keeping local wisdom can be done in two ways, either preservation or development from the old, for example by altering size and proportion, and refining form and color, to match with their target customers.

Discussions

1) Retrieving Craft Wisdom

![Figure 5: Crafts Value in Relation to Indigenous Knowledge Retrieval Activities](Source: Chuenruedemol, W. (2011))

There are multi levels in accessing indigenous craft knowledge. In each level, there will be different incentives for stakeholders to explore and retrieve their indigenous knowledge and crafts know-how. The dominant cultural elements of crafts create direct economic value to the community, which is vulnerable to changes and the domination of marketing trends. Therefore, the search and selection for indigenous authenticity in dominant cultural elements is crucial. Emergent and residual cultural elements of crafts are obviously potential areas to be explored. For residual cultural elements, how to help the community bring their own culture back to life after a decline needs the assistance of outsiders to accelerate the process. Parallel with desk research on local art and craft history, learning by doing in the master/apprentice fashion with the local craftsmen can be conducted. If this opportunity is regularly arranged, the local craftsmen can practice their crafts skills and enhance them to the level so that they can create true artistic value to the products. For the emergent cultural element of crafts, designers can enhance crafts social and cultural value by contributing their creativity with a new perspective on the local socio-cultural context to capture the unseen indigenous crafts know-how and even
establish new set of crafts cultural artifacts for the needs of the locals. Therefore, designers’ role is not only to activate the new cycle of design creation based on indigenous wisdom in collaboration with the craftsmen, but also to trigger local craftsmen and the community in several ways. However, if an enthusiastic younger generation interested in preserving indigenous knowledge exists, there is no need for an outside designer to intervene at all because their culture will evolve by their own natural course. The outsider can only help with public relation and keep the closed-looped connection running. Ideally it is the task of the community itself to retrieve their own declining cultural identity to become dominant again.

2) Mutual Benefits

Thai society is based on mutual reliance and cooperation, for example, the act of rice harvesting. Revenue and earnings received had never been problematic as labor and outcomes were unmeasured (Petchmak, 2004). Nevertheless, the main goal of community members participating in this new economic creativity project was geared towards revenue and profit sharing. In order to achieve collaboration from the community, mutual benefits are considered to be a very important factor. Take the teachers at Wat Yang Thong primary school case for example. When the project first started, the school lacked enough teachers to run the class. The project helped by providing extra teachers to help teach the class. Another example is the community’s need for a new design since they sought to expand their product line for a wider target audience. As a result, the project had helped with a new marketable design for their bamboo handbag category. However, the mutual benefit issue needs to be cautiously and sensitively handled. Especially when the community lacking social strength, conflicts can easily happen among the members and with the outsiders.

3) A Self-Reliance Community

A generation gap existed in the studied community where the older generation carried on the task of weaving and keeping the community economy running and none of the younger generation seemed interested in prolonging this indigenous knowledge. The older people feared that their knowledge would become eventually extinct because of the younger generation’s abandonment of a local village industry that promised low economic returns and little career excitement. In short, they underestimated their cultural intrinsic value. The designer acted as a bonding agent between these two generations in the community, as the indigenous knowledge retriever from the older generation and the inspiration of the local younger generation. They solely work as an outside mechanism to accelerate the process, and at a certain point when the community is ready, they should be replaced by the local younger generation who are trained to replace the outside designers’ task.

Similar strategy has appeared with the case of ‘Hub System’ in Indonesia. A product designer, Joshua Simandjuntak has proposed the model of sustaining indigenous craft knowledge whilst embracing new design. In crafts villages in Indonesia, outside designers commonly come into the village with enthusiasm to produce their design with technical support of the local craftsmen. After their departure once the prototypes are made, there exists a ‘vacuum’ of a community’s design inspiration. With such intermittent stimuli, it has resulted as in unsustainable progress among any stakeholders.

The ‘Hub’ is, therefore, created as the actual sharing place within the community where local craftsmen and visiting designers can share and exchange know-how and ideas on design utilizing indigenous crafts techniques. The knowledge acquiring facilities are equipped for craftsmen searching for knowledge from outside, while collaborative working space is also provided for designers to learn the hands-on techniques from craftsmen.
The objectives of this system is to prompt local craftsmen to regularly practice and share their indigenous crafts know-how through interaction with outsiders, and in return, the new and fresh design creations of these ‘Designers-in-residence’ will trigger local design perspective and also be accumulatively archived. Even though the designers leave the community, the system and knowledge will remain to constantly drive the new cycle of learning (Simandjuntak, 2010).

Furthermore, priority should be given to utilizing indigenous knowledge and local narratives and inspiration, rather than market demand if one wants to develop the local commerce sustainably. The proper marketing channels can be sought once the new indigenous-based products are created. Knowledge transfer and accumulation are necessarily conducted in parallel with foreseeing and understanding potential markets.

Conclusion

Skill-based know-how can only be learned by practice. Learning in social and cultural context is almost as important as the indigenous craft knowledge itself as it is extensive learning towards real understanding of local wisdom. With a respectful approach to the locals, the research integrated all stakeholders from the community to partake in the learning, so as to achieve the mutual goal of retrieving the local identity and cultural asset.

Because in the ever-changing world economy, where the temptation of mass, fast-paced development and economic lure are hard to withstand by smaller societies, an indigenous society needs to adopt an effective modern mechanism. In this case such a mechanism was introduced by the outside source of young designers to balance a community’s age-old cultural identity with modern marketing demands. In doing so, it shows how society can start to develop in a sustainable manner and how a culture’s identity can be retrieved, respected, valued, and even elevated.

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Design for Longevity: Obstacles and opportunities posed by new public policy developments

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Abstract
This paper explores the implications for design theory and practice of recent public policy initiatives that aim to promote longer lasting products. Public concern relating to product lifetimes and, specifically, a perception that manufacturers of certain consumer durables are responsible for planned obsolescence, is long established. Academic engagement in this area has latterly increased and governments have taken interest in product longevity as a means of increasing resource efficiency and reducing waste. One of the driving forces is the revised EU Waste Framework Directive, which requires Member States to develop waste prevention programmes and highlights product life extension as a means of reducing waste. A subsequent Government review of waste policy in the United Kingdom indicated an intention to promote ‘resource efficient product design’, of which one element would be ‘design for longer life, upgrading, reuse or repair’.

A range of possible implications for designers of this emerging public policy are considered in this paper, which questions the feasibility of increased product longevity in the light of the demands of market-oriented and growth-driven economies in Western Europe and addresses the potential role of designers in achieving such change. Drawing upon data from a series of semi-structured interviews with design practitioners, it considers how able and how motivated designers are to respond to the challenge of increasing product lifetimes and how they might utilise any power they have to affect change.

The paper relates these findings to the UK Government’s pledge to work with businesses to ‘design and manufacture goods that are more efficient, durable, repairable and recyclable’. Unless businesses see the prospect of commercial gain, they will not specify such products. The paper concludes that a mix of regulatory and market-based instruments will need to be adopted by government if increased product longevity is to be regarded by business as a credible strategy.

Keywords: product lifetimes, planned obsolescence, public policy, design for longevity, sustainable design
Obsolescence and longevity

This paper explores the implications for design theory and practice of recent public policy initiatives in the United Kingdom that aim to promote longer lasting products by presenting the findings of a recent preliminary study of designers’ attitudes to product lifetimes.

There has long been public concern relating to product longevity; specifically, a perception that manufacturers of certain consumer durables are responsible for planned obsolescence and an objection to the waste generated by short-lived goods (Packard, 1963, Slade, 2006). An attempt to revive debate on the topic in the early 1990s (Cooper, 1994) attracted considerable media publicity but did not lead to any notable change in public policy (Cooper, 2010). Recently, however, academics across several disciplines have explored various aspects of product longevity (e.g. Cooper, 2010; Gregson and Crewe, 2003; Mugge et al., 2010; Murakami et al., 2010; Oguchi et al., 2010) and the British Government has begun to take an interest in product longevity as a means of increasing resource efficiency and reducing waste (Defra, 2011a; ERM, 2011).

Explaining recent interest

Public policy has rarely addressed product longevity explicitly, and historically when it has done so the context has most often been an economic recession rather than concern about waste and the other negative outcomes of a throwaway culture.

Thus when America faced a recession in the 1920s investment banker Paul Mazur noted how ‘if what had filled the consumer market yesterday could only be made obsolete today ... that whole market would be again available tomorrow’ (Slade 2006:60), while a tract in 1932 proposed that the Government should impose maximum product life-spans in times of widespread unemployment, at which point ‘people would turn in their used and obsolete goods to certain government agencies’ (Slade, 2006:75). Meanwhile designers Roy Sheldon and Egmont Arens were promoting what they termed ‘obsoletism’ as a ‘device for stimulating consumption’ (Slade, 2006:66).

While there is no record of governments actually imposing maximum life-spans, in more recent years several have adopted an alternative means to achieve the same end: offering financial incentives to consumers who trade-in energy-using products such as vehicles, refrigeration equipment or boilers over a certain age. These ‘scrappage schemes’ were introduced in the USA and many European countries during the global recession that began in 2008, most notably for cars. An earlier scheme operated in the UK from 1996-2002 for inefficient fridges (Cooper, 2010).

Such scrappage schemes have been motivated in part by a desire to stimulate economies at a time of recession but also, to one degree or another, by the need to reduce greenhouse gas emissions arising from excessive energy use (Van Wee et al., 2011). At the same time, the United Nations Environment Programme and European Union, mindful of problems caused by excessive waste and the contribution of embedded carbon in products to greenhouse gas emissions, have considered the potential for waste prevention through a more efficient use of resources, including increased product longevity.

One of the outcomes has been the European Union’s revisions to the Waste Framework Directive (2008/98/EC), which introduced a requirement for Member States to develop waste prevention programmes and refers to product life extension as a means of reducing waste. Another is the Ecodesign Directive (2009/125/EC), which provides a framework within which compulsory design requirements may be set, the parameters of
which include ‘extension of lifetime as expressed through: minimum guaranteed lifetime, minimum time for availability of spare parts, modularity, upgradeability, reparable.’

In Britain, the Department for Environment, Food and Rural Affairs (Defra) responded by commissioning a research study on product lifetimes (Defra 2011b, 2011c; ERM, 2011) and, in a review of waste policy (Defra, 2011a), proposing several initiatives aimed at increasing product longevity. The review put waste reduction in the context of a resource efficiency programme and indicated that the Government intended promoting ‘resource efficient product design’ (para 40), of which one element would be ‘design for longer life, upgrading, reuse or repair’ (para 65).

**Design and product longevity**

This paper seeks to explore some implications for designers of this emerging public policy and the potential role of designers in contributing to the proposed shift towards longer lasting products. First, it briefly reviews the historic debate on product longevity among designers, from the contribution of Victor Papanek to more recent interest promoted by the Dutch design network Eternally Yours and the UK-based Network on Product Life-spans.

A debate on planned obsolescence began to grow in America over 50 years ago, initially emerging within the business community but later stirred by the popular writings of Vance Packard (1963). The initial reaction of designers reflected prevalent cultural norms in industry. Indeed, it was Brooks Stevens, co-founder of the Industrial Design Society of America, who, in a talk in 1954 on the mission of the industrial designer, created a popular definition of the concept of planned obsolescence: “instilling in the buyer the desire to own something a little newer, a little better, a little sooner than is necessary” (Cooper, 2010). Not surprisingly, his implicit support for the validity of design as a marketing ploy fuelled much debate.

As the modern environmental movement emerged, a few designers, most notably Victor Papanek (1972), argued that the design community should accept a greater degree of social responsibility, although many years were to pass before such thinking entered the mainstream. Initially it emerged as eco-design, alternatively termed green design (Burall, 1991; Mackenzie, 1991) or design for environment (Fiksel, 1996). At this stage product longevity was not given a high profile, as engagement by the design community in the debate on sustainable development largely arose as a result of legislative threats in areas such as energy efficiency and recyclability. Following the 1992 Earth Summit, however, which did much to legitimize interest in sustainability to government and industry, economic and social perspectives were incorporated into the concept, which evolved and consolidated into ‘sustainable design’, and as a quest for ‘greener’ products gathered momentum, life cycle thinking became pivotal (Heiskanen, 2002).

This paved the way for a new wave of young designers to explore the durability of goods and the potential for product life extension (Chapman, 2005; Mugge et al., 2005; Park, 2003; Van Nes and Cramer, 2005, 2006) and the development of guidelines for product lifetime optimisation as part of design for environmental sustainability (Vezzoli and Manzini, 2008). Two international multidisciplinary initiatives were created to promote understanding of the topic, the Dutch design network Eternally Yours (Van Hinte, 1997, 2004) and the UK-based Network on Product Life-spans (Cooper, 2010).

**Methodology**

In order to explore the level of awareness among designers of the challenge posed by inadequate product lifetimes and their perceived ability as practitioners to respond and
contribute to the necessary change, data was collected through a series of semi-structured interviews.

The semi-structured interview was considered an appropriate method as it allows the degree of flexibility necessary in a relatively novel field of research. In-depth interviews were undertaken by telephone and recorded for subsequent transcription. On average, the interviews lasted 30 minutes.

The sample comprised twelve designers working for companies with whom Nottingham Trent University has established links as a result of their offering placements to undergraduate students or participation in its Future Factory project (which provides support to local companies). The interviewees were all qualified designers and most worked in design consultancies, although one worked in a retailer’s buying department. A satisfactory gender balance was achieved and, with one exception, all interviewees were located within the UK. Their clients included retailers and other businesses, in addition to customers through direct sales, and a range of product sectors were represented, including furniture, lighting, home accessories and electronics.

The interview schedule was constructed around four areas of interest:

- The extent to which the designer was concerned about the environment and whether any such concern affected their output
- Awareness of the designer of the various factors that determine product life-spans and any experience of planned obsolescence
- The extent to which the designer felt able to influence the life-span of products and, specifically, to encourage consumers to keep them for longer
- The designer’s opinion on the likelihood of a trend towards longer product lifetimes and whether this would require some form of Government support.

Following the interviews the transcripts were coded and analysed in order to interpret the data and identify key themes, using established techniques (Bryman, 2001).

**Key Findings**

**Consumer attitudes and behaviour**

Designers expressed a wide range of views relating to consumers as purchasers and users of products and the implications for product lifetimes. Several noted how attitudes had changed over time; for example, some suggested that the practice of handing products down between generations had become less common. Reference was also made to a lowering of consumers’ expectations of product lifetimes.

One positive theme that emerged was the degree to which clients conveyed an understanding of design and their level of engagement with products. Several designers said that they believed awareness of design has risen in recent years and that purchasers were increasingly design-conscious. Such appreciation, it was suggested, might lead to increased demand for higher quality and longer lasting products and a willingness to invest in these. That said, a need to cultivate awareness of products was also considered necessary, specifically an ability to consider the whole product life cycle: understanding the nature of trees and forests in the case of furniture and, for leather goods, the animals from which leather is derived. References were made to increased
understanding of sustainability, particularly among the young, although some designers indicated that clients were uninterested.

Designers’ impressions of consumer interest in product design were certainly not all positive. For example, one referred to ‘ill-informed’ purchasers who either did not know or did not care about product quality. An example given was of people buying chairs without first sitting on them to test them for comfort and quality. Another designer referred to ‘increasingly frivolous’ attitudes. People did not only want the newest version of electronic products or to periodically update their home accessories, but regularly changed products such as items of furniture that were once regarded as long term investments. Several designers suggested that it was not possible to stop people wanting the latest fashion or newest technology.

Designers referred to attitudes not only affecting the purchasing process but the care with which goods were subsequently used. The quality of care might exert a considerable influence on an item’s life-span, as when furniture was mistreated. Several designers argued that the care with which products were used would be affected by their value. If products were cheap, owners might make no emotional connection with them, whereas luxury items would be more carefully maintained.

Overall, designers conveyed a belief that society would inevitably be divided between people who valued design quality and were willing and able to pay for this and others who favoured cheapness. This meant that there would always be variations in product longevity: a key question would therefore be whether the balance in society between these contrasting attitudes might change.

The influence of the designer

Designers were asked to consider their personal attitudes to product longevity and the extent to which they felt able to exert an influence on clients.

Most of the designers interviewed expressed an interest in sustainable consumption in general and product longevity in particular, although differences emerged on the extent to which they felt they could personally exert an influence through their work. One noted wryly that definitions of ‘lifetime’ varied and that a product’s lifetime was, in effect, the period until the receipt was lost.

Several designers indicated that they had a deep commitment to addressing the environmental impact of consumption. One described his desire ‘to design a timeless piece.’ Another spoke of his guilt at not using resources well. Some considered a degree of compromise inevitable and concluded that, if a product was to be short-lived, the designer should at least try to ensure that materials were recoverable.

Some designers had evidently reflected at length on how different approaches to design might influence product life-spans. One spoke of the risk of adopting an ‘outspoken design’ that would end up as a niche product with a short life cycle. Another pointed to the risk of design being ‘too aggressive’. There was, one said, a need to ‘tiptoe between the USP (unique selling point) and not scaring off consumers.’

Most of the designers indicated that their direct influence over product lifetimes was limited, the exception to this general rule being the designer-maker. One stated baldly that he had no influence; a product’s life-span was up to market forces. Another noted that he could, at least, aim for reliability. It was also suggested that, even leaving aside the user, design was not the only determinant of life-spans: there might be a significant design input but the product might subsequently be poorly made.
Most designers indicated that they generally worked to briefs set by others. They were aware of the market within which they were operating, but it was up to the client to determine the market positioning for products. The client would determine their requirements by, for example, visiting trade fairs and assessing the market. One designer noted that clients might request regular changes to products, for whatever reason, which they would periodically have to redesign.

Designers had to design for the consumer, not themselves, according to one interviewee. That said, another designer indicated that he chose his clients very carefully in order that he could maintain his personal integrity. Others did not share his concern and commitment: one designer, asked about how to encourage consumers not to discard products prematurely, stated that promoting retention was not in a designer’s interest.

**Style and technology**

Two themes to emerge as challenges facing designers with regard to product longevity, depending on the market, were periodical changes in style and fashion and pressure created by technological advance.

In the case of the former, one designer suggested that it is often cheaper products that tend to be fashion-led, although another pointed out that style is crucial in the car industry and few people would want to purchase a new Ford Mondeo in the style of even five years ago. Within the home, it was suggested that people are changing their décor more often and this often leads them to purchase new products. An example given was of people changing fabrics for home furnishings due to a new style emerging rather than as a result of a fault.

For many consumers mere functionality does not suffice. One designer argued that people have a natural desire for change. As an example, another said that in recent years the balance between traditional and modern kitchens that he designed had been completely reversed. On the other hand, it was also suggested that, far from arising out of a ‘natural’ desire for change, consumer uptake of fashion items was strongly underpinned by magazines and relatively cheap prices.

One designer said that changes in style had a significant impact on the market and were thus problematic. Frequent changes in style might result in lower quality products because manufacturers operate on the assumption that consumers will not want to retain long lasting products that become outmoded.

Companies were defended by one designer as locked into the current system. Manufacturers fear that not regularly changing their products’ style will result in reduced sales. They are also influenced by the fact that retailers may only give their products a ‘window’ for a limited time period because the prevailing retail culture demands cycles of change.

Another challenge to designers is the pace of technological advance, most notably in the electronics sector. According to one designer, the technological changes that meant computers quickly become out of date due to ever-changing processors and motherboards were deliberate and irresponsible. Another said that it was impossible to keep up with the succession of technological advances when designing screens.

Pressure comes from various directions. One designer noted that companies may feel compelled to utilize the latest technology because this would result in their products being stocked for longer by the retailer.

**Designing for longevity**
Several designers made reference to the poor intrinsic quality of many products. One referred to the prevalence of ‘cheap crappy furniture’ and many examples were given relating to furniture: the use of engineered wood, cheap veneers that were easily damaged, use of paper foil rather than wood, a lack of corner blocks and a widespread use of low quality wood and foam cushions. Upholstery, the durability of which is readily identifiable through a rub test score, was of variable quality. Reference was also made to flimsy appliances and the irreparable nature of many small electronic items such as hairdryers and kettles.

Asked about designing products for longevity, several approaches were mentioned. One proposed a user-centred approach, describing the importance of focusing attention on the final user and how he or she would relate to the product. Another referred to the need to create emotional connections so that the user would not want to discard the product. The role of the designer was to add value and meaning. A starting point, it was suggested, was to seek to learn from history and other cultures as to how products come to be long lasting. One designer suggested that a balance was needed in some cases: it was beneficial to utilize traditional techniques but not to disregard useful technological innovations.

A range of practical suggestions were made. One designer suggested aiming to create a premium feel by focusing on the product’s ‘touch points’. Another proposed that the use of metal should be preferred in order to create a robust feel. Mention was also made of the importance of modular design, particularly in the context of reparability. One designer suggested that fixings, which were sometimes considered a weak point, being liable to snap, could be enhanced through good design and used positively to allow for ease of disassembly. In the specific case of furniture, suggestions included use of solid wood (on the grounds that people are more likely to retain such products) and good associated hardware, and taking care over edging. Another designer suggested working across different markets; she had compared the quality of fabrics designed for the commercial market with ‘arty-farty fabrics’ aimed at the consumer market and found that the former were not only more durable but significantly cheaper.

Problems posed by the transient appeal of fashion were noted. One designer admitted that he would only be excited by his new iPhone for ‘about a week.’ The use of ‘durable aesthetics’ was proposed, as were the benefits of adopting a ‘neutral’ style. One of the tasks of the designer, it was suggested, was to find an aesthetic that keeps an unchanging product attractive in an ever-changing market. By not ‘being trendy’ it was more likely that a product would have an extended shelf life. Another designer spoke bluntly of a need to ‘avoid fashion’.

Design for longevity requires consideration of the possibility of product failure and identifying solutions. One designer suggested the possibility of offering an extended guarantee underpinned by insurance. It was suggested that if products were to be longer lasting, planning for spares was especially important. One designer went further and proposed that there was a need to consider the whole ‘repair infrastructure’; in other words, thinking beyond the product to a solution based on a product-service system.

**Market-driven influences**

Many designers highlighted evidence that product lifetimes are influenced by market forces. One suggested that the market invariably dominates over other considerations, such as ethics. This was problematic. As the present economic and financial system rewards sales growth, companies promote replacement rather than retention. One designer suggested that simple commercial logic meant that companies would not want a designer to create an ‘everlasting gobstopper.’
A few designers adopted a less critical view of the market, suggesting that it allows for a range of products of different levels of quality, including higher priced goods that should last longer. More, however, expressed concern, particularly concerning quality.

Several considered that markets are shaped unduly by price considerations at the expense of other variables. According to one, ‘price-driven markets’ resulted in reduced quality. The fact that many products cost less than in the past was not necessarily viewed positively. One designer thought that society could not ‘afford cheapness’ because of the implications for quality and value. Another raised the possibility that problems arise because retailers require a relatively high mark-up.

The use of inappropriate business models in some sectors was criticised. One example provided by a designer from the furniture sector was a retailer who made the price of products very low and depended on ‘add-ons’ and finance deals in order to make a profit.

In general, designers did not focus criticism on companies; they appeared to judge that the problems lay with the system within which companies operated. Thus concern was raised by several designers that the international economic system led to repair work costing more than replacement with new items. The price of smaller electronics, for example, meant that they were invariably irreparable. Change would need engagement in the debate from international authorities and governments.

Different views were expressed on the implications of economic recession for product lifetimes. One was that sustainability became more difficult to promote as people were less able to afford higher quality products, while another was that recession results in slower product development cycles, which would lead to people replacing products less often.

**The role of government**

Designers were lastly asked whether they considered that the Government might have a role in promoting product longevity. Contrasting opinions were expressed.

One designer expressed the view that, faced by excessive resource use and waste, the best course of action was to trust markets to be responsive. It would be inappropriate to seek to ‘force’ change, although the Government could rightly use measures such as its procurement policy to promote good practice; indeed it was already doing so with regard to personal computers.

By contrast, a designer with a rather different perspective argued that the Government has a ‘massive role’ to play, because in order to achieve change it would be necessary to address the economic system. Another suggested that any solution would need to respond to the logic of the market which drove companies to seek capital growth and produced an incentive for them to sell more products and encourage premature replacement.

Thus while designers’ approaches differed, there was a shared recognition that commercial pressures exerted an important influence upon product lifetimes. References were made to the need to work with industry and to change manufacturers’ attitudes, although without significant detail. The potential role of government in other areas identified by designers was uncontroversial, such as promoting designer-makers, giving exposure to examples of good practice, and developing second hand markets.

Designers also suggested that the Government needed to engage with consumers. One said that there was a need to encourage consumers to associate quality with longevity, and to link this with British-made products. Another said she was wary of patronizing consumers, who she considered did not need government help in making their decisions.
Finally, it was proposed that product longevity should be linked to the carbon agenda, with which industry and consumers alike were familiar. One designer argued that there was no single solution and that, ultimately, a change in culture was required; this would need to involve the education system and teaching children to improve care of the material world. More specifically, the importance of design education should be recognised, as it would lead to better appreciation of products and how they are designed.

**Conclusion**

The interviews in this study revealed designers to be familiar with different forms of obsolescence and influences upon product life-spans, and aware of some theoretical and practical approaches to design for longevity.

The extent to which they felt able to influence product life-spans was determined to a large degree by the context within which they worked and the markets in which they operated. In most cases they considered that their power to effect change was relatively limited. Thus while many had a personal interest in environmental concerns, this did not necessarily affect their output, except at the margin.

Designers expressed awareness of the market-driven nature of Western economies and the factors that shape how companies operate. Many voiced concern at the financial logic driving practices that resulted in short-lived goods, while recognizing that it was not easy for an individual company to implement a solution. They were also mindful of the diverse nature of consumers and their complex attitudes and behaviour.

Asked about the role of Government in promoting longer product lifetimes, designers identified several options. Some were uncontroversial, such as establishing a dialogue with industry, promoting good practice and improving the profile of design education in schools, while proposals for more systemic change appeared more divisive.

The British Government pledged in its waste policy review to work with businesses to ‘design and manufacture goods that are more efficient, durable, repairable and recyclable.’ The findings from this study suggest that, for their part, designers would be keen to contribute. Unless businesses see a prospect of commercial gain through manufacturing and selling products designed for longer lifetimes, however, they will not invite designers to adopt this approach. The systemic nature of the problem suggests that a mix of regulatory and market-based instruments will have to be adopted by Government if increased product longevity is to be regarded by businesses as a credible strategy.

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Reflective Methods in Design Pedagogy

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Abstract
This study proposes reflection as a pedagogical approach in design education. Design students lack of process was noticed as they struggled with basic ideation and exploration. To more effectively communicate the notion of process, reflective methods were introduced within the design studio. Reflection enhances learning and productiveness, vital goals of the education process (Russell, 2001). Jack Mezirow, an educator and researcher made the following statement about critical reflection, “reflection may enable individuals to change their habits of expectation and, as a result, develop more accurate perceptions, avoid premature cognitive commitments, and achieve greater flexibility and creativity” (1991).

This paper presents research involving the benefits of using reflective methods in design education. A reflective framework is proposed, three methods are presented and results are analyzed. Understanding the design process, through reflection, will produce more effective designers, independent learners, creative thinkers and visionaries in the design field.

Keywords: reflective practice, design process, graphic design, education
Introduction

The traditional project-focused design studio includes artifact-based problem solving. Students are given the task of designing a brochure, poster, website, etc. In our evolving society, the field of visual communication design is ever changing. With new technology, mediums and methods, students will be designing solutions for contemporary problems that might not even exist today. They need to learn to adapt in their practice. As designers and educators, process is at the core of design. How a designer arrived at the solution, the steps they took, in many instances, are more important than the solution itself. In fact, AIGA, the Professional Association of Design, uses the word ‘process’ in their definition of what a designer does, “graphic design is a creative process that combines art and technology to communicate ideas.”

We continually emphasize process to students, yet it became evident of a lack of development pronounced in their minimal sketches, limited ideation and overall satisfaction with their initial idea. Thus the question, how do we more effectively communicate the notion of process? In an effort to shift students thinking away from solely the final artifact, improve their problem-solving abilities and provide them with a deeper understanding of their process, reflective methods were employed. Motivated by the need to include reflective methods in the design classroom, with the end goal of improving the design process, this paper explores three methods: process books, written analysis and visual process maps.

Reflection Theories

There are a multitude of definitions and theories on reflection. For this study, reflective practice is defined as a learning approach that encourages contemplation in one’s actions and ideas. This leads to them being modified, extended and refined, in a continuous cycle. Figure 1 shows The Kolb Cycle, also called The Learning Cycle, which includes reflection as a key step in the learning process. David Kolb, an educational theorist, states “it is necessary to reflect on the experience, to make generalizations and formulate concepts which can then be applied to new situations” (1984). Having students reflect and assess their own work, is effective in enhancing learning and achievement (McDonald and Boud, 2003).

In his paper titled, Reflection in Higher Education: A Concept Analysis, Russell Rogers compares and contrasts several theoretical approaches on reflection from Dewey (1933); Schön (1983); Boud, Keogh and Walker (1985); Langer (1989); Loughran (1996); Mezirow(1991); and Seibert and Daudelin (1999). His analysis revealed many commonalities including: (1) reflection is a cognitive process or activity, (2) reflection requires the individuals active engagement, (3) reflection is triggered by a situation or experience, (4) reflection results in a new understanding. One of the main outcomes of using reflective methods in the classroom is learning. Reflection enhances learning and
productiveness, vital goals of the education process (Russell, 49). Mezirow (1991) further argued that reflection leads to transformative learning. “Thus, reflection may enable individuals to change their habits of expectation and, as a result, develop more accurate perceptions, avoid premature cognitive commitments, and achieve greater flexibility and creativity”(1991). To summarize, as one learns through reflection they are able to improve in their practice.

Donald Schön, a prestigious thinker in the area of reflection, developed numerous concepts related to professional learning. These theories are noted in his book, *The Reflective Practitioner: How Professionals Think in Action* (1983). Reflection-in-action is defined by Schön as the ability of professionals to ‘think what they are doing while they are doing it’. When practitioners reflect-in-action, they describe their own intuitive understandings (1983:276). In contrast, Schön’s theory of reflection-on-action, articulated in his book, *Educating the Reflective Practitioner* (1987), occurs after the event, is consciously undertaken and often documented.

**Reflection in Design**

Research has been conducted about reflective methods across various disciplines, however, there is limited research about how this translates to a visual communication design studio environment. In the paper titled *Design Responsibility as Reflective Practice*, Joy Boutrup, et al.(2009) relates Schön’s theories to the textile and fashion design disciplines. Referencing Schön’s description for a solid design process as “a reflective conversation with the situation” (Schön, 1987), a designer must be aware of a problems requirements, expectations, possibilities and be willing to adapt and change in order to have a reflective practice. Boutrup states, “the designer enters a dialogue, as Schön calls it, a conversation with the design situation, and in developing the design the situation “talks back” to the designer” (Boutrup:2). “In answer to the situations back-talk,” notes Schön, “the designer reflects-in-action on the construction of the problem, the strategies of action, or the model of the phenomena, which have been implicit in his moves” (Schön:79).

In the design studio this conversation with the design problem, reflection-in-action, manifests during class critiques and workdays. As students work on assignments there is a thinking out-loud that occurs as the student enters into a dialogue with their work. Phrases such as, “maybe if I make this larger” and “what if I move this element,” and the like are verbalized as they reflect on design decisions while at work. During critiques, design students are asked to stop and reflect on their work and the work of their peers, creating an interpersonal reflection.

From the stated evidence, reflective practice is one of the most helpful strategies/methods a student can utilize to further their understandings. Reflection should be an integral part of the students’ design process and, in turn, enhance each individual project. Aside from the verbal reflection that occurs daily in the classroom, how do we make design students consciously engage in reflective practice?

**Participants**

For this study, the participants were sophomore and junior-level visual communication design students at Kent State University. Sophomore and junior-level students were involved in two of the methods, process books and written analysis, while only junior-level students completed the visual process maps. Each class consisted of 16-22 students, the work assessed is from six courses for a total of 114 students. It is important to note the role of the instructor in the reflective process. Some theorists, such as Kolb (1984) only concentrate on the practitioner (in this case, the student) as the principle if not sole
participant in the reflective process. While Schön (1987) amongst others, included a second significant contributor: the coach, mentor or supervisor. For this study, working with students in higher education, the instructor was a key contributor to the reflective process. They provided question prompts, analyzed results and encouraged best practices.

**Methodology, developing a reflective framework**

As previously mentioned, there is limited research in embracing reflective methods in the design studio classroom. This research expands upon a reflective framework developed by Grant Ellmers in his paper, *Reflection and Graphic Design Pedagogy: Developing a Reflective Framework to Enhance Learning in a Graphic Design Tertiary Environment*. In design, the finished artifact is critiqued, but rarely do students critique the process used to arrive at their final solution. This puts emphasis on the artifact and not the thinking behind it. Thus, the process becomes disregarded and devalued. Ellmers explains its importance, “understanding the design process is an important aspect of becoming a professional graphic designer as this can provide a platform to transfer expertise to different design contexts.” He argues that, “The inclusion of a reflective framework in traditional graphic design pedagogy has the potential to provide a scaffold for the learner to engage with the design process” (2006:3).

Figure 2 shows the reflective framework developed by Ellmers. This method includes “reflection-in-action” adopted from Schön (1987) and the author’s addition of a written report at the end of the project. This formal assessment task in Ellmer’s reflective framework is designed to engage the student in a final stage of reflection, while providing them with a platform to articulate their understanding. He states, “the process and reflective assessment task encourages the student to identify critical incidents from the design process and contextualize them within the outcomes of the final design artifact. This is significant in that the student assumes responsibility for identifying important moments of the design process there by encouraging them to be independent learners” (2006: 7).

Figure 3 shows the reflective framework developed by the author for this research. Derived from Ellmers’ framework, this method includes the addition of process books and a process map, allowing for a visual reflection of the entire process. The three methods for reflection covered in this paper are: process books, written analysis and visual process maps. While process books and written analysis have been utilized in higher education, this paper’s contribution lies in the research collected from these two methods coupled with the creation of an innovative method of reflection, the visual process map. The process map was developed by the author and colleague, Gretchen Caldwell Rinnert at Kent State University University. The value of reflection lies in its potential to refine a students design process, resulting in stronger outcomes. Reflection practice successfully fosters the growth of a process dialogue in the classroom and navigates students away from a narrow-minded and results-based focus.
Jillian COOREY

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**Figure 2**
Source: Reflective framework, Grant Ellmers (2006)

**Figure 3**
Source: Reflective framework, Coorey (2011)
Techniques to foster reflection in design

Method 1: Process books

Throughout each assignment, students completed a process book. The process book is a well-organized sequence of their design methodology from beginning to end. It includes, but is not limited to, research, thumbnails, brainstorming lists, roughs, experiments, notes and refinements. Anyone reviewing this document should be able to follow the students thought process throughout the project. Increasingly, design educators have been collecting process books from students at many universities. Requiring a process book not only serves as an assessment tool for instructors, it also emphasizes the importance of process, ideation and revisions to students.

To maximize the effectiveness of a process book, students are asked to continuously compile their work allowing for organic growth and development, not just something haphazardly put together at the conclusion of a project. The true value is found when students, while still working, are able to reflect and analyze their design decisions, retract any ineffective outcomes and determine new directions. When introduced in the classroom, the books should directly result in increased dialogue and communication regarding process between instructors and students.

Method 2: Written Analysis

At the end of each assignment, students were required to reflect with a written analysis. This makes students consciously aware of their actions throughout their working process. Often, design students view themselves solely as visual thinkers, not practicing the skill of writing. The analysis promotes writing within the context of design. This is not a research report, rather a first-person narrative describing their process and actions, encouraging students to connect with their work on an emotional level.

To begin, students were provided with questions to help guide them to individual comprehensions. They were instructed to explain their design process: who, what and why you developed this project in the specific manner that you did. Analysis should be specific and summarize the research process and conceptual focus. Students were to discuss intentions, color design elements, mood, typefaces, the stylistic quality and impact of their design. To encourage a deeper reflection, students are instructed to not just tell us what we can see, i.e.; “I chose to use red,” but reveal why the use of this particular red in specific places is important. As they analyze their process, they gauge their overall success with the final solution. What did they learn? Would they do something differently? This assessment motivates students to become independent learners as they identify important moments of their design process.

Method 3: Visual Process Maps

In researching reflective methods, authors employed journaling (Ghaye & Lillyman, 1997 and Pavlovich 2007), blogging (Beale 2007) and written assessments (Russell 2001). These techniques are rooted in the printed word, in contrast, the process maps employ visuals using imagery, graphics and typography, a medium comfortable with design students. In a discipline that studies visual expression, the maps are a visual representation of the reflective process.

Throughout all projects, process is heavily emphasized to our students, but in many instances, students have never completed a project that focuses on their working habits and understanding of the design process. For them to become better designers, they must comprehend their own process in order to improve upon it. The project began by sharing the work of Hugh Dubberly, founder of Dubberly Design, and his book on
processes titled, *How do you design?* The book is a reflection of various techniques and tactics designers use in the field. In presenting these examples, he promotes debate about design and development processes. Working in collaboration with Jack Chung, Shelley Evenson and Paul Pangaro, Dubberly designed a concept map illustrating the creative process (Figure 4). This became a jumping off point for this project.

Reflecting on a recent class project, students were asked to map and explain their design process. They analyzed their personal process documenting strategy, timing, research, problems encountered, ideation, brainstorming and finding inspiration. “Hands on” approaches were used as the class sketched, made lists and used concept mapping as tools for reflection. Using Post-It notes they were able to easily rearrange and shuffle information, organize data into categories and create hierarchy (Figure 5). Small group critiques allowed for a deeper reflection as students explained their methods to peers. The final artifact was a poster that translated their experience (Figure 6). The posters allowed students to see their process shortcomings and what they could improve upon in order to be more innovative and efficient designers.

The entire exercise was completed in two weeks. This brief period forced students to work quickly and succinctly. The learning objectives for this assignment included: employ the practice of self-reflection in the design process and to utilize image-making skills along with typography to create a successful composition.

![Figure 4](image1.png)

*Source: Dubberly Design Office (2009)*

![Figure 5](image2.png)

*Source: Coorey. (2011)*
Figure 6
Examples of completed process maps, Source: Coorey (2011)
Assessment of reflective practice

The challenge of assessing reflective practice has often been how to gauge if learning is occurring, as reflection is an internal process. Fernsten & Fernsten (2005) recommend using rubrics to assist students and faculty to see the development of skills in reflective practice. Rubrics were constructed for each method used (Figures 7,8) to clarify varying levels of reflective practice. Prior to the assignment, goals and expectations of each reflection task were discussed so students understood what was expected. However, expectations were not rigid, to allow for the personalization of the reflective process.

In providing assessment, it should be used for students to experience it as part of the learning process, rather than a separate evaluation (Wiggins 1993; Earl and LeMahieu, 1997). Assessments should address how the student is progressing and how they can improve. In the paper, *Enhancing student learning through effective formative feedback* (Juwah et al., 2004), seven principles of “good feedback practice” are given and are critical benchmarks used throughout this study:

- Facilitates the development of self-assessment (reflection) in learning.
- Encourages teacher and peer dialogue around learning.
- Helps clarify what good performance is (goals, criteria, standards expected).
- Provides opportunities to close the gap between current and desired performance.
- Delivers high quality information to students about their learning.
- Encourages positive motivational beliefs and self-esteem.
- Provides information to teachers that can be used to help shape the teaching.

While there are numerous methods for reflective practice, few studies focus on the achievement and results of using reflective practice. Some studies argue that the student should be the center of reflective assessment (Bond, 2006). Bond states, “The actual reflective assessment, however, must belong solely to the learner” when students are involved in assessment “students are empowered to take ownership and responsibility for their learning” (2006:11). While the students should have a personal attachment to their reflections, in this study the instructor also acts as a guide assisting students to grow with their reflective practice.

Reflection is a personal process and has a variety of approaches. The challenge for educators wishing to incorporate reflection into the classroom is to clarify the process without formularizing or oversimplifying it (Rogers, 2001:52). Students must not think of reflection as just another task that has to be completed, but they must place value in the reflections.
<table>
<thead>
<tr>
<th>PROCESS BOOKS</th>
<th>Organization</th>
<th>Required Material &amp; depth/range of book</th>
<th>Prepared for class</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Organization is strong, easy to follow design decisions from beginning to end</td>
<td>Includes research, roughs, iterations, revisions, final shows a clear process and ability to make design decisions</td>
<td>Brought process book to class consistently</td>
</tr>
<tr>
<td>4</td>
<td>Organization is good</td>
<td>Includes a majority of the required materials</td>
<td>For the most part, brought book to class</td>
</tr>
<tr>
<td>3</td>
<td>Organization is sufficient, however more work is needed for better clarity</td>
<td>Includes a most of the required material, needs more work on several steps of the process, does not show enough of the design methodology</td>
<td>Often brought book to class</td>
</tr>
<tr>
<td>2</td>
<td>Randomly placed together</td>
<td>Missing a few of the components, process is not evident</td>
<td>Rarely brought process book to class</td>
</tr>
<tr>
<td>1</td>
<td>Haphazardly put together, very unclear as to any sort of organization</td>
<td>Missing many of the components, unclear process</td>
<td>Never brought book to class</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WRITTEN ANALYSIS</th>
<th>Organization</th>
<th>Interpretation and Evaluation</th>
<th>Design terminology</th>
<th>Writing</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Paper is well organized, easy to follow, clear start, focused paragraphs, conclusion</td>
<td>Comprehensive, develops reflective interpretation, shows insights into design decisions and understandings, demonstrates knowledge of strengths and weaknesses</td>
<td>Demonstrates an excellent understanding of design terminology</td>
<td>Writing is clear and correct, reveals a proficiency of appropriate vocabulary</td>
</tr>
<tr>
<td>4</td>
<td>Paper is organized enough to be understood</td>
<td>Shows a good ability to interpret and evaluate decisions made, some components are overlooked</td>
<td>Demonstrates a good understanding of design terminology</td>
<td>Writing is clear and correct, shows appropriate vocabulary</td>
</tr>
<tr>
<td>3</td>
<td>Paper is somewhat organized but difficult to follow, choppy</td>
<td>Design decisions and ideas are adequately described, but perspective is limited, does not reveal connections to thought process or reasoning for decisions</td>
<td>Demonstrates an adequate understanding of design terminology</td>
<td>Writing is fundamentally correct and what is expected at a college level</td>
</tr>
<tr>
<td>2</td>
<td>There is little organization and confusion occurs</td>
<td>Narrow analysis, without context or interpretive depth</td>
<td>Shows some understanding of design terminology but there are consistent errors, does not use well</td>
<td>Writing contains numerous errors</td>
</tr>
<tr>
<td>1</td>
<td>Paper lacks any organization, consists of random thoughts</td>
<td>No content/concept to analysis</td>
<td>Does not show any understanding of design terminology</td>
<td>Lacks a focus, incoherent</td>
</tr>
</tbody>
</table>

**Figure 7**
Rubrics used for reflective assignments, Source: Coorey (2011)
### Results

**Process books**

Process books are a significant tool for assessment when evaluating the students process. A well-constructed and thorough process book gives the viewer a glimpse into the students design methodology. They show growth and development, conceptual thinking, modification and responses to critiques and feedback (Figure 9). In applying the rubric to this example, the student was given the highest value (5) in each category as the book presented is clearly organized, shows appropriate depth and provides insight into personal thought processes. Much like a diary, the process books allowed for a visual examination of the temporal sequencing of their progression from start to finish.

### Rubrics used for reflective assignments, Source: Coorey (2011)

<table>
<thead>
<tr>
<th>PROCESS MAPS</th>
<th>Research &amp; Reflection</th>
<th>Typography</th>
<th>Composition</th>
<th>Overall Design Approach</th>
<th>Project Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Excellent level of research and reflection, shows clear insights, thoughtful connections</td>
<td>Highly effective use of typography, multiple levels, well integrated, careful consideration of legibility and readability</td>
<td>Careful attention is given to hierarchy, graphic elements and typography, clear contrast, good use of space</td>
<td>Design is of highest quality, aesthetically pleasing, unique and innovative ideas</td>
<td>Continuous growth was shown throughout project, multiple iterations</td>
</tr>
<tr>
<td>4</td>
<td>Good level of research and reflection, shows clear insights, thoughtful connections, however is lacking in one area</td>
<td>Typography is strong, shows a nice sensitivity</td>
<td>Composition is strong, needs some minor refinement</td>
<td>Design is good and well executed</td>
<td>Development was good, pursued several iterations</td>
</tr>
<tr>
<td>3</td>
<td>Average level of research and reflection is shown, need a deeper investigation into research/reflection</td>
<td>Typography is average, needs more exploration, contains typographic errors,</td>
<td>Composition needs refinement in one-two of the above started areas</td>
<td>Design is average/adequate</td>
<td>Development is adequate/average, struggles in certain areas</td>
</tr>
<tr>
<td>2</td>
<td>Research and reflection barely scratches the surface, needs a deeper investigation, more connections needed</td>
<td>Typography needs refinement, contains typographic errors or is illegible or unreadable</td>
<td>Composition is lacking in several necessary areas</td>
<td>Design is below average</td>
<td>Development felt slow</td>
</tr>
<tr>
<td>1</td>
<td>Does not show any time/effort put into the research and reflection stage of the project</td>
<td>No attention to typographic detail, poor typographic decisions, type is illegible or unreadable</td>
<td>Composition is poor, no hierarchy, no contrast, no thoughts given to the space</td>
<td>Design is poor</td>
<td>Showed no development during project, process is lacking</td>
</tr>
</tbody>
</table>

*Figure 8*

Rubrics used for reflective assignments, Source: Coorey (2011)

*Figure 9*

Example of a student process book, Source: Coorey (2011)
Figure 10 uncovers the students ability to self-critique and self-reflect, resulting in self-directed learning. In addition to highlighting a students strengths, the books also reveal where struggles occur. As a design educator, looking at the entire process is taken into the consideration when giving a grade for the final project. This forces a student to be proactive from the beginning of each project. Students do not have the ability to take a lackadaisical approach to their work during the course of a project and will see their overall grade suffer. Value is placed within the process. A process book that includes research, iteration and analysis—key components of the design process, is given a higher grade compared to one with few explorations. Much like a diary, Requiring them is not only a useful tool for instructors, but often students view them as the culmination of their efforts.

A statement regarding process books from a student:

...I was so astonished by the progress I made from the beginning to the end of this project that upon completing it, I sat my final next to my process book and compared all my earlier spreads with my finals. Very little has stayed the same from my original design, and that is by no means a bad thing. Seeing my progress from one semester to another fills me with pride.

Written Analysis

It is important to keep in mind that students are taking a risk in the content they write and should feel comfortable expressing their own opinions. Grading and evaluation can become a perplexing task as their subjective nature defies the standardized criteria of unbiased assessment (Pavlovic, 2007). The written assessments were graded, but not so strictly as to inhibit students honesty. If they were not graded or awarded some merit, students would not put in the effort.

Phyllis Crème outlines a guideline for assessing student-learning journals; much of the criteria stated was used in assessing the written analysis,

...a) comprehensive as it meets requirements of an introduction, conclusion and demonstrates syllabus coverage;
b.) shows understanding of the material, with the ability to select, summarize, analyze and show relationships between concepts, both within the course and outside of it;
c.) shows self-awareness of the writer as learner, both in relation to the ideas on the course, and to course activities, processes and colleagues; and
d) demonstrates that the writer is prepared to take risks with the material in relation to their own political and intellectual position. (Crème, 2005:290)

If the student was able to provide a clear comprehensive analysis of the process they took, making connections between concepts, provide insight to the reasoning and thought
behind their decisions, and show steady improvement, full credit was given for the analysis. If a student simply pointed out what they did that was obvious when viewing, i.e. “I used red”, with no revelation about their internal thought process, little credit was given. In evaluating the written assessments, notations were made so students understood where improvements were needed. Questions were also provided, provoking a deeper investigation from the student.

Growth and a better comprehension of the design process occurred as the semester progressed and analysis improved. Critical thinking was occurring as evident in their commentary on their personal practice and skills. Their learning was apparent during class critiques. This was especially noted in the sophomore-level classroom where students are still finding their voice in design. As students grew stronger in analyzing their own work and process, they were able to provide more valuable class critiques to their peers.

In this excerpt from a student, she is able to identify what parts of her process were lacking,

*I believe one of the main reasons I struggled with the first half of this project was because I tried to rush myself. In starting this problem, I failed to employ any of the knowledge I gained from problem 2. I should have done more work by hand and progressed slowly, feeling out all of my options and looking more closely at my spacing and image selection. However, after seeing the designs of other students and evaluating my process, I began to improve...Looking back at my finished work...my spreads feel paced very similarly and I believe that is my book’s major drawback.*

**Reflection shows concept development, (not just blue for blue) as stated by this student,**

*To play off the surgical topic, I wanted my designs to have a sterile feel. My color choice was a teal color to reference the color you often scrubs in hospitals. My font choice was Avenir, a nice clean sans-serif font to give a modern feel. It also reminded me of something that a hospital would use.*

It was also important that excerpts showed comprehension of design terminology in analyzing their work,

*...thin strokes were used to add contrast to the book. The juxtaposition of thick and thinks allow the headlines to achieve hierarchy without being too overpowering. To further a harmony between spreads, I used circles in the folios and images.*

In the excerpt below, the student demonstrates how their understanding would create new behavior in the future,

*I learned a lot from this project. I know now that it takes time to come up with a typeface to use. You really have to look at the contrast of headlines and captions of the body copy that you decide to use. It has a huge effect on how you want to portray the flow of your piece.*

At the end of the semester, students were asked several questions about what they learned from the analysis. Answers to the question, “share your thoughts on writing an analysis at the completion of projects,” included:

- It was difficult at some points, but helpful to think about how I’ve grown and what I’ve learned.
- I think it gives the project some closure and gives you (professor) a better insight on our thoughts.
I feel it is important to do as reflecting is an important part of design. Sometimes it is hard not to feel like bragging.

I felt it was more like something I had to get done and didn’t give it much thought.

With a majority of the students finding the written analysis beneficial (67%), the last remark shows how reflection can sometimes be viewed as simply another task to be completed. It is important to stress the value of reflection, yet one key component of reflection is the readiness and willingness of the individual to engage in the reflective process. This is noted by Dewey (1993), who claims that reflective practice requires open-mindedness, wholeheartedness and responsibility from the learner.

The analysis also allowed for the refinement of course projects on the instructor’s behalf. Students expressed where they had difficulty and where they needed further instruction. Said feedback is an important tool for the instructor to reshape and improve assignments, a rewarding, yet unintended outcome.

**Process Maps**

The student learning was assessed through anonymous surveys which included a Likert scale and short answer questions. Sixty-three surveys were completed for a response rate of 84%. Survey evidence strongly supports the positive feedback we received from students in the classroom. Ranking their answers from 1 (strongly disagree) to 5 (strongly agree), 77% of students responded with a 4 (agree) or 5 to the statement, “reflecting on my creative process was helpful and useful for future projects.”

One of the short answer questions asked, “Please explain what you learned in completing the process map?” Responses included,

- I was able to learn where my process was lacking.
- My design process is flawed, but now I can work on what I need to improve on.
- It forced me to really reflect on my process, something I have never done before.
- Figuring out how my mind works. Seeing my thought process on paper was interesting, it gave me a deeper understanding why I work the way I do.

Many responses to “what was your favorite part about completing this exercise?” included “making it personal” and “self-evaluation” reaffirming the value of a self-reflection project. As students explained and evaluated their diagrams they were able to realize the successes and pitfalls of their process, gaining a deeper understanding.

After the completion of the project, interviews are currently being conducted to see if students continued to apply these methods in their design practice. The interviews are informal and unstructured, as to solicit responses without suggesting outcomes. Results are forthcoming.

**Future Studies**

As this can be considered a pilot study, current research is being conducted on a new group of students. New studies utilize a control group, students who are not participating in the three stated reflection methods. Both groups will be asked to share their thoughts on the design process. The end results remain the same, to see if reflection will result in a stronger comprehension of one’s personal process.
It is important to state the initial goals of the study, using reflection as a tool to better understand and improve students design process. While each of these methods worked towards this goal, from the data collected, there are several areas to be critiqued and improved upon. One drawback of the written analysis includes students potentially editing their thoughts to present themselves in a “better light”. The possibility of students producing biased reflections to accommodate professors must be taken into account.

Additionally, in reflecting on the past through the written analysis, there is potential to forget definitive moments of the process. One solution would be to record verbal commentary during class critiques. These un-edited, reflection-in-action moments serve as concurrent data as students verbally walk-through their process. Furthermore, as previously stated, to get the most out of reflection, the student has to be willing to engage. Some students viewed the reflection as just another task and did not take it to a deeper level.

**Conclusion**

In its nature, the design process is reflective. This paper advocates for the inclusion of reflective methods as a tool to better understand the design process. So often in design education, the focus is put on the end artifact, overlooking how effective the student was in their approach to solving the problem. The primary objective of design education needs to be the development of process related skills, as opposed to placing too much attention to the designed products in studio classes (Tschimmel, 2011). A successful learning environment is one with reflective methods at its core.

Including reflective methods in the design classroom makes students consciously aware of their design process, providing them with the ability and knowledge to improve upon it. “Students’ ability to reflect on their learning and make adjustments accordingly has been identified as one of the most significant determinants of student success (Conzemius and O’Neill 2001).” Students have been exposed to reflective methods throughout their education starting at an early age. However, teachers must make students cognizant of reflection in their discipline. In the book “Reflection in the writing classroom” Yancey (1998) argues that our culture has become obsessed with external evaluation. Because of this, teachers must encourage students to reflect upon their learning. If teachers do not require students to assess their own work, students will become dependent on outside feedback.

This study proposes reflection as a pedagogical approach in design. Reflection is a topic with limited research done within the design discipline. Using process books, written analysis and visual process maps, students reflected on their design methodologies. From the feedback received, the visual process maps was a highly effective method of introducing reflection into the design classroom. The creation of the visual process maps and the analysis of this study offer a unique contribution to the design community. While these methods have improved student knowledge of their own process, it has yet to be determined how this will affect their work in the far future. Future studies will focus on the creation of additional methods, and monitoring students ideation and design process in future courses.
References


Design and the Innovation Agenda
– A Scottish perspective

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Abstract
Against the backdrop of increasing focus by UK policy makers and international academics on the links between design, innovation and economic growth, this paper details an ambitious research project being undertaken in the UK. The project is titled ‘Design In Action’: a knowledge exchange hub running from 2012 to 2016 through which interdisciplinary teams will engage in collaborative design to pilot a new model of design-led innovation.

As Design In Action (DIA) is in the stage of early development, this paper will outline the research that is being proposed and how the ‘sandpit’ method of intensive workshops will be used to enable collaborative innovation. It will detail the planned aims of the project, both in concrete terms (i.e. the number of products created) and in terms of how it is intended that the project will promote design as an economic driver. The paper will address the theories that have influenced the development of DIA, touching on the role of design in the innovation process and how the DIA team has defined the creative process that will be fostered. Finally the paper will, through the lead author’s doctoral research, add to the debate on the model of ‘design-driven innovation’ championed by Roberto Verganti, how the model compares to the approach of user-centered design and how the conflict between these two models has impacted the discussions of the role of the user in the development of a toolkit for innovation.

Keywords: design as strategy, design-driven innovation, design thinking, user-centred design, knowledge exchange, economic growth
Design and the Innovation Agenda
– A Scottish Perspective

Introduction

The UK Government is placing creative and cultural industries at the heart of its plans for achieving future economic growth, competitiveness and innovation (HM Spending Review, 2010). In this proposal, design is identified as one of the main drivers, having a proven capacity to grow the economy through new business development and knowledge exchange. The Universities and Science Minister David Willetts (2011) noted:

“Design forms an integral part of the Government’s plans for innovation and growth and it will be a prominent feature in our upcoming Research and Innovation Strategy. Good design can help business to thrive and improve public services and with over 230,000 people employed in our design industry it makes a significant contribution to our economic wealth with £15 billion spent on UK design in 2009”.

The Chief Executive of the Technology Strategy Board (UK) also highlighted the critical importance of Design to the (technology-led) innovation process during the Science & Innovation 2011 conference (Gray, 2011), advising the scientific community to ignore design at their peril as it offers deep knowledge and understanding of the ‘human factor’.

Design as a strategic discourse and tool has been developed in the areas of, for example, Design Management (Borja de Mozota, 2003; Cooper & Press, 1995) and Service Design (Kimbell, 2011) where the phrase ‘Design Thinking’ has been adopted to market and communicate the strategic potential of the discipline. Despite this progress, it remains little understood with many companies still viewing design as peripheral despite its potential for cross-sector multi-disciplinary application.

This paper will introduce Design in Action (DIA), which is a hypothesis, a proposition for testing and communicating knowledge of design as a strategy for national economic and cultural growth. DIA is major research project, one of four new Knowledge Exchange Hubs for the UK Creative Economy funded by the Arts and Humanities Research Council (AHRC) that promote sharing of ideas and approaches in design research and seek to avoid duplication of effort across a nation while encouraging greater strategic working across agencies, organisations and partners who traditionally have competed for the same public funding and/or audiences. The paper will outline the research, its methodology and reference key operational aspects of the concept of design as a driver of innovation; the approach that DIA will eventually take is still in its early development stage. The intention of this paper is to explain the planned outcomes of the DIA project, and to introduce theories of innovation (identified to date by the lead author’s doctoral research) relevant to the development of DIA research into the role design can play as a strategy for innovation and as an organisational tool.

Design in Action

Design In Action is a strategic intervention where industry and academia and other partners will engage with the process of design to identify and develop opportunities. It is
Design and the Innovation Agenda – A Scottish perspective

a national network of organisations committed to working in effective collaborations. The objectives of DIA are to communicate the transformative potential of design; use collaboration and co-design to challenge and change the understanding of design as a force for sustained economic growth in business.

DIA will use a method of disruptive thinking - the sandpit, to provide a unique space for participant companies to explore entirely new methods of visualising and problem solving with individuals from different disciplines. This disruptive thinking approach seeks to enable participants to find new perspectives on and opportunities for their own organisation’s growth and development that would not be possible in the existing environment of their company and team.

DIA harnesses the strategic thinking capabilities of design and designers to work on problem identification. It intends to establish dialogue with multiple stakeholders to envision multiple scenarios for emergent issues and complex problems (in the areas of food, sport, ICT, rural economies and wellbeing). The core knowledge exchange activities to be undertaken include 15 ‘Sandpit type’ events (an extreme model for facilitating innovation.) The purpose of these events is to promote the value of design as a catalyst for innovation and strategic development among Scottish businesses and agencies as well as to provide businesses with a chance to engage with a new model of design-led innovation. The sandpit events will allow DIA to test and adapt its approach to design-led innovation with the input of participating companies from around Scotland, resulting in numerous real-world outputs of processes, products and services (see table 1 below for details of DIA’s predicted outputs) as well as a finalised model for design-led innovation that will be disseminated internationally through DIA’s online portal. Support (from the leading national agency for supporting creativity) through 40 awards of up to £10,000 will allow the design community to engage with the process, and these will be specifically targeted at the design sector's micro-enterprises and sole traders. Successful ideas emanating from the sandpits will be eligible for further awards of up to £20,000 for the development of prototypes. Businesses can also access 40 one day Change Audit Grants to evaluate current processes.

The companies involved range from independents to SMEs to multi-nationals and collectively they have pledged over £1.5M in support of DIA and its activities. The following chart indicates the level of activity and the expected outcomes.

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1 After the UK Government’s funding settlement announced in December 2010, the AHRC initiated a two-stage process for knowledge exchange to encourage expressions of interest and, following that, full applications from consortia of universities working in strategic partnerships with creative businesses and cultural organisations to strengthen and diversify their collaborative research activities. Following two rounds of peer review the following four were selected as lead institutions for the KE Hubs for the Creative Economy: University of Lancaster, University of Dundee, Queen Mary, University of London and University of the West of England.

2 The Sandpit is a new yet demonstrably successful tool for nurturing innovation. It is an intensive discussion forum where freethinking is encouraged in order to delve deep into real world problems and uncover innovative solutions. The sandpit is a residential interactive workshop over 3 days usually involving 15-20 participants: a director/leader, a team of expert mentors and a number of independent stakeholders. An essential element of a Design in Action sandpit is a trans-disciplinary mix of participants taking part, comprising industrialists, researchers and potential users of the outcomes. The aim is to drive lateral thinking and radical approaches to addressing today’s most pressing challenges.
Predicted outputs, results and impacts of DIA (2012-2015)

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OUTPUTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>No. of events held.</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>32</td>
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<tr>
<td>No. of SMEs attending events.</td>
<td>70</td>
<td>80</td>
<td>90</td>
<td>100</td>
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<td>No. of SMEs assisted with High Level support</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>30</td>
<td>120</td>
</tr>
<tr>
<td>No. of SMEs undertaking Design Innovation</td>
<td>12</td>
<td>18</td>
<td>20</td>
<td>21</td>
<td>71</td>
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<tr>
<td><strong>RESULTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased investment in RTD by SMEs.</td>
<td>£300,000</td>
<td>£500,000</td>
<td>£600,000</td>
<td>£700,000</td>
<td>£2,100,000</td>
</tr>
<tr>
<td>Products, processes or services developed</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>35</td>
<td>110</td>
</tr>
<tr>
<td>No. of new companies formed.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td><strong>IMPACTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Increase in turnover in assisted business.</td>
<td>£100,000</td>
<td>£200,000</td>
<td>£300,000</td>
<td>£400,000</td>
<td>£1,000,000</td>
</tr>
<tr>
<td>Total no. of gross new jobs.</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>50</td>
<td>140</td>
</tr>
<tr>
<td>Total no. of gross jobs safeguarded.</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>50</td>
</tr>
</tbody>
</table>

Table 1
Predicted activity and outcomes of DIA

The Team delivering ‘Design in Action’

DIA will operate as a centre with a Directorate (see fig 1) under the Principal Investigator, Professor Georgina Follett OBE. Professor Follett, as a contemporary craft practitioner and Deputy Principal of the University of Dundee, is in a unique position to bring together the design and business communities with the knowledge bases of the University of...
Dundee and other strategic academic partner institutions. Professor Follett will preside over a Project Steering Group, which will include representation from partner organisations in industry and in the public sphere and from academic institutions in the form of Co-Investigators from each institution. The collective skills and experience of the Co-Investigators along with the resources and networks of the partner organisations provide a strong management base and the ability to establish a knowledge exchange hub, the outputs of which will be disseminated throughout the Scottish business and research communities. The Project Steering Group will be chaired by Sebastian Conran, designer and MD of Sebastian Conran Associates, further attracting designers and industry to engage with the DIA project.

\[ KE \text{ Management Infrastructure} \]

- **PI (Director)**
  - Professor Georgina Follett OBE

- **Project Steering Group, with Chair, Sebastian Conran, MD.**
  - Industry/Academic/Agencies

- **Manager**
  - (Deputy Director)

- KE Research Infrastructure
- Strategic Partners
- Events Manager
- Design Portal Manager
- Administrator

**Fig 1**
Management infrastructure of the Design In Action Knowledge Exchange Hub

**Communication and Dissemination Strategy**

Outside of the issue of leadership, a crucial factor in the success of DIA in fostering innovation through design is the effective communication of its findings with the relevant audiences - local, national and international, new and old. DIA will adopt a wide-ranging dissemination strategy to build understanding of design across Scotland for all audiences and, build understanding of design in Scotland across the globe. Central to the dissemination strategy is an online portal that will be well-publicised and will aim to communicate the processes and toolkits for fostering innovation with audiences using a variety of visual and multi-media methods. The discoveries of DIA will also be exhibited across Scotland and beyond in a variety of traditional and non-traditional spaces to build momentum, visibility and an appetite to engage with the process of design and build audience understanding.

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3 Co-Investigators for DIA are Professor Barbara Townley from the University of St Andrews, School of Management, Professor Paul Harris from Gray’s School of Art at Robert Gordon University, Professor Simon Briggs at Edinburgh College of Art, Research Department, Dr. Louis Natanson from University of Abertay’s Institute of Arts, Media & Computer Games, Professor Alastair Macdonald from Glasgow School of Art and Dr. Louise Valentine from the University of Dundee’s Duncan of Jordanstone College of Art and Design.
To achieve this objective partnerships with existing organisations and emerging cultural institutions have been nurtured, most notably with the V&A London and through the development of the new Victoria & Albert museum at Dundee (V&A at Dundee which is a national project aligned with strategic priorities for Scotland)\(^4\).

**Support requested by firms engaging with DIA**

DIA aims to be responsive to the areas that Scottish firms have self-identified as being integral to the increased innovative capacity of their organisations. This can be described as addressing the *micro-level* of fostering innovation through design, namely through directly working with a diverse group of partner organisations to support innovation through a variety of tools and support systems. The following details the help that has been specifically requested by the 34 companies that are supporting DIA:

- 88%\(^5\) of companies requested provision of **networking** opportunities both within the design sector and across other sectors.
- 88% of companies requested promotion of **collaboration**, both within the design sector and with the wider business community, especially larger, 'non-creative' firms that may be considered by some designers as 'hard-to-reach' for the purpose of developing joint-ventures and sharing resources.
- 15% of firms requested tools to **inspire creativity** provided in a dedicated 'space', free from the day-to-day demands of running a business.
- 82% of firms requested **knowledge exchange and access to design research** being undertaken at Universities for the purpose of identifying potential new products and services as well as mitigating the demands of R&D.
- 6% of firms requested opportunities to discuss emerging social, technological and design **trends** with access to future-thinkers.
- 32% of firms requested opportunities to **engage with the public** and potential end-users to inspire product and service development.
- 50% of firms requested **promotion of the role of the design sector** in Scotland.

Walsh et al (1992) details the route by which products, services and processes are developed and consumed as the “creation-production-consumption” triangle. DIA

\(^4\) The vision for V&A at Dundee is that it will be an international centre for design housed in a world-class building at the heart of Dundee’s waterfront. Designed by Japanese architect Kengo Kuma, the building which embodies world-class design and innovation, will host major exhibitions of international design, helping people understand their own and others’ cultural heritage. It will celebrate Scotland’s design heritage, inspire and promote contemporary talent, and encourage design innovation for the future. V&A at Dundee will become indispensable to makers, teachers and industry nationwide as a place for the cultivation and exchange of knowledge, opportunity and design innovation. It will develop opportunities for diverse communities to engage with, learn from and enjoy design creativity, past and present. It is an ambitious project driven by opportunity and need, conceived and led by the University of Dundee in partnership with V&A London, University of Abertay Dundee, Dundee City Council and Scottish Enterprise. It is an initiative that has received financial support from The Scottish Government to the tune of £15M (2011-2015). It is an integral part of The Scottish Government and its agencies and partner’s vision to position Scotland as a leader in design-led innovation, leading to cultural and economic well-being.

\(^5\) Figures rounded to whole number.
supports each of these three stages identified by Walsh by enabling the creation of ideas (tools to inspire creativity and the promotion of networking, knowledge exchange, public engagement and trend analysis), the production of new products, processes and services (collaboration; financial and prototyping support) and consumption (promotion of the value of design among the business community; promotion of the design sector among the public as discussed in greater detail below). However, DIA recognizes two new and equally important stages of the development cycle, namely those of identification and reflection. DIA posits that identification of the problem itself is a crucial stage in the innovation process and that it is necessary to use the approach and language of design to completely dismantle assumptions and interrogate what is known about an issue before agreeing on how to define the problem at hand. Finally the reflection stage will enable critical evaluation of the usefulness and meaning of the products, services and processes that are developed, which is critical to ensuring DIA’s process of innovation is valuable to all participants and to the wider economy. Furthermore the identification-creation-production-consumption-reflection process is not a linear cycle but one with stages that are, to a certain extent, interchangeable. With continuous input of the participants, or ‘users’, of DIA’s innovation process a considered approach will enable identification, consumption and reflection to take place throughout the course of development.

Furthermore DIA will identify steps to strengthen the Scottish design ecology as a whole and will implement these steps. This can be described as addressing the macro-level, namely promoting growth and innovation indirectly throughout the Scottish design sector as a whole by making toolkits, research findings, idea generation techniques and online resources available to firms throughout Scotland through the well-publicised DIA online

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6 It should be noted that this diagram does not indicate the weighting that will be applied to each of these activities. An accurate weighting will not be possible until the after the sandpit workshops have taken place and their activities analysed.
portal. This will complement the work that the V&A at Dundee museum will undertake, promoting the importance of the design sector and of design thinking among the Scottish public, so as to foster a public who are educated in the role of design in their cultural life and who demand high quality design in their products and services.

In order to understand how the Scottish economy can be strengthened at the national level using design-led innovation we can look to other nations that have successfully nurtured strong design and manufacturing sectors. The strength of Italian design in fostering growth of the Italian economy has been of particular interest in the discussion of the future development of Scotland as a design leader. Verganti (2008) outlines a number of ways in which Italian design firms have achieved both sustained growth and the creation of numerous innovative products, far beyond what would be predicted for companies of their size and with their available resources, including:

- An established and talented arts and crafts sector
- The ability to attract the best design talent from around the world
- An industrial base of small, flexible firms
- A consumer base who have been educated in the ways of design and demand highly-stimulating, well-designed products.

In order to provide a strong base from which to develop a new model of innovation, DIA has fulfilled these criteria through the partner organisations that are supporting with the Hub. Not only do the firms include a number of experienced arts and crafts firms and a large number of small, flexible SMEs, DIA has attracted the internationally renowned designers and prioritises the professional development of the Scottish design sector through the work of the DIA Professional Steering Group. The aim of DIA is to move from a project-to-project approach to partnership working towards a strategic approach, utilizing the expertise of the members of this group in order to foster an effective and sustainable approach to nurturing national cultural and economic growth through design, enabling greater understanding and use of the value of design as a strategic tool.

Finally, as identified by some of the organisations engaging with DIA, promoting the role of design in the cultural and economic life of Scotland is an important element in fostering demand among the public for well-designed processes, products and services. Importantly DIA is linked to the construction of the V&A Museum of art and design in Dundee, which will play a large part in promoting the importance of design in Scotland. The more educated a consumer base is in the language of design and the more used they are to being surrounded by well-designed products and environments the greater the demand will be for well-designed products (Verganti referencing Gelant, 1994). Verganti (2008) notes that this is a large reason for the success of the design firms in Italy as consumers are highly demanding of meaningful new products. Through the founding of the V&A in Dundee, it is the aspiration of all involved that the profile of design in Scotland

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7 22 of the 34 of the partner organisations fit the description of flexible SME, being small to medium sized firms with wide networks and a range of freelance associates to call upon.
will be raised and a greater demand for innovative new products and services will be fostered. V&A at Dundee presents a unique opportunity to promote consciousness of the role of design in everyday Scottish life among the public, this will be complemented by DIA’s efforts to promote awareness of the potential value of design thinking in the innovation process among Scottish businesses and a willingness to utilize design approaches during strategic development.

**Push and pull of innovation**

The terms push and pull refer to the factors that are seen to be the catalysts of innovation, whether driving innovation forward (i.e. push), such as new technological developments, or a need (i.e. pull), such as a demand fostered by a new social trend or the opening of a new market (Kaiman & Schwartz, 1982). It is when both push and pull factors occur simultaneously that successful innovation is most likely to occur and to be adopted (Zmud, 1984). Past innovation literature has frequently focused on the importance of the push, usually a technological innovation that makes developing new products and services possible (Roussel et al, 1991) before eventually moving to a more integrated approach to the drivers of innovation that also considers the importance of the pull of the market and the influence of the increasingly well-informed, demanding consumer (Nobelius, 2004).

Research and Development (R&D) plays an important role in the innovative push, as this activity is necessary to discover new forms of technology, or discover new ways of using existing technology. While R&D investment does tend to be reflected in innovative capacity, R&D frequently puts a large financial strain on SMEs that, in the short-term, can negatively impact their profitability (Heimonen, 2011). This is possibly why such a large percentage of the partner companies gave access to research and knowledge exchange as reasons for their involvement with the Hub as they may struggle to make available sufficient resources to undertake their own in-house R&D.

Conversely, the pull factor can most easily be described as the needs of the user and the demands of the market for products and services that respond to the changing demands of modern life (Kamien & Schwartz, 1982, pg 35).

Verganti (2003) proposes a new form of innovative push that is distinct from the traditional binary push-pull innovation model; that of the innovation of meanings or of the “design-push approach”, whereby a product is designed so that it communicates a new socio-cultural meaning. If we acknowledge that “no design works unless it embodies ideas that are held in common by the people for whom the object is intended” (Forty, 1986), designers taking the design-push approach (or ‘design-driven innovation’ approach) are borrowing their images, language and messages from the cultural zeitgeist. This approach is classified as a push factor, rather than the pull of the market (i.e. the pull of user demands) as it is not the consumer or society at large that is creating the demand for these products with innovative meanings and new symbolic values, it is
the designer or design team that reinterprets the meaning of the object and impresses their unique vision for what this object should signify on the consumer through the presentation, appearance and marketing of the object.

Verganti’s model of design-driven innovation could be said to be quite seductive and has been implemented by many firms (Leavy 2010), offering the possibility of creating iconic, emotionally affecting products that are also commercially successful. It has also found support in design management theory given the way in which it elevates design to the level of technological innovation, arguing that designers have the power to play an equally important role in economic growth.

**Design in Action and Verganti’s Design-Driven Innovation**

It is DIA’s belief that it is necessary for organisations to participate and collaborate in diverse networks in which actors share both knowledge and discourse, using the language of design in order to extrapolate shared cultural understanding, discuss emerging social trends and to deconstruct understanding of the issues facing society, from which new products, processes and services can be created. The model proposed by DIA will decentralize the innovation process from the design ‘gurus’ who are so central to Verganti’s model, so that design can be fully utilized as a key business competence and organizational tool by all the participants in DIA’s sandpit events, both designers and non-designers alike. While useful in encouraging discussion of how design can function as a driver of innovation, Verganti’s supposition that innovative design takes place within experienced design teams is counter-productive to the collaborative approach of DIA and to DIA’s goal of disseminating design as a business competence throughout the Scottish business community. To do this non-designers must be able to see the value of DIA’s approach and understand how design can be used in the boardroom to shape company strategy, rather than being the impenetrable domain of design experts.

Furthermore, restricting ourselves solely to a push-pull model of innovation, with design merely taking the place of technology in the equation, takes an overly reductive view of the developments in recent decades of the conceptualization of the innovation process. As the first generations of innovation models, as outlined by Rothwell (1994), focused mainly on linear processes of push and pull, definitions of innovation have since evolved to that of a more integrated approach in which systems integration, networking and communication between diverse actors are key to innovative success. The approach of DIA is akin to the definition of innovation as described by Leonard & Sensiper (1998) as being largely dependent on the social and communicative process through which diverse groups of actors can engage, share knowledge and express new ideas and approaches. The organisations engaging with DIA have demonstrated a clear understanding of the importance of this though their desire to expand their networks and to take part in formalised activities to enable, not only traditional networking but also, profound dialogues on trends and socio-cultural phenomena in order to create new products and services that have impact with the wider public.
Verganti’s research is very much rooted in the Italian product design sector so that the design-driven innovation model he proposes is one that demonstrates how emotional messages can be communicated through tangible objects. As such this greatly limits the degree to which this model of design-driven innovation can inform the development of DIA’s innovation model, given that DIA aims to foster product, service, system and process innovation. This is not to say that tools that have emerged from Verganti’s school of design-driven innovation, such as ‘language brokering’ as described by Dell’Era et al (2011), may not be useful in enabling collaboration and problem identification. But their influence and use will be predicated by their ability to equally foster innovation of services, processes and products and the degree to which they can be utilised by those participants who do not have a design background. Developing a model that is able to provide a framework in which product, service, process and system innovations are equally supported and that enables collaboration between both designers and non-designers will be of chief importance as DIA’s model is developed.

DIA will provide partner organisations with access to the research of national academic institutions that, in turn, will provide the push of new knowledge and technological developments, along with opportunities to explore and discuss new ideas. The complimentary work of the V&A at Dundee’s 2011 to 2014 pre-opening programme will foster a greater appreciation of the role of design, which will lead to an increased demand for quality design among Scottish consumers while the support of DIA will help open up new, international markets for Scottish firms.

Furthermore DIA will work alongside governmental organisations and funding bodies to secure the finance and policy support to ensure a fertile environment for design-led innovation within DIA itself and eventually throughout Scotland. While the approach and the tools that will be used by DIA to foster design-led innovation are still very much in the early development stage, the planned result is the implementation of a fully integrated approach, taking into consideration push, pull and policy factors affecting the innovation process with the hope of providing the best opportunity for the successful conception and adoption of design-led innovations.

Collaborations and User-centred Design

Collaboration was overwhelmingly reported by partner organisations as a main reason for wanting to engage with DIA; firms not only wanted to widen their networks and identify potential new business-to-business customers but also to share resources and skill-sets, to be able to take on larger projects than they are currently able and to identify and conceive new joint-projects. Co-design was seen by these firms as an important way of effectively innovating by gaining the outside perspective of professionals from another sector or discipline without the expense of contracting consultants. It should be noted however that in complex, cross-sector partnerships the process of innovation must be carefully managed to maximize the benefits, manage expectations and minimise tensions that arise between partners (Bidault & Cummings, 1994). As recommended by Bidault &
Cummings an organisational assessment will be undertaken by DIA during the sandpit events, before partnerships are formed to assess the best management techniques to efficiently guide the innovation process. However given that designers and other creative professionals are adept at project work and frequently move between different working teams, collaboration, even with teams from other sectors, is often smoother and more productive for designers and skills and knowledge are effectively shared for the benefit of the whole team (Vinodrai, 2006). It is particularly beneficial for those SMEs wanting to break in to foreign markets to pool resources, networks and skills through partnerships thereby reducing the risk associated with entering new markets (Li & Qian, 2007).

Some partner organisations desired to use DIA to better understand and connect with new audiences, which raised the important question of the role of the end-user in the innovation process. Visciola (2009) clearly describes two differing approaches to user-involvement in the design process, firstly that of the incremental user-centred design whereby the way in which users interact with existing products is carefully researched and these products are then developed to better accommodate user behavior; and secondly that of radical “deterministic design”, so called because it aims to affect new behaviors through the meaning a product is designed to convey and is devised with the input of small groups of designers, rather than using the direct input of large numbers of consumers. This latter form of innovation is commonly referred to as “design-driven innovation” as already discussed and has been defined and championed by Roberto Verganti, describing it as “the innovation of meaning” (Verganti, 2008) potentially using a “Rhetorical Innovation Process… that foresees the application of figures of speech as semantic operators” (Dell’Era et al, 2011).

Visciola (2009) and Verganti’s (2008) explanations of the differences between incremental user-centred design and radical design-driven innovation are thought-provoking and the design-driven innovation model provides an exciting iteration of designers innovating the meanings and significance of objects. However, these models of innovating may not be mutually exclusive, with Lettl et al (2006) detailing how motivated, entrepreneurial lead users can inspire radical innovation at the beginning of the innovation process.

There are key advantages to user-centred design in that it provides new perspectives from those outside the design ‘circle’; a greater affection for the product if users believe they had a hand in its creation and can result in products that better address functional-concerns and real-world issues (Read, 2005).

Verganti (2008) states that the drawbacks of user-centred design is that it leads to incremental innovation rather than radical, and while it may be suited for improving the use of existing products and technologies, users are immersed in pre-existing social context which restricts their ability to re-interpret products in unfamiliar ways and ask for change. It is the designer who has looked at social trends and has the background of visual language and design history so as to create radical new products. Furthermore
Redstrom (2006) states that in focusing so completely on the end-user there is the risk that the experience will become too well planned and the user can become “trapped” by the designers’ intentions, denying the opportunity for the user to find their own ways of interacting with, experiencing or instilling their own meaning in the product or service.

There is a role for both of these forms of innovation through design, particularly as there have been requests for both the opportunity to work with end-users to better tailor products and services to their needs, and for tools that foster creativity and provide a ‘space’ away from the demands of companies’ regular customers. Customers can often have a massive impact on the work of smaller firms and be seen to sometimes constrain the ability of firms to develop new offerings as they tend to respond to existing customers’ needs rather than thinking strategically (Laforet & Tann, 2006). While these two approaches might seem counterintuitive there is a role for both in the approaches to design-led innovation that DIA will facilitate. The innovation process that takes place through DIA will not be linear, allowing the opportunity for trans-disciplinary teams of designers, academics and managers to explore new understandings of products, services and solutions; engage with end users of products and services; and to reflect themselves as users of DIA’s approach to using design as a tool of innovation and strategy development.

The research methodology of DIA and its inherent requirement of interdisciplinary and transdisciplinary approaches offers opportunities to people from a broad spectrum of subject areas and skillsets to join together to conceive, plan and prototype innovative solutions. As such the approach of user-centered design will prove potentially influential in the development of the tools and models that result from DIA to ensure they effectively address the needs of the organisations that take part in the sandpit events. For example, it has been important to consult and respond to the self-identified needs of Scottish firms; however it has also been necessary to take a step back from the demands of companies and consider the recommendations of theoretical and practice-based research for developing successful innovation processes. In this we can see the conflicting approaches of the design-driven innovation model and of the more consultative user-centered design model in action. Members of the DIA team will inevitably bring their unique definitions of design as strategy and as a driver of innovation to the table as DIA’s toolkits are developed and they will have the luxury of taking a strategic view of the needs of Scottish industry as a whole, however the feedback of those firms that work directly with DIA and the support needs that they express will also inform the development of DIA’s eventual model of fostering growth through design-led innovation. The toolkit for design-led innovation that will result from DIA’s transdisciplinary approach will be disseminated through DIA’s online portal and will aim to enable users to visualize new solutions to existing and emerging scenarios, create new understanding using the language of design and to bring teams’ diverse skills and competencies to solving these issues.
Summary and Future Development

Numerous questions have been raised during the initial development of the Design In Action model of design-led innovation that requires consideration. As highlighted by Kimbell (2011, pg 286) a key difficulty in using design thinking as an organisational tool in diverse groups is that this approach can often “privilege the designer” at the expense of other group members with different backgrounds, leading to a situation in which designers are the arbiters of the innovation process and the input of non-designers is limited. Designers are the arbiters of the innovation process and the input of non-designers is limited. How the DIA sandpit events are conducted and how design-led innovation is made accessible and useful to non-designers will be key in ensuring the DIA model equally engages all participants and gains traction in the business communities. Similarly as individuals who span knowledge domains and sectors often are the most proficient during ideation activities (Bjork, 2012) we will develop DIA in a way that fully benefits from those who are the most proficient in ideation activities as well as fully engaging those who are unfamiliar with such concepts so that all participants benefit from and contribute to the innovation process.

Furthermore it will be necessary to evaluate the types of innovation that are successfully fostered as a result of DIA’s sandpit approach as empirical research has frequently disagreed on the effects that different network structures can have on successful innovation e.g. radical innovation versus incremental innovation, continuous innovation versus discontinuous innovation (Hempala & Magnusson, 2012). It is the goal of DIA that it will provide a model that will successfully foster numerous types of innovation, but the analysis of the results of DIA may demonstrate greater success in fostering one type of innovation over another.

It must also be noted that as current knowledge of design is strongest in terms of product design it will be enlightening to see the DIA project develop and add to emerging research on innovation through design, particularly in terms of service and process innovation.

The twin investments over the next four years of the V&A at Dundee design museum and of the Design in Action knowledge exchange hub provide a unique opportunity for Scotland to push design to the forefront of debates around economic growth and cultural life. With both projects sharing complimentary objectives, the potential for the profile of the V&A at Dundee to bring attention to DIA’s resulting toolkit and model of design-led innovation provides a rare chance for the concept of design as a strategy for innovation and as a core business competence to be promoted and disseminated throughout the Scottish business community.
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Upcycling: Where function follows form

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Abstract
Up-cycling is a “responsible” design approach in which designers seek to put discarded consumer products, such as bottles, to new and valuable uses, such as making lampshades. Since that approach involves finding new functions for extant manufactured forms, up-cycled products appear to be typical of other products created as a result of both designers and users adapting extant forms to serve entirely different functions. This form-adaptive approach appears to reverse the causal direction implied by Louis Sullivan's famous dictum “form ever follows function”. This paper then reviews antecedents of the up-cycling approach historically, in order to critically examine the form-function relationship in selected examples of engineering, weapon and consumer product design.

The example of the Venturi tube shows that it can form a component of products with functions as different as wind instruments, carburetors and jet pumps. Although the Venturi effect can only be created by a tube of very specific form, the functions it performs can be very different. Furthermore it is shown that the Venturi effect can be created without use of a Venturi tube, by means of adapting the extant parts of a gas turbine to create a novel secondary compressor.

The same form-adaptive approach can be found in primitive tools which evolved into weapons such as the mace and the billhook. Ceremonial versions of the mace show that the communication of ideas is a crucial function of many designs. Since beliefs and values change over time, communicative functions are not temporally fixed. It is argued that the primary function of many up-cycled products is to comment positively on sustainability issues by demonstrating how consumer waste can be transformed into something far more valuable by creative virtuosity. Consequently, up-cycled designs appear to function less successfully in helping to physically manage post-consumer wastes.

Keywords: design and society, representation, sustainable design, product planning & development
Paper

Introduction

Designers frequently innovate artefacts and systems by adapting some pre-existent form to a new function. This is seen in the late 19th Century development of the high rise architecture made possible by W. Baron Le Jenney’s adaptation of a pre-existent system of building steel bridges on American railroads to meet the demands of constructing multi-storey buildings in cities booming within geographically constrained footprints. It then appears ironic that it was one of Le Jenney's apprentices, Louis Sullivan, who coined the modernist design mantra: “It is the pervading law of all things organic and inorganic… That form ever follows function.” Sullivan’s use of the word ‘follows’ suggests a causal direction in the design process: choose a function → find the form to perform it, as opposed to: choose a form → find a function it can perform.

Yet the historical evidence does not seem to support the primacy of either direction over the other; designers appear to work in both directions. For example, the design approach that adapts pre-existent product forms to different functions is still evident today in the work of those seeking to address the issues of sustainable consumption by means of “up-cycling”, which involves redesigning discarded manufactured goods such as packaging and tyres into new products, such as lampshades and furniture. Hence, up-cycling is an interesting design approach to examine because it invites designers to think more carefully about the form-function relationship identified by Sullivan’s “law”, and in particular, to think about how the functions of artificial objects might be characterised.

Seen in historical context, up-cycling is itself one manifestation of a pervasive form-adaptive approach to making objects, in which designers or users adapt an object with one common use into another, and this multi-functional use of a common physical form may improve understanding of how artefacts, as distinct from organisms, originate and develop into the forms observed. The method of this paper then involves historical review and analysis of a handful of artefacts both past and present, chosen to illustrate features of designed objects that can easily be misinterpreted by those choosing to accept Sullivan’s dictum uncritically.

1. Unprecedented forms

Engineering design provides many examples that appear to best illustrate the notion of form following function. A case in point is the carburettor used in the earliest commercial automobile engines and still employed in small two-stroke engines. The inventive step claimed by Lazar et al.'s 1894 patent, illustrated in Figure 1, involved using a converging-diverging tube to entrain and mix volatile spirits with the flow of air drawn through the tube by the intake stroke of the engine. Although the carburettor was undoubtedly a novel artefact, the form of its mixing tube was not unprecedented, since it is a feature of wind instruments such as trumpets, that were being made and used in Egypt in the second millennium B.C. The unprecedented, or “inventive” step, then involved finding a new function for such a tube to perform inside a fuel dispensing apparatus, which was to mix fuel and air in the proportions suitable for a continuous process of combustion in a relatively light-weight four-stroke engine. What made the Lazar invention possible was a scientific understanding of how air flows inside such a pipe, first developed in the late 18th Century A.D. by the Italian physicist Giovanni Battista Venturi, after whom such tubes are now named. Furthermore, the entrainment and mixing effect noted by Venturi is not just used in carburettors, it has been subsequently employed to build wind tunnels and “jet pumps” free of moving internal parts, that are capable of transporting solid particles as well as fluids.
Thus, a physical effect created by a specific physical form permits it to be incorporated in a diverse range of artefacts with functions ranging from the production of musical sounds to the pumping of solid particles. Sullivan’s view of the relationship between form and function then appears correct in terms of the need to design a converging/diverging tube with very specific length to width ratios in order to create the Venturi effect. Yet since the effect can be put to many uses, the Venturi tube is a common component of a diverse range of artefacts, each having a different function to the other. Therefore, designers do not utilise the Venturi effect in the same way in each artefact, and a trumpet will no more perform as a useful jet pump, than a jet pump will perform as a useful wind tunnel. It then appears to be knowledge about the Venturi effect which “leads” to the design of diverse artefacts that serve different functions, and incorporate a common converging-diverging tube component into a plurality of differing product forms.

Moreover, new products also arise as a consequence of designers imagining a new application of the Venturi effect, as in the aerothermopressor, an experimental compressor developed by the US military in the 1940s and 50s, which actually injected water droplets against the flow of hot exhaust gasses from the combustion chamber of a jet engine, in order to raise their pressure before they entered the turbine stage of the engine. In other words, the design strategy adapted the expanding nozzle of a combustion chamber into a secondary compression stage by means of slowing the exhaust gases with a secondary flow of fluids injected through a secondary converging nozzle, thereby creating a Venturi effect without using the physical form of a Venturi tube to do so.

These engineering designs further reveal that artefacts are seldom “pure” forms; they are more typically compound ones, which may happen to incorporate a number of common pure forms such as tubes, wheels, cogs and so forth. The greater the number of such components found in any one product, the greater are the number of possible permutations of net form and function – and to pick up on Sullivan’s biological analogy, the greater are the possibilities for the product to evolve into a different “species”. Consider for example, the way the first mobile telephones such as the Motorola GSM have evolved from radio-signalling devices controlled by basic computer components into mobile computers such as I-Phones and Androids that incorporate radio-signalling components. Furthermore, mobile phones cannot be considered merely as engineering designs, because their design appears driven far more by human than by engineering
factors, among which personal status appears especially important, judging by many consumers’ willingness to volunteer themselves into Mac and Android factions. My next examples then involve consideration of the intangible functions performed by the form of an artefact, which include the communication of values and beliefs.

2. Physical and intangible functions

It is hard to imagine a more primitive artefact than a club, the favourite attribute of a caveman in any cartoon. By the middle ages, warriors were better protected from the injuries inflicted by such weapons by skilfully designed and made plate armour. In response, armourers developed far more effective clubs known as “maces” which carried armour-piercing flanges and/or spikes, as illustrated in Figure 2. The cost of making these better designed steel edged clubs restricted their use to the elite class of mounted knights, who in a feudal society held their land and superior social status in return for military service to their lord. The Angevin kings of England were among the most militarily active feudal monarchs of their day, engaged in fighting on frontiers stretching from Ireland to Spain. This meant that much of their governance of these territories had to be performed by proxy, using lesser members of the royal entourage, in particular, highly trusted members of a 20 strong royal bodyguard instituted by Edward 1 in 1278, known as the Sergeants-at-Arms, who were armed with maces for close quarter defence of the king.7

![Figure 2, Mace, 14th Century (Wiki Commons)](image)

Since the king also used these formidable sergeants to collect loans and levy taxes from what were often likely to be reluctant donors, it became customary for the sergeants to signify to various regional assemblies and parliaments that they had the king’s authority to start the proceedings by entering an assembly carrying items that made their identity and purpose clear (bearing in mind that many of those present were illiterate and had probably never seen either the proxy or the king before, either personally, or in image). Given the expense and professional obligations of being a royal bodyguard, an armoured man carrying the latest design of mace would be well on the way to convincing the assembly of his position. If he were also preceded by an attendant parading the kind of richly decorated long-sword with which a monarch would “dub” suitably qualified retainers as one of his chosen “knights”, then he would have substantial evidence of his authority to legitimate the proceedings on the monarch’s behalf, as well as an effective close quarter weapon with which to maintain order (a continuing responsibility of British parliamentary sergeants-at-arms).

In former British dependencies across the world, including those which have successfully rebelled against the British crown, governmental assemblies continue to be opened and closed by such a parade of sword and mace, with the latter having evolved from a vicious
looking steel weapon into a decorative confection of silver, as illustrated in Figure 3. Every element of the mace from its finial to its pommel then provides opportunity for the silversmith to incorporate signs of governmental authority, including crowns surmounted by church crosses, coats of arms and other emblems of donors and sponsors. Beyond these signifiers, the ornamental mace also symbolises the wealth, prestige and aspirations of the assembly it legitimates, such that even a modern and egalitarian university like the U.K.’s Open University has a mace formed from a single piece of titanium, a costly high-performance material associated with aerospace industries.

![Figure 3, Ceremonial sword and mace of Drogheda, Ireland (www.heritagecouncil.ie)](image)

It is also interesting to note that the descendants of Anglo-Norman kings continued to favour the mace and long-sword as symbols of their military and civic authority rather than the weapons of the rank and file Englishmen they drew into their continental armies. The longbow and billhook (or English bill) were universally recognised as being the national weapons of English armies. In the 100 Years War, their combination was devastating to the elite knightly cavalry essential to the battle tactics of medieval Western European armies. The bill-hook, illustrated in Figure 4 provides another example of an artefact adapted to serve a different function, since in peace-time it was a pruning tool for peasants who maintained the hedgerows and orchards of their Norman conquerors. For those who saw an opportunity to escape agricultural serfdom by volunteering to fight for French-speaking masters waging war in distant lands, mounting their pruning tool on a longer handle gave them at least the credibility of owning a weapon with which to fight. In battle, the curved “bill” proved particularly useful for hooking and dragging opponents to the ground, where an unhorsed knight could be supressed by anyone possessing simply a knife, since that could be inserted into gaps in a suit of armour that existed in the groin or helmet. Alternatively, a swinging bill could be highly effective in piercing armour (although that diminished the opportunity for ransoming a vanquished knight). Moreover, George Silver’s 1599 manual shows that the pole-mounted billhook was used differently in agriculture and battle, since in combat, the pole was essential for parrying thrusts and tripping rushing opponents. In other words, the physical function of the pole appears defined by its different uses in different contexts, and not by any original design intention, such as reaching higher branches when pruning trees. Having proved its worth, the billhook was soon modified by rudimentary blacksmithing into a more specialised weapon, by cutting into the basic form and pulling away strips to form spear like points, or improved hooks, which created the kind of weapon illustrated in Figure 5. This design provided most of the functions of the later halberd used by Swiss and German pike militia who finally made knightly cavalry a redundant military force.
It is fair to assume that for military men of the day, the very form of the bill-hook, manufactured by much cruder processes than the knight’s mace, would have communicated its origins as a modified peasant’s tool, which would hardly be suitable for communicating the authority of a feudal monarchy, even though the billhook was probably responsible for overcoming many more of the king’s knightly opponents than the mace. To the modern historian, the simple modifications of a pruning tool into a weapon that made a band of peasants the military equals of a squadron of mounted aristocrats communicates other ideas, not only about social evolution, but about the way we might choose to view the vestigial traces of medieval society as embodied in picturesque rituals involving ceremonial swords and maces. This may demonstrate that since intangible functions concern communication, they are not fixed, but change over time, according to changes in social attitude and the benefit of hindsight. In defence of Sullivan’s law, it may then be thought that its causal direction becomes more defensible if the notion of function is restricted to that of physical utility. However, the consideration of up-cycled products shows even more clearly how difficult it is to dissociate the physical and the communicative functions of artefacts.

**Up-cycled goods**

Our own age focusses attention more upon the problems of surviving our own means of production than of war. Up-cycling is a design strategy which both professionals and amateurs have adopted in order to address the problems of sustainable production and consumption. Whereas design strategies termed “responsible” or “sustainable” look prospectively at using more sustainable technologies and materials in order to make products and systems, up-cycling involves a retrospective process of finding new functions for extant products no longer suitable for performing their original ones. Characteristically, these expired products accumulate as problem wastes, such as packaging and automobile parts, which if not buried in landfills, are recycled into raw materials that can either be reformed into new products of the same type in a “closed loop” manner (e.g. glass back into bottles) or in a secondary use manner (e.g. timber waste into animal bedding or fuel briquettes). Since designers are seldom directly engaged in the industrial recycling of bulk materials like cellulose, plastics and rubber, their contribution then tends to be limited to either a) prospective consideration of the lifecycle of the products they are now designing, \(^{10}\) or b) retrospectively finding new uses for products that have already reached the end of their lives. Up-cycling is then a label describing the kind of strategy described in b). Given that the profit motive is simultaneously a cause and a possible palliative to the problem of sustainable production, anyone involved in a b) type strategy is obliged to consider how far they can find solutions for expired products which valorise its residual worth to the greatest extent.
Parallel with these design strategies is what may be termed a “craft” strategy that involves the consumer, rather than the designer following some received DIY formula for re-using common household products. This thrifty maintenance and reuse of domestic items is evident in the colourful slashed and puffed costumes of the Swiss and German militias mentioned above, since they were initially made by repairing the few clothes a peasant soldier possessed with serviceable pieces of clothing stripped from the fallen. In more recent times of need, governments have acted as the providers of the DIY formulae, as seen in the U.K. Board of Trade’s “Make Do and Mend” campaign of the Second World War. With the coming of the worldwide web there are now a host of sources, such as “www.instructables.com” giving useful advice (mostly free) about how householders can either give a new lease of life to expired products, or turn them into other useful items through application of a little craft skill. However, since the object of this craft approach is to reduce personal domestic consumption rather than to create new marketable products, once the cost of labour is factored in, the approach seldom valorises expired products to the degree found in the commercial strategies of recycling and up-cycling.

When practised by professional designers, up-cycling can raise the value of the marketed product higher than the original donor product, as is evidenced by the price of the pleasingly designed recycled tyre furniture items made by Tread, and indeed, similar items made by artisanal enterprises in developing nations, usually following a design pattern copied from some other source, and then marketed to developed nation consumers by locally-based retail organisations. The marketing stress placed on the terms “recycled” and “eco-friendly” for these products, evidences that many developed world consumers are prepared to pay a premium on “responsibly” produced goods, as is understood by supermarkets who place a higher mark up on “organic” foodstuffs, even when there is reason to believe they cost little more than foodstuffs grown using industrialised farming methods. Thus the production and marketing of goods that can wear an “eco badge”, appears predicated upon the perceived intangible benefits of those products.

Perhaps the most valued perceived benefit is the responsible use of materials. Yet when the mass of tyres just in the UK that are scrapped as unfit for remanufacture can be estimated from 2004 figures at 1350 tonnes annually, it is evident we would need to purchase far more recycled tyre products than we do presently, in order to keep pace. Whereas any quick financial calculation would suggest that if we did keep pace, the effect would be to raise the cost of scrap tyres to a point where it would no longer be economically worthwhile to make recycled tyre products, particularly not by the present handmade processes.

What is then striking about the more successful examples of up-cycled goods is the way they have communicated not only a worthy re-use of expired products, but also a worthy demonstration of artistic prowess. Such a demonstration of prowess is evident in the prize-winning lampshades designed and made by Sarah Turner using discarded soft drinks bottles, illustrated in Figure 6, or alternatively, the baroque wonders made from worn out chain drives and wheel rims by Carolina Fontoura Alzaga, shown in Figure 7. These examples evidence both aesthetic and design approaches familiar from the introductory courses of the Bauhaus and the constructivist sculptures produced by “artist-engineers” like Naum Gabo and Antoine Pevsner. The approach involves taking one, or a few elementary stock forms produced by industrial processes and repeatedly linking the forms together in some iterative manner in order to create a beautiful new form, which can be appreciated in its own right as may a nautilus shell, but preferably, according to modernist design teaching, by forming it into something as useful as a shell is to a mollusc.
Yet as this analogy suggests, in any hierarchy of products serving useful functions, an upcycled lampshade, however beautiful, may not rank as highly as its original donor parts, which presently provide the most cost effective means of distributing potable water and connecting final drives to motors. The much higher cost of these lampshades not only reflects the premium expected for artistically communicative products, but also the fact that their design commits them to being produced by hand, rather than by the kind of mechanised mass-production used to produce the donor parts. Other than thrift products, it is hard to find any examples of professionally designed upcycled products that are a) as cost effective as standard mass-produced designs, b) able to utilise the mountains of consumer waste as effectively as industrial re-processing. Therefore, while it may seem harsh to say so, most present upcycled designs act merely as tokens of what many consumers may believe to be the embodiment of “responsible” design, even though some shine as embodiments of the constructivist aesthetic.

Whilst in terms of physical function, the upcycling design approach clearly demonstrates a reversal of the causal direction implied by “form follows function”, it is not as clear whether this also applies to its communicative function. The lampshade examples appear to evidence the intention of making extraordinary and beautiful objects out of ordinary mass-produced utilitarian products which communicate few, if any aesthetic values to consumers, even if the design aware ones may view the donor products as embodying the kind of “machine aesthetic” celebrated by Purists in the 1920s. Therefore the endeavour to both recuperate and enhance the aesthetic appeal of these expired products through a new design and make business can be taken as evidence of a design strategy having the functional aim of using modernist art techniques to valorise waste products in any manner that develops a mutually satisfactory commercial relationship between designer and consumer.

The fact that it is possible to interpret the messages communicated by these examples of up-cycled goods in either a positive way that views them as demonstrations of how post-consumer waste can be successfully recuperated by good design, or in a sceptical way that questions how successful their design and manufacture is addressing that problem, again indicates that communicative functions cannot be defined simply by appeal to the designer’s intentions. Furthermore, the fact that users can adapt objects such as the plastic bottles used by Sarah Turner to different physical functions, such as plant pots,
juice squeezers, reducing the capacity of a toilet flush tank, etc.\textsuperscript{19} shows that the physical functions of designed objects are also mutable, according to the needs of their users. So although the designer of such an artefact might feel they have the right to define its physical function, in reality, the users of the artefact have the power to transform that function into something entirely different. Jared Diamond makes this same point about sophisticated inventions, such as Edison’s phonograph.\textsuperscript{20} Seeing a money-making opportunity, jukebox manufacturers soon transformed the mechanism Edison intended to be an office machine into a music playing device, which subsequently proved to be physical function most widely performed by consumer owned versions of the phonograph.

Conclusion

Interestingly, Sullivan’s own work does not itself wholly conform to common notions of the modernist aesthetic. He stood apart from his modernist contemporaries in his commitment to ornamenting his new high-rise buildings with virtuoso decorations executed in costly materials, as on the celebrated facades of Chicago’s Carson Pirie Scott department store of 1899. Ironically, this commitment to applied ornament ran counter to the thinking of most of his modernist contemporaries, who preferred to hold Sullivan to his notion that every function of a design, including its intangible ones should be intrinsic to its form, as advocated by Adolf Loos in his 1908 essay Ornament and Crime.\textsuperscript{21} The fact that Sullivan found a place for ornament in his own design work suggests that his notion of function was confined to physical utility, rather than any combination of utility with intangible communicative functions. Yet even if we restricted the notion of function to physical utility, the evidence of the examples discussed above does not convince us that designers work only from the choice of a desired function towards the creation of a form that performs that function. The form of a stout stick can suggest a club with which to pound grain, and the resulting effects can suggest the more aggressive functions of weapon, which as it is refined over time to favour those who benefit from the aggressive function, evolves into a symbol of their enhanced status and the kind of society they have helped create. At the dawn of an era in which there is a growing awareness of the need to institute more sustainable means of production and consumption, up-cycling might be seen as a first tentative step among professional designers to explore ways of recuperating expired products by means ingenious, if not yet wholly effective in addressing the physical problems of waste management.

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sophisticated inventions, such as Edison's phonograph. Seeing a money-making function into something entirely different. Jared Diamond makes this same point about physical function, in reality, the users of the artefact have the power to transform that although the designer of such an artefact might feel they have the right to define its functions of designed objects are also mutable, according to the needs of their users. So yet wholly effective in addressing the physical problems of waste management.

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A Speculative Approach to Drawing as Visualizing Thinking

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Abstract
This paper starts from the premise that drawing can be a means of visualizing thinking, with an emphasis on the process involved. A gap often seems to exist in the minds of students of visual/material creative fields in ideas-generative contexts, between thought and action. The thesis is that the gap between thinking and doing can be reduced to being near simultaneous, in this instance through drawing. The methodology is practice-based, with a range of contribution from mid-program and final year students of communication design. Drawing is both the means and the subject of the research. The paper introduces the research’s theoretical basis, considers its application and concludes with subsequent developments. Some of the students’ practical work and linguistic responses illustrate points of the text. The research suggests that at prior or early stages of the design process the relative autonomy of the medium itself can offer visual/material suggestions and objects. Due to the ongoing nature of their practice, the students themselves have moved the research on from its original premise. The paper concludes by proposing to continue the research by observing how one can think about and rationalize one’s visual perception of movement at the moment of engagement in the drawing process.

Keywords: learning, participatory approaches, experience, creativity, philosophy, design practice, teaching
A Speculative Approach to Drawing as Visualizing Thinking

Introduction

The paper concerns drawing as a means of visualizing thinking, as conducted in an ideologically broad-based Communication Design program in Bangkok, Thailand, with Thai students studying through English language. The title’s reference to visualizing rather than visual thinking gives emphasis to the process of turning thinking into visual forms. Such a process is speculative in the sense of being conjectural, experimental, and insofar as this is the nature of thinking itself. A purpose of the research has been to introduce drawing situations where this process can be both observed and experienced. The usefulness of such a process has been to suggest an alternative to students’ tendency to formalize their ideas conceptually, where visualizing is a retrospective illustration of thinking.

The content of the research is applicable either to a starting generative mode of design, to an exploratory period prior to designing, or to students of design who have a more generic approach to their practice. Students participating in the research have at the same time been using the practical benefits in their studio projects, either in response to a project brief or as their final year independent projects. These other projects have also enabled evaluation of the research.

The Theoretical Basis of the Research

Students participating in the research have worked on discovering its relevance in and through the work itself, individually and collectively. Confirmation of this is most in evidence in work that a few of the students have moved onto, as described in the Conclusion. The role of this paper’s author, as teacher and researcher, has been to track the issues of the research practically and in relation to the work on creativity and visual perception by the theoretical physicist David Bohm. Additional reference has been to psychoanalysts D. W. Winnicott and Marion Milner, French writer and theorist Hélène Cixous, and philosopher A. I. Tauber.

Insofar as speculation means as yet unproven, notional, and experimental, the kind of thinking commensurate with this is likely to be what (Bohm 2004: 70?) terms "reflective." Such thinking also characterizes the research itself, and the Conclusion introduces areas into which the research has more recently moved. Imaging, according to Bohm (ibid), is carried out in the nervous system, whether or not in relation to an
externally perceived object, and a combination of thoughts "... resolves the difficulty, first in relation to the image (i.e. in the imagination) and later in relation to the actual fact." In this sense, visualizing as something which is at once affected by, and determines thinking, is likely to involve imaging ideas in process, with their less-than-finished formulation. In a similar context of creatively-influenced writing, (Cixous 2005: 37/38) states that 'if she were less uncertain she would make decisions rather than essays'. The 20th Century French cultural premise of Cixous is appropriate on the basis of French theory's speculation on the relationship between language and other forms of communication. The process of reflecting is in this instance considered through the filter of the visual/material medium of drawing.

Bohm (1980: 23) states that one should not think of the content of thought and the process of thinking that produces it as separate: "...content and process are not separately existent things, but, rather, they are two aspects of one whole movement." This quote has bearing on the integral relationship between thought and thinking and the medium of their exposition, how the research has developed, and the role of movement in the research, practically and philosophically.

A broad definition of creativity as suggested by British psychoanalyst Winnicott (1996: 13/19) may underpin designing in terms that acknowledge the role of human subjectivity. Winnicott (1996: 13) states: "the strain of relating inner and outer reality" relieved by an "intermediate level of experience" commensurate with the child who is "lost in play." A 3rd year student, B., has stated of her approach to her work:

I should draw to find my own space in those public; before I lose my chance to get into that space this is my first time to see what I usually ignore. I will drive into it, through my imagination....

Winnicott's 'strain between inner and outer reality' relates to the difficulties that students seem to have in articulating thoughts in an external visual sense as immediately as possible after their thinking. The research has therefore explored the medium of drawing as providing "an intermediate level of experience" psychologically, and for where it is pitched in relation to the process of designing on a program that is broad enough to include questions of socio-cultural and personal reflection.

The starting hypothesis of the research, that thought and action relating to visualizing could be simultaneous, has been challenged by the theory of (Bohm 1980: 74), who states that thinking cannot be uninfluenced by memory; this in a broad sense that in turn interacts with sentience and corporeality. However, according to Bohm (1980: 65), a "flash of understanding" can often precede thought, which he terms an “intelligent perception,” after Piaget (Bohm 1965, 1980). Such perception, Bohm
suggested, is the only phenomenon of the mind which is not conditioned by memory. The words of a 3rd year student, J., reflect this: “It’s kind of confusing when there’s a picture in your head of what the thing looks like that you’re trying to push away, but it’s still there but blurry.” Bohm’s theory, however, does not preclude that students’ tendency to conceptualize at the outset of presenting questions can at least be reduced by a shortening of the time-frame between thinking and acting. Equally, the facility of the flash of unique insight, an “intelligent perception,” remains in place as something which can either precede visual thinking or occur at any point in the process of visualizing.

The proposition that thought is a material process suits the possibility of thinking as transformed into a visual/material medium, and can substitute for more open and less-structured thinking. It could almost be said that the medium has itself to offer as a form of thinking, whereby students participating in the project should be sufficiently unrestricted by their assumptions to interact with what are the medium’s automatic tendencies. According to Bohm (1980: 197), “…something may behave with a relative and limited degree of autonomy, under certain conditions and in certain degrees of approximation.”

The question of human subjectivity links to the above considerations. A reason for encouraging the generative and exploratory character of visualizing thinking is to enable students’ greater self-involvement, especially insofar as the process is creative. If subjectivity is comprised of individual human sensory experience, where many kinds of feeling are common and shared, it should be possible to utilize these and allude to them by visual and material means. Equally, these might be assessable to
some extent objectively in oneself, and comparatively with the subjective experience of others. Fesser (2010: 111) cites the philosopher David Chalmers on qualia, or human feelings: "Here there is no gap between appearance and reality, because the appearance - the way things seem, which is constituted by qualia themselves - *is* the reality." If the basic mechanism of the engagement of feelings is reflexive, this is at work before, within, or despite the activity of conscious thought. According to Tauber (2010: 182), there is a distinction between reflexivity and self-reflectivity, the former as a "passive mode of self-consciousness" and the latter as "an active introspection". 3rd student, B., had the following to say of the approach of her colleague, P., towards his work:

*In our sharing session with my group,*
*we talked about those conscious subject…*

*I wonder as she told me that P's virtue is to work with unconscious drive.*

*He's born and live his life with unconscious driving.*

*But my unconscious drives quite weak so I work with conscious mostly.*

Debatably, students' individual enquiry into how their subjectivity works in relation to their designing will facilitate their appreciation of the reciprocal interplay of this from the client or beholder's point of view.

Similarities with the topic of this paper are apparent in recent research by Nell Breyer, *Motion Perception: Interactive Video and Spatial Awareness*, Journal of Artistic Practice, Current Issue (2011), who uses the medium of interactive video to consider how 'human movement drives the phenomenology of space', particularly the sections *Tuesday: Volume*, concerning space, and *Wednesday: Time*, concerning movement.

**The Approach in Practice**

The research project has been explored between six classes. Four of the classes have been with 3rd year Communication Design (CMD) students and two classes, Final Project Preparation and Final Project, have been with 4th year CMD students, over two semesters. Of the four 3rd year classes, the main two have been Parallel Studio/Drawing (which is a supportive concept to the design studio) consisting of ten students. These same students have explored their studio projects mainly through drawing, with the paper's author as their main advisor. Eleven 4th year students have approached their final year through their interest in drawing and 2D image-making and several 3rd year students have started to use drawing in their more independent work.

The Parallel Studio/Drawing class has involved several exercises concerning articulating movement through drawing, and two exercises that
have been objectively structured around visualizing thinking. The following short descriptions indicate the scope of the drawing exercises across the two groups.

A three-hour drawing exercise, *Two Time-lapsed Photos*, conducted with 3rd year Parallel Studios/Drawing students, concerned linking two time-lapsed photos from a cinematic narrative through drawing to suggest continuity across the gap in time and the missing transition/s. Students were required to respond to a precise set of verbal instructions.

A three-hour drawing exercise, *Drawing Verbal Prompts*, conducted with 4th year Final Project Preparation students and with participation of some 3rd year drawing students, formed the generative basis of the 4th year students' independent work. This exercise was also an experiment in formalizing a situation where students would respond with near immediacy to linguistic prompts. The exercise resulted in six A2 charcoal drawings from each student. Students were provided with several keywords, for example such terms as 'object'; 'relation'; 'contrast'; 'separate/combine', as prompts from each of Mimicry; Time; Cause and Effect, each prompt producing one drawn response at a time, resulting in each drawing having several steps.

Students were instructed to respond immediately to the prompts with the first thought that entered their heads; this translated visually and materially
through the medium. It was stressed that whatever the students drew should as nearly as possible correspond with their first thought.

According to Bohm (2004: 62): "...we have to consider the relationship between imagination and reason if we wish to obtain an adequate account of the operation of the process of thought." An illustrated presentation to both student groups theoretically contextualized the work that they had been doing in terms that encouraged them to be more aware of the role of their personal subjectivity, hence being able to read the difference that often exists between the generating thought and its visual/material outcome. A 4th year student, G., wrote the following on the process:

*While I draw these project, when listening to the keyword I try to analyze, connect, and modified the meaning of the words. So I draw it by a raw Idea which on my head first. The interest point is the Image which pop up in my head that is a kind of the main perception then from the thinking base transfer the image as fast as possible for avoid the modification thinking to decrease the gap between two senses as close as possible that is the kind of Idea about transferring information between senses.*

In a presentation to both 3rd year and 4th year, participating students were introduced to Marion Milner's *The Hands of the Living God* (1969), a psychoanalytical case study by Milner of her patient, Susan, through an exploration of the latter's doodle drawings. A key point, through direct reference to Milner, was that "...a symbol is both itself and the thing it stands for, without being identical to it." (2011: 46), in other words the idea that meaning can either be suspended or felt to exist in ways that do not obviously correlate with drawings' visual and pictorial qualities. In the semiotic context, Chandler (2004: 35) states that "...communication and media theorists... stress the importance of the active process of interpretation, and thus reject the equation of ‘content’ and meaning." It was explained to students that Milner's project with her patient was to help her to pass through her emotional block and achieve once again, "free compliance with the outside world."
Reference in the presentation to Cixous’s corporeal visual/psychological interpretation (1998: 38) of several major artists’ drawings: "...we want to draw the instant. The instant which strikes between two instants," contextualized the question of reflexivity in terms of professional artists’ practice. The suggestion of wanting to achieve immediacy between thought and action recalls the question of thinking in relation to the interaction of the creative agent with the autonomy of the medium, as posed by Bohm.

Thinking in may consequently define the silent immediacy of engagement with the activity, while thinking through may relate to retrospective thought-based and linguistic communication of the form, content, purposes and suggestions of the resulting drawing. It was useful too, in a cautionary sense, to convey the point that Milner makes about her patient: "...an extreme and excessive concentration on logic and outer things at the expense of both reverie and fantasy." (2011: 47)

Several exercises in stop-frame drawn animation provided the basis of focus on movement. The formality of the routine of stop-frame drawing, instead of disrupting students’ imaginative flow, seemed to allow them to explore their imagination in an almost meditative sense. The sense of the students understanding the space which they were constructing through their own corporeality is substantiated by Böhme’s phenomenological interpretation (2003): “The space of bodily presence is essential to my bodily existence, since to be bodily present means to find oneself within an environment." The research has more recently involved specific exercises in drawing movement with some students.

An approach to thinking in the activity of drawing in a free-form sense with 4th year final project students has resulted in a tendency towards self-reflective abstractions of the body.
Two sets of visual studies by a male 4th year student (left), and a female 4th year student (right), who are exploring self-reflectively through the human image (2012)

The Research’s Conclusions

Insofar as thinking in and through the medium of drawing is now in process, a way forward with the research has been to focus more closely on the question of articulating movement. According to Arnheim (1972: 379), similar to (Bohm 2009: 245), "Stroboscopic motion... takes place between a memory trace and the perpect of the present moment."

Stroboscopic may here mean the perception of an apparently automatic tendency of marks made, which appear to move in their repetition across the drawing, and the apparent movement of the object and its aspects, to which the marks refer. Self-observation in this instance may take the place of self-reflection, in an investigative context, as further example of how human consciousness interacts with what are conventionally viewed as being external phenomena.

A specific current question of the 3rd year design studio class, to which some of the 3rd year students are responding through their interest in drawing, concerns visualizing time & space as a dual phenomenon in the context of memory. According to Bohm (1980: 268), “…sequences of moments that ‘skip’ intervening spaces are just as allowable forms of time as those which seem continuous.” It is proving useful to adapt the question of articulating movement in drawing to that of the lapse of time that such a question spans in the process, and how shapes that are generated can be read both as figure/ground reversals and spaces in the Bohm sense. The 3rd year students have not yet begun to individualize this to their own needs in respect of the project brief, but the idea has been put to them that the movement drawings can be adapted to the project through this direction of their thought.
A Speculative Approach to Drawing as Visualizing Thinking

Two sets of visual studies by a male 4th year student (left), and a female 4th year student (right), who are exploring self-reflectively through the human image (2012)

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In the context of interactive video, Nell Breyer (2011) has stated: “We can switch immediately from taking in one instant of time discreetly to many instants of time layered or merged together. …our understanding evolves through individual, empathic translation and physical engagement.”

There is some indication that self-reflective involvement in drawing is being more deeply appreciated, where drawing, in this instance, is a channel for the medium generally as a means of personal conversation. One 3rd year student has also been using drawing as part of an independent study of a ramshackle wooden house and its owner, where her drawing also interacts with poetic text as a means of externalizing her dialogue with herself.

3rd year student, V’s use of drawing for a project outside of the curriculum (2011)

*He cut himself with the wood, twice*
*She said*
*And disappear*

*There’s more than 3 persons here*
*His past, this I call one*
*He is two*
*She is three and myself is four*
Some 4th year students are now also using drawing independently, either as a main medium or as a key support medium. Such developments confirm that students have gained from the drawing experience, and can continue to engage in the program's familiar content through being more immersed in a medium which conveys strong implicit visual/material characteristics.

The main linking thread in the research between a variety of exercises and two groups of students with differing needs on the program has been the question of how one thinks in and through the medium, and by dint of thinking that results in seeable and readable material, in a semiotic sense, how one communicates thought. Insofar as the transcription of linguistically presented or formulated ideas into a visual/material medium is nevertheless problematic, increased by teaching and learning in the context of English as a second language, the immediacy and subjective warmth of the medium of drawing has helped to facilitate this process.

References


A Speculative Approach to Drawing as Visualizing Thinking

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4th year student, G’s drawings in black ink that attempt to visualize internally sensed muscular tension (2011)

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References


Design for All: Stimulating students to search and research

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Abstract
This paper discusses the teaching of Design for All in a university based design school. It explains the approach taken to encourage engagement and learning with a subject that is as much a philosophy and an ethos as it is a field within design with specific knowledge sets, design processes and methods.

Taking a hybrid approach, the Design for All course combines a traditional lecture/seminar format, with problem based learning centred in student project work. The rationale is to help the students to search to understand various dimensions of the problem space along with the current state of certain key issues, and to research ways to integrate all this information and move forward. In this way, they are indirectly guided to look at the bigger picture, to understand how people work around problems in order to try to combine small and incremental changes to product design alongside creatively moving forward and bypassing fundamentally inaccessible products and making systems accessible. That is, they move beyond re-design to innovative design.

The authors hope that the approach taken here, of stimulating students to search and research may be useful to other educators who are engaged in teaching areas of design (sustainable design, transformational design) whose paradigms permeate the whole of the design endeavour, and require students to think beyond the apparent constraints to emergent properties.

Our paper draws upon the experience of teaching Design for All to try to position the role of search (roughly, seeking to understand connections between the input and output in the problem space) and research (ways to integrate the information) and the place of design and of redesign. It is ‘in-progress research’ reflecting on how these activities aid critical thinking and analysis in underpinning the creativity and innovation of products and systems.

Keywords: teaching design for all, problem based learning, project based learning, design ethos, creativity
Introduction

In the last two decades, the teaching of Design for All has become more widespread not just within Design Schools, but indeed wherever products, systems, services and environments are being designed and created. Thus we find Schools of Architecture and of Computer Science both incorporating some form of teaching about accessibility, whether it concerns the built environment or an internet application.

Design for All is generally treated as synonymous with Universal Design. It is the term preferred by the European Union, and respects not just inclusivity but also diversity. It strives to create products and environments that are usable by the greatest number of people and, where a single solution is not possible, then equal and attractive, but non stigmatizing, alternatives are provided. In this way the diversity of individuals is celebrated rather than forcing people into accepting a ‘one size fits all’ approach. Such designs will mean that temporary disabilities (such as when someone has broken an arm, or lost their glasses) or handicapping situations (when a screen display is exposed to the sun’s glare; when a station announcement is drowned out by the noise of an incoming train) are catered for in the design brief and its fulfilment. Design for All believes that in this way that it will enhance all design, with features that are used by everyone regardless of their abilities, just as remote control devices for TVs, garage doors, etc. are used by all, and not just those with mobility impairments. Finally, even if ‘for all’ can never realistically be attained, Design for All “forever attempts to close the gap through an increasingly informed practice of designing for a continually broadening and deepening population.” (Steinfield & Tauke 2002: 29)

Promotion and motivation of Design for All used to be central aspects of the teaching of the subject, but several issues underpinning the need for Design for All are now more widely acknowledged, particularly those related to demographics: i.e. the rise in the proportion of elderly and disabled in most of the world’s populations; and those related to the individual rights movement; and the subsequent politically incorrectness of not including the needs of the disabled when designing.

This has meant that presently there is now less time needed to be spent on explaining such issues, and more time available to spend on more formal methods. This enables educators on the one hand to build on the experience gained by the continual maturing of the field, and on the other to provide more structure to what is still at heart an ethos or a philosophy of design or in the words of one eminent researcher in the field “an attitude of mind” (Newell, 2000:43).

We believe that when faced with teaching and learning such kinds of design, it is important for students to be engaged on two types of problem based activity: firstly to search, i.e. seeking to broadly understand various dimensions of the problem space as well as current state of certain key issues; and secondly to research ways to integrate information and move forward with in-depth understanding of the problem space and possible solutions. We see the search activity as derived from Simon’s metaphor of design as seeing the input and outputs of problem situations, and seeking to understand the “black box” in between (Simon, 1999:121). Further, we hope that this type of approach may be useful to other educators who are engaged in teaching areas of design (sustainable design (Cramer, 2007; Jansson et al.; 2008; Gürel, 2010); transformational design (Burns et al. 2006; Inns, 2007; Jonas, 2011); capabilities approach (Dong, 2008)) that deal with such design philosophies that can permeate the whole of the design endeavour.
This paper reflects upon the experience of teaching a Design for All one semester course to fourth year design students in a university based five year degree course in Greece for the last six years. It examines the relationship between project work that is mainly research based and the development of the students’ critical and analytical skills. The aim of the paper is to highlight and explicate the various interdependencies between research and analysis, and reflection and creation, and the role of Design for All in stimulating these activities. In this way it hopes to add to the discussion regarding search and research (Friedman, 2003) and their connections to design.

Examples of popular and widely used products that are not Designed for All might be, for instance, ‘click and point’ digital cameras. Left-handed users generally find these items difficult to use, because the buttons to click are positioned for use by right-handed users. Worse, they may be impossible to use by people with disabilities that are related to their hands (for instance in terms of grip, grasp, missing fingers, etc.) caused by diseases, accidents or age-related weakness.

Students’ first reaction when challenged to think about re-design of such products, tends to a decomposition process. They analyse the needs of each type of user and then, piecemeal fashion, create solutions to each problem. However, while there may be some useful results gained this way, it most often leads to unrealistic or counter-productive thinking. For instance, creating two types of camera for left-handed and right-handed users respectively is not economically feasible, nor even desirable for an item that may be used by persons other than its owner. Another outcome may to incorporate a mish-mash of conflicting requirements, such was seen in the real world design of mobile phones marketed for the elderly and disabled by both LG and by Vodafone several years ago that included large buttons and speakers at the expense of screen space, and did not really solve anybody’s problem, despite being designed using the best research techniques in capturing design requirements.

In the course on Design for All, the students are guided to avoid this experience of limiting the problem space into the redesign of specific products, and of trying to define the needs of various groups of disabled users, and coming up with a piecemeal, impractical or conflicting sets of solutions for different small problems. Instead, students are challenged to look at the bigger picture, to search to understand how people ‘work around’ problems, in order to combine small and incremental but useful changes to product design alongside innovative and creative ways of moving forward and bypassing fundamentally inaccessible products on the way to making accessible systems.

Teaching and researching in Design for All -

The subject matter of Design for All is first and foremost influenced by its status as a design philosophy. It represents a paradigm shift that has effectively challenged the hidden assumptions that designers hold, and has significantly altered the way many designers—as well as policy makers, educators, and the public—think and act. Nevertheless, it is still not mainstream design. According to Ostroff, (2011: p 32)

“Until universal/inclusive design is infused in preprofessional and continuing education, the attitudes of designers will limit their understanding and appreciation of diversity. They will continue to shape their designs for a mythical average norm, creating barriers that exclude the contributions and participation of millions of people all over the world.”
### Awareness Raising

This has direct consequences on teaching Design for All. It means much of the teaching is directed at raising awareness of what it is to be disabled in the modern world. Because designers tend to design for themselves (Keates, 2003) and because teaching programmes are limited in time, many choose to spend an important portion of teaching time educating their students about disabled and elderly users with a variety of awareness raising exercises. These are of two main types: the first are simulations where the objective is for students to experience disability (using wheelchairs, spectacles to reduce eyesight, etc.). The second are various interactions with disabled and elderly users such as inviting people with disabilities to lecture to students; involving users in evaluating/testing existing designs and those produced by students; studying user requirements through interviews, ethnographic observations and interviews, etc. (Newell, 2000; Christopherson, 2002; Nicolle & Maguire, 2003; Petrie, 2006; Kotze, 2007; Carpinelli & Neumann; 2010).

It is encouraging to find that there has been some progress in understanding the limitations posed by new technologies. This has been aided by a wide range of informative documents, (e.g. those produced by the WAI and the RNIB in the UK and the fact that a variety of useful multimedia material has been produced. This ranges from home videos by disabled and/or elderly users mounted on publicly available sites, like YouTube, (see, for instance the video: “How a Blind Person Uses The ATM”¹ and resources produced by organisations such as the University of Washington’s DO-IT (Disabilities Opportunities Internetworking and Technology). These include videos where people with disabilities explain how they use computer technology both in terms of the benefits and the problems they experience.² At the other end of the spectrum are purposefully dramatised productions with professional actors that enact scripts centring on problems people face with technologies (Newell, 2011).

This material would not be so useful if there were not a positive social response from designers and design students in a climate that increasingly favours Design for All. So with awareness needs possibly decreasing, there is more time to be spent on teaching students how to design for all and elaborating theoretical foundations and empirical approaches along with processes, methodologies, tools & methods.

This is welcome, because formal methods for teaching Design for All are limited in scope and often provide only very high level guidance (Keates & Clarkson, 2003; McAdams & Kostovich, 2011). Christophersen (2002) noted three aspects to teaching Design for All: theory, end user involvement and evaluation, yet most teaching centres on end user involvement and evaluation

### Evaluation

Evaluation may be undertaken either with users or against criteria, such as guidelines. Evaluation in Design for All has the added dimension that elderly and disabled users may be more difficult to recruit and assess, because of sensory or physical problems which impede communication. Further, there are difficulties in collecting a homogenous group of users and there can be conflicting requirements between user groups. For example, screen displayed messages on mobile phones are useful for people who are hard of

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¹ Video: How a blind person uses an ATM  
http://www.youtube.com/watch?v=Jzah0A6iC5o

² see the range of video resources at http://www.washington.edu/doit/Video/
hearing but of little use to those with impaired sight. Sandhu (2002) suggests multilayered approach that tests against the characteristics of the users, of the tasks, of the environment, of the product and of the system. He offers checklists against which characteristics can be tested. The USERFit tool, developed by Abascal et al. (2003) takes a similar approach with an automated tool.

**Guidelines**

The other type of evaluation involves testing against guidelines such as the Universal Design Principles (1997). Guidelines are useful for other things as well, for whilst all principles may not be relevant to all designs, they can be used to guide the design process, as well as to educate both designers and consumers about usable products and environments.

However most sets of guidelines used for Design for All tend to suffer from being too high level and/or not aligned with common design methodologies and processes. In Law et al. (2008) guidelines of various types specifically drawn up to aid designers working on Design for All in Information and Communication Technologies (ICTs) were critically examined and evaluated heuristically. With one notable exception of guidelines that were designed and evaluated by design professionals, the other guidelines were estimated to be weak in regard to supporting typical design processes and the design mind-set of those involved in Information and Communication Technologies (ICTs) design. Some guidelines, like those from the Web Accessibility Initiative (WAI) of the W3C have been recently been revised, and there is not yet widespread consensus on their usability.

**Toolkits**

Other Design for All educators have worked hard on creating aids such as the range of tools in the Inclusive Design toolkit\(^3\) which is a joint venture between the University of Cambridge and British Telecom (BT). The toolkit includes such things as an exclusion calculator, which allows users to understand how many people would be excluded from using the designed product/system. It has as well a design log to record design decisions; impairment simulator software, a ready-made set of personas, and a tool to prompt users through the (inclusive) design process.

**Design Process**

In terms of design process, the San Francisco State University has detailed a design process for their Universal Design module that follows six steps: understanding, observing, interpreting visualising/realising, evaluation/refining and implementation. (Gomes, 2009). Taught modules are given on the economic, social and legal aspects of Universal Design.

**Knowledge Sets and Skills**

As can be inferred, there is no ‘theory’ of Design for All, and perhaps this is to be expected, in as much as there is no overarching theory of Design itself. However, there are definitions and methods organised into knowledge sets and skills. An initial survey collected information about the type of knowledge and skills being taught under the umbrella of Design for All, and this information was then organised into a taxonomy. The categorisation was then assessed for its usefulness and completeness in several ways – in a practical workshop setting, by expert review, and by using it in real world educational

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3 Inclusive Design toolkit http://www.inclusivedesigntoolkit.com/betterdesign2/
settings (Darzentas, 2003; Nicolle et al. 2005). The refined framework of this taxonomy is presented in Darzentas & Darzentas (2003) and shown in Figure 1 below.

This shows how sectors other than ICT, such as those for the Built Environment or Transportation Systems, could be represented.

This work was part of two major curriculum efforts in Europe (both funded by the European Union), that have helped to organise the teaching of Design for All. The Inclusive Design Curriculum network (IDCnet) created the taxonomy and curriculum working groups in the European Design for All eAccessibility Network (EDeAN) and DesignforAll@eInclusion project (Keith & Whitney, 2008), carried the work forward by examining how the knowledge sets might be broken down into various modules organized around learning outcomes.

![Figure 1 Taxonomy of Core Knowledge and Skills](image)

The taxonomy is meant to be descriptive, rather than prescriptive, and does not in any way mandate the form that a specific course might take in terms of emphasis, topics and depth/breadth of knowledge and skills.

In our department, we focus particularly on products and systems that include information and communication technologies (ICT), however the profile of our graduate students is such that they could apply their Design for All knowledge and techniques to other non technologically enhanced areas such as products which do not contain computers, or interior design, or design of services. Frequently students continue the work they have done on the course and carry it over to studio work and competitions. Student concepts have won awards in accessible street furniture, accessible bathroom layouts and accessible shopping experiences.

**Teaching Design for All by project based work**

In this section we describe the Design for All course that is taught to 4th year undergraduate students on a 5 year degree course in the Department of Product and
Design for All: Stimulating students to search and research

Systems Design Engineering. Students on this course have normally already followed the Human Centred Design stream, and will have completed courses on Human Computer Interaction and Interaction Design, as well as courses in Ergonomics and Cognitive Science. In addition, they will have participated in 6 studio courses. In the 5th and final year, students are required to complete a work placement and a final project dissertation that has a large research component.

Description and Time Frame

The Design for All course is taught over one 13 week semester. Strictly speaking, it is a hybrid course, combining traditional lecture/seminar (2 x 2 hours a week) with a research based project. The students begin working on their group project outside the class time after approximately four weeks of lectures. This is enough for them to have become acquainted with the general knowledge and skill sets of Design for All (see Figure 1). The lectures are supplemented by assignments and discussion. The lectures continue with the knowledge sets that pertain to Information and Communication Technologies, (approximately weeks 4 to 7).

The instructions for the group project ask for a structured report and a presentation to the class. A suggested template for the report structure is:

- Introduction which sets the boundaries of the topic under investigation.
- The current situation in regard to Design for All;
- The challenges still to be overcome, (unmet requirements)
- Possible solutions (product and system service level)
- Conclusions (synthesis and critical review of what has been researched, described, analysed and suggested).

The students are not asked to focus on solutions to problems, although they invariably do seek an end point. They are told that they are being assessed upon their search/research and synthesis skills, and the degree of innovation they bring to their suggestions, rather than on how well they have dealt with “small” problems (e.g. suggesting installing an awning to reduce sun’s glare on screen display).

The students present their group work to their fellow students during the class hours at approximately weeks 8 and 9. This is done is the following way, the students must adhere to a strict deadline of 15 minutes presentation time (and 5 minutes for questions, clarifications and critique). Each group is assessed on their presentation skills, as well as on the content.

In terms of presentation skills, students must be able to demonstrate that they are able to ‘practice what they preach’ and present in an accessible fashion. In order to assess this part of the exercise, problems will be simulated. This may be situation based, i.e. a fault with the screen projection, and this means that the students must have either have a backup prepared (e.g. another presentation means, such as handouts, or alternative projection device), or they must continue their presentation without the visual back up of overhead slides or movies and be able to compensate for these. Other simulations may be persona based. For example, students are told that there are people with impaired vision in the audience. They must be prepared to cope with this eventuality, by for instance, describing all visuals material and making sure that they do not leave unsaid gestures or just point to objects, but describe them as well.

Programme of study available at [http://www.syros.aegean.gr/1388.aspx](http://www.syros.aegean.gr/1388.aspx)
In terms of content, students are assessed on the breadth of search and depth of research. Their methods of dealing with the information they have searched for, as well as problem definition and innovation (looking for solutions to identified problem situations) are part of the brief and the students are awarded marks for these aspects.

In the last classes (approximately weeks 10-13), after the presentations have been made, are spent in summing up the methodologies used to examine the information amassed by the groups, to highlight the strengths and weaknesses of various approaches and to suggest how various approaches might be combined. Since students have already discovered by themselves some ways of dealing with the information, they are more receptive to understanding the methodologies and are able to reassess them more confidently.

The final course assessment is the in the form of written exams. There are some set knowledge questions, but the bulk of the grade goes to answers to questions on hypothetical design brief and asks students to describe how they would go about responding to the brief and Design for All.

The final grade is a composite of the marks from the final exams (50%) and the work for the projects (50%). The project is marked with 25% for the presentations and 25% for the written work.

The time frame for the 13 week semester is shown in Figure 2 below:

**Figure 2: Timeframe for Design for All course**

**Pedagogical goals**

Following the typology of project methods elaborated by Lee (2009), the project based component of our Design for All course falls roughly into the category of “guided project method.” This sits midway between the directed and independent scale of projects. The goals for such types of project methods are for: “investigative acquisition of knowledge and collaborative inquiry in a defined area making significant use of decision making, synthesis and argument” (p 555). This type of project is directed at “involved learners” on a scale with autonomous learners at one end and dependent learners at the other.

**Research based projects and Problem based learning**

In addition to being a research based project, we see this work as being also problem learning based. This style of problem based work makes students particularly aware not just of what they have found out (search) but what conscious of the need to do something
with information: to integrate it and eventually progress it into design concepts. The hope is that it encourages “student led acquisition of knowledge” (Tovey, 2011, p.5), regarding not just the aspects of the problem space, but ways of dealing with it in order to make some meaningful progress. We believe that this way of working is important to students and practitioners of design, as a way to help them to synthesize search and research activities, but also to lead to more creative idea and concept generation.

**Group projects versus individual projects**

The project work is always undertaken as group projects because in the authors view, group projects have several advantages over individual projects. From the practical point of view, with approximately 45 students undertaking the course, it is not possible to review in class time so many projects, the group projects on the other hand, bring this number down to a manageable but this is not the main concern. The main advantage of group work is that, as has been advanced by constructivist pedagogical theory, knowledge is sustained by social processes and that knowledge and social interaction are inseparable. Therefore, in group work, students are actively encouraged to interact socially, when undertaking their desktop based research as well as other research (real-world activities, such as observation of users, interaction with systems, task analysis, interviews and questionnaires). They are also encouraged to report back during class discussion time on things that they have had difficulty with; that interested them; that they were surprised by, etc. in a spirit of sharing experiences. This report-back happens at the end of each lecture, and fosters cross-fertilisation of ideas between the groups, and learning beyond the timeframe of the lecture hours. It has a great benefit in helping students to articulate their understandings and to analyse their views. A typical problem occurring in Design for All is when students come up against conflicts in user requirements, or when Design for All it does not seem logical to them. For instance, “if I make a system accessible to children what happens to tall people who use it” or “do blind people go to the cinema?” and most frequent of all, when students begin to believe that designing specialised individualised solutions is perhaps a better use of their time, rather than trying to find something that suits everyone.

**Constructivist versus Traditional**

The teaching strategies employed try to steer a middle path between the excesses of constructivist approaches, including discovery, problem based, experiential and inquiry based learning. Criticisms levelled at this collection of approaches is that if the level of guidance is too minimalist then learning will not occur. According to Kirschner et al. (2006), guidance can only recede when learners have sufficiently high prior knowledge to provide their own ‘internal’ guidance. However Design for All does lend itself to constructivist learning approaches because of the nature of the knowledge domain, which has something of an encyclopaedic structure (Perrenet et al., 2000). What this means is that the order in which various concepts are encountered is not prescribed, and further learning will not be affected by a missing topic. This is in stark contrast to engineering, which has a hierarchical structure and many topics must be learnt in a certain order, because missing essential parts will result in a failure to learn later concepts (Mills & Treagust, 2003).

**Case study example – projects on Self Service Terminals**

In order to illustrate the results described above, this section will present some of the work done by students. For the past two years, the students have been asked to consider accessibility and usability of self-service terminals (SSTs) and related devices used by
members of the general public. SSTs provide access to information and applications for communication, commerce, entertainment, or education. SSTs now cover many application domains including:

- financial services via automatic teller machines (ATMs), chip and pin payment terminals and online banking security devices
- travel services via ticket vending machines (TVMs), ticket validating machines and self-service check-in kiosks at airports
- retail goods and services via vending machines, self-service petrol pumps and self-service checkouts at supermarkets
- access to information such as government services kiosks, wayfinding in hospitals or shopping centres or information about cultural heritage (in museums, etc.)

Other terms for SSTs and related devices include: cash point machines, digital kiosks, digital order stations, electronic point of sale (POS) machines, interactive kiosks, internet kiosks, public digital terminals (PDTs) and self-service kiosks.

These systems are proliferating rapidly and providing more and more goods and services, from medical services (e.g. hospital check-in machines) to government services (e.g. postal services).

Yet while the benefits of self-service have been recognized by organisations that deploy self-service terminals, the acceptance by users is more varied. For some people the disadvantages outweigh the advantages, with the attractiveness of the 24/7 service offered by the systems offset by exasperation, frustration, and anxiety-filled experiences. Worse still, for other users, particularly older and disabled individuals, the systems are simply not accessible, excluding them from the goods and services on offer and the potential benefits of self-service.

These features of self service make them very suitable for students who can bring to bear a variety of knowledge and skill sets. As fourth year students, they have already followed semester long courses in Human Computer Design, and Interaction Design, as well as Ergonomics and Cognitive Science (each two semesters). They have already followed six design studios. They have still elective courses to undertake and in their 5th and final year a dissertation, which has a large research component. Thus they fit well into the descriptor supplied by Lee of “involved learners”.

Three recent projects on SSTs concerned: a food vending machine for use in schools, cinema ticket issue machines, and booths for recycling household waste products. As can be understood, within the topic of Self Service Terminals there are more than just ATMs and TVMs. The students are responsible for finding the type of service/device they want to research, although the particular instantiation has to be approved before they can start work.

In each project the students undertake a large amount of desk based research work. The research may often be combined with data gathering and/or evaluation activities when there are real world examples of the type of service available. The types of activities undertaken by the groups are as wide ranging as the groups are inventive and have resources. Activities include, besides the obvious one of examining the artefact in situ, observing usage and documenting barriers drawn on their understandings of human limitations. In addition, groups have organised user to test the SST it, have contacted user groups to interview them about their experiences with such artefacts. They have contacted manufacturers of SSTs and deployers of SST services (in one case, the local bus company) for their understandings about accessibility. The results of all the work
carried out by groups are combined into the report and the presentation which are made available to all students to consult, are revisited in final lectures and form part of the subject matter for the final exam

**Cinema Ticket Issue Machine**

The group that worked on the cinema ticket issuing machine appeared to have the least complicated project. The booking of tickets was undertaken online, and task of the SST was to issue the tickets. The visited two cinemas and documented the use the service at each. They documented the difficulties and categorised them according to location difficulties, interface difficulties, service difficulties. This allowed them to make suggestions that improved the situation in each of the three categories. This included simple things like making the location of the machine easier to find, better hardware design (screen tilts) better software for simpler more intuitive interaction. Regarding the service, they found that although apparently simple to describe (the online form stated “please pick up your ticket at the cinema ticket issuing machines”), but not to execute. They cited various problems, (such as not understanding what validation the machine needed to issue tickets, i.e. a code or the credit card that was used to book the ticket). The unnecessarily complicated process led them to make some radical suggestions for improving the service, such as virtual tickets making use of RFID technology, checked by going through a gate, and thus avoiding the issue of paper tickets and the manual checking of them. The use of loyalty cards could also carry users’ preferences for seating, special needs, etc. Some of the ideas are shown in Figure 3 below

![Figure 3: Cinema virtual ticket validation](image)

**Consumer waste recycling booths**

The group working on the recycling booths were also able to go and study these in situ. They observed the problems users encountered. They noted the problems of size and space for approach; problems with interaction: understanding what went where, and how to insert the different objects into the openings provided; and how to understand the reward scheme (small amounts issued as debits at retail outlets or the amount credited to a charity).

They concluded that the booths were difficult to use by themselves, but their location and maintenance made them unpleasant, thus reducing motivation, while for elderly or disabled people, the service was difficult to use of various manifestations of the problems already mentioned, but also because the booths are located at shopping areas and not
close to homes, meaning they must be transported. This group also made some recommendations for improvements, but felt that to increase usage of these facilities they should be relocated.

They examined other types of recycling services and schemes as part of thinking about how these services could be made accessible to all. They began their presentation to the class with a graph showing that of all the countries in the European Union, Greece has the lowest activity in recycling. From this point, their work was able to analyse the problems of the booths, but also to account for the some part of low rates in recycling by consumers.

The pictures below show some of the documented problems

![Pictures 1, 2 and 3](image1.jpg)

In the first picture, the booth is only accessible via steps, in the second, the children are not easily able to reach the openings, while in the third, the LCD screen is a very small refreshable line that is difficult to read.

**School Snack Vending machines.**

Students are not always able to examine in the real world examples of actual services. Since the work is research based this is not a problem. A case in point was the group working on the vending machines for schools to provide healthy snacks for primary school children. They used the internet to find out about available systems, to understand and document the problems of child obesity and also food allergies, and to make a reasoned case for a system that would allow the child to interact with a vending machine.

An important part of the proposed system would be to allow children to make choices, but for the items to be chosen to be predetermined by their parents from an online system. In this way the parents would be able to ensure their child did not acquire unsuitable foods, but at the same time the children could make choices just like the other children. A rough prototype of system was sketched out. The system was designed to be used by children, but could also be adapted for other institutions, such as nursing homes for the elderly. A card acting as an electronic wallet could be used in the transactions, and this could be ‘loaded’ online by parents or guardians. The interface was simple and based upon pictures and colours rather than labels and buttons, since the users were not able to read.

Just as a rough guide, this project had an extensive bibliography citing 21 journal articles and 70 websites. It covered areas such as abilities of children of primary school age, the psychology of children with food allergies, laws governing sale of food in schools, and of course, food vending machines and services.

**Developing critical and analytical skills, fostering creativity.**
These three projects have been chosen to illustrate various styles of search and research. With this short presentation, we have tried to illustrate how such research based work can help in the development of critical and analytical skills. All of the groups moved well beyond fixing the immediate accessibility problems. Their mode of working encouraged them to think beyond the machines to the services they offer, to recruit other technologies, to see that by designing with one group in mind (for instance children) it is not so hard to adapt the system to other groups that need similar services.

The link between critical and analytical skills and research is helped by scaffolding with methods and tools. The students here used variously already acquired knowledge and skills, methods used by other groups, or asked directly for help during discussion time. After the presentation, the lectures dealt exclusively with methods and tools used in Design for All that help designers to understand the needs and limitations of disabled and elderly, and shows how to include them in the design process, which moves from being for the ‘user’ (singular) as in discourse of HCI and Interaction Design to being for ‘the users’, (plural).

The link between research and creativity may be assisted by two different factors, one is particular to Design for All. Many (Springer et al., 2004, Bieling, 2010) cite being inspired by disability, meaning seeing how people cope with adverse situations or conditions or realising that there are other senses that we have not fully explored. For instance, our sense of smell, or of hearing, senses which are often highly developed in people with sensory deprivations. This was the case of one of our students (Biliouri 2010) who won an award for glassware which has sound capacity inspired by a blind friend.

Another, more general and cognitively based theory, holds that is making new ideas from old situations that have some similarity with the one being studied (Bonnardel, 2000). For Ward (2002), creativity is derived from a process that consists in the activation and novel recombination of previously learned knowledge elements that then results in the generation of new properties. Further, they note that the more people are forced to move away from similar taught examples, the more creative they become. Thus we contend that the search and research activity of the students, although it may lead to uncovering information that is later discarded for the project work, may either reside in memory for future creativity or may evoke some kind of creativity concerned with the project in hand.

Conclusions and Discussion

Current discourses in design pedagogy reflect the concerns of both practitioners and theorists. It is important for those engaged in design pedagogy to push design research to provide the theoretical foundations, as well the research methodologies and the processes, methods and tools including empirical approaches for various types of design activity. As noted by Tovey, research in design pedagogy can inform curriculum design and design research helps in providing the theoretical underpinning for design educations” (2011). Our work here both reflects inwards on Design for All, and outward to Design itself.

Subjects in Design, like Design for All, or sustainable design or transformational design do not confine themselves to sets of knowledge that students can learn. It is as much a design ethic, an ethos and a design philosophy. The purpose of the course in Syros is not to teach the students to design inclusive products, systems and services, as much as it is to open their minds to thinking about different types of users and diversity in contexts of use. It is a way for them to learn about the ways and the tools available to help them design inclusively, and to encourage creative thinking about problem solving, whether they take their inspiration from those who cope with everyday situations by finding
workarounds, or whether they develop an affinity and understanding of the needs, wants and desires of people. The intended result is that they are able to create new designs by liberating themselves from current paradigms, to try out ideas that are attuned to people.

By not focusing so much on solutions, but more on problem definition, critical thinking and analysis are encouraged. Critical thinking and analytic skills help students to be more creative and innovative in the solutions they do come up with. To substantiate this claim, our paper has tried to explain how, by not letting the students to only re-design’, that is, look at existing solutions and then try to fix them, encourages them to think more clearly about bigger picture.

In addition, it is our belief that such hybrid teaching strategies and designs can help foster greater understanding of what has been learnt, better articulation of the connections between design process activities and outcomes, and greater facility in communicating design decisions, leading to, hopefully, better designs and designers.

It is also unashamedly to change student designer’s ways of thinking. As one student put it: “I cannot look at anything now, be it product, system or service, without asking myself: ‘Would my Granny be comfortable with this?’ and thinking about ways to change things so that she, and people like her, are not left out.”

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Reflecting on the Future of Design Education in 21st Century India: Towards a paradigm shift in design foundation

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Abstract
Design Fundamentals or Basic Design, as it was referred to in early design education has come a long way since its origins at Bauhaus and its further evolution at Ulm.

In the nascent period of industrial design, the work primarily focused on physical products. Today, however, designers need to deal with complex issues. 21st century design education needs to be able to design and develop strategies for all and not just look at ‘Good Form’. There is a visible shift from client-driven projects towards a more reflective ‘Issue Based’ design education that strives for more socially inclusive, locally/glocally/globally relevant solutions - from ‘Human Centric Design’ to ‘Life Centric Design’.

There are no universal design solutions available that can address the unique problems of the Indian people such as healthcare, rural and urban sanitation, quality education at the primary and secondary levels, transportation, rural housing, agricultural support, safe water and many other sectors of the Indian economy that provide opportunities for design intervention. It is becoming very important in design education to include political, social and ecological discourses in a collaborative, inter/multidisciplinary way thus enabling a conceptual understanding of ‘intangibles’ like values, social responsibilities, empathy, humility and local/global relevance and perhaps then participate actively towards nation building.

This in-progress research attempts to establish that there is a need for a paradigm shift in design education in 21st century India and scope aspects that need to be rooted and nurtured in design foundation.

Keywords: design foundation, design education, paradigm shift, issue based learning, collaborative learning
Introduction

The in-progress research so far

1) Traces the history of modern design education in India, and the introduction of Western aesthetic sensibilities and design thinking. Design education in India borrows heavily from the Bauhaus and Ulm tradition, resulting in homogenization in pedagogy.

2) Establishes the need for a paradigm shift in design education, while retaining its essential character. Design today is complex, yet designers are seldom involved in national level decision-making. Design education needs to have students from across disciplines working in collaboration.

3) Identifies issues of concern, crucial in design education today, using qualitative research methods. Early industrial design primarily focused on physical products. Today however, the concept of design has permeated into all aspects of life and living. This naturally involves complex social, political and economic issues.

The research attempts to establish that there has been a massive paradigm shift in design. It is imperative that design education should address this constant change with a dynamic pedagogy, specifically in Design Foundation. It aims to explore new ways of working collaboratively that allows for grass root level co-creation of design fundamentals.

Background

The Foundation Programme of most design curricula has evolved from a need that was originally perceived at Bauhaus and Ulm as an introduction to ‘elements and principles of design’ and ‘design thinking and action’. According to M P Ranjan (2005), this need has not changed in spite of a substantial change in the tools and processes of design in the information age.

There is a need to revisit the traditions of design learning and try to understand the role played by basic design and see how it should be woven into the process of inducting new entrants into the realm of design thinking and action. Design is no longer seen as merely skill based but is in fact taking on new meaning. It is increasingly being recognized as distinct from art and science and therefore the search for educational processes that are distinctly ‘designerly’ need not be a misplaced pursuit (Ranjan, 2005).

The Bauhaus Heritage

Modern design education originated during the Industrial revolution where craft traditions and apprenticeship processes through which design used to be practiced, was steadily replaced by industrialization. The first school to formally create a series of assignments within a curriculum to introduce students to formal design education was the Bahaus in Germany. Set up in 1919, post World War I, the Bauhaus was a creative centre that was home to some of the greatest design thinkers of those times. The educational experiments initiated by the school were an inspiration for design education throughout the world. The founders of the Bauhaus tradition identified those qualities that needed to be nurtured in an art and design student, both in the form of skills and sensibilities as well in their conceptual abilities and attitudes when dealing with materials and the real world of design action (Ranjan, 2005).
The HFG, ULM: Inherited Bauhaus Heritage

The HfG Ulm, emerged as a continuation of the Bauhaus experiments in design education under one of its former students, Max Bill. However under the leadership of Tomas Maldonado, its focus veered from a foundation in art to science and society. The faculty, comprising eminent teachers and thinkers across disciplines, experimented with design education and documented the results in a series of 21 journals published between 1958 and 1968. This research, theory building and sharing has had a lasting impact on design education including design teachers in India. (Ranjan, 2010).

The closing down of the HfG Ulm in 1968 saw the scattering of its faculty and students across the world, all steeped in the Ulm ideology of public good with design theory and action. This resulted in significant action on the ground in the form of new design education in Latin America by Gui Bonsiepe, in India by Sudhakar Nadkarni and H Kumar Vyas and in Japan by Kohei Suguira, besides the numerous other influences in Europe and the USA that continue to this day.

NID AND IDC: Inherited HfG, Ulm Heritage & Influence Of Pedagogy

In India, modern design education began in the late nineteenth century with the opening of schools in architecture and art (commercial and fine art). It brought in Western design thinking, ideas and aesthetic sensibilities. On the request of the then Prime Minister Jawaharlal Nehru, Charles and Ray Eames’s ‘India Report’ initiated Industrial Design practice and education in the post independence period. Charles Eames who had drafted the guidelines based on which the National Institute of Design (NID) was founded, had spent some time in the Ulm School of Design (HfG Ulm). In spite of the focus on Eame’s report on Indian design tradition and sensibilities, the design education programmes in India, like in many other countries, actually borrowed its pedagogy and thinking from Bauhaus as well as Ulm school tradition.

Many early teachers at NID were trained in the same school. This deep-rooted connection between HfG Ulm and NID influenced thoughts, ideas, philosophy and hence the Foundation Programme. Prof Sudhakar Nadkarni holds a Diploma in Industrial Design from the HfG Ulm and taught at NID. Later he left NID to set up the Industrial Design Centre (IDC) in 1969 at the Indian Institute of Technology Bombay (IITB) in Mumbai and introduced, in IIT Guwahati, the first and the only undergraduate programme in design at any IIT in India. Prof Kirti Trivedi did his post-graduation from IDC in Industrial Design and later at the Royal College of Art, London. He later worked as a UNESCO Fellow in Japan under the guidance of Prof Kohei Sugiura, who had been guest faculty at HfG Ulm. In 1984, Prof Trivedi introduced India’s first Master’s degree program in Visual Communication at IDC.

Prof H Kumar Vyas spent 10 months at HfG Ulm before commencing the first Product Design programme in 1966 at NID. Prof Mohan Bhandari spent a year in Germany with Herbert Lindinger (a German Industrial Designer from HfG Ulm) and on his return coordinated the Foundation Programme. He left NID in 1982 and subsequently joined IDC, IITB. The three leading national design schools in India continue to be influenced by the Ulm doctrine.

Prof Trivedi (2003:9) notes in his article, Sarvodaya - Betterment of All, “One of the propositions put forward by the Hochschule fur Gestaltung, Ulm in its founding philosophy was that the quality of human life can be bettered by improving the quality of the man-made environment. But that alone would not be enough.” He also quotes Tomas
Maldonado who wrote in Ulm 2: “Man exists not only to utilize objects and even less — as they will make us believe nowadays — to consume products. But man will constantly be confronted with the intentional and unintentional demands of his consciousness. And these demands cannot be satisfied by soundly designed consumer goods alone” (Trivedi, 2003).

There is much wisdom in the processes by which basic design evolved at Bauhaus, then Ulm and later at NID and IDC and these lessons must not be lost...Design was seen as an important tool for social development, a creative problem solving activity. The problems of areas such as healthcare, education, employment, housing, population, agriculture, transportation and natural disasters could all be solved by careful design. It was with these intentions that NID and IDC were established in the 1960s with public money to help in the social and economic development of India. (Ranjan, 2005:11, emphasis as per original)

According to Prof Trivedi (2003), the student projects in the early days of the institutes reflected this concern for reducing the stress and strain of the daily existence of the common man. Students learnt to design by working on projects such as hospital trolleys, first-aid kits, premature baby incubators, mobile healthcare systems, seed-cum-fertilizer drills, sugarcane crushers, solar heaters, hand tools, safety equipment for welders, wheel-chairs and crutches etc. However, with the repositioning of design as a marketing tool in the era following the ‘globalization’ of the Indian economy, this perception of the role of design has sharply changed (Trivedi, 2003).

Cultural Context

Aesthetic sense goes beyond the visual - it could include all the senses. In a country like India, we see a definite influence of its history and diverse culture in architecture, artefacts, fashion, accessories, communications, products and even food. Unfortunately today, the visual experience of modern spaces across the world has become similar – evident in architecture, interior spaces, advertisements, websites, signage, products, colours etc. The gradual breaking down of cultural diversity through homogenized design education has lead to similar lifestyles. To preserve our distinct cultures the learning process that has created total homogenization needs to be revisited.

Prof Trivedi (2003:9) points out that, “A potentially powerful tool for social development has been hijacked to become a servant of marketing.” According to him, the values of the design profession were different just two decades ago. There seemed to be a consensus in the design community in the 1970s and 80s: sustainable development, protecting the environment, reducing consumption by reusing and recycling, empowerment of the individual, peace, harmony and encouraging a spirit of collaboration are the underlying values of the design profession. By doing away with these socially useful objectives and by agreeing to adopt the role of a weapon in the competitive market economy, design stops being a constructive force. He believes it results in the displacing of local cultures, depletion of the variety of ideas, defacing the environment and ends up controlling mankind in a manner never witnessed before. Designers, who themselves are controlled by those who want to fuel desire, discontent, greed and consumption, become willing participants in this destructive role of design.

Homogenization Caused By Education

The Western model of teaching design has brought about a homogenization of aesthetic sensibilities. Courses from Bauhaus and Ulm has its own problems - aping the west, notion of Western design being better than Indian design, losing identity, developing an
inferiority complex and emerging cultural insensitivity warranting a relook at the current learning process.

Even though the visual language is universal, the elements of design could be contextualized. In September 2010, NID organized a conference (in collaboration with Goethe-Institut / Max Mueller Bhavan Kolkata, HfG-Archive Ulm & IFA (Institute for Foreign Cultural Relations, Germany) Stuttgart in Kolkata) 'LOOK Back – LOOK Forward: HfG Ulm and Basic Design for India', where it shared, after fifty years, its curriculum through an extensive documentation of the work of the students of the Foundation Programme. Surprisingly, students from diametrically different institutions, many of them barely a couple of years old and with minimal infrastructure (such as National Institute of Fashion Technology (NIFT), Delhi; Pearl Academy of Fashion, Delhi; IILM School of Design, Gurgaon, Institute of Apparel Management (IAM), Gurgaon and Indian Institute of Craft Development (IICD), Jaipur), produced work similar to that of NID which has a rich heritage and infrastructure spanning five decades. Needless to say, the profiles of the students defer significantly, but nevertheless, this similarity of work among students of across various design schools is apparent and could be attributed to the pedagogy followed over decades.

The Current Design Paradigm

In the early days, the main of focus of industrial designers was form and function, materials and manufacturing. Today, however, the issues are much more complex and challenging. For emerging areas such as interaction, experience, and service design, new skills are required. Classical industrial design is a form of applied art, which requires deep knowledge of forms and materials and skills in sketching, drawing, and rendering. The new areas, on the other hand, are more like applied social and behavioral sciences and require understanding of human cognition and emotion, sensory and motor systems, and sufficient knowledge of the scientific method, statistics and experimental design so that designers can perform valid, legitimate tests of their ideas before deploying them (Norman, 2010).

Paradigm Shift In Design

Thomas Kuhn (1970) defined a paradigm as some implicit body of intertwined theoretical and methodological belief that permits selection, evaluation and criticism.

Paradigms gain their status because they are more successful than their competitors in solving problems that have been recognized as being acute by those addressing them. Accordingly, paradigm shifts occur when new models emerge to guide scientific research and hence transform mainstream theoretical approaches or lead them unto new paths of inquiry (Kuhn, 1970). Design foundation needs to identify and develop such a paradigm shift.

The need to perceive concepts differently, to reframe our approach to complex systems, is a reality that we must reckon with and which requires new pedagogical methods. Rather than simply focus on passing on knowledge, then, it is necessary to develop thinking methods that will generate new knowledge. These methods need to lead us to better solutions not only for business but also for humanity and the planet as a whole. (Peinado and Klose, 2011:104, emphasis as per original)

In the 21st century, design will undoubtedly impact society in countless new ways. There is enough evidence establishing a visible shift from client-driven projects towards a more reflective ‘Issue Based’ design education that strives for more socially inclusive,
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inferiority complex and emerging cultural insensitivity warranting a relook at the current learning process.

Even though the visual language is universal, the elements of design could be contextualized. In September 2010, NID organized a conference (in collaboration with Goethe-Institut / Max Mueller Bhavan Kolkata, HfG -Archive Ulm & IFA (Institute for Foreign Cultural Relations, Germany) Stuttgart in Kolkata) ‘LOOK Back – LOOK Forward: HfG Ulm and Basic Design for India’, where it shared, after fifty years, its curriculum through an extensive documentation of the work of the students of the Foundation Programme. Surprisingly, students from diametrically different institutions, many of them barely a couple of years old and with minimal infrastructure (such as National Institute of Fashion Technology (NIFT), Delhi; Pearl Academy of Fashion, Delhi; IILM School of Design, Gurgaon, Institute of Apparel Management (IAM), Gurgaon and Indian Institute of Craft Development (IICD), Jaipur), produced work similar to that of NID which has a rich heritage and infrastructure spanning five decades. Needless to say, the profiles of the students defer significantly, but nevertheless, this similarity of work among students across various design schools is apparent and could be attributed to the pedagogy followed over decades.

The Current Design Paradigm

In the early days, the main focus of industrial designers was form and function, materials and manufacturing. Today, however, the issues are much more complex and challenging. For emerging areas such as interaction, experience, and service design, new skills are required. Classical industrial design is a form of applied art, which requires deep knowledge of forms and materials and skills in sketching, drawing, and rendering. The new areas, on the other hand, are more like applied social and behavioral sciences and require understanding of human cognition and emotion, sensory and motor systems, and sufficient knowledge of the scientific method, statistics and experimental design so that designers can perform valid, legitimate tests of their ideas before deploying them (Norman, 2010).

Paradigm Shift in Design

Thomas Kuhn (1970) defined a paradigm as some implicit body of intertwined theoretical and methodological belief that permits selection, evaluation and criticism. Paradigms gain their status because they are more successful than their competitors in solving problems that have been recognized as being acute by those addressing them. Accordingly, paradigm shifts occur when new models emerge to guide scientific research and hence transform mainstream theoretical approaches or lead them unto new paths of inquiry (Kuhn, 1970). Design foundation needs to identify and develop such a paradigm shift.

The need to perceive concepts differently, to reframe our approach to complex systems, is a reality that we must reckon with and which requires new pedagogical methods. Rather than simply focus on passing on knowledge, then, it is necessary to develop thinking methods that will generate new knowledge. These methods need to lead us to better solutions not only for business but also for humanity and the planet as a whole. (Peinado and Klose, 2011:104, emphasis as per original)

In the 21st century, design will undoubtedly impact society in countless new ways. There is enough evidence establishing a visible shift from client-driven projects towards a more reflective ‘Issue Based’ design education that strives for more socially inclusive, locally/glocally/globally relevant solutions. The need to create a more sustainable world is giving rise to design opportunities in a wide gamut of areas like green design to safeguard people’s health and wellbeing; sustainable design which attempts to protect ecosystems for future generation and green architecture which attempts to develop healthy habitats. Instead of focusing on design as a product - focus on design thinking as a process - then design ends up having a bigger impact.

Having said that, in the context of the current design education scenario, Design Thinking may perhaps now be referred to as Sustainable Design Thinking and this is about how you use/take the methods and sensibilities of designers and apply them to all kinds of problems. It is a form of thinking that results in an entirely different outcome and is about new choices and new alternatives that didn’t exist before.

The purpose is to accelerate innovation and ability to solve various kinds of problems in business and society and it starts with people, human centered design and uses a set of creative tools like experiential prototyping, storytelling, visual thinking to develop ideas such that it becomes useful solutions.

Figure 1. Paradigm Shift in Design Practice

Source: Author, Indrani De Parker, 2011
Design must change. Design must be returned to the society as a culture forming and shaping process with an ethical and sensitive activity that is multi-dimensional, unselfconscious and ubiquitous. All professions and academia must be steeped in the design ethic and take ownership of relevant parts of it if we are to discover the true power of the discipline at the leading edge of human evolution which should be both environmentally sustainable as well as socially equitable in the days ahead (Ranjan, 2009).

**Think Big...Understanding of a Wide Spectrum of Knowledge**

According to Don Norman, designers often lack the requisite understanding of a wide spectrum of knowledge and the ability to think big. Design schools do not train students about the complex issues surrounding human and social behavior, about the behavioral sciences, technology, and business (Norman, 2010). It is becoming very important in design education to include political, social and ecological discourses in a collaborative, inter/multidisciplinary way thus enabling a conceptual understanding of ‘intangibles’ like values, social responsibilities, empathy, humility and local/global relevance which in turn enables a more active participation in nation building.

Design thinking is becoming a new medium for identifying gaps in old ways of problem solving and filling those gaps with innovative solutions. This shift from designers as creators, who design for people, to designers as co-creators, collaborators and perhaps facilitators, who design with people is defining designer’s role in the future.

**A New Design Initiative In India - Vision First**

The Indian design community is excited — the Indian government has committed to the setting up of four new Institutions for Design Education (NIDs) in the country. This is a significant step towards using design as a leverage to enhance the country’s ability to innovate, and in using design as a force for enhancing the quality of life in the country (Vision First, 2011). Vision First is an initiative to create a perspective on creating design competencies in India. The idea is to tap the collective wisdom of the vibrant design community and other stakeholders of design in India and co-create a vision for further actions and taking design to those areas where it has never been before.

*In India, on one hand, we are privileged to have a large rural base of people with agricultural and artisanal skills and a huge diversity of knowledge, tools materials and experiences. In the march towards a mostly Western, industrialized model of development much of this indigenous knowledge resource is being lost. Design skills could be used to trigger new imagination, propose daring new scenarios, which build on what people know and empower them to become partners in shaping their destinies. On the other hand, Indian industry and services are maturing rapidly. Indian corporations are becoming multinational. To remain competitive in the global marketplace, industry must respond to new sets of challenges from users who are seeking more than usefulness and usability. They are looking for emotional connectedness, commitment to green values, transparency, fair use of labor and so on. (Vision First, 2011, emphasized as per original)*

Design discipline in India has been attempting to address the conflict between the need to rapidly modernize, need to promote economic development to tackle poverty and the need to minimize the effects of economic developments on traditional culture. Caught in this conflict, design schools in India have been walking a tightrope, balancing between international design approaches and those rooted in local issues and tradition of India.
Globalization has exacerbated this conflict, forcing us to question the validity of the tightrope walk, particularly in design education (Athavankar, 2005)

Sam Pitroda, Advisor to India’s Prime Minister on Information, Infrastructure and Innovation, shared his thoughts at a meeting with Vision First. The biggest need for design, Pitroda emphasized, is in the government. He claimed that he has repeatedly said, “With a 19th century mindset and 20th century processes, we are trying to meet the needs of the 21st century. We need to redesign processes, redesign tools, technologies, if we are going to be really globally competitive and create the kind of job that we need to create for 550 million young below age of 25. We have no options but to innovate into things differently. But how do we get people to think differently?” According to him this is only possible through new mindsets, new thinking and a new way of looking at things.

**Need For Change in Design**

Contemporary design, as an activity, profession and outcome, appears ill equipped to deal with issues of pressing importance. New demands are being made of design, as societies and cultures confront a globalized political, corporate and environmental agenda, encompassing global warming, pollution, scarcity of water and energy resources, poverty, social malaise and health scares. Designers, and others who call their efforts ‘design’, need to reexamine their role in this 21st century. Design is now also required to deliver more sustainable patterns of production, consumption and systems, which would improve quality of life for humans and co-existent life forms (Fuad-Luke, 2005).

Richard Buchanan (2001) claims that system thinking is nothing new. What has changed is our perception of a system in today’s scenario. Where the focus was once on material (things) systems, it is now increasingly on human systems, the integration of information, physical artefacts, and interactions in environments of living, working, playing, and learning (Buchanan, 2001).

Shifts in society, technology, and our environment are changing the world in ways that are difficult to anticipate. The resulting challenges are complex, ambiguous, and interrelated. Complex systems are shaped by those who use them, and in the current era of collaborative innovation, designers are having to evolve from being the individual authors of objects, or buildings, to facilitators of change. These types of challenges are best addressed through a collaborative interdisciplinary approach; an approach that depends as much on disciplinary knowledge (what) as on process knowledge (how) (Kooi, 2010).

In his special address at the 10th CII-NID India Design Summit 2010, ‘Design Democracy - Design for Billion Customers’, managing director, Fabindia, William Bissel, said that India had missed the first real design revolution. “Almost all of what we see in India was born of the scarcity of thinking of the 1950s, 1960s and 1970s. Indian planners believed that there was a scarcity, everything was in short supply and there was no reason for design. It killed India’s great aesthetic tradition.” Design today has evolved into a strategic tool for structured innovation. At the macro-level, there is a strong positive correlation between the use of design and national competitiveness. But with the economy’s liberalization and the presence of a billion young consumers, design will have to redefine itself.

During the same Summit, Prof Nadkarni, stressed that change can be initiated only when there is a change in education. He urged everyone involved in design education to promote this change.
Design Education Must Change

Today designers work on problems involving complex social, political and economic issues. We still need classically trained industrial designers: the need for styling, for forms, for the intelligent use of materials will never go away. However, service design, interaction design, and experience design are not about the design of physical objects: they require minimal skills in drawing, knowledge of materials, or manufacturing. In their place, they require knowledge of the social sciences, of story construction, of back-stage operations, and of interaction.

Today’s design problems are too complex to be addressed by a single discipline, as they exist at the scale of systems and communities. The prevailing strategies of design education belong to another time and may leave graduates unprepared to address the interdisciplinary demands of complex, systems-level problems. Further, the approaches to developing student understanding in fields other than design are still those of general education, in which non-design courses parallel the core curriculum but are never truly integrated by design faculty in the work of studios. (AIGA Educators Conference, 2010)

A multidisciplinary approach broadens the ‘objective’ of design and rising complexity of contexts requires new multidisciplinary knowledge. A new form of design education is needed; one with more rigor; one which is more scientific; with updated technology; and which pays greater attention to the social and behavioral sciences and to business. In order to do so, one will have to move away from the existing courses of those disciplines and establish new ones that are appropriate to the unique contextual requirements of design but with continuous nurturing of aesthetics, which is a critical and important component of design (Norman, 2010).

India, in this context, has a unique opportunity, to innovate a new kind of design education at the exact moment when four new NID campuses have been announced.

John Thakara (2011) elaborates, “India is not alone in needing to innovate new educational models. On every continent, outside its Big Tent – on the edge of the clearing – exotic new species of design and business education are emerging. These new schools and courses have names like Yestermorow School, Deep Springs College, Kaos Pilots, School of Everything, Social Edge, Deep Democracy, Centre for Alternative Technology, Schumacher College, Living Routes, Gaia U, Crystal Waters, Horses Mouth, WOOF, The Art of Hosting. These ‘outliers’ (not mainstream universities) are where the real innovation is happening - in terms of content, form and business model. Few designers, few policymakers, and few entrepreneurs, have even heard of these places. But they are significant, for me, because they meet the requirements of these new times. They can be the competition – or the collaborators – for design education in India and beyond.”

The emerging discipline of Service Design and Social Design in particular needs a lot of support from better design education and industry expertise. In today’s world, the emphasis is on interaction, experience, and service, where designers work on organizational structure and services as much as on physical products, we need a new breed of designers. This new breed must know about science and technology, about people and society, about appropriate methods of validation of concepts and proposals. They must incorporate knowledge of political issues and business methods, operations, and marketing. Design education has to move away from schools of art and architecture and move into the schools of science and engineering. We need new kinds of designers, people who can work across disciplines, who understand human beings, business, and technology and the appropriate means of validating claims. (Norman, 2010 emphasis as per original)
However, Norman also warns against losing the wonderful, delightful components of design. The artistic side of design is critical: to provide objects, interactions and services that delight as well as inform. Designers need to know more about science and engineering, but without becoming scientists or engineers. According to Norman it is time for a change and believes the design community, must lead this change.

Ezio Manzini (2011), points out that design schools are where the next generation of design experts are educated. Fundamental education plays a pivotal role in building a better future by preparing better designers. Design schools should also play an additional role—that of agents of sustainable change. Manzini goes on to explain, “It is important to note that this second role (agents of change), largely reinforces the first one (to educate future generations of designers): as the world continues to undergo fundamental changes, the most effective way to prepare future (competent) designers is to involve students in problems, opportunities and design methods that today appear radically new and as yet involve only a small number of active minorities.”

**Issue Based Learning In Design Education Today**

The research began with a search for issues of concern in the current Design Foundation curriculum. As the research proceeds, there is a possibility of a pattern emerging from the data collected. This phenomenon occurs in a complex arena with many influences such as culture, history, attitude, values, roles, physical space, interaction between and among learners and learnees, etc. Too many factors and aspects are involved in this activity—that it seems hard to quantify and isolate, since these factors are qualitative and complex. Most of the empirical material gathered would be qualitative and inter-subjective.

Primary data was collected through in-depth interviews and focus group discussions (during conferences, seminars and panel discussions) with design educators, professional designers who interact with design students as mentors or who share a common concern for design education. Data was also collected through secondary sources such as published books, papers, and reports and unpublished work like blogs and emails.

Some empirical material was gathered through experimental models conducted with students over a certain time period. This consisted of observations, documentation and reflections made in the teaching of a new innovative course or module. It included qualitative feedback from the students about different tools, models and methods that were used in the course.

A phenomenological approach was adapted with the aim that the empirical material collected will offer indications and suggestions as a basis for discussion and reflection. This may not necessarily lead to ‘hard’ proofs but could be considered as ‘indicators’ or ‘directors’.
Issues of Concern in Design Education Today

- Learning To Learn
- Opening Minds Without Fear To Make Mistakes
- Seeing Mistakes As An Important Learning Process
- Developing An Attitude
- Mind (Un)Set First; Skill Set Second
- Participatory Mindset
- Multi-Tiered Methods Of Learning; Collaborative Learning
- Wide Spectrum Of Disciplines; Multi/Cross/Trans/Inter Disciplinary
- Nurture Young Responsible Designers
- Spirit Of Exploration And Experimentation
- Conviviality
- Personal & Social Values
- Ethical Awareness
- Evolution Of Design With The Progress Of Technology
- Importance Of Environmental Studies And Rural School Experience
- Learning To Work In A Diverse Environments
- Learning To Co-Create
- Design Thinking
- Thinking With The Hands
- Basic Skills (Micro To Macro - Personal To Professional)
- Permeation Of Design Into Other Professions
- Process Of Inquiry; Multiple Inquiry Systems
- Cultural and Historical Consciousness
- Multilingual And Multicultural
- Sustainability
- Social Awareness And Responsibility
- Environmental Awareness And Responsibility
- Infrastructural Awareness
- Epistemic Of Science And Technique
- Bottom-Up Approach
- Urban Vs Rural & Global Vs Local
Collaborative Learning In Design Education Today

Designers (i.e. the experts who have been specifically trained in design thinking and design knowledge) need to face systemic changes that are driven by a growing number of actors. These actors together can generate wide and flexible networks that can be collaboratively conceived, developed and generate sustainable solutions. The paradigm shift in design today changes the position and role of professional designers. Traditionally, designers have been seen and have seen themselves as the only creative members of interdisciplinary design processes. In the emerging scenario this distinction blurs, and they become professional designers among many non-professional ones. However, this does not mean that the role of design experts is becoming less important. On the contrary, in this new context, design experts have the crucial function of bringing very specific design competence to these co-designing processes. That is, they become process facilitators who use specific design skills to enable the other actors to be good designers themselves. (Manzini, 2011:11, emphasis as per original)

Thus design schools can play a significant role in the emerging scenario and, generate new models and ideas in education to map the paradigm shift. Today's design problems exist at the level of systems and communities, and are too big and too complex for any single discipline to address. Collaborators need to be from fields as diverse as anthropology, cognitive psychology, computer science, business, and social policy. Current strategies of design education need to evolve to prepare students to address the interdisciplinary demands of complex, system-level problems.

Conclusion

Designers should be one of the most holistic groups of professionals, given their practice-based multidisciplinary education; an education that includes science, technology, humanities and arts. As responsible citizens, they can design products/artefacts/objects that are unique yet reflect the concerns of sustainability. Thus, the paradigm shift from ‘Form Based’ to ‘Issue Based’ needs to be embedded in design education - especially in Design Foundation.

India as an emerging market has grown rapidly, thus giving rise to both aspirations and anxieties about the potential socio-economic and environmental repercussions. This has thrown up new opportunities for designers, entrepreneurs, activists, policymakers, investors, and so on. Design could focus on developing dynamic and flexible innovation systems, through which all actors collaborate to create and develop, options which encourage sustainable lifestyles and inclusive prosperity.

The research attempts to establish that there has been a paradigm shift in design. Given this shift, it stresses the need for a concurrent and corresponding shift in the design pedagogy most critically at the design foundation.

Some questions that need to be addressed are:

1. What is multidisciplinary practice and how is it different from conventional design practice?

2. How should a transformed pedagogy of design education be mapped onto the changing practice?
3. What skill sets should students learn in a new collaborative learning scenario and which aspects of the traditional pedagogy need to be preserved?

4. How should students be prepared effective teamwork develop a participatory mindset?

5. Should research in design include research in areas other than design, but related to it?

6. What pedagogical system in design foundation would help train designers to provide more than visualization services to a decision-making team?

7. Is it possible to provide a space within design foundation to promote caring of nature and other life forms and to lead sensitive lifestyles?
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3. What skill sets should students learn in a new collaborative learning scenario and which aspects of the traditional pedagogy need to be preserved?

4. How should students be prepared effective teamwork develop a participatory mindset?

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6. What pedagogical system in design foundation would help train designers to provide more than visualization services to a decision-making team?

7. Is it possible to provide a space within design foundation to promote caring of nature and other life forms and to lead sensitive lifestyles?

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The 10th CII - NID Conference Designing for a Billion Customers, New Delhi, Dec 2010
UNBOX: A Festival of Actions at Intersections, New Delhi, 2011

The 11th CII-NID Design Summit, New Delhi, Dec 2011

Interaction Session Of Design Professionals, Educators, and other Professionals From The Fashion Industry with The Minister Of Industry, Commerce & Textile, Shri Anand Sharma, New Delhi, Dec 2011

IIInd WE ASC World Education Culture Congress, Organized by Shruti Foundation, In collaboration with Indian Council for Cultural Relations, Congress Theme “Education Culture” for Organic Progress, Special Focus: Natural Knowledge and New Experiment, New Delhi, Jan 2012

Samvaad II, A Conference on Education; Co-hosted by The Heritage school, Gurgaon, Sidh, Mussoorie & Mount Madonna School, U.S.A., Feb 2012

Design Education: What you wish was taught in a Design School. An inspiration for design teachers and design learners, Organized by British Council, New Delhi, Feb 2012

Global Service Jam, A Premier Design Thinking Event, Organized by ThoughtWorks Technologies, Gurgaon, Feb 2012

Global Service Jam (or GSJ) is a premier design thinking event wherein friends, colleagues & complete strangers are given 48 hours & a common theme to research, design & prototype concepts for brand new services. Services could be Online (Mobile apps, Websites) or offline (in Education domain, Airline domain, Car sharing, etc).

**Focus Group Discussions**

International Conference “LOOK Back-LOOK Forward”, Kolkata

CII - NID Conference Designing for a Billion Customers, New Delhi,

Curriculum Review Meet: Review and Ratification of academic curriculum at the National Institute of Fashion Technology, New Delhi

Discussion on curriculum development as part of the continuous process of evolving pedagogy Indian Institute for Craft Design Faculty, Jaipur.

Discussion on curriculum development as part of their discipline expansion programme with the faculty at Arch Academy of Design, Jaipur.

Discussion with Mr Sam Pitroda and 17 representative designers ‘Vision First’ regarding setting up of 4 new NIDs, New Delhi

Association of Designers in India (ADI), First meeting Delhi Chapter, New Delhi

Meeting On Starting New Design & Innovation Centres with Sam Pitroda, New Delhi

A group of designers and educators representing design community in India on February 1st, 2012 for a brainstorming session at India’s Planning Commission at the invitation of the advisor to the Prime Minister on Innovation. The team has been invited to participate in an ambitious plan to expand the design education infrastructure for India.
Co-creating with Companies: A design led process of learning

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Abstract
Design emerged and spread at the beginning of the industrial era in a strongly industrial and product-oriented environment. Therefore it developed and consolidated around the notion of industrial product. Today, different voices are calling for a new role for design as a driver of innovation. Especially the notion of co-design, intended as the process of involving customers and end users in developing new products and services has been largely discussed as a source of competitive advantage and as a key element of innovation for companies. Co-design can help companies in generating new and alternative solutions that can satisfy the market needs mainly exploiting approaches and tools that allow customers to express their creativity. On the contrary scarce attention has been spent on the phenomenon of “co-designing with companies”, as a participated design process that takes place between professional designers and people working in companies. This form of co-design shows different characteristics with respect to co-designing with end users. It emerges as a complex process that: (i) aims to apply design methods and competences to investigate the current problems that impair a company to innovate; (ii) considers co-designers as experts, who bring into the innovation process their expertise, along with the company’s culture, values, rules, processes, technologies (which may at the same time impair or enable innovation); (iii) is a learning process, during which co-designers can observe and make practice with the way in which designers investigate the space of a problem and develop visions of the future that can support innovation; (iii) normally ends with ideas for artifacts and services, but also with intangibles results, such as new business models, new processes and rules, new competences, new organizational structures, which may affect the company’s vision, strategy, culture, leadership and processes of development, pushing the company towards transformational changes.

Keywords: co-design, design processes, organizational change
Introduction

Co-design is an approach to design research and practice rooted in the tradition of User-Centered Design (Norman, 1995) and Participatory Design (Ehn, 1988), which involves users and other stakeholders in the design process. Applied in the development of innovation for companies, co-design often takes the name of ‘co-creation’, and deals with how organizations can co-create effectively involving consumers in generating new ideas and products.

Many companies are developing strategies to create and manage modes of continuous user-driven innovation and to make profit from them, mainly through co-design platforms and collaboration with lead users. Co-creation can be beneficial to companies because active collaboration with potential users often leads to capturing consumers’ latent needs, and to develop innovative ideas (Chesbrough and Appleyard, 2007; Christensen and Raynor, 2003; Cautela, Rizzo, Zurlo, 2009).

Here design competences are applied to facilitate the involvement of users and to design and exploit participatory tools and techniques to support companies in designing with their customers (Brown, 2009).

A consistent series of contributions in design research has largely experimented with the co-design methods and techniques to engage users in the design of products, services, experiences, and the correspondent design strategies (Brant and Mattelmaki, 2009; Ehn, 2008; Sanders and Stappers, 2008). Also literature from managerial science has treated the issue, mainly under the umbrella of open innovation, analyzing the characteristics of markets, companies, communities, products, services and experiences that feed this phenomenon (Chesbrough, 2003). More recently, design research investigated how design practice could assist the management of organizations, and under the concept of “design thinking” was suggested the use of certain aspects of the design competences in management. This approach, claimed in the field of design (Brown, 2009) as well as in the field of design management (Martin, 2009), is seen as a fresh approach in order to solve problems that companies face in developing innovation by focusing on people and their needs and desires in a co-design trajectory.

However, the practice of co-creation is based on the belief that anyone can be creative and contribute to the generation of ideas (Sanders and Stappers, 2008), and its application in productive contexts has mainly resulted in the commitment of the top management of organizations in using external designers as consultants to apply co-design processes and techniques to envision innovative solutions for customers and with customers, that companies should subsequently exploit to innovate in the market.

Assuming this point of view, co-design approach results in a form of externalization of the process of innovation to an external design team composed by design experts and customers that never affects the company internal processes.

But the good development of new products, even in cooperation with users, is not always sufficient to guarantee their realization and success. A large number of issues were identified that strongly affect innovation in organizations, such as cross divisional work, cross disciplinary work, resistances to changes and to overcome dogmas, need of new competences, inefficiency of production and business processes (Sange, 1990; Hamel and Prahalad, 2000).

This paper discusses two cases of co-design processes in companies involving professional external designers, people from the company’s management and employees
coming from different divisions/areas, bringing specific knowledge about the company and its market. Common characteristics to both cases are that the companies:

- are product developers;
- wish to innovate adopting design knowledge;
- have in-house competencies for the development of products.

The analysis of cases has focused on the results of the process of co-design between external designers and people working in companies. The analysis pointed out two classes of artifacts: a set of new ideas and solutions for products and services that the company will be able to offer to the market; a set of intangibles results, linked to a transfer of competences coming from the design approach, as the capability to analyze and frame problems by adopting new processes, new competences, new rules and procedures, which in turn can affect the entire company’s culture.

Co-creating with companies as a learning process: evidences from two case studies

Literature on managerial sciences (Cheesbrough, 2003; Verganti, 2009) as well as from design research (Deserti, 2009; Deserti and Rizzo, 2011) pointed out how innovation does not hold value in itself (or only for end users), but must be rooted within the need of a company (or a market) to develop changes, exploiting valuable opportunities and building new specific business models.

Meanwhile, literature from organizational sciences underlined how innovation is very hard to be achieved, or even detected, for organizations with a strongly established culture. Employees have deep-rooted beliefs on what the value proposition of their company is and on how to sustain it, and it can be difficult to enroll them in new visions, drawing the attention of the company on new ideas (Schön, 1983; Polyanyi, 1998). Within this frame, the problem of modeling and transferring processes to support companies in innovation was discussed as linked to the activation of creativity as a basic attitude for the envisioning of the change. The strong role recognized to creativity in traditionally “non-creative” activities let to look at the design culture and practice as a source of process models and as a mindset, which could be more effectively applied combining the renewal of the offering with the development of new correspondent business models (Bucolo, 2011).

The work of Schön (1983) and Polyanyi (1998) indicates that design can be a creative approach to learning that can help people in companies to:

- overcome their organizational and cultural dogmas and beliefs;
- see the big picture, discovering new customers’ insights and latent needs;
- visualize alternative value propositions and business models.

Central to this approach is the ability of the designer to interpret complex contexts to build and visualize multiple futures, which are then deconstructed to reveal needs, constraints and opportunities (Madhavan and Grover, 1998).

In this paper we present 2 different experiences of co-design processes in companies, with the purpose of investigating this peculiar form of co-design, connecting it to a process of learning that takes place inside an organization, or else that turns into an organizational change.

Cases have been selected applying the following criteria:
representing examples of application of design tools and methodologies for co-design in real industrial contexts;

- aiming to envision changes and to develop innovation overcoming organizations' dogmas;

- aiming to achieve these results activating high levels of employees' participation.

We will use the cases afterward described to derive some evidences, supporting us to argue that when co-design takes place between a group of people working in a company and external design experts, its effects can be classified in two classes of artifacts: a set of new ideas and solutions for products and services that the company will be able to offer to the market; a set of intangibles results, linked to a transfer of competences coming from the design approach, such as new ways to analyze and frame problems by adopting new processes, new competences, new rules and procedure, which in turn can affect the entire company's culture.

**Business model innovation through a design-based process: the case of an Italian manufacturing company**

**The context**

The experience of a machinery manufacturer in Italy offered the opportunity to test a set of tools for business model design and innovation and verify the quality of the output. In recent years the company faced a consistent decline in sales of machinery due to global competition and market conditions. The company was forced to re-think its strategy and business model. The fundamental challenge was the one of developing a consistent line of business shifting from products to services. One of the most critical aspects in designing this change was in the strong manufacturing culture of the company, and the fundamentally technical and mechanical background of most of the employees. These aspects made it very difficult for the company to "see" a different future and a different way to make its profit.

The solution that the company decided to choose to overcome these difficulties was based on the massive involvement of a large part of the employees (150 people) in a series of ten innovation workshops, planned and facilitated by designers, aimed at designing possible business models for new services (Pini, 2011).

**The project phases**

The project was structured in three phases that involved different subjects within the organization and generated different results.

The first phase was the definition of the overall goal of the innovation process, and the expected impact of the ideas generated on the whole performance of the company. Together with the top management, designers proceeded to establish the innovation agenda for the company by: i) identifying the lines of business development depending on the available resources and the overall corporate strategy for the years to come; ii) selecting an area of development that could be addressed through innovation workshops; iii) establishing a goal for the innovation teams that might be at the same time challenging and yet accessible. In this case, top managers decided to attribute to the different teams the same goal: i.e. to increase revenues by 10% in the next three years through the introduction of new services, without affecting the current product lines.

The second phase was focused on configuring and managing innovation workshops. These workshops were managed through the support of facilitators familiar with the co-
design approach, and were structured around two phases: (i) Overcoming organizational dogmas and envisioning the future; (ii) Designing a possible business model for the service offering.

The third phase was devoted to analyze results obtained during each workshop and to generate, starting from data, clusters of ideas that could be supported by common business models.

**Workshops aims, structure and tools**

It was agreed with the company management to involve a large portion of the employees (150 individuals) in the innovation process with the following aims: i) offer a signal of radical change in the current company’s culture, centered on product and functional fragmentation; ii) work with teams composed of people coming from all the functional areas of the company to acquire different and sometimes conflicting points of view, cross-fertilizing the participants.

Each workshop was structured in 4 modules lasting 2-4 hours, and generated a specific output that was functional to the success of the following activities.

*Overcoming organizational dogma.* This was the first module for the participants, placed right after a short introduction on the workshop goals and agenda, and a definition of services and business models. In this stage, participants were asked to define a set of beliefs on the company and the market that they perceived as possible dogmas, limiting their ability to innovate, and then to report them on post-its, sticking them randomly on a wall.

*Scenario building and knowledge generation.* Following the disclosure of the dogmas, participants were asked to depict a possible market scenario, representing through the use of characters the major changes that would take place in the different macro environmental categories (political, economic, social, technological, etc.) in the near future, as well as in the internal environment of their company.

*Insights identification.* On the base of the different stories presented, participants defined the insights related to the main concerns and interests of the characters previously depicted.

*Service idea generation.* Using the Empathy map as a starting point, participants generated ideas of possible services that might help their customers in satisfying their emerging needs, avoiding threats depicted in the scenario. In this phase of the workshop, people found useful to return to the dogma wall to subvert dogmas as a trigger for more creative thinking.

*Business model design.* On the set of ideas selected, participants were asked to draw the possible business model to support their service and turn it into a business system capable of generating the expected increase in revenues.

Scenario building and storytelling techniques were adopted to generate insights related to the needs and expectations of customers, overcoming dogmas limiting the ability to see customers and their needs under a different perspective; business model definition techniques, based on the model proposed by Oserwalder and Pigneur (2009), were adopted to define coherent value-chain solutions.
Results

As a whole the project produced 30 different business model prototypes related to services, capable to sustain the expected increases in sales given by top managers as an overall goal for the project. Business model canvases, collected and clustered in families, were presented to the top management for further implementation. Business models dealt with the creation of new services for different customer segments: i) large global companies; ii) small companies and industrial districts; iii) retailers and distributors. The different clusters of business models were created grouping together services that presented similar concepts, served a similar segment of customers or displayed some similarities in the value proposition and revenue models. The most promising areas of innovation were related to small companies and retail. The cluster of services for small companies is focused on the idea of “mobile open workshops”, allowing craftsmen and small producers to access machineries and assistance without buying machineries that could be used only randomly for a specific production or a small lot. The company would provide technical assistance, machinery setup and run an online reservation system, where customers could ask for consulting on the specific set of machineries needed to perform a specific task. The revenue stream is guaranteed through a pay-per-use billing model.

Maps of the organization dogmas. People were forced to see together and cluster dogmas. For example there might be managerial dogmas ("we have no time to plan long-term activities"; "new ideas cost a lot of money", etc.); market dogmas ("our customers are very traditional and do not like new ideas"; “there is no future in serving small businesses”, etc.); competitive dogmas ("we have to follow the market leaders"; “we cannot compete on costs”; etc.) or organizational ones ("careers are made in functional areas"; “it is difficult to integrate people coming from different sectors in our company"). The elicitation of dogmas allowed participants to discuss about them and develop a more open-minded approach to the observation and the perception of external threats and opportunities. Particular attention was given to the discussion of market and customer dogmas, since participants tended to follow the beaten path on this subject, representing their customers in a traditional and oversimplified way, and displaying resistance to consider the elements of value that customers might like to receive apart from the product.

Scenarios for the next three years. Scenarios for the final markets aimed to define the major internal and external challenges to be faced in the near future. The clustering of scenarios served as a base to create stories with a dominant theme, in which customers are the main characters, adopting storytelling techniques as the backbone of the activity. Some groups depicted scenarios dominated by the issue of the scarcity of resources and the need to increase the rate of savings in transformation processes, due to increase in all company's costs; others focused on environmental issues, de-localization of small companies or digitalization of retail and distribution.

Insights were related to the main concern and interests of the characters previously depicted. The tool that was adopted to produce insights is the empathy map of Xplane (Fig.1) (Osterwalder and Pigneur, 2010).
This map, based on a short emphatical description of the customer (what he sees, feels, hears, thinks, and which are the main activities he/she undertakes), forced participants to act and think like the customer they described. Starting from these descriptions, participants were able to identify the pains and the gains that their customers wanted to avoid and achieve. As a result of this process, participants could identify latent needs and wants of their potential customers, overcoming their product-based corporate culture, and developing a clearer vision of their effective necessities, which did not appear linked to the usage of machineries, but to the future of their companies, the digitalization of marketplaces, the environmental concerns and the lack of skilled manpower.

The service ideas. Service idea for small companies were generated on the insight that most of the craftsmen are focused on daily activities, feel a strong uncertainty about the future, and are not willing to invest in new machineries or develop new skills. The set of service ideas aimed at helping customers in creating new value for their company, and were focused on developing a more positive stance towards innovation and production flexibility.

Service ideas for retailers were based on the dominant idea of reducing the need of stock and inventory through the digitalization of the outlet and many customer relationship processes. The service offered should be based on an open platform, where dealers and retailers could configure their virtual shop and optimize customer services and spare parts assistance. The service designed would work not only for the products of the company, but as a sort of digital wholesaler or e-commerce platform, thus allowing to manage all products and suppliers. The revenue model is linked to the site consultation, and is based on a service fee plus extra price for custom-fit services.

In general terms, the results of the project were satisfactory, providing not only a set of new ideas but also different business models, allowing the choice of different assets needed, key processes, cost structures, channels of distribution and relationship, and revenue models. The future challenge is to reward the work of all the people that took part to these initiatives in order to create a positive environment for future innovation activities. From an organizational culture perspective, the workshops helped the participants to gain a wider vision of the different roles and functions within the company,
and to overcome some deep-rooted dogmas strongly limiting their ability to see alternative futures for the company.

**Innovating a company’s culture through the development of a new brand and product-service system**

Brinna is a new Brazilian home furniture brand, part of MD Móveis Group, located in Rio Grande do Sul. At the time when the project started (November 2005), the company was producing unbranded products, positioned in the mid-low segment of the market, and was developing the awareness that this segment would be in a nearby future completely controlled by the organized distribution, which was already leaving very small margins to producers, making them compete just on price.

The company asked our research group to guide a cultural transformation, shifting from the capability to operate in a traditional industrial environment to the capability of interpreting a post-industrial context.

**Project structure**

The request from the company was turned into a long-term cooperation project (5 years), with an intensive first phase (2 years) structured in sequential and concurrent steps.

The first step consisted in the construction of a long-term strategy, based on the development of a portfolio of brands with different competitive aims and positionings. These competitive positionings stretch from the mid-low to the high-end segments of the market, and on the introduction of design knowledge and competences inside the company.

The second step of the project consisted in the development of a R&D department, characterized by an advanced model of interaction between functional areas, which were put in the same space to make them exchange knowledge and ideas, and work together from the early stages of the development of the new products.

The third step consisted in the development of the first new brand, in terms of opportunities, positioning, values, expected characteristics of products, and the definition of its visual identity.

The fourth step consisted in a wide research, meant as a tool to nurture the development of new products.
The fifth step consisted in the development of the initial product portfolio, which was structured through a workshop involving young designers: the basic idea was that our institution should not get in competition with professionals, but integrate their work offering them opportunities. The subsequent steps, not described here, were finalized to the transformation of conceptual ideas in solutions, and the establishment of a production and retail system.

**Workshop aims, structure and tools**

The workshop involved 25 young designers, supported by 4 experts with a wide experience in the sector. The conduction of the workshop was highly structured, and did not start with a simple brief, but with the presentation of a preliminary research, conducted in 6 months, synthesized in 3 dossiers delivered to all the participants:

- company and market research, whose main aim was to define the technological and market framework (capabilities of the company, competitors, peculiar characteristics of market etc.);
- blue-sky research, whose main aim was to provide a set of innovation pathways and inspirational references, in form of scenarios and moodboards;
- brand-identity research, whose main aim was to provide guidelines on the new brand, which was still not existing.

The design brief was thus a synthesis of the dossiers, defining specific requests to designers in terms of expected products. The goal of the workshop was to develop conceptual solutions of new products, starting from the system of constraints and opportunities described in the dossiers.

The workshop was conducted in a 2 months period, during which designers were structured in teams, free to organize their time except for 6 reviews with experts, giving technical support on the development of products. Reviews were organized as seminars, so that each team could interact with the other teams and with the experts, exchanging ideas and stimulating both a cooperative and a competitive attitude.

**Results**

The result was the development of nearly 100 ideas for new products, in the form of conceptual designs, ranging from simple freestanding objects to more complex systems and families of objects.

Most of the products presented innovative characteristics, more on the form and use sides rather than on the technological one, since one of the assumptions was to use traditional technologies that the company already possessed or could easily acquire.
The final presentation involved the owners of the company, however, was not intended as a gate in a linear process. The application of a typical funnel model, such as Cooper’s stage-gate, was refused in the early steps of the project, considering that it would create a contradiction between efficiency and capability of sustaining creativity and innovation.

Figure 4. One of the final products

The selection of the concepts passed through a prototyping phase, conducted in the following months by the company with the help of designers and prototypists, representing the first nucleus of the R&D department. The prototyping phase gave a better understanding of what could be immediately produced, and what would need revisions or improvement of production capabilities.

Almost no solution was discarded, since the general idea was that all the innovative conceptual solutions could be useful, and that the problem was not just to select the ones that would have gone on to the further step of development, but to build a “shelf innovation” approach, preserving solutions that could be adopted in the future.

Lesson learnt

Cases reported in this paper are examples of application of co-design in new contexts. They report experiences of use of design skills to help companies in facing the problem of innovation, applying co-design to involve the different internal expertises. The aim of these kinds of processes is to force out-of-the-box thinking in situations where the deep knowledge and the familiarity with the solutions inhibit innovation. Here designers are triggers of new visions, even when the design intervention is limited to the ideation of new products (second case), forcing the company’s employees to learn how to think in a systemic way.

In fact, analyzing and comparing cases in detail we found that:

Even if their initial aim was to design a new product or service for the company, both cases ended with the conception of innovative business models, based on a dynamic and systematic change at different levels of the organization;

Co-design was conceived as an experience/learning process with a twofold aim: (i) forcing employees to encompass their limits in envisioning innovation, and (ii) educating them to the potentiality of the design approach. To support the first goal we adopted a series of tools, that we call strategy tools, including scenarios for envisioning, trend books, promising cases, promising design trajectories. Strategy tools synthesize professional designers’ vision on the innovation trajectories that the company could implement. These tools represent challenges to employees’ ideas and suggestions on new possible directions, stimulating innovation. To support the second goal we used a series of tools, that we call co-design tools, including storyboards, probes, creative exercises, quick and dirty prototypes, sketching techniques, designed to allow employees to express their ideas and visualize them.
Co-design took place among designers and people from different companies’ divisions to facilitate learning and mutual collaboration among people from the companies. With the use of homogenous teams it would have been more difficult to overcome dogmas and cultural limitations, since the perceptions of all the participants would have been aligned on pre-built ideas influenced by their functional role.

Designers acted as triggers of new visions that led both companies to reflect on strategic changes. Designers helped figuring out new scenarios and trajectories, making them available as subjects of discussion in the co-design process.

Moreover, both cases represent a change in the way in which co-design has been intended and practiced until now. They have moved beyond the paradigm of envisioning innovation by designing with end users. Instead, they begun helping companies in exploiting internal resources, driving existing competences in re-defining solutions and approaches to the market.

The analysis of cases pushes us to reflect on two different issues: (i) where design skills were applied; (ii) which are the results of these experimentations.

About the application of the design skills and competences, we observed that companies are increasingly grappling with problems that are ambiguous in nature: neither the problem nor its direction or outcome is clear at the outset. As a consequence if designers were traditionally implied in productive contexts to respond to a given brief, in the analysed cases their involvement begins before the design brief is formulated (in the second case the preliminary dossiers were developed by a design-led team). The role played by design in the first case was much more that of facilitating a collaborative process among different company’s expertises. This meant enabling people to work together for mutual benefit, far from what might be traditionally described as a design approach. In fact, the results of the project are mainly represented by the creation of artefacts which helped to illustrate the identified opportunities (scenarios, business models, new positioning maps).

In the second case we observed that the adoption of a design-led approach in the development of new products brought the company to re-design the structure of its organisation: from the internal competences to the production processes; from the brand values and identity to the communication strategies and processes. The results of the process are linked with the diffusion of design culture within the company: new competences and a new internal design centre, new production processes, new partnerships with external suppliers, new distribution chains, new products.

Assuming this point of view, as previous studies already started investigating, organisation itself seems to become object of design (Buchanan, 2004), revealing the potential of design in leading the radical changes that companies should adopt to face the problem of innovation (Burn, Cottam, Vanstone, Winhall, 2006).

References


About
Design Research Society

Founded in 1966, the Design Research Society (DRS) is the multi-disciplinary learned society for the global design research community. Members and participants are drawn from diverse backgrounds and as well as running a biennial conference, DRS sponsors a wide range of events and publications, including the Design Research Quarterly. DRS essentially aims to advance the theory and practice of design through the production and dissemination of scholarship and other forms of knowledge.

DRS 2012: Bangkok is the first DRS biennale conference to be held in Asia. It is held at Chulalongkorn University in Bangkok on 1-4 July 2012. DRS: Bangkok 2012 opens to a variety of global perspectives on the theory, education and practice of design. Our informal theme is Re:Search: Uncertainty, Contradiction and Value which we hope will encourage a distinctly contemporary exploration of issues facing international design communities.

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