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MULTIFUNCTIONAL WOVEN ELECTRONIC TEXTILES BY DESIGN PRACTICE

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Keywords—Design, E-textiles, Weaving, Woven design

I. INTRODUCTION

This research is an experimental enquiry of electronic textiles (e-textiles) materials development through woven design practice. Integrating electronic properties into the construction of textiles using woven methods are applied to exploit textile design’s potential to make multifunctional soft circuits as one-piece structures on the loom.

E-textiles have extensive applications such as in wearable computing/technology, connected electronic products, responsive environments and other soft product platforms [1]; however, they are still a new evolving area of development. E-textiles are ultimately aiming to combine the two previous separate areas of electronics and textiles together, to enable viable functioning e-textile products that truly integrate electronics into and onto textiles [2].

Previous developments of e-textile have faced challenges to achieve the desired vision of a flexible, robust and fully functional material [3]. The majority of past works in e-textiles have taken a strong focus on a technical approach (i.e. function before form). This research adopts a design approach to constructing woven soft circuits. Using design methods with textile design expertise this research seeks to develop woven e-textiles from a creative perspective that may help to realize alternative approaches and novel outcomes.

The design process follows a creative route that attempts to draw equal emphasis on both the physical form and function; thus sees both as significant drivers in producing innovative e-textiles. Drafting concepts through sketching, prototyping and circuit testing are vital to the end designs that are translated into complex woven structures.

Through integrating electronic components via the weaving process with the use of conductive yarns, responsive and adaptive woven e-textiles are produced, whilst pushing the boundaries of traditional weaving methods. The intention of the research also extends to enhancing and advancing the progression of e-textiles by more considered design through woven structural manipulations that seek to utilise their full potential.

II. DESIGN METHODOLOGY

The weaving method forms the main making activity; however, this research is directed via a design process.

A. Weaving Process

Weaving is a form of constructed textiles where the process involves a warp (the vertical threads) and the interlacing of the weft (the horizontal threads). There are a vast number of established woven structures already used in woven textiles; each producing a different surface texture, aesthetic and tactile quality. Plain weave is one of the most basic structures, as illustrated in Figure 1.

The weaving processes in this research are woven by hand on a 24 shaft Arm Patronic dobby loom. Each warp draft is exclusively designed to allow the execution of the type of woven cloth required. The loom is set up by hand and weft yarns are selected depending upon the qualities needed. One method of manipulating the weaving process is to weave multilayer cloths simultaneously; when two layers are woven with this technique this is known as double cloth (Figure 2.). Using block draft threading plans and applying woven double cloth structures enables predetermined sections of the cloth to be controlled and interact between layers; making isolated (woven pockets or tubular configurations) or exposed areas. This method is heavily applied to much of the practical output to allow for improved integration of electronic components.

B. Design Process for E-textiles

For this research, the practical making of woven e-textiles follows a series of design process stages; from initial concept through to woven executions that are instigated and are crucial to the final outcomes. Inspirations for the form and function of the textiles are sought and used to translate through to the ideation process, that organize and formulate
a breakdown of ideas to take forward into sketching and making paper/fabric prototypes. The prototypes help to envisage the physical forms of the textiles and the complexities of the electronics integration that are then circuit tested. Woven structures are designed and planned to suitably fit each part of the e-textile that are executed via the weaving process. The end samples are tested and analysed, where the results are also used to inspire and reiterate for further sampling. The design process flow is illustrated in Figure 3. On instances where woven structures need to be visualised, the process may go back to prototyping stage, but then continue to follow through the process.

III. FINDINGS

The research has successfully created functional woven e-textile soft circuits. ‘Dual soft switches’ is a woven e-textiles sample where two sets of soft switches control two independent LEDs (Figure 4.). Woven manipulation techniques enabled the integration of electronic components during the weaving process, whilst simultaneously allowing imitation of electronic circuit behaviours (i.e. soft battery holder, soft switches, conductive tracks and connections). Dual soft switches was woven as a continuous piece of weaving using single and double cloth techniques, an extra warp and selective weft yarns that have effectively translated electronic circuitry into woven construction.

IV. CONCLUSION

Challenging existing weaving methods have produced a collection of e-textile soft circuits. Analysis of the current experimental e-textiles outputs direct future designs, as they are drivers to inform the next models. Each of the collections seeks to improve and challenge novel approaches and functions of woven e-textiles.

Using a design led process to make e-textiles have enabled addressing both the physical form and electronic behaviours equally. This approach supported a balanced relationship between the two disciplines and helped merge the languages of electronics and woven textile design. The creative led methods have inspired alternative solutions for integrating electronics into woven e-textiles.

Conclusive finding in this research using novel methods to weave e-textiles will be prepared to be published in journal papers.

V. FUTURE DIRECTIONS

Using the samples of multifunctional woven e-textiles, these will be used to develop into ‘modular e-textile units’. The e-textile modules will be employed as the design format as they will be used in different configurations to form a sequence of multiple modules. Specific components of the multifunctional e-textiles will be attributed to each of the modules. The e-textile modules are intended for exploring connection and engagement of self creation of e-textile artefacts in a system and to inspire e-textile applications. The modular design will provide adaptable and multifunctional e-textiles for a variety of end applications.

Future expansion of this research will continue to work through an experimental design-focused process, to develop more advanced woven e-textiles, different scales and with complex weave structures to progress them onto power and jacquard looms for potential commercial weaving. Investigating user engagement of modular e-textiles is also an area of future research scope.

REFERENCES

Keywords: human centred design, recommender system, privacy concerns, social network service, software agent

I. INTRODUCTION

Over one billion people are living in cyberspace at present. One difficulty of this situation is that cyberspace is getting more and more complex. Users retrieve an abundance of information from cyberspace, yet the consequential diversity and complexity of the information results in difficulties for people to productively identify what is most useful and relevant for them. This situation has become even worse within the context of the Web 2.0 because human information is much more volatile than the information available from traditional Websites. In the Web 2.0 environment, particularly in social network services, the profile of a person continuously changes whereas the information or description from a traditional Website remains quite static. The complexity issue is also associated with multiple identifications. Users must manage their friends, connections, contacts or networks separately for each service, a problematic phenomenon which is commonly referred to as the ‘walled garden’ issue.

In order to address the complexity issue, software agents such as buyer agents, user agents, monitoring-and-surveillance agents and data mining agents have been utilised for serving and supporting people, and for preventing people from being confused or overwhelmed, thus assisting with mediating activities. Particularly within the context of the social network service, a recommender system, one of the software agents, has played a decisive role in helping social network service users to find their friends, family members, or connections without great difficulty.

However, privacy issues in social network services have been constant issues since its inception. These issues have become more critical because of the software agents although they act on behalf of users. It might be possible to say that the software agent has obviously been a useful and effective tool considering the large quantities of extraordinarily complex information on the Internet. On the other hand, there are always inevitable and potential hazards that are particularly related to the privacy issues due to the monitoring-and-surveillance, data mining techniques and the autonomous nature of software agents. Moreover, the current recommender systems might be able to help users to rapidly expand their connections in the early stages of using a social network service, but users tend to have different motivation for using the services after expanding connections to a certain level.

The situation suggested above indicates that the users’ privacy concerns can be diverse if the users vary in motivation and usage patterns. Software agent designers or developers, however, tend to fail to notice users’ diverse and constantly changing motivation for social network service usage. In other words, the designers or developers are not aware of the differences of users’ privacy concerns. Consequently, it is possible to argue that the research on the difference of users’ privacy concerns could benefit the designers or developers in theoretical and strategic ways. This research, therefore, aims to develop a conceptual framework of users’ privacy concerns in social network services, and to propose each user type’s model of privacy concerns through the empirical method.

II. METHODOLOGY

There are four key phases of the research – discover, define, develop and deliver. The research described in this paper covers the define phase and a part of the develop phase. Figure 1 presents the overall methodology and process of the research.
analysis methods using NVivo software. In the second step of the define phase, the deductive content analysis method was employed to confirm the current situation within the context of social network services, thus the main problem was defined.

The inductive content analysis was conducted in the first step of the develop phase. As a result, prospective needs for recommender systems in social network services were identified based on the main issues and vision derived from the interviews. In the second step of the develop phase, a conceptual framework of users’ privacy concerns in social network services will be developed for a questionnaire survey.

In the deliver phase, the results of the questionnaire survey will be statistically analysed with a structural equation modelling technique to test the conceptual framework, then each user type’s model of privacy concerns will be proposed.

III. FINDINGS AND DISCUSSION

The aim of the interviews was to obtain an explicit understanding of software agents in social network services in practise from the viewpoints of the three main stakeholders.

During the deductive content analysis process, main categories were created under five main themes – relationships between stakeholders, examples of software agents, strategy/experience, main issues and vision. Main findings of the five themes are as follows:

1. Relationships between stakeholders: It was identified that business, government and consumer are three main stakeholders in the social network service sector. However, consumers are less aware of the government stakeholder.

2. Examples of software agents: All stakeholders are generally in accord with the opinions on the software agent examples in social network services – recommender system, personalised web feed and notifications.

3. Strategy/Experience: This theme describes whether the business and government strategy positively affected the user experience. As a result, there are three facets of strategy-experience association, (1) protecting personal information disclosure strategy and use of privacy settings experience, (2) quality user experience strategy and positive experience of recommender systems, software agents and targeted advertisements, and (3) users’ point of view strategy and personalised services experience.

4. Main issues: Privacy, lack of user type consideration, and networking and privacy dilemmas were the main issues that all stakeholders were concerned about. In regard to the differences between stakeholders, the business stakeholder is concerned about difference of opinions between stakeholders, excessive workload, lack of newness and localisation. On the other hand, the consumer stakeholder is concerned about overwhelming unwanted information, technical issues and government’s excessive restrictions.

5. Vision: All stakeholders agree that social network services will be more and more engrained in users’ daily lives. Moreover, the government stakeholder anticipates that users will be less anonymous, and mobile platforms will dominate over desktop or laptop PCs for online social networking.

In order to identify prospective needs for recommender systems in social network services, the inductive content analysis was conducted. As a result, all stakeholders agreed that rigorous privacy policy, innovative service model and user type consideration are required for the recommender system design. Besides, there were other opinions on the prospective needs such as empathy with human needs, cooperation with other stakeholders, quality user experience and appropriate user research (see figure 2).

IV. CONCLUSION/FUTURE PLAN

Based on the findings so far, it is possible to argue that further intensive research on the consumer stakeholder and on different user types’ privacy concerns is necessary. In the next stage, therefore, the research will focus on developing a conceptual framework of users’ privacy concerns in social network services, and to propose each user type’s model of privacy concerns through the empirical method.

![Figure 2. Prospective needs for recommender system design](image-url)
What are the Opportunities in Partnering Open Design with Citizen Science for Bespoke Monitoring within Hobby or Niche Communities

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Citizen science, Design toolkit, DIY, Digital manufacture, Open design

I. INTRODUCTION

This project is investigating how open design can extend citizen science’s reach by exploring new opportunities that previously were not possible until the advent of technologies such as the Internet and web 2.0, Direct Digital Manufacturing (DDM) and advanced sensing equipment. This paper reports on work-in-progress to enable citizens to address sustainable, economic and social challenges using bespoke processes, open design and manufacture on demand, involving industry partners.

The project will run design workshops that involve corporates and Non-Government Organizations (NGOs) benefiting from either creating bespoke monitoring equipment or working with users to gather data. The partnering of open design with citizen science can empower users to monitor their own environment by creating their own devices for either community use or scientific gain. The work could foster new user relationships that use HCI methodologies, approaches and areas for deployment.

Open design, in one vein enables collaborative efforts by providing incentives and methods for the freely sharing information [1]. This type of activity can be underpinned by a system that enables people to easily access or create design information to make personal artefacts. Direct Digital Manufacturing (DDM) refers to computer controlled fabrication tools, directed in their operation by Computer Aided Design (CAD) tools. These digital tools facilitate open design and help turn design information into artefacts. DDM is “lowering the entry point to manufacture” and can make objects to bespoke needs and requirements [2]. Designing and making things go hand in hand; open design can open processes that digital manufacture can optimize to turn concepts into tangible things.

An example of open design utilising digital fabrication is the Open Structures (OS) project. The research project explores the possibility of a modular construction model where everyone designs for everyone. The platform is based on a geometrical grid, ensuring parts created by different users complement each other [3]. The OS platform lets people copy and re-appropriate components for their own assembly or project which enables a community to develop around the system. Freely distributing design information coupled with accessible DDM technology allows a large number of people to engage with the manufacture of goods over a wide geographic area. In some cases DDM can “lower the entry costs to bespoke or custom designed objects” so users can shape products to their own needs and requirements [4].

Citizen science uses “non-professional volunteers to gather information and data from the environment around them” [5]. A discrete area of this discipline is community monitoring, using groups to monitor specific data. The approach of citizen science can either be:

1. Community consultancy model; community defines the problem and professionals complete the study.
2. Community workers model; professionals define the problem and the community gathers the data.
3. Community-based model; participatory research model, community defines problem, gathers data, analyzes and interprets the data [6].

Existing projects have included; aerial balloon monitoring kits, thermal photography, water sensing and spectrometers. With devices made from purchased kits or assembled using off the shelf components. These projects have led to different audiences engaging in the citizen science models previously explained.

Community monitoring can involve many stakeholders such as, interest groups, site specific communities, government and non-government organizations to gather data “to address increasingly complex and emerging environmental and sustainability issues” [7]. This project draws on research into the areas of open design, digital fabrication technologies and citizen science. It is the view of this project that through open design and DDM the technology for citizen science can be developed collectively, on-line, by a community and fabricated globally on demand. Digital manufacture allows new product ideas to be fabricated on demand; however these devices are “often stalled by the concepts and ideas that users create” [8].

II. DESIGN/METHODOLOGY/APPRAOCH

A. The project intends to

1. Develop a set of methodologies and a system for developing community monitoring tools.

The open design tools used in any monitoring endeavor are only relevant if the context they are used in makes sense. For this reason it is also an intention to develop a design toolkit that maps out the possible stakeholders, scenarios for environmental requirements, and types of information gathered. Open design can create opportunities suited to batch or niche production, in numbers that were previously too costly for mass manufacture. In turn this means citizen science can respond to niche areas with bespoke functionality, possibly opening opportunities in low funded or niche areas. This approach is being tested live, with a project the “Conversations with Bees” using open design.
2. A toolkit that aids the creation of project briefs and specifications for monitoring.
A toolkit aiding the creation of briefs builds on previous work, the “Conversations with Bees” project that used a community consultancy citizen science model. The project worked with local beekeepers after an ethnography study. The next step in the project is work on concepts that can be applied to a community worker citizen science model (professionals decide problem, people gather data). This area will be expanded upon with different NGO’s, to see possible patterns or opportunities.

3. Identify possible and credible stakeholders.
The project intends to work with groups, government agencies, (NGO’s) that could benefit from community monitoring, but have previously been unable to explore this avenue. The work needs to explore more organizations who could benefit from bespoke monitoring and its opportunities.

Sample projects from the toolkits findings would be produced using digital manufacture and deployed with relevant parties for testing. It will be designed so the needs and requirements of the user will be the primary concern, e.g., their attempts to distill concepts quickly leading to applications. The process should enable a more conceptual approach giving the participants a framework to work within.

4. Identify territories where this will work and understand possible pitfalls or opportunities
The intention is to explore new opportunities through the workshop processes with industry partners, relevant NGO’s and through public engagement exercises. Public workshops have already been explored; more industry partners need to be included in future work.

An analogue design process will be created that enables workshop stakeholders and participants to outline possible project briefs, applications and environments they want to monitor. Feedback from this targeted study will shape possible applications and try to encompass as many relevant disciplines and organisations as possible. The main focus of the studies will include:

1. Possible applications and opportunities that can be explored.
2. Public engagement and designing for and with amateurs.
3. Stakeholders in the community worker, citizen science model.
4. Broaden possible applications of citizen science and open design.
5. The concept of users selling or donating data they have gathered.

III. FINDINGS/RESULTS
The toolkit has been initially tested with water engineers, looking to include younger generations in rain monitoring, many more workshops are scheduled with different parties but currently this is a work in progress. The toolkit has already informed a product for monitoring the health of honey bees forming a reciprocal relationship between the beekeeper and the monitoring agency. The work still needs to include more groups that have bespoke requirements with low initial investment where digital manufacture can make an impact.

IV. CONCLUSION/DISCUSSION
The toolkit so far has highlighted how different parties need a framework to construct conceptual ideas and apply new technologies. The procedure could also present new opportunities for manufacturers to produce mass manufactured components that allow for greater bespoke applications.

V. FUTURE PLAN/DIRECTIONS
The toolkit needs to be tested with a wide variety of audiences to see patterns, themes and opportunities it can create. The process also needs to clearly define more situations where this type of activity is not appropriate.

REFERENCES
A PASTE DEPOSITION MODELLING (PDM) PROCESS IN THE CONTEXT OF JEWELLERY

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Keywords—Paste Deposition Modelling, Precious Metal Clay, Infill patterns, Green-ware shrinkage, Rapid Prototyping, Additive Layer Manufacturing

I. INTRODUCTION
Paste Deposition Modelling (PDM) is an additive layer extrusion method which presents new design opportunities. Rapid Prototyping (RP) has been widely adopted as part of a step-change process for creating precious metal jewellery. PDM is explored here, focussing on the capabilities of depositing precious metal clays for jewellery. Open-source software is utilised together with an approach to programming user originated infill geometries to form structural parts; differing from the somewhat automated processing by closed commercial RP systems. Metal clays, by their nature, shrink on firing and this often needs consideration in the construction of craft objects. Some characterisation of the sintering process, shrinkage and the resulting material properties of the various formulations of PMC has been undertaken by (McCreight 2010).

In an attempt to show control over the shrinkage, rings were considered as a suitable vehicle as they could erstwhile show the aesthetic characteristics of PDM when not considered as a strictly cast volume and using infills. The deposited rings are then subjectively treated in view of the conventional methods of working with metal clays. Using workshop techniques the ability to deform fired rings was ascertained. This shows a bridge between the automated and the ‘touched by hand’. Considerations are given as to this hybrid nature of craft versus machine and the exploitation of PDM for its characteristics. Finally, further areas of development are put forward, including consideration as to whether the process can be developed as a computer controlled method of making jewellery.

II. DESIGN/METHODOLOGY/APPROACH
The research draws upon the development of open systems, it uses hacked together hardware and subverts software to explore syringe based PDM. It aims to extend the materials available for RP. Areas of investigation have included medical devices, embedded electronics, product design and jewellery; the latter being the subject of this article. Competing RP processes are DMLS (Direct Metal Laser Sintering). Progress in DMLS for jewellery has been slow; equipment is expensive and requiring a bed of precious metal powder DMLS would not be viable for SME’s (Small and Medium Enterprises). DMLS has been recently developed by EOS and Cookson Precious Metals with a demonstrator machine; it is envisaged that precious metal DMLS may become a service (Jordan and Fletcher 2012).

Key research questions concern whether metal clays can be adapted for 3D deposition. In the first instance this means diluting them to a consistency that will pass through a tapered syringe nozzle, determining the deposition parameters, and finally seeing whether the reformulated material will sinter fully. From initial results, a range of 3D geometries that show the limits of deposition can be developed. Finally to show how such materials, within the constraints found may be used for jewellery, a range is developed that suitably aligns the aesthetics of PDM and the possibility of self-originated infill structures with the intentions of the designer. This is subsumed within the creation of rings as they demonstrate the ability to create a product to a set size, taking into account material shrinkage during firing. It is considered that the internal structure of the part achieved by infills may also have an effect on the overall shrinkage. The investigation shows that the design exists in three domains, virtual, built as clay, and as metal and how these come together as a hybrid RP-Craft process.

III. FINDINGS/RESULTS
To determine the overall shrinkage of the part, the rings were measured using a ring size gauge in both the green-ware and fired state, these figures were then compared to the original CAD to determine the shrinkage from design to green-ware and design to fired. What is ascertained from these observations is that there are design differentials of wall thickness, external and internal wall geometry, infills and potentially build height that
significantly affect the resulting size. Whilst this could be benchmarked through trial and error with personal craft enquiry; the process would also benefit from computational modelling to predict and compensate for deformations occurring during build, and incorporate the shrinkage from design to fired part.

Figure 2 Collection of printed rings, both textured and burnished. In bronze and silver metal clays

IV. CONCLUSION/DISCUSSION

It has been shown that metal clays can be adapted for PDM. They can be prepared with large tolerances using simple tools and dispensed through a syringe nozzle. Firing schedules were determined and it was found that ‘BronzClay’ and ‘PMC Pro’ sintered fully and could withstand basic wroughting.

PDM is in its infancy and as such outcomes from the process that are constrained to a target size will require some trial and error to achieve the desired results. However designs where tight size tolerances are not a crucial element but are more geared toward an aesthetic expression then PDM in its current form becomes simpler to implement. An exploration of metal PDM for craft outcomes that are not dimensionally constrained would appear an appropriate way forward. A pendant featuring wire geometry was created. (Figure 3)

Generating PDM programme files is a multi-step process that could be deemed complex and off-putting for many but not all. It is an approach in the open-source domain common to many types of research. Masterton (2007:20) created a process for intervening in the automatic generation of cutting tool paths for metal decoration using ‘Corel Draw’. PDM similarly offers opportunities for design by control of the tool paths and infill patterns. Ideally a platform based system to develop geometries and tool paths for is needed. As such approaches become mainstream they should eventually grab the attention of software developers.

The layered PDM creates a texture which can be exploited within the product’s visual identity. PDM can deposit metal clays using a number of different sized nozzles. They could be larger or finer than the 0.6mm nozzle used here. With PDM the ability to deposit even larger filament diameters allows for further exaggeration of the texture. The ability to quickly change filament diameter makes this a re-configurable arrangement that is less directed by the constraints of the 0.1 to 0.4mm filament diameters typical of FDM. Whilst a layered texture is evident it can also be selectively blended and made smooth, according to the designer’s intention. This brings about a process that can be a hybrid in that it is RP yet regains the nature of being ‘touched by hand’. With PDM for metal clays there isn’t a step-change and only the material required in the part is prepared, rather than a bed of powder. Combined with the desktop prototyping merits, this could be an open-source low-cost and versatile machine for cold forming silver and other metals which also brings aesthetic opportunities.

Figure 3 Silver pendant. Joint winner of the Technological Innovation Award 3D, in the annual UK Goldsmiths’ Craft and Design Council ‘Craftsmanship & Design Awards.

REFERENCES


SUSTAINABLE EVENT-LED REGENERATION: LONDON 2012

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Keywords— London 2012 Olympics, Mega-Events, Urban Regeneration, Sustainable Development, Stakeholder Decision-Making

I. INTRODUCTION

Since the early 1990s, there has been a widespread trend towards the use of mega-events to promote a city, stimulate the local economy and regenerate rundown post-industrial areas and communities. Among different types of urban regeneration models such as property-led, retail-led, housing-led and design-led regeneration, event-led regeneration has had a greater economic, tourism, physical and socio-cultural impact and meaning for host cities when compared to their relatively short duration. The importance of mega-events in city regeneration has in consequence gained increasing attention. When events are used as a tool for urban regeneration, they give the host city the opportunity to produce a new and entrepreneurial image, internally and to external audiences. In the context of mega-event based regeneration, multiple stakeholder perspectives are essential when analysing the outcomes of such events and all stakeholders have to be in consensus in order to deliver sustainable events. In order to understand how event policies are realised, it is important to know how different actors are involved and interact in an event-led regeneration. Therefore, this study aims to critically evaluate the expected regeneration impacts and legacy effects arising from hosting the mega-events by analysing the regeneration stakeholder decision-making structure in the Lower Lea Valley where London 2012 Games will be staged.

II. DESIGN/METHODOLOGY/APPROACH

Research methods include document analysis, semi-structured interviews with the stakeholders in the planning and organization of London 2012 and observations. The institutions which are going to be interviewed are selected on bases of their relevance to social, physical and economic regeneration of London 2012 Olympic Park (see Figure 1).

The interviews have been conducted face-to-face at the working environment of the interviewees and each lasted around 30-60 minutes. Interview questions are directed towards understanding plans undertaken to develop a strategy, the response to the mega-event led regeneration, reasons behind decisions made, expectations from regeneration, and relationships with other stakeholders.

Figure 1: Regeneration Decision-making Structure of London 2012 Olympic Games in 2011

Research methodology adopts an integrative approach in which built environment, social structure and stakeholder organization structure are studied together. In order analyse sustainable development in any regeneration project, it is important to understand the relation of these three components with each other. The research uses multiple theoretical perspectives, sources of data and methodologies to analyse the case. Changes in built environment, social structure and stakeholder organization are analysed in connection with each other, not as single units. Each aspect is evaluated accordingly with the changes in others to understand the complex structure of the regeneration in a holistic way.

III. FINDINGS/RESULTS

The Olympic Park is located within the Lower Lea Valley, in the Boroughs of Newham, Hackney, Tower Hamlets and Waltham Forest. It is situated around the River Lea, bordered by the A12 in the north and Stratford High Street in the south (See Figure 2). The Park is primarily situated on contaminated and derelict land. Much of the land is fragmented and divided by waterways, sewers, overhead pylons, roads and rail lines. The area is also home to some of the most deprived communities in the country and has significant levels of unemployment. The London 2012 Olympic Games became a catalyst to regenerate the economic, social and physical structure of East London. Regarding the vision and objectives of London 2012, it is clear that leaving a sustainable regeneration legacy in the East London is one of the most crucial targets of the Games.
The initial findings suggest that multiple stakeholder perspectives are essential when analysing the outcomes of mega-events and all stakeholders have to be in consensus in order to deliver sustainable events. There are a large number of organisations involved in delivery and legacy of London 2012. This includes political leaderships at national, city and borough levels, organisations founded for the Olympics and other regeneration bodies of East London.

In order to have sustainable event-led regeneration, the governance has to be sustainable as well. A critical success factor for the Olympics was the quality of the relationships between the stakeholders. Continuity of the staff in key roles, and their willingness to invest in building trust helped to build up a sustainable relationship (Norris et al., 2013). Therefore, while mediation and managing power relations appear as the strengths of London 2012 regeneration organisation structure; knowledge transfer between stakeholders and representativeness of the structure can be stated as the main weaknesses.

IV. CONCLUSION/DISCUSSION

The primary research analysis provides a sound base from which the planning of more sustainable major events can be undertaken in the future and the evaluation of their impact more fully measured across a wider stakeholder community. This may go some way towards what Getz proposes as a model of sustainable events (2009) and for which this study will contribute empirical evidence and conclusions which may be further developed in subsequent research.

V. FUTURE PLAN/DIRECTIONS

The way that the decision-making structure and power relations reflect on the built environment is analysed through stakeholder interviews, policy reports and master plans of London 2012 Olympic Park and its surroundings. Next stage of the research will be analysing the focus group meetings held in four Olympic host boroughs surrounding the Olympic Park since the extent that changes in built environment response to the needs of local communities will be evaluated through the analysis of focus group meetings and policy documents.

REFERENCES


Keywords— Public Space, Spatial, Urban Design Process, Strategies.
MEANINGFUL SPACES: RECLAIMING PUBLIC SPACE FOR ITS RESIDENTS

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I. INTRODUCTION

"More and more people are moving into towns and cities to live and work, altering the urban/rural balance of countries worldwide" [1]. In today’s world the number of people living in the cities is increasing rapidly, as living in endless cities is what individuals demand. This leads urban planners to focus more on public urban space extensions, without much consideration of the elements of life between buildings, which can encompasses cultural significance and usability of public spaces. "These elements remain remarkably constant even as architectural styles go in and out of fashion and the character of the 'life between buildings' changes" [2]. These 'spaces' closely relate to the human aspects, rather than the architectural image of the city. Generally, urban planners in today’s developments tend not to look at human aspects such as gender, class, age, culture and the relationship between public and private space; which all influence in how people would experience these with spaces. "Evidence drawn from the city of Edinburgh shows how divisions between public space and private space operate at different scales and take different forms in different neighborhoods. These forms illustrate how gender and class are interwoven in demarcations between and connotations of public and private spaces. In one of the neighborhoods examined, some breaking down of traditional gender connotations of public and private spaces is detected, a process that is closely associated with privileged middle-class lifestyles" [3].

Currently many of the public spaces are commercially produced and orientated “Attention to lifestyles has given rise to new, highly visible consumption spaces, such as nouvelle cuisine restaurants, boutiques, art galleries and coffee bars. It has also generated new complex, retail strategies, combining advertising, sales real estate development and entertainment." [4], which cause us to question the value and the intention of each public space design, and if it compromises the commercial essentials with the human and cultural needs. This potentially leads us to a point where we should consider the anthropology of space and place “Both conceptual and material dimensions of space as well as of built forms and landscape characteristics are central to the production of social life.” [5].

The aim of the research is to generate a new public space design methodology thereby influencing planning strategy, which will allow inhabitants to reclaim their cultural values.

Culture is often defined as a way of life or, the production and circulation of 'meanings'. These meanings are woven into everyday life through the use of rituals, language, beliefs, images, signs and symbols in objects, the built and the natural environment. Thus, culture enables us to ‘make sense’ of things around us. It is however important to note that objects and spaces on their own have no meanings, but it is we, who through the process of using words and images pull together our experiences and analogies to give meanings and form concepts in our heads that help objects and spaces in the real world. Du gay et al. [6] push this model further by suggesting that the 'Circuit of culture' demonstrates a process whereby culture gathers meaning at and through five different processes - representation, identity, production, consumption, and regulation.

Each of these processes is interlinked in an on-going process of cultural encoding and distribution of meaning. For example, the way culture is represented affects how it is identified, produced, consumed and finally regulated. This rule holds for all the other four processes as well. Further, this model is of particular relevance to the creative domains as it demarcates the links between the 'five' interlinked processes as being populated by 'cultural intermediaries'; meaning professionals in the advertising, marketing and design industry and their impact on the derived 'meaning' of products and spaces.

Figure 1. Circuit of Culture and Double Diamond Design Process

II. DESIGN/METHODOLOGY/APPRAOCH

A. Introduction

Looking at the Double Diamond [7] design process model brings attention to how urban design process works in cities like Salalah, Oman. Despite the fact that all these theories and guides of urban spaces, such as design process models are contributed and accessible to everyone, many urban organizations and authorities in the Gulf States are not following it. However, some municipalities have their own structure of processing design projects, which could be similar to the Double Diamond model, but, with less concern for the first stage
that highlights the discover and define processes. Therefore, this research has separated the diamonds into two major stages; conceptual stage (feasible review) and implementation stage (concept review), which assist in developing the research hypothesis and methodology.

This research seeks to ascertain if it is feasible to fill the gap of the cultural context that would allow the researcher to integrate it with the approach of evolving methodology for the study of urban spaces. Moving to the implementation stage, from developing to delivering would pass through a chain of processes that are all based on the conceptual stage diamond.

The research is in progress of evaluating the merged theoretical configuration on three public places: Brentford high street development (UK), Salalah- Haffa town project (Oman), and The Shad (UK). Through addressing the following questions, the hypothesis of this research will aim to evolve a new methodology for the study of urban spaces within the cultural context. It will also introduce a new methodology for dealing with urban conceptual designs that allow residents to reclaim their cultural space, thereby amplifying the geographical and symbolic sense of place.

- What is the gap between designer’s intention and public perception?
- How different groups of people from different backgrounds, experience and define particular design? Or how that design or space appears to each group?
- If the emotional response of their public space has been altered by the current globalization influence? If yes, How? And how would that apply in conceived, perceived spaces?
- Are ‘local’ communities culturally fulfilled? Why? What is the possible assumption for such an issue?
- (Based on existing case studies) What are the implications of merging Circuit of Culture, Double Diamond Process (CCDD) and the three aspects of public response in an integrated process development? And would the outcomes possibly enable a new scope for urban design studies?

III. FINDINGS/RESULTS

The initial assumptions that were figured through the study cases provided suggests a gap between the urban planner’s intention and the public perception; also, a lack of coherent culture participation in public space design strategies.

IV. CONCLUSION/DISCUSSION

The hypothesis that this research is testing intends to take quantitative approach to provide concrete data that further studies can be based on. Also, it will measure the possibility of using the (CCDD) configuration as a new conceptual design method that combines the meaning of things through the engagement with them, in a cultural context.

V. FUTURE PLAN/DIRECTIONS

After data collection, compare and contrast analyses will take a place between the following clusters: Urban planners Intention: Public Perception; Brentford High Street Development: Salalah-Haffa Town Project; and DD Process: CCDD merged processes, to characterize the potential breach in public space design processes, strategies; with the intention to evolve a new methodology through the research recommendations and advanced proposals.

REFERENCES

CORPORATE-LEVEL DESIGN POLICY FOR INNOVATIVE MANUFACTURING IN THE UK

Jea Hoo Na, Youngok Choi, Ray Holland

Design

Third Year of PhD

Keywords— Design-driven Innovation, Design Policy, Design Thinking, Innovative Manufacturing

I. INTRODUCTION

Design as a tool for increasing the innovation capability (1) and business competitiveness (2) has been reported over the years. Design is no longer seen as an aesthetic-centric activity, but is increasingly recognised as a strategic tool because of its ability to bring new or enhanced meanings for products, services, brand and even for company culture. The world-leading companies such as Apple, Dyson and Burberry are using design not only to create beautiful products, but also to apply design thinking in the management of the businesses. Unfortunately, this development and recognition of design are not applied fully for manufacturing in the UK.

Alongside the design development, the manufacturing is being recognised by the UK government as a way to overcome the current economical instability and increase the competitiveness of the nation. Therefore the UK is emphasising the development of innovative manufacturing (as a catalyst and enabler to increase competitiveness through advanced and high-value manufacturing). However, the research recognises that the focus is very much on the technology-driven innovation, lacking design utilisation. This can reduce the chance to spear ahead of global competition and increase competitiveness of the company.

For an effective convergence of design-driven innovation within a company as whole, it is important to embrace the corporate-level design policy which guides the infusion of design in new product development (NPD) as well as in management of the business itself. Hence the key questions for the PhD research are (i) what is the role of design in innovative manufacturing? (ii) what do the changes in design paradigm mean for innovative manufacturing companies? and (iii) How can corporate level design policy be developed and implemented? With these research questions in mind, the overarching aim of the PhD research is to create a corporate level design policy guideline for innovative manufacturing companies in the UK to strengthen competitiveness through effective use of design in all levels within corporations. However, this paper will concentrate in answering the first two questions which will aim to understand the context of design and manufacturing development in conjunction with innovation and business policy.

II. DESIGN/METHODOLOGY/APPROACH

There are two main phases of the research. First (Phase One) is an exploratory research to identify the importance of innovative manufacturing and to evaluate the utilisation of design within manufacturing in the UK. The second phase (Phase Two) is to create a categorisation of the innovative manufacturing and to identify the relationship between business success (both internally and externally) and design especially in conjunction with innovation. Critical analysis of overall results will then be conducted to identify the drivers and barriers of corporate-level design policy development as well as identifying the influential factors.

The methods that were used to achieve these research goals included both primary and secondary research in form of literature review, case study, questionnaire survey and in-depth interviews. The literature review was conducted in both phases of the research in the areas of (i) manufacturing development in the UK, (ii) expansion of design in business and innovation, and (iii) business management and policy.

The primary research in the Phase One consisted of interviews and questionnaire survey. There were two stages of interview process where the first stage aimed to identify the relationship between the innovative manufacturing within UK manufacturing with 3 experts from the academia in the field of manufacturing. The second stage was to identify the utilisation of design and innovation within manufacturing in the UK with 10 interviewees from various manufacturing companies in the UK who were all in senior manager level or above. All interviews were conducted using semi-structured face-to-face interview with duration of approximately one to two hours. Qualitative content analysis of the interview transcripts were conducted. In between the two stages of the interviews, an exploratory questionnaire survey has been conducted. The stakeholders were various manufacturing companies in the UK Total number of 370 companies that were contacted with approximately 13% reply rate (48 replies). Microsoft Excel was then used to conduct quantitative analyse of the findings.

The Phase Two includes the case study of the manufacturing companies that has received innovation award of EEF manufacturing award and the Queen’s award. Companies were chosen to identify the requirement of innovative manufacturing to categorise what is needed for a company to be recognised as innovative. In the view of design and innovation, the manufacturing companies were selected from the Design Management Europe (DME) award and Design Business Association (DBA) design effectiveness award. Further secondary research in form of literature review has been conducted to identify manufacturing companies that adopt the design thinking throughout the company to prosper in both design-driven innovation and technology-driven innovation.

III. FINDINGS/DISCUSSION

The interviews with academics within the manufacturing field along with literatures indicate that the innovative
manufacturing is at the core of advanced manufacturing, enabling scientific and technological researches to be commercialised and enable advanced manufacturing to expand into high-value manufacturing (4). The survey indicates that almost all manufacturing companies regard innovation as important in giving the company a competitive advantage. The interviews with the manufacturing companies also revealed that almost all see innovative manufacturing as their company’s most important agenda. In the case of design within the company, the survey shows that the overwhelming majority of manufacturers (88 per cent) indicating that design is important for their company. However, the problem lies not in the manufacturing companies’ perception of design as being important but the company’s utilisation of design. The survey provided the description of design by manufacturing companies where the majority (75 per cent) of the companies described design as ‘a process by which information is transformed into a tangible outcome’ where only 37 per cent felt that design is ‘a strategic tool for the business’. The interviews indicated that the majority of manufacturers utilise design within the operational (technical) aspect of manufacturing, not within holistic part of the overall business. Figure 1 further illustrates this, as the manufacturers indicated that the design is mostly used within NPD and production within the manufacturing value chain.

The aim of design-driven innovation is to influence the whole company through design thinking. It should have a prominent voice in the decision-making process, and in vision and strategic planning. Examples of successful companies which have embraced design-driven innovation - including Alessi, Fiat and Apple (1), have something in common. These companies have all embraced design at the top level of the company. However, a CEO with a great interest in and awareness of design is not enough to make the whole company more innovative (5). A systematic approach to fully utilise design thinking across the business therefore requires design to be at corporate policy level to increase the chance of success and reduce the risk of irrational decision-making. The corporate-level design policy is placed at the organisational level of the business in a context model by Needle (6) which enables design to influence the whole company. This ensures that the company uses design as a strategic tool by utilising design thinking, thus encouraging design-driven innovation as illustrated in the figure 2.

IV. CONCLUSION/FURTHER PLAN

To thrive in the increasingly competitive and complex global market, UK manufacturing firms need to embrace both technology-led and design-led innovation. For innovative manufacturing firms, who are already more receptive to the value of design, the corporate-level design policy will encourage the use of design thinking as a strategic tool for business management, from strategy formulation through to the operating levels, encouraging continuous innovation for the manufacturing company.

The next stage of the PhD research will be concentrated on further research on the relationship between the corporate-level design policy with business and innovation management. Furthermore, a design policy model including the identification of its stakeholders will be created which will then be the bases of developing the guideline for corporate-level design policy.

REFERENCES

**I. INTRODUCTION**

The wireless telecommunications is one of the most powerful industries worldwide. According to the research company Gartner (2012) by the end of 2011, over 440 million handset devices were sold. However, since its establishment, this sector has been through radical changes. During its early years, geographical clusters (e.g. Japan, Europe and United States) develop their markets supported by rigid local government policies (Steinbock, 2003). In a later stage, a series of market deregulations encouraged the entrance of new firms and competition increased. At that time, value chain was the most prevailing market approach. The emergence of the (mobile) internet brought major shifts to this industry (Funk 2001, cited in Funk, 2009). It helped the expansion of established companies and also the entrance of other players (Steinbock, 2003), particularly from different sectors (e.g. computing industry). The current market landscape is highly fragmented characterized by an intricate network of firms (such as Manufactures, services providers, mobile operating system providers). As a result, value delivered to users is co-produced by different companies (Value Network – Peppard and Rylander, 2006). In addition, new entrants such as Apple and Google are thriving in this new sector, delivering innovative market solutions through their mobile ecosystems. On the other hand, manufactures such as Nokia are struggling to compete in a sustainable way in a sector that once it dominated.

Regarding the current market panorama and the diverse roles that design has been playing in this sector (e.g. creating new products and services), how this discipline can be used by handset manufacturers to assist in future forecasting activities (for example considering the next generation of products)? There is a latent need to develop a conceptual framework that addresses the roles and contributions of design in future forecasting processes in the mobile telecom industry.

**II. DESIGN/METHODOLOGY/APPROACH**

This study relies on the strengths of qualitative research approaches and methods. In terms of secondary research, a literature review based on a wide scope of sources comprising books, academic papers, articles, industrial and trend reports was conducted. At that stage, the data collection process focused on investigating and exploring different topics such as the wireless industry (e.g. its establishment and evolution; products and services; key players and overall industry structure); trends (major current phenomena such as social media) and design (as a discipline; as a mindset; as a research technique and as a forecasting tool).

On the other hand, to gather primary data, a series of in-depth interviews with a 10 experts from different backgrounds (from both industry and academia) was conducted. This approach was used to collect fresh and up to date information regarding the three major topics previously mentioned: wireless industry, trends and the use of design. The semi-structured interview method was selected due to its fair level of flexibility, allowing the researcher to probe the interviewers either to clarify unclear issues or to probe them regarding critical key topics under investigation. The insights from primary research not only confirmed (in many cases) but also clarified and complemented those information collected in the first stage (secondary research).

On the other hand, to gather primary data, a series of in-depth interviews with 10 experts from different backgrounds (from both industry and academia) was conducted. This approach was used to collect fresh and up to date information regarding the three major topics previously mentioned: wireless industry, trends and the use of design. The semi-structured interview method was selected due to its fair level of flexibility, allowing the researcher to probe the interviewers either to clarify unclear issues or to probe them regarding critical key topics under investigation. The insights from primary research not only confirmed (in many cases) but also clarified and complemented those information collected in the first stage (secondary research).

Finally, in order to proceed with the analysis of these qualitative insights, this research employs distinct theoretical frameworks such as Grounded Theory. Based on its fundamental principle (‘to build a theory from data’ - Corbin and Strauss, 2008), this method is used to code, combine and understand the potential relationships that emerged from data in order to create the intended framework.
III. FINDINGS/RESULTS

Overall, the literature review provided a clear snapshot of the mobile telecom market. Concerning the use of design on forecasting activities, the examples reviewed focused more in the outcomes rather than the processes (this can be explained by the commercial sensitiveness of the data conveyed).

Conversely, findings from the primary research (experts’ interviews) provided an ‘extra-layer’ of knowledge about the wireless sector (including several related key issues) and how design has been used in this particular industry.

One of the main concerns of handset manufactures are related to the increasing market dominance of new entrants, Apple and Google (originally from the computing industry) that has been made through their mobile ecosystems and also the potential commoditization of handset by mobile operating system providers (e.g. Google/Android). On the other hand, since these two companies (Apple and Google) pursue different strategies, specialists point out that the major opportunities are related to the existence of distinct mobile ecosystems to attend different users’ needs, leading to innovative market solutions.

Regarding the use of design, professionals revealed that it plays a wide array of roles according to different stages of the Design Process. Therefore, this discipline can be used to assist in decision-making processes; as an empathic method to understand/investigate users’ needs; as a tool to create new products and as a technique to inform, communicate ideas and develop scenarios for future products/services.

IV. CONCLUSION/DISCUSSION

Based on the findings collected until the present date, a generic design-led future forecasting procedure takes into account different factors such as the roles played by designers, users’ requirements, experts’ insights, environmental issues and business aspects. These characteristics were reinforced during the interviews conducted (e.g. specific market gaps or constrains, the value/relevance of users’ inputs; how designers create and communicate future concepts/ideas; the impact of trends in NPD and the contributions of the experts for design process). As a result, to assist in forecasting processes, the design discipline must be flexible enough to cope with several demands, combining ideas and insights into actionable future business opportunities translated into innovative products and services. Finally, the level of innovation desired by a company cannot only be related to the factors previously presented but also, it is related to the commitment, willingness and buy-in of key stakeholders to take (calculated) risks.

V. FUTURE PLAN/DIRECTIONS

In the current stage, the analysis of the data collected through primary research is almost completed. After coding, clustering and looking for patterns and missing gaps in the information, the researcher will proceed to the next stage, developing the proposed design-led future forecasting model. After that, the newly created framework will be evaluated through interviews with experts to check its functionality, relevance and accuracy.
I. INTRODUCTION

The twenty-first century will see an acceleration of the ageing global population. Increased life expectancy and the growing complexity of needs associated with the ageing population could result in a substantial increase in demand for long term care in the future. The number of care home places will require an 82% increase, about 630,000 extra spaces, by 2030 (BBC, 2011).

British policies on care for older people have focused on providing good quality and ensuring that services meet older people’s needs. Despite many advances in care homes quality over recent years, serious quality problems such as neglect and conditions of isolation of residents have been reported.

Due to the fact that a large proportion of the residents in care homes are frail and suffer from cognitive impairment, their views are often neglected. In care homes usually other people such as professionals, relatives, commissioners, policy-makers and politicians speak for the residents, and the voices of residents themselves are generally quiet and often silent (Bowers et al., 2009).

Identifying residents’ needs and requirements is vital for improving residents’ satisfaction in care homes (Low et al., 2003). Quality function deployment (QFD) has been widely recognized as an effective tool in customer-driven products or services development (Raharjo et al., 2011). It is useful for capturing and integrating the voice of the customer (VoC) into every aspect of the design and delivery of products and services for ensuring customer satisfaction.

II. DESIGN/METHODOLOGY/APPROACH

QFD methodology starts with capturing data on the needs and requirements of the customer. In this study the tools of Voice of Customer (VoC) analysis were adopted to identify: the key customer segments of the care homes and the residents’ needs and requirements.

The Kano Model (Chaudha et al., 2011) was applied to categorize residents’ requirements as well as to understand the nature of quality and residents’ satisfaction. Kano’s theory proposes that the relationship between quality and satisfaction is not always linear (i.e. One-dimensional), and it can be two-dimensional (Chaudha et al., 2011), i.e. “must-be”, which means the quality is expected by the customer, so increasing the quality will not result in greater satisfaction; or “attractive”, which means the provision of the quality is exceeding the customer’s normal expectation, leading to excitement (Figure 1).

The QFD method consists of the construction of one or more matrices. The first matrix of the QFD method is referred to as the House of Quality (HOQ), because its appearance resembles a house. HOQ converts the voice of the customer into the voice of the organization (Chaplin and Terninko, 2000). In this study the HOQ was constructed not only for translating residents’ voice into the organization’s voice but also for identifying and prioritising the most important residents’ expectations.

The QFD process starts by listening to the customer’s voice. In this study, in-depth interviews with 25 residents, in three different care homes were conducted to identify customer (residents) requirements. That was followed by a customer survey with a larger group of residents (102 residents in 35 different care homes) to convert the highly-ranked residents’ requirements, i.e. Demanded Qualities (DQ), into a set of valid quantitative data to assess (1) residents’ preferences related to the selected DQs, (2) their satisfaction level with given services, and (3) to classify the customer demand attributes using the Kano model. The research methodology is summarised in Table 1.

<table>
<thead>
<tr>
<th>Study</th>
<th>Method</th>
<th>Tools</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study 1</td>
<td>Interview</td>
<td>VoC</td>
<td>15</td>
</tr>
<tr>
<td>Study 2</td>
<td>Survey</td>
<td>Kano</td>
<td>102</td>
</tr>
<tr>
<td>Study 3</td>
<td>Matrix’s Analysis</td>
<td>HOQ</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Figure 1. Kano Model (Source: Chen and Chuang, 2008)
III. FINDINGS/RESULTS

From the many statements extracted from the interviews, 28 resident requirements were captured. The residents’ requirements, i.e. DQs, were grouped and ranked using the analytic hierarchy process (AHP) to identify the relative importance of each DQ, and then all DQs were put in an order of importance, in which “Empathic Staff”, “Social Interaction” were identified as the two most important residents’ needs and requirements.

The larger survey results confirmed that “Empathic Staff” and “Social Interaction” were most important requirements. In addition, “Safety” and “Homelike environment” were also identified as most important requirements. “Involvement” was considered as the least important requirement.

The findings of the Kano questionnaire indicated that among the most important 12 DQs, three were “attractive” qualities, nine were “one-dimensional” qualities and none were “must-be”.

The HOQ was used to translate customer voice into the organization voice (Performance measure). It enabled the priority of improvement of each performance measure to be determined. The first six prioritised improvements are as follows:

- time that resident’ receive direct supervision,
- environment that is visually comfortable,
- staff time spending on residents,
- staff behaviour,
- personal communication with resident,
- meeting residents’ needs.

IV. CONCLUSION/DISCUSSION

The voice of the customer (VoC) has proved to be effective in gathering care home residents’ uttered and unuttered needs.

By using the Kano model the attribute of each residents’ requirements has been identified, which can be beneficial for developing products or services in such a manner that improving residents’ satisfaction can be achieved.

The House of Quality provides a link between DQs and performance measures. It has proved to be an effective tool to get insights into what is essential for improving the services/products in care homes, and this will lead to both increased residents’ satisfaction and the quality of care homes.

V. FUTURE PLAN/ DIRECTIONS

The last step will be the evaluation of the QFD methodology with experts to establish its usefulness in improving the quality of care home.

REFERENCES


Keywords—MDS, Patent Map, Technical Correlation, Technical Feature, TRIZ

I. INTRODUCTION

This paper presents a visualised approach to reveal technical correlations by evaluating graphic information in patents in the field of mechanical inventions. Such an approach improves on the previous offer method based on Multi-Dimensional Scaling (MDS) (Chen and Chen, 2007; Chen, 2009). The new approach enhances objectivity in patent evaluation by adopting engineering parameters from the Theory of Inventive Problem Solving (TRIZ) (Altshuller, 1999); and offers an alternative method to identify infringement. Thus ‘TRIZ-led patent mapping’ adopts TRIZ as criteria for patent evaluation, in order that the underlying general engineering parameters in technical features of competing designs can be compared.

II. METHODOLOGY

The research is a TRIZ-led, MDS-based patent mapping. Attribute-based data are collected by the evaluation method using TRIZ parameters as criteria. MDS visualization is done by ALSCAL programme (Hair et al., 1995). There are five steps (Fig. 1): to define technical features and evaluate their relevance to refined TRIZ parameters (Step I-II); to calculate the similarity between technical features (Step III-IV); to configure technical correlation maps (Step V); and (4) to interpret the maps for infringement identification (Step VI).

III. RESULTS

In the case study, the TRIZ-led patent maps present correlations between features extracted from claims. The correlations represent the inventiveness between each technical feature. Such maps explain the technological reason of the lawsuit of anticipation. The mapping result strengthened the court judgments.

IV. CONCLUSION

This research applied parameters from TRIZ to MDS-based patent mapping, which is a novel alternative method that enables the evaluation of graphic information in patents that reveals technical correlations that are demonstrated to enhance patent strategy and identify patent infringement. Compared to previous MDS-based mapping methods, the use of TRIZ-led patent mapping enhances the objectivity in evaluation by adopting stable criteria from TRIZ engineering parameters and using less subjective objects, i.e. technical features in patent claims. The new approach has
been tested on one case study, which has explained the technological reason of the lawsuit of anticipation.

V. FUTURE PLAN

Collecting attribute-based data indicates that TRIZ-led patent mapping can be developed for individual respondents or aggregated to form a composite map. Further work can be done in the statistical comparison of input data from focus group interviews.

REFERENCES

AN EXPLORATION OF DESIGN PROJECT OUTPUT FACTORS & METRICS

Stephen Green, 1st Supervisor – Prof. Graeme Evans, 2nd Supervisor - Dr Hua Dong

Design Subject Area
Year 4 of part time PhD

Keywords— Design effectiveness, Design impact, Design metrics, Design ontology, Design process,

I. INTRODUCTION

The work summarised within this abstract is a component of a larger PhD study titled Predicting Design Impact. There is considerable interest in quantifying the impact of professional design activity: At a policy level the UK Design Council identify that 80% of UK business agrees that design will help them stay competitive in the current economic climate[1]. The UK DCMS identifies that design contributes £1.6bn of the £59.1bn GVA generated by UK Creative industries[2] and various government reports highlight the potential of design and the creative industries to contribute to the future economic wellbeing of the UK, eg Cox[5], Sainsbury[3] and Dyson[4]. Although it is noted that nearly 80% of businesses surveyed stated that designers are only ‘quite good’, through to; ‘not good at all’, at communicating the value of design activity[6]. At firm level the DBA’s Design Effectiveness Awards or the European Design Management Award aim to highlight individual cases of the positive impact of design activity. But these initiatives do not necessarily lead to a finer grain understanding of the ingredients and recipe for design success and to identify the Critical Success Factors (CSFs) which underpin design impact. This information can then be used to expand the interim ontology to include output factors and as a basis for formulating concepts and strategies for communicating and Predicting Design Impact.

II. DESIGN/METHODOLOGY/APPROACH

In 1986 The Design Business Association (DBA) founded the DBA Design Effectiveness Awards (DEAs). Running annually, they have played an important role in promoting the value of good design in business success. Winning entries are judged by an expert panel to provide clear evidence of this success. Almost alone amongst design awards, success is evaluated in terms of commercial or organisational benefits. The entries provide rich validation and powerful communication of the variety of ways in which design can transform products, brands, services and market performance. Working in collaboration with the DBA, detailed data was made available for a sample of 46 case studies selected from the 265 submitted in the three years 2009-11. Table I shows how the selected sample also represents a spectrum of 14 design disciplines.

<table>
<thead>
<tr>
<th>Discipline</th>
<th>DBA main category</th>
<th>All 2009-11</th>
<th>Selected cases</th>
<th>% of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2D Graphic Comms</td>
<td>1. Corporate/Brand Identity</td>
<td>60</td>
<td>7</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td>2. Print</td>
<td>15</td>
<td>2</td>
<td>13%</td>
</tr>
<tr>
<td></td>
<td>3. Interactive &amp; digital media</td>
<td>7</td>
<td>3</td>
<td>43%</td>
</tr>
<tr>
<td>3D Packaging &amp; Product</td>
<td>4. Packaging</td>
<td>107</td>
<td>12</td>
<td>11%</td>
</tr>
<tr>
<td></td>
<td>5. Point of Sale</td>
<td>5</td>
<td>3</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>6. Product</td>
<td>10</td>
<td>6</td>
<td>60%</td>
</tr>
<tr>
<td>Environments</td>
<td>7. Interiors</td>
<td>9</td>
<td>1</td>
<td>11%</td>
</tr>
<tr>
<td></td>
<td>8. Temporary exhibitors &amp; experiential environments</td>
<td>2</td>
<td>2</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>9. Museums, Galleries, Events and Visitor Attractions</td>
<td>8</td>
<td>4</td>
<td>50%</td>
</tr>
<tr>
<td>Strategy</td>
<td>10. Internal Communications</td>
<td>12</td>
<td>3</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>11. Communications Design</td>
<td>1</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>12. Design Management</td>
<td>7</td>
<td>1</td>
<td>14%</td>
</tr>
<tr>
<td></td>
<td>13. Design for Society</td>
<td>16</td>
<td>1</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>14. Environment</td>
<td>6</td>
<td>1</td>
<td>17%</td>
</tr>
<tr>
<td>Total entries</td>
<td>265</td>
<td>46</td>
<td>17%</td>
<td></td>
</tr>
</tbody>
</table>

The DBA case studies are written up by the entrant in a variety of forms to highlight the individual project attributes. The first phase of data processing was to standardise the information into categories and to compile this in a spreadsheet. Each case study can then be re-compiled/merged into a standard format from the categorised data. The second phase of data processing rationalised the descriptors for factors within the complete...
set of case studies. The final phase of data processing coded the rationalised descriptors as a basis for analysing the complete dataset.

Table II summarises the categories of data and the analysis questions which were applied to the complete rationalised and coded data for all 46 case studies.

### Table II. DBA DEA DATA CATEGORIES AND ANALYSIS APPLIED

<table>
<thead>
<tr>
<th>Data category</th>
<th>Analysis</th>
</tr>
</thead>
</table>
| 1. Rationalised hard outputs (eg quantitative data and related descriptors) | a) Categorisation of hard output factors and metrics  
b) Instances of the use of different factors within the data-set  
c) Comparisons of specific output metrics such as sales growth  
d) Comparisons between design disciplines |
| 2. Rationalised wider impacts (eg qualitative output data and related descriptors) | a) Categorisation of wider impacts  
b) Instances of the use of different factors within the data-set  
c) Comparisons between design disciplines |
| 3. Comments and Questions arising from the case study outputs | a) Rationalisation of comment & question factors  
b) Categorisation of output factors  
c) Review of output factors identified in comparison to the literature |

### III. FINDINGS/RESULTS

The significant quantity of data available (ref Tables I & II) has facilitated production of a wide range of results; for example the initial analysis work identified 71 types of hard output categorised into 11 subcategories. Likewise 86 types of wider impact descriptions were identified and organised into 9 subcategories. The most frequently occurring category of hard output metric was - as would be expected - sales performance (32% or 19 of the case studies sampled). The average figures from case studies including these key metrics were 163% sales growth and nearly £16m increase in sales. Within the case studies which include sales growth and design fee data the Design Council’s measure of ratio of design cost, or fee, to sales growth can be calculated. The average from these 19 case studies is £179 for every £1 spent. This is significantly more impressive than the Design Council’s figure of £20 increase in turnover for every £1 spent on design. However it should be noted that the DEAs are exemplars of award winning performance, and that there is limited reliability in this methodology. Across this small data set there is no obvious correlation between design fee:sales growth ratio and design fee. Eg we cannot deduce that spending more on design necessarily increases sales proportionally. These examples represent a small part of all the results generated from the data with further analysis ongoing.

### IV. CONCLUSION/DISCUSSION

The sample size and reliability of the underlying data means that the quantitative analysis possible is of limited value. Further work could explore these findings in relation to other micro economic or company level studies of design impact. However for the purposes of the wider Predicting Design Impact study the value of the work is in the identification and classification of design impact factors and metrics. The DBA DEA study of 46 case studies has generated a considerable amount of analysis which can be used to populate an expansion of the interim design ontology and as a basis for further studies. It is noted that with a focus on commercial success the DBA DEA data does not comprehensively capture impact covering a broader range of outcomes. For example factors covered by a Triple Bottom Line approach. Therefore further work is required to fully populate a design process output ontology.

### V. FUTURE PLAN/DIRECTIONS

Along with the earlier studies (eg the interim design ontology, HEET radar and Design process maps[7]) there is now a basis for generating concepts for communicating and predicting design impact. Future activity will follow the pattern of an iterative design process with input from design professionals and design researchers (eg in workshop events). Prototype methods will be tested and evaluated with live design project case studies including design student work (pedagogic application), design consultancy work and in-house design work (professional applications). For the purposes of the completion of the PhD, this work will conclude in early summer 2014, with completion of the associated thesis in early 2015.

### REFERENCES


Clevenger & Haymaker, 2011, p443)
DESIGN LEADERSHIP AND COMMUNICATING DESIGN DURING FFE OF NPD

Koogin Han, Dr. Busayawan Lam

Design Management

3rd Year of PhD

Keywords—Design Communication, Design Leadership, Fuzzy Front End (FFE), New Project Development (NPD)

I. INTRODUCTION

Design has been defined as the process which connects creativity and innovation. From a business perspective, design can add value by differentiating products and services to create unique selling propositions. Yet many companies do not take advantage of design benefits due to misunderstandings of design, silent design, constant conflicts between the diverse culture, thinking styles and behaviours of designers and business professionals. These issues have been repeatedly observed for decades. In particular, the early stage of new product development (NPD), known as Fuzzy Front End (FFE), can be frightening to NPD members, because clarifying the product’s concept at FFE is complicated and difficult, and most companies fail to have clear product definitions (Khurana & Rosenthal, 1997). Cooper (1993) has indicated that errors in a project’s activities at the outset can result in disaster. Numerous researchers recommend that designers who are comfortable dealing with complexity should undertake a leadership role in the product development process (Von Stamm, 2003). Understanding project requirements (Murphy & Kumar, 1997) and good communication have been identified as vital success factors, since this FFE phase allows modifications, reorientations and drastic changes in new product planning (Moernaert et al., 1995; Seidel, 2007). Competent designers, good at communicating design, have been considered as design leaders since the 1970s (Topalian, 2010); however, finding a designer who wishes to become an NPD leader and has business experience is difficult (Perk, Cooper, & Jones, 2005). Previous research in design leadership has demonstrated what design can achieve: defining duties of design leadership from top design-led companies, leadership requirements for design teams and design team leader’s behaviour for design team members’ satisfactions. However, research about identifying the profile of the design leader, on how they are able to communicate and deliver design, is rare. Thus, this research aims to explore systematically the profile of designers and design leaders during the early stage (FFE) of NPD. Also, it examines differences between designers’ and design leaders’ leadership and communication styles; thus, it suggests a design leadership model that delivers design to non-design NPD members at FFE.

II. DESIGN/METHODOLOGY/APPROACH

This design research inductively examines designers’ leadership and communication methods and styles. Then, it explores how design leaders’ leaderships influence and communicate design to non-design members during the FFE of NPD. Thus, it has a more qualitative nature, meaning it is unique and specific rather than generalised (Greene & Caracelli, 1997). Synthesised and identified findings from the literature reviews on leadership studies, design leadership, communication during FFE and communicator styles are indicated to design the primary research plan. The primary research has two phases. For the first primary research stage, the purposive samples of young designers are saturated. 32 different discipline students of engineering, design and other business are observed for 4 days within a multidisciplinary NPD programme at St Etienne, France. This setting provides opportunities to analyse and observe young designers’ leadership abilities and communicating styles, and their difficulties in communicating design to non-designers. In order to have unbiased research data, this research uses mixed methods, such as observation, semi-structured interviews and questionnaires like leadership dimension questionnaires (Dulewicz & Higgs, 2003) and Communicator Style Measures (Norton, 1978) based on the literature reviews. It concurrently gathers quantitative and qualitative data. Then, it comparatively analyses data as either having similarities, differences or some combination of them (Creswell & Clark, 2007). Secondly, synthesised key issues from the first phase indicate the design of the second phase, which is to explore how design leaders communicate design and what kinds of leadership they have. 8 design leaders are identified as theoretical samples based on conducting content analysis of 39 case studies from Design Council’s design leadership programme which provides SMEs with the opportunity to meet design leaders in order to help solve their business issues from a design perspective. Semi-structured interviews have been applied. Thus, findings from the second phase will be systematically analysed to formulate a design leadership model.

III. FINDINGS/RESULTS

The initial findings from initial researches are different profiles of designers and design leaders including behaviours, leadership styles and communication styles. Thus, these differences lead designers to be more productive on aesthetic and visual task. In contrast, design leaders are more effective on identifying a NPD direction at the early stage. Firstly, attitudes, leaderships and behaviours of these designers are strongly led by their motivations. Their productivity was based upon their interest. Sometimes they reduced their productivity when their own design concepts were rejected. However, they showed strong productivity on the visual and aesthetic aspects of design task under time limit pressure. Secondly, designers showed lack of self-awareness. Due to their pre-perceptual ideas about a new project, it led them to misunderstand the project brief and
they did not try to clarify the key issues. Paradoxically, they believed they had good knowledge about business environment and think strategically. Lastly, designers believed themselves as attentive but they are not and are highly expressive. Also, the observation and interview results indicated that designers had difficulty of delivering their design concept to team members and the audience at the concept presentations. Although designers believe they are more productive, most of them hope to be more effective on leading and communicating design; thus they wish to improve their leadership and message delivery abilities.

On the other hand, the design leaders showed themselves as passionately empathetic, active listeners to what the non-designers had to say, insightful in their questions to understand business environments and what design capacity can benefit a business project. They are also led by motivation as designers; however, their motivations are interest in a project sponsor’s business environment. After college period, they trained themselves how to listen carefully after realizing the difficulty of delivering design. In particular, being independent is important because design leaders usually go to meetings by themselves and clarify all business issues to sell design.

IV. CONCLUSION/DISCUSSION

Designers and design leaders are led by motivation. However, different interests of motivation lead them to develop different types of skill sets. Designers know what and how to produce the aesthetic part of design effectively and efficiently. In contrast, design leader identifies where to go for NPD direction and what kinds of design are needed to achieve NPD aim. A new project initiated by marketing, technology or other disciplines will significantly benefit from using the design leadership. Design leaders can envision and share about distinctive market opportunities of NPD by realizing future benefits from the beginning to maximize the capability of design. Indeed, organisations that wish to train design leaders may identify designers from this design leadership model. Also, designers who wish to become design leaders can benefit from the key insights of this research.

V. FUTURE PLAN/DIRECTIONS

This research still is on the primary research and will systematically analyse the data. All gathered data will be triangulated for the validity claim of this study. Triangulating different sources of researched data coherently to justify different perspectives can be argued as the validity of the study (Creswell, 2009). It will comparatively analyse to create a conceptual model as a grounded theory which will be validated. The anticipated outcome will identify the profile of a design leader as well as elements of communication to lead non-design team members to understand design led new market opportunity and defining a NPD direction as agreed.

REFERENCES

I. INTRODUCTION

For driver safety, situation awareness and brand perception, it is becoming very important for automotive designers to consider the emotional state of the driver in response to the various events taking place during the driving experience. Situation awareness is defined as the knowledge of what is going on around us, for the ability to understand how information, events and actions will impact our goals and objectives. It’s also claimed that poor situation awareness contributes to more accidents than improper vehicle speed or driving technique [1]. Emotional or affective reactions to the different sensory stimuli are an often neglected component of interior automobile design development, although being crucial, since emotional events have the capability to interrupt ongoing cognitive processes and automatically grab attention, eliciting an attentional or behavioral switch towards these events [2]. Stimuli from all sensory modalities can carry emotional information, from visual to auditory and even simple vibrotactile stimulation, although little systematic research has focused on how stimuli other than visual elicit emotions.

Therefore, in order to improve road safety and driver engagement, it is important for car designers to consider the drivers awareness and emotional response to the various events taking place during the driving experience, and to find the most efficient way to minimize signals that can distract and annoy the driver, while maximizing signals that are useful in assisting the driver by amplifying the meaningful information or signal to noise ratio. These signals must capture attention and obtain fast and intuitive responses from the driver in critical situations, while maintaining an appropriate level of information load which makes the driving experience pleasant and relaxing in non-critical situations [3].

The main motivation behind this research is to develop an understanding of the correlation between steering wheel vibration characteristics and the driver’s subjective response in order to be used as the basis for the development of steering perception enhancement systems [4], which in turn will improve steering feel and driver situation awareness. Perception enhancement systems (figure 1) selectively amplify the key environmental phenomena needed to enrich user interaction and sensory branding for making the world more intuitive.

II. METHODOLOGY

Research Objectives:

- Identify what factors affect the human emotional reaction to the steering wheel vibration stimuli perceived and expected.
- Define the semantic descriptors, which drivers use to describe their feelings of the perceived vibration.
- Measure which semantic descriptors can be categorised with which driving scenarios.
- Define the key steering vibration signal features, which are most associated with the descriptors gathered.
- Modify and assess the steering wheel vibration to improve the driver’s perception of the key descriptors.

The research aims to develop a Sensory Evaluation Scale (SES) that involves measurement of the perceptual, cognitive and linguistic characteristics elicited during driving conditions. The methodology will involve online questionnaire surveys, field studies (in-situ driving route) and laboratory experiments (test bench within Brunel-PER laboratory,) to achieve a collection of quantitative and qualitative data.

The research project will involve interpreting the "descriptors" being used by the driver and measurement of
various driving scenarios according to the descriptors gathered. After which evaluation of the driver’s emotional response towards their experienced and their expected feelings of the steering wheel vibrations. The main test involved in this study will include manipulation of steering wheel vibration features recorded from various driving scenarios and mapping those features to the key gathered driver descriptors. Finally the sensory evaluation scale will be developed and refined by mapping the vibration characteristics that elicit a cognitive and emotional engagement.

III. RESULTS

A preliminary two-part study was run to assess the driver’s emotional response based on their experienced and expected feelings of steering wheel vibration. The first part involved investigating what form of correlation exists between measures of the valence and the arousal dimensions of the human emotional response to steering wheel vibration. Results showed a linear correlation between intensity and the valance and arousal dimensions. The second part involved a questionnaire study which gathered the driver’s emotional feelings they associate to their expected steering wheel vibrations for various driving scenarios. The emotional assessment method for both of these studies involved a Self-Assessment Manikin scale. The results were then joined and plotted on a two dimensional space shown in figure 2. The highlighted data points show signals which did not match between the drivers expected and experienced ratings. The results highlight in green and red show the main signals that need to be addressed during the next stages of this study.

The red highlighted (broken concrete, broken lane and country lane) roads are shown in more detail in figure 3 which were expected to be have a pleasant rating but in fact were experienced as unpleasant. These three road profiles had the highest intensity ratings compared to other road profiles used.

IV. CONCLUSION

The conclusions drawn from the preliminary study are that the affective dimension of valance is a decelerating function of the r.m.s. vibration level, whereas the arousal dimension is an accelerating function. The questionnaire survey revealed the road profiles which do not match the driver’s expectations to their experiences. It can also be concluded that differences in the response to steering wheel vibration are mainly attributable to the differences in the vibration intensity, although factors other than vibration intensity may affect the emotional response. This research presents the main three vibration signals what need to be explored further in terms of the presence of high peak events or high frequency band amplitudes as highlighted in figure 3.

V. FUTURE PLAN

Currently a field study is being carried out, with the aim to extract driver’s judgment and impressions of a vehicle’s steering feel qualities when driving over various road surface types. The descriptive words used to relate to the felt steering wheel vibrations will be gathered to determine the vocabulary that drivers use to refer to their steering vibration perception, to be used to develop a measurement scale needed for the next experiment of my research.

REFERENCES

School of Engineering and Design-ResCon13

Design Management for Female Academics in Saudi Universities to improve the work Environment

Nouf Alnassar, Dr Susan Grant, Dr Ray Holland
Design Research
2nd year

Keywords— Design Management, Design Research, Ergonomics, Female academics, Work environment and its improvement

I. INTRODUCTION

At present, the Kingdom of Saudi Arabia (KSA) is going through a transitional development phase where it is becoming a leading country for GCC (Gulf Cooperation Council) and MENASA (Middle East North Africa South Asia) regions. Higher education development is one vital element of economy and trade for Saudi Arabia. This research concerns the needs of Saudi Arabian female academics in female-only colleges and universities. In the available academic literature, these needs and different dimensions have not yet been considered extensively, especially with respect to design in their work environment.

The studies of literature reveal that workplaces under the present circumstances design and focused in general on both gender workplaces. Without taking into account the differences specific needs, especially in countries where organizations are in practice due to religious and culture restrictions Such as Saudi Arabia. Corby and Stanworth (2009) indicated that women have different demands in the workplace from men and they settle for less than satisfactory conditions in their work lives. Cornelius and Skinner (2008) approached women in senior management to determine what differences they exhibit in their approaches to work and what their requirements and measurements of success might be. Women are well represented in service sector work, including libraries. Soltani et al (2010) have written about the satisfaction of service sector employees; also Hadfield and Sen (2009) have presented information about UK women working in libraries. This research will focused on female academics in four different universities, in UK and KSA. Researcher has visited two universities of UK and then Princess Nora University in KSA and concluded that the newly built Princess Nora University has being selected between the 100 most innovative and inspiring urban infrastructure projects in the world (constructionweekonline, 2012). But designing of offices for female academics and overall workplace does not meet the requirements such as daycare center, resting break, noise, colors, internal natural lights, comfortable in offices and satisfaction in work environment.

This study therefore, aims to formulate a strategy suited to female university in Saudi Arabia. The course of action that leads us to determining the said framework would be divided into two principal phases: philosophy and strategy.

II. DESIGN/METHODOLOGY/APPROACH

This research study examines cases of female Saudi Arabian universities and recommendation of congenial work environment within the context of design management applications. The study proposes use of design research, ergonomics and systems design thinking to develop the university design which facilitates removal of physical and cognitive barriers for female academics. Study was carried out in the following steps:

a) Observations of female academics in the workplace.
b) Photo audit and archival documents.
c) Observations analyses.
d) Focus groups of female academics to study issues of concern and to review design solutions.

III. FINDINGS/RESULTS
1. Researcher has visited Brunel University in UK and Princess Noura University in Saudi Arabia, and recorded observations of the work environment.

2. Evaluated the design of present work environment in the female academics and highlighted areas to be focused for designing at Saudi University.

3. Researcher constituted focus groups to study qualitative aspect of this research.

4. Design management strategies and Design thinking can significantly improve the workplace design for female academics in Saudi Arabia Universities.

IV. FUTURE PLAN/DIRECTIONS

Future plan is to conduct structured interviews with female academics in KSA and UK to assess the needs and develop the design solution in terms of a framework for workplace improvement in Saudi University and this will reflect on the university success, academics loyalty and attract talents.

REFERENCES


CULTURE-INSPIRED DESIGN PRINCIPLES, METHODS AND TOOLS

IN CURRENT PRODUCTS

Yu-Han Wang, Sheng Feng Qin, David Harrison

Design research

Keywords— culture-inspired, product design, culture characteristics.

I. INTRODUCTION

This study aims to explore design guidelines from the literature and current products: (1) to classify cultural elements from product design applications, (2) to identify and interpret the design principles, methods, tools being used and (3) finally to deduce culture-inspired design guidelines based on Grounded Theory. The research methods include literature review and case studies to investigate culture-inspired products in the market against classified cultural elements. The research contribution has three-fold: firstly, we classified culture elements into three categories: artefacts, nature, and spirit in terms of literature review. Some design guidelines are found, but they are quite vague for designers to apply. Secondly, from our case studies of cultural products in the market, we created mappings between classified culture elements and the corresponding design principles, methods and tools. Based on this mapping, a set of design guidelines for each type of culture element is developed.

II. DESIGN/METHODOLOGY/ APPROACH

Regarding to literature survey conducted in 2012, the papers which are related to culture and design are searched by keywords, such as cultural product, cultural design, product design…etc. in the Web of Knowledge database, Summon library database, ACM Digital Library, IEEE/IET Electronic Library results in ; journals related to design which are design issues, design studies, Design Management Journal, International Journal of Design… ; journals related to culture which are Harvard Journal of Asiatic Studies, International Journal of Cultural Studies, International Journal of Cultural Policy, while low related papers are found in other culture related journals, Design Management Journal, SAGE, Creativity and Innovation Management, Taylor & Francis…etc. ; and also relevant conference papers. In all, 21 books, 16 conference papers and 30 journal papers were highly related to this study. However, rare studies were published about cultural symbols and design rules that have been applied in existing culture-inspired products. So, research gap is what these cultural characteristics and their classifications are, so that designers could have an overview of current culture-inspired products and how they are applied. In the meanwhile, what cultural characteristics have not been applied, and what kinds of products have not been applied to will be investigated in this study. Therefore, previous related works identify three key research questions regarding guidelines of culture-inspired design and classifications of cultural characteristics from the existing culture-inspired products. The research questions are (1) What are key and transferable culture-inspired characteristics/ elements in existing culture-inspired products? (2) What are the design guides that have been applied to culture-inspired products in each cluster of cultural elements? (3) What are potential guides of designing culture-inspired products which can be explored in the future? Hence, literature review and case study approaches are chosen to answer these questions.

III. FINDINGS/RESULTS

1) A classification of culture-inspired characteristics

Based on the literature review [1][2][3][4][5], it can be concluded that culture is roughly identified into visibility/tangibility and invisibility/ intangibility. Specifically, visibility refers to materials or artifacts, while invisibility means philosophy or spirit. Furthermore, materials are divided into nature and cultured which means human-made. Based on these studies, a classification of cultural characteristics is defined as artifacts, nature and spirit. For artifact category, the further categories stem from the museums. The categories of museums are collected from British Museum, Louvre, National Gallery of Art, Museum of London, MoMa, Glencoe and North Lorn Folk Museum, National Palace Museum, National Museum of Korea, Tokyo National Museum,…etc. Thus, sub-cateoloies of artifacts are artistic creations, sculptures, living utensils, social life, architecture, technology and pastimes. In nature aspect, it includes landscape, seascape, local flora and local fauna. In spirit aspect, it includes philosophy symbols and colour meanings. So, for the first research question, a classification of culture which would be applied to culture-inspired products is identified.

2) Applied design guides of culture-inspired products

Design models and design processes for culture-inspired design are suggested by recent studies [6][7][8]. In particular, the specific design rules such as imitating, deconstructing, following structure or functions, transforming, abstracting, integrating, combinatory, simile, metaphor…etc. are highlighted. Forty-five samples of culture-inspired products are collected from iF design award, Taiwan international cultural and creative industry expo award, gift shops of National Palace Museum, google image search, and design
Nature

Spirit

- Landscape
- Seascape
- Local flora
- Local name
- Philosophy symbols
- Colour meaning

Artworks

- Calligraphy
- Paper cutting
- Traditional painting
- Paper cutting
- Fan
- Dioram
- Porcelain
- Lacquer ware
- Ceramic
- Bone
- Sculpture

Cultural characteristics

- Artistic creation
- Domestic
- Social life
- Architecture
- Technology
- Fashion
- Sports
- Music

Table 2: Applied design rules on culture-inspired product

<table>
<thead>
<tr>
<th>Design rules</th>
<th>imitate/simply</th>
<th>abstract/simplify</th>
<th>deconstruct</th>
<th>transform</th>
<th>combine</th>
<th>with other cultural characteristics</th>
<th>with other functions</th>
<th>colour change</th>
<th>image transferred</th>
<th>form followed</th>
<th>function followed</th>
<th>meaning followed</th>
<th>2D to 3D</th>
<th>3D to 2D</th>
<th>3D to 3D</th>
<th>3D to ID</th>
</tr>
</thead>
</table>

3) Potential guides of designing culture-inspired products

The majority of the culture-inspired products are inspired from artistic creations and the most common used design rule is image transferred and normally there is rare correlation between cultural characteristic and the product itself. On the other hand, some award-winning products are designed considering among the meaning of cultural characteristic, the function of products and users’ emotion within the cultural context via use behaviour. Therefore, the potential guides will further develop in aspect of meaning transferred and unapplied manufacture tools.

IV. CONCLUSION/DISCUSSION

Most of the products are inspired from artefacts, especially from artistic creations; the most common applications are products in the kitchen and home category, and followed by in the fashion category. Products of other categories could be considered to be exploded, such as technologic products. In the aspect of design rules, most commonly used rules are simile and image transferred from 2D artistic creations, and form transferred from other 3D artefacts. Furthermore, the applied manufacturing tools are print transfer, laser cutting, in-mold decoration, carved and pressing die pottery and ceramic making methods. The contribution of this study is a specific classification of cultural characteristics corresponding to current products and design rules are proposed. Accordingly, designers can have an overview of what and how culture-inspired products are in the markets and what can be further exploded.

V. FUTURE PLAN/DIRECTIONS

In this study, it is shown that many design rules can be applied into different culture-inspired products. And furthermore, what kind of culture-inspired products can efficiently arouse users’ emotion and differentiate themselves in the markets. Moreover, our future work is to interview designers to understand what they need when they apply cultural characteristics into product design.

REFERENCES

GUIDELINES TO USE ISLAMIC ART AND CULTURE IN BRANDING

Hadeel Silsilah, Busayawan Lam, Sarah Silve
School of Engineering and Design
3rd year

Keywords—Commercial brands, Islamic art, Islamic symbols, Islamic Culture, Islamic and non-Islamic market.

I. INTRODUCTION

The research aims to investigate the current use of Islamic Art in commercial brands/products and develop a tool to assist designers in applying Islamic Art appropriately. To ensure the usefulness and practicality, the tool is properly evaluated in the context of idea generation and concept development.

Nowadays, many types of art have been exploited for commercial brands. Several studies have proved that applying appropriate art can help differentiate products and brands from those of competitors, as well as increase brand values. For example, Davis and McIntosh (2005) state that art can “satisfy customers’ desires for beauty, excitement, enjoyment, and meaning.” Art goes beyond enhancing brand experience; it can encourage dialogue between brands and customers, and conversations amongst customers.

In addition, embedding simplified Islamic art symbols in commercial products can increase sales. However, the lack of clear guidelines can result in high risks of misuse, misinterpretation which could damage the reputation of the brands. This research identifies key challenges and proposes how to address them properly. These challenges will encourage designers creativity to apply new Islamic art symbols appropriately in commercial products. This paper proposes a tool that can assist designers in unleashing the hidden values in using Islamic art and guide them apply Islamic Art correctly. Figure 1 demonstrates the strong interest in applying Islamic art among international brands, such as Coca-Cola and Starbucks.

According to several case studies were conducted with leading brands international and Middle Eastern, the majority of Islamic Art used in commercial applications is currently based on designers’ interpretations without any guidance. The lack of clear guidelines has led to improper use of Islamic Art in commercial products. The biggest challenge is deciding what Islamic Art’s elements and culturally referenced graphics are suitable, and how they can be applied in commercial products to effectively convey Islamic cultural values.

B. Semi-structured Interviews

Six brand managers that use Islamic Art imagery in their brands and products were interviewed. The majority strongly agreed that an absence of clear guidelines led to difficulties in creating a recognisable Islamic style. Moreover, such absence leaves brands to rely on what non-Islamic design agencies provide. The experts noted that the strongest element of Islamic Art is Arabic calligraphy, which is highly appreciated in the Islamic culture, as it is the language of the Quran. Appropriate use of Arabic calligraphy could significantly enhance brand value and recognition.

C. Questionnaire

The online questionnaire survey was conducted with a good mixture of participants from different age groups and cultural background. The total number of participants was 117. 69 came from Saudi Arabia and 49 from other countries. The outcome indicates that although symbols in commercial brands have to be recognisable (e.g. Chinese

Table I. CASE STUDIES ABOUT ISLAMIC ART COMMERCIAL USE

<table>
<thead>
<tr>
<th>Clients</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coca-Cola (Ramadan Can and poster)</td>
<td>Use of cultural images was not appropriate which did not help to deliver the real cultural and Islamic value of Ramadan</td>
</tr>
<tr>
<td>Starbucks (Ramadan Paper cup)</td>
<td>Use of colour was not successful which caused difficulty in widely recognising the art origin</td>
</tr>
<tr>
<td>Pepsi (Ramadan Can &amp; Bottle)</td>
<td>Lack of creativity is clear as the same well known images and patterns are used in the theme</td>
</tr>
<tr>
<td>Saudi Designer Nawal Almaimani (Logo &amp; Garments)</td>
<td>Creative use of Calligraphy in logo and in fabric prints which helped women Islamic garment to more elegant and deliver the vision successfully</td>
</tr>
<tr>
<td>Saudi Designer Nabila Nazer (Logo &amp; Garments)</td>
<td>Combination of Islamic art patterns on clothing which could help the designer’s collection be recognisable by Muslim and non-Muslim market</td>
</tr>
<tr>
<td>Saudi Arabian Airlines</td>
<td>Lack of creativity in linking the Saudi cultural heritage with the Islamic imagery</td>
</tr>
<tr>
<td>Andalusia Café (Café and Islamic Library)</td>
<td>Good example of Cultural images and Islamic style however lack of simplicity is clear</td>
</tr>
<tr>
<td>Tamani Hotel Dubai (art at Tamani)</td>
<td>Great combination between Islamic art work and customer hospitality and experience</td>
</tr>
<tr>
<td>Rateel (Dates shop)</td>
<td>Contemporary Arabian cultural style of serving traditional dates</td>
</tr>
<tr>
<td>Mawaddah Group for Holy tourism Saudi Arabia</td>
<td>Logo inspired by Islamic art shapes and calligraphy however style quality was very poor</td>
</tr>
</tbody>
</table>

II. QUANTITATIVE AND QUALITATIVE RESEARCH

A. Case studies
characters) to signify their meaning, they should not be too complicated. Subsequently, art and cultural graphics should be simplified to an extent. However, traditional values and core meanings must remain visible. The survey results also suggested which graphic elements should be considered as top priorities when applying these images, such as colours, creativity, simplicity, artistic style, innovation, culture and heritage. Some cultural symbols and graphics give a positive image and make the brand look more appealing to wider audiences. The results from literature review, case studies, interviews and questionnaire were analysed to extract key issues, which form a basis for the development of the tool.

III. FINDINGS

Noticeably, there has not been any significant development in terms of applying Islamic art to international brands and products. Recently, international brands, such as Coca-Cola and Starbucks, have applied Islamic Art to their products to celebrate Ramadan in Islamic countries despite the fact that these brands do not have any Islamic roots. They clearly want to make their products appeal to the Islamic markets.

The new tool (Guideline Cards) is a collection of 21 cards representing diverse ways that designers can understand Islamic art elements. They are designed to assist design teams in incorporating Islamic Art elements as well as meanings into their designs. These Guideline Cards are inspired by IDEO method cards. They act as guidelines that explain meaning behind Islamic Art elements and give examples of good use of each element. Each card contains three types of guideline:

1. Literal explanation of the philosophy behind the shape
2. Visual example of how to create the shape using geometry
3. The elements are illustrated with real-life examples of how the element was used in the Islamic world.

![Circle in Islamic Art](image)

**Figure 2 (A) Front of the Card**

![Cultural References of Ramadan](image)

**Figure 3 (B) Back of Card**

Figures 2 and 3 show an example of guideline cards. The top image represents the front and the bottom one shows the back. In this example, the front of the card explains the role of the circle in Islamic Art. It contains a few verbal descriptions explaining the meaning, the philosophy and the role of the circular shape in Islamic Art. This text is accompanied by an explanation of how the shape is developed using geometry. The back of the card provides images to communicate the meanings expressed in the card, as well as examples of how circular shapes are used in the Islamic Art.

A. Focus Group

The method was used to measure the effectiveness of the proposed tool in a form of guideline cards. Two experimental style focus groups were carried out with eight participants in total (four participants per group; each group included a graphic designer, an artist, a brand manager and a marketer). Although both groups were given same brief, designing a Ramadan-theme product for Costa Coffee, only one group was given the set of guideline cards. This allowed the researcher to clearly compare the final results and evaluate the effectiveness of the cards. Table 1 shows the ideas proposed by both groups.

<table>
<thead>
<tr>
<th>Group 1 With Cards</th>
<th>Group 2 Without Cards</th>
</tr>
</thead>
<tbody>
<tr>
<td>The team found it easy to link ideas with real Islamic meaning on Ramadan and cultural references</td>
<td>The team stuck with a few original ideas and found it difficult to come up with further ideas</td>
</tr>
<tr>
<td>Idea development was considered to be more organised. Results focused on the real concept of the month</td>
<td>Ideas were created based on cultural references of Ramadan without an in-depth Islamic spiritual meaning</td>
</tr>
<tr>
<td>They were inspired by the visual as well as the philosophy of Islamic art</td>
<td>The group relied on research as well as images on the Internet</td>
</tr>
</tbody>
</table>

IV. CONCLUSION

The study clearly indicates that certain images and symbols of Islamic Art embedded in commercial products are widely recognised and appreciated. However, these images need to be properly simplified so that they will not interfere with other elements of the brands (e.g. logos), and can be recognised easily and accurately interpreted. Thus, there is a need to provide a guidance showing not only contemporary images of Islamic Art but also simplistic applications of Islamic elements. The proposed set of cards intends to provide inspirations for designers, as well as those seeking a creative spark in their work by using Islamic Art and cultural values.

V. FUTURE PLAN AND DIRECTIONS

The next stage of this research is finalising the cards. In addition, two designs will be developed one will be assisted by the cards and one will be produced without the cards. This will provide a clearer idea of the level of the cards’ effectiveness in practice. At this stage, the draft of the first chapter has been completed. The submission of full thesis is expected to be at the beginning of November 2013.

REFERENCES

AN INVESTIGATION OF DESIGN PROCESS OF CULTURAL-INSPIRED PRODUCT FROM CULTURAL RESOURCES: PEKING OPERA PAINTED FACES (POPF)

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Design
2nd Year of PhD

Keywords—Peking Opera Painted Faces, semantics, transforming, symbolic elements, cultural design

I. INTRODUCTION

The research considers current Peking Opera Painted Faces as a culture resource. The research aims to examine the multiple-attributes of the facial painting arts in association with stage performing arts. The first research objective is to study and develop design methods to transfer the symbolic meanings into cultural and product design. The second objective is to explore the possibility and the way of transferring higher level semantics associated with facial painting and performing arts into cultural product design. My research in this year is focused on the literature review and case studies in order to identify the state-of-the-art in the related culture inspired design in terms of design methods and processes. POPF is used as a focus point to guide my study. This study may also apply the semantic features of other Chinese Traditional facial painting forms such as KUNQU to the modern design, and establish close contact with all aspects of social life. Application of such a culture resource may include including product design, interaction design, system design and service design in China and Western countries, along with the integration of other elements of traditional Chinese cultures and arts.

The term “painted face” refers to the colourful facial make-up of an actor in traditional Chinese drama. Such make-up is stylised in form, colour, and pattern to symbolise the characteristics of specific roles. The POPF is characterised by symbolism and exaggeration. So that a vividly painted face enables audiences to see expressions clearly even from a distance, a great advantage in the days when dramatic performances were usually staged in the open air before large crowds.

POPF as a branch of traditional Chinese cultures and arts has been known all over the world. However, modern young Chinese people do not truly understand it and not think much of it. Besides, it is a vague concept in the eyes of Western peoples. At the same time, Cultural creative product design is popular in these resent years. So it is necessary to find a proper way to spread POPF. To the important is the facial colours, types and symbolic meanings of POPF is worth studying.

II. DESIGN/METHODOLOGY/APPROACH

We developed a series of methods using in both of primary research and secondary research, such us literature review, case study, interview, focus group etc.

This paper reports on the preliminary investigation of the field research and its related research of POPF. The research gaps and existing methods were indentified from literatures collected via one main online database in terms of current related journal papers and conferences papers.

A. Literature Review

We explored a series of keywords which are related to facial painting or cultural transforming design at the beginning. Then classified words with similar meanings or characteristics, such as Facial Painting & Painted Face & Facial Mask etc were used. After that, we designed search set-ups with the combination of keywords from different classifications, such as Facial Painting & Peking Opera, Facial Mask & Facial Makeup & Chinese Opera etc. Search set-ups are shown in Table I.

B. Case Study

In order to indentify existing applications without literature report, we explored a series of historical remains and products with commemorative meanings related to POPF for making a summary of the whole classifications of different applied methods with the using of cultural elements. Besides, we want to summarise a semantics database of cultural elements of POPF from among its facial colours and characters, types and symbolic meanings, sourced from certain typical and well-known illustrations of POPF.

TABLE I. DATA SEARCH SET-UPS

<table>
<thead>
<tr>
<th>Aim</th>
<th>Collect the related literatures of POPF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method</td>
<td>Data retrieval system (Online)</td>
</tr>
<tr>
<td>Search Process</td>
<td>Brunel Library &gt; Databases &gt; Web of Knowledge &gt; Web of Science</td>
</tr>
<tr>
<td>Access Date</td>
<td>30-08-2012 (Web of Science)</td>
</tr>
<tr>
<td>Search Limits</td>
<td>Timespan – Date Range: From 1970-01-01 to 2012-08-30</td>
</tr>
<tr>
<td></td>
<td>Search keywords in “Topic” or “Title”</td>
</tr>
<tr>
<td></td>
<td>Refine Result – Advanced Options: Exclude (by Science Categories)</td>
</tr>
</tbody>
</table>

TABLE II. EXISTING PRODUCTS OF POPF

<table>
<thead>
<tr>
<th>Classification</th>
<th>Typical Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td></td>
</tr>
</tbody>
</table>
III. FINDINGS/RESULTS

Research Gaps

The amount of 483 full-papers is our initial and original data resources of literature. The cultural and creative industry is a newly emerging industry globally developed from various cultures. It is also a kind of aesthetic economy and a creative industry. Culture is a kind of code hidden in these product designs or in the producers. Design is de-code, re-presentation, or de-culture. So through the transformation to interpret the current cultural styles and characteristics, and through meanings of codes, signs, and representation, the relation among design, culture, and code is combined to one.

TABLE III. TYPES OF RESEARCH GAPS

<table>
<thead>
<tr>
<th>Design/Product Design</th>
<th>Principle/Guideline of Transforming</th>
<th>Research Directions</th>
</tr>
</thead>
<tbody>
<tr>
<td>With using the same or similar symbolic approaches to express cultures and arts</td>
<td>Transforming methods for the expressions between cultures and applications</td>
<td>Similar cultures and arts in different countries and areas</td>
</tr>
</tbody>
</table>

Design methods

Existing design methods are summarized into two categories:

Compared with the research gap and the research aim, we established the connection between them. We found design principles and transforming methods among similar painted arts and cultures with using similar symbolic expression ways to POPF. The most popularity of current transforming methods are “Side-effect transforming” like deforming part of patterns, changing colours, add textures with the using of body tattoo and stage performances.

Besides, from the Case Study, we found that the most of current existing products simply used the traditional meanings of POPF or mapped the entire illustrations of POPF, fewer amounts of products was designed with transforming methods through setting up the connections between the component parts of the painted face and the function of the products.

TABLE IV. ANALYSIS OF CULTURAL ELEMENTS

<table>
<thead>
<tr>
<th>Illustration &amp; Figure</th>
<th>Facial colour</th>
<th>Type of the painted face</th>
<th>Symbolic meanings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultural Elements</td>
<td>V.S. the characteristics of specific role</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IV. CONCLUSION/DISCUSSION

Through my literature research and case studies, we found several research gaps, and these would be the start of my future design. Comparing to attributes of general product design, the cultural product design generally changes from use-base to the elevation of symbol value to bring out the product’s peculiarity and its differentiation. So we would add our design thinking to the original colour languages and semantic meanings of POPF, made the expression meanings of Painted Faces could completely correspond with the indicated information of product design.

V. FUTURE PLAN/DIRECTIONS

- Continue to summarise the knowledge base of cultural elements of POPF from among its facial colours and characters, types and symbolic meanings.
- Continue to summarise the key design guidelines or principles among similar painting expression ways in different cultures.
- Apply these cultural elements to “Human” and “Product” – the modern expression of traditional design semantics and the innovate comprehension of fixed Painted Faces.

REFERENCES