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The Effect of the Merging of Design Disciplines and its Implication for Product Design Education

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Abstract: Design in industry is changing and design education needs to evolve accordingly. The borders between design disciplines are blurring with the different areas of design extending into each other. Design problems have become more complex as several technologies are combined to produce not just stand alone products but systems and services that are interconnected. To date product design has only been concerned with the hard-ware of a product but now the focus must also be on the disciplines and areas of design that are impacting on product design. Despite industry advances there is a belief that education is not supporting these opportunities. Evidence has shown that currently there is a poor link between design practice and design education. Many product design courses are based on the craft based Bauhaus style studio course which place an emphasis on aesthetics and form. Skills such as rendering, model making and styling are the focus despite the fact that industry is now looking for skills in other areas. This paper reviews the disciplines of design that are merging with product design. It examines the variety of design approaches and methods used by those disciplines. This shows that a holistic approach is needed to solve today's design problems. This paper contributes to a better understanding of product design in industry and can contribute to educators in developing educational strategies for the teaching of product design.

Keywords: Design Disciplines, Product Design, Methods, Approaches, Education

Introduction

DESIGN HAS EVOLVED from a narrow focus on aesthetics and function to include other areas such as services, branding, business strategy and technology. The borders between design disciplines have blurred with the different areas of design extending into each other. The shift is now towards user centred design, strategic planning, innovative product development, sustainable product development and interdisciplinary collaboration (Kolko 2005). Changes in technology are having an impact on the type of products being created. The internet, telecommunications, computer and wireless devices have opened up new design possibilities (Moritz 2005). As physical components may only be a small part of 'the product', designers are working as part of a team on a broader set of design problems integrating specialist expertise where needed (Moritz 2005, Wohlfarth 2002). Service design and design for sustainability are currently the fastest growing areas of design. Designers are now adopting leadership roles and carrying out tasks that go beyond design activities to support the whole new product development (NPD) process (Perks et al. 2005). Companies are looking to designers to deliver innovation, establish brands and improve systems. They are using designers more strategically across their business to help them grow and compete more successfully in global markets (Burns et al. 2006).

Despite industry advances there is a belief that education is not supporting these opportunities. Evidence has shown that currently there is no great link between design practice and design education (Roald 2006, Gajendar 2003). This has resulted in design education lagging up to ten years behind current design practice (Weightman and McDonagh 2006). Many product design courses are centred on the craft based Bauhaus style studio course; which place an emphasis on aesthetics and form, teaching skills such as rendering, model making and styling. However, industry is now looking for skills in the areas of user centred design, strategic planning, innovative product development and interdisciplinary collaboration (Kolko 2005).

InterTradeIreland (2008) in a review of the design service sectors in Ireland argue that the opportunity for designers to contribute to other sectors of the economy is not being optimized. The report recommends a holistic approach from designers and clients to develop a business culture to promote the advantages of design and produce higher skilled designers in the areas of business, technology and innovation. While digital, multi-media and communications graphic design are expected to grow a decline is expected in the area of product and industrial design due to the outsourcing of design and manufacturing to other countries. The service sector and high-tech industries are high growth areas within Ireland and it is into these areas that product design will need to expand.

This paper presents a study of the literature on the changing field of product design. The objective is to show how design practice has evolved and the effect that this has had on product design as a discipline. The paper is of benefit to design educators as it defines the scope of emerging design practice. It highlights the crossing over between design disciplines, the integration of product designers across the full development cycle and the adoption of new methods and approaches to design. The impact of this on design education is also discussed and possible models are proposed. The paper contributes to a better understanding of design practice and can inform educators in developing educational strategies for teaching product design.

The paper is structured as follows; first a discussion of the key growth areas of design is presented. This is followed by a review of the approaches and methods that can address these growth areas. The paper concludes with a discussion of the challenge that these developments create for design education.

Key Growth Areas of Design

Product design has traditionally focused on the skills that give shape to a product or technology. Emerging design practices, centre on people and societal needs and require different methods to address larger scopes of enquiry. We are no longer simply designing products but also the future experience of people and cultures. What we design and how we design will change and the impact on education will be immense (Sanders and Stappers 2008). A review of the literature on product design suggests six key growth areas (though this is not exhaustive) as illustrated in Figure 1. These six areas are described below.

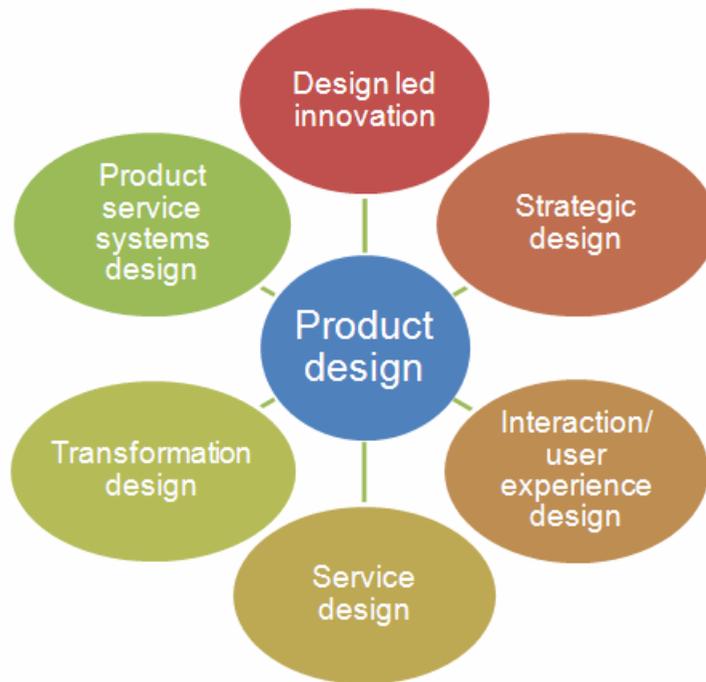


Figure 1 Growth Areas of Design

Design Led Innovation

Design-led innovation refers to innovation that has design at its core or in which designers provide the ideas or drive for new product development (Candi 2010). The importance of design at the early stage of innovation is now recognised with designers involved in scientific research. Design is rapidly evolving: it is not simply a tacit and unmanaged process, but a complex approach to innovation that combines both aesthetic and technological innovation (Hertenstein et al. 2005).

The key to innovation today is the socialization of invention. This is where innovation is not just led by technology but considers the application and benefit to users and society. It is the designer who is the link between technology and society. Design led innovation is where technological innovation is combined with meaning innovation. Meaning innovation refers to innovation that considers the meaning of a product to the user, how it effects and enhances the user experience. These have to be driven both by technological innovations, so they are technology driven, as well as by meaning revolutions, in which case they are also design driven. An example is where Wii harnessed the radical technological revolution in sensors with a radical change in the meaning of a video game, to great success (Verganti 2009).

Traditionally designers work to a brief where a problem is detailed for them to solve. Wormald and Rodber (2008) state that most creativity lies in the front end (also known as the ‘fussy front-end’) of projects. Designers using design methods can better understand the

user requirements and can also visually communicate a new technology that has not yet been put into production. There is evidence to show that if designers are involved at the beginning of a technology project the benefits are greater than market research and as important as IP protection (Design-Council 2009).

Design thinking and new tools and methods in ethnographic research have created a new model of innovation that is flat, open-source and dynamic. Designers engage with technologists early and perhaps more productively, to build open platforms that are tools that consumers can customize to their own needs (Nussbaum 2009). The iPhone is an example of this.

The process of design has become a more collaborative effort between designers and technologists using a methodology that emphasizes rapid prototyping, reflection and refinement (Madden 2006). There is no longer a hand over of concept designs from designer to technologist but a practice where the technologist and designer work side by side using concurrent design approaches to identify potential solutions. This is much faster than the traditional process of sequential design.

Strategic Design and Design Leadership

Designers now are involved earlier and more extensively in the NPD process and have increased ownership of that process. They are involved in the strategy of businesses by identifying customer needs and developing brands. In traditional roles designers responded to briefs but now designers are becoming problem finders as well as problem solvers by helping organizations to define as well as respond to a problem (Parker 2009, Maciver and O'Driscoll 2010). Designers are developing new skills such as research, observation and business analysis skills. To be able to interpret critical information involves interactive and communication skills (Perks et al. 2005). In many companies designers are taking up the role as leader of the NPD process (Perks et al. 2005, Roald 2006). Not all designer will take on leadership roles, but where they do they need training in business and marketing skills such as negotiation, motivation, and persuasion. These skills are also necessary to gain support from other functions and the acceptance of the designer in a leadership position (Perks et al. 2005, Maciver and O'Driscoll 2010).

Van Patter 2003 (cited in Roald 2006) states that designers must take on larger strategic responsibility or end up as a profession of labourers. There is now increased competition for designers as business professionals are themselves using design methods to solve issues (Roald 2006). Design education is not focused on developing the skills of building propositions and business cases and the communication of ideas in terms of benefit to users and customers (Peterson 2004). While 93% of students surveyed by the Design Council (2005) felt that business skills were necessary only 53% of heads of design schools in the U.K agreed.

Interaction Design/ User Experience Design

MacDonald (2006) states that interaction design is likely to become the key skill of this century. Interaction design is an area that is converging with product design. Products are increasingly embedded with digital technology to enhance functionality. Interaction design is about the creation of user interfaces to access information technology. It focuses on the

user's experience of a product and so is also known as user experience design. The skills required are an understanding of; human cognition, emotion, user experience, context of use and task analysis, in addition to the creation of intuitive functions: presentation of choices, error feedback and failure recovery (MacDonald 2006).

As the user's experience has become more important designers must develop the user interface before the core hardware and software (Tung and Deng 2002). This shift necessitates a product development process with an interdisciplinary team and concurrent design approach. Frankel (cited in Tung and Deng 2002) maintains that industrial designers should be capable of designing good interaction systems.

IDEO is an international design consultancy working across several design disciplines.¹ Many of IDEO's interaction designers have a background in industrial design. The demand for interaction design has increased significantly in recent years particularly with the increased role of the internet and product systems. The focus of product design has shifted to user experience design and important skills are the ability to structure, organize and design information systems (Stillion 2000).

Interaction design has thrived in recent years while traditional product design has declined. Product designers must adopt a more user centred approach considering how people interact with products over time, the cultural relevance of products and the social and environmental consequence of design decisions. Physical objects are useful but the larger experience of using them is more significant. Designers should apply a process that creates an experience-orientated solution instead of an object based result (Fry 2009). Designers must be flexible and prepared to adapt the design process to the design problem. Experience design is complex as it involves user motivations and behaviours within constraints. For designers to solve for this complexity they must be prepared to work more rapidly and change more frequently (Fry 2009).

Service Design

The market is full of products and to stay ahead of the competition companies need to offer new value. More and more companies are looking to services as a means of providing value to customers and advances in technology are creating new possibilities in this area (Moritz 2005). As products are becoming platforms for services, product designers must adapt to this shifting focus of design.

“A service is any activity or benefit that one party can offer to another which is essentially intangible and does not result in the ownership of anything. Its production may or may not be tied to a physical product.”

(Design-Thinkers 2009).

Service design is the design and arrangement of the interaction between the service provider and end user through creative processes and methods (Design-Thinkers 2009). Service design is where user orientated strategies and concepts are designed to make services work better for an organisation and their client (Moritz 2005). Service design can be both tangible and intangible and can involve artefacts and other aspects including communication, environment

¹ Since 1991, IDEO has topped Business Week's list of winners of the annual Industrial Design Excellence Awards, and in 2005, the magazine named IDEO one of the twenty most innovative companies in the world.

and behaviours (Hollins 2009). Services happen over time and are constantly evolving. They are interactive across different touch points and involve systems and planning and combine other design disciplines (Moritz 2005).

In many developed countries including Ireland and the U.K manufacturing has declined but the service industry has grown and now accounts for between 70% and 80% of GDP (InterTradeIreland 2008, Hollins 2009). Services must be designed and trends are focusing on not just the product but also the process and service interface which is known as ‘whole life design’ (Hollins 2009).

Service design uses the ability to question norms and practices that are not apparent to those working in a particular setting. It involves empowering people to make changes. Service design relies on deep user research requiring the designer to have emotional intelligence and empathy for the user. In parallel the designer needs to maintain a design mindset in the translation of research into actionable insights (Parker 2009).

Katz (2009) describes service design education as at a vanguard of change having evolved over the last decade, mainly through progressive product design courses with new courses now emerging in Britain. These new courses also reflect the shrinking demand for traditional product design graduates, skilled at hand-rendering electronic gadgets and specifying injection moulding processes and tools but less suited to a knowledge-based, service economy. This is why product design courses need to evolve, adapt and take advantage of areas of growth such as the service industry.

Transformation Design/ Service Design of Social Systems

Transformation design as coined by RED, the research and development team within the British Design Council is service design applied to social systems (Saco and Goncalves 2008). Designers in this field are often driven by a social mission where increased consumption the basis of product design, is no longer seen as the only marker of growth (Parker 2009). It is about applying design in new contexts in the area of public services, systems and products that addresses economic and social problems. It focuses on the user at the centre of the design problem and collaborates with users and front line workers to achieve solutions to complex problems.

Product Service Systems

“At Virgin Atlantic we recognised that thinking about product and service separately was nowhere near as powerful as thinking about them as one” .

(Lorenz 2008)

A combination of products and services is known as Product Service Systems (PSS) where products are embedded with digital technology incorporating services, strategies and brands etc. (Collina 2008). It has in many cases removed the traditional borders of the different design disciplines.

The term Product Service Systems is the extension of one design discipline into another. The design process may start with a product, and may then include a service, packaging and communication etc. The design approach takes into the account the impact of each design discipline on the others to ensure an overall solution. Product Service Systems addresses

product chains and systems. It looks at elements and processes within a context, considering their environment and relationship to other components. It requires a multidisciplinary team to generate joint up thinking and a holistic approach to problems (Collina 2008). An example is the iPod which is part product (hardware) part database (iTunes) and part inventory (storing of music) with an integrated service offering (Saco and Goncalves 2008).

As design problems have become more complex the role of the designer has changed as they have now become involved across the full lifecycle of the product. As the emphasis in design is moving more from the hardware of a product to the interaction and user experience and the service supplied by the product different disciplines of design are extending into each other.

Approaches and Methods in Design

The previous section presented the key growth areas in product design. The aim of this section is to review the approaches and methods that can be used by designers working within these growth areas. Designers need to select the method most appropriate for the problems they encounter, traditional design practices are no longer sufficient. Figure 2 outlines these approaches and methods.



Figure 2 Design Approaches and Methods

User Centred Design

Understanding user needs is critical for business success, therefore designers need to understand the needs and desires of users (Weightman and McDonagh 2006). Conventional market research has limitations. User centred designers engage actively with end users to gather

insights that drive design from the earliest stages of product and service development. This understanding increases competitiveness, and gives customers products that they find intuitive and easy to use. (Black 2008)

This approach was originally devised for the design of interactive systems but is now important to any design process. Where products have user interaction it is essential that the user is involved in the design process (Black 2008). A user centred designer is a key team member and product designers have the skills to take on the role (Gulliksen et al. 2003). Even though product design consultancies advertise in this area, they struggle to recruit individuals with the necessary skills (Rothstein 2002).

Participatory /Co-design

This is a further evolution of user centred design where the users and stakeholders collaborate in the design process. It is often the user who has deep insights into a particular application and engages with the team in the design process (Sanders and Stappers 2008). Putting the user to the forefront of design is applicable to all design disciplines.

Inclusive Design

There has been a recent shift in attitude, away from treating those with disabilities and the elderly as special cases requiring separate design solutions, towards integrating them into the mainstream of design. This is critical for social equality but there is also a commercial advantage with opportunity for business growth through new products and services. The reason for the shift in attitude can be attributed to the demographic change of our populations. In Europe there are 130 million people over the age of 50. By the year 2020 it is predicted that half the adult population will be over that age. It is no longer viable to design separate solutions for half of the population so innovative design solutions are needed to create greater social inclusion (Coleman 2006). Inclusive design is an approach that ensures products and services address the needs of the wider population irrespective of age or ability.

Design for Sustainability

‘A morally defensible form of economic and social development that meets the need of the present without compromising the ability of future generations to meet the needs of others’.

(Brundtland 1987).

As regulations are set to become more stringent and consumers more aware of environmental issues design for sustainability will grow. The Design Council (2007) notes that the more environmentally aware businesses are responding to customer demands for greener products by looking for sustainable solutions. Design for sustainability considers not just environmental issues but a broader scope of benefit to society and the economy (Boks and Diehl 2006). Consumers are demanding products that are healthy and socially responsible (Waage 2007). However many companies find that designers do not always have the expertise in this area (Design Council 2007). There are few undergraduate courses dedicated to sustainability principles in the U.K (Design Council 2007).

Interdisciplinary/ Multidisciplinary Development Teams

Teams are of major importance in any organisational context because, with increasing product complexity, groups work together in order to accomplish problems they cannot solve individually (Stempfle and Badke-Schaub 2002, 2007). Increased competition, reduced lead-times and product differentiation have resulted in a change to the design process with designers working as part of a fully integrated team. This allows designers to take a holistic approach to projects to develop a good understanding of the skills of colleagues enabling them to work more effectively. An additional benefit is mutual learning where designers learn about other disciplines and others learn about design. Innovation and creativity are enhanced through team work. Better solutions emerge to problems as a result of a pool of knowledge in the areas of design, processes, materials, manufacturing and quality (Stark 2000).

Multidisciplinary team-work is at the heart of IDEO reflecting the belief that it is the key for innovation. A team can be formed from a wide variety of disciplines such as: human factors, ergonomics, industrial design, mechanical, electrical, software and manufacturing engineering (Stillion 2000). Multidisciplinary team-work, is standard practice in industry, but much rarer in education (Design Council 2007).

Traditional methods of learning focus on the individual (Davis 2008). Newer perspectives of learning recognise that learning is less a solitary act and more about collaborating with others to pool knowledge and tools (Jonassen et al. 2006).

Summary

Product design has evolved beyond the aesthetics and form of objects to moving into new areas and disciplines. Designers must take a holistic approach to projects that include a combination of disciplines such as service, user experience and interaction design. The way designers work has moved to an emphasis on team work with an understanding of other disciplines. User centred and sustainable approaches are central to the design process. Designers have increased their involvement in the NPD process and are taking on leadership roles. These changes to the way designers work have created a need for a review of how designers are educated.

Implication for Education

“A better understanding of how people design will certainly inform design pedagogy”.
(Dym et al. 2006)

Designers, since the middle ages, have engaged in experiential and studio/project-based learning strategies where the emphasis has been on aesthetics and form. These modes of learning have generally continued unimpeded and design has largely been overlooked by educational theorists as an area for academic learning (Lee 2006). Although the influence of the Bauhaus model has been significant, contemporary debate around design education signals a period of transition (Buchanan 2001, Niederheman 2001, Lee 2006). An exchange between education and practice is long overdue (Rothstein 2005).

Some colleges in recognition of the changes to design practice have started to offer business skills, complex problem solving techniques, collaboration and interdisciplinary education.

As design boundaries are blurring hybrid courses have emerged to combine more than one discipline. The MFA in Media design (Art Centre College of Design, U.S.) combines communication and interaction design (Burdick 2007). The Koln International School of design offers a multidisciplinary course across thirteen areas of design called “Integrated design”. There is a view however that this will create generalist designers without specialized skills (Heskett 2002) and as a result specialist courses have also been established such as the MA in Design Interactions (RCA) London.

To fully utilize the expanding role of design and to gain credibility in business, designers need further training to cope with new demands (Maciver and O’Driscoll 2010). However it is not possible to create one undergraduate course that will equip students to work across the full spectrum of the design fields and the NPD process. One approach is to teach transferable skills to students to allow them to work across the diversity of design. Links with industry to create real world design projects are crucial to the education of designers (Breitenberg 2006, Cardozo et al. 2002). Industry problems are very different from the types of problems often used in education. Students are often not prepared for solving real world, problems (Jonassen et al. 2006). Active learning or experiential learning through projects that integrates disciplines, is also an approach that better facilitates the solving of today’s complex design problems (Seidel and Godfrey 2005).

Conclusions and Recommendations

This paper has shown that product design practice has changed. Product designers are now working across many other design disciplines as well as taking more responsibility within a broader scope of the NPD process. Product design education therefore needs to respond and develop teaching strategies in accordance. Various approaches to broadening education to reflect the practices in industry have been explored. One possible model is to create a generalist first two years of a four year program that covers several design disciplines and a final two years that streams into one discipline while maintaining an input from the other disciplines. The generalist years would introduce the skills and processes necessary for any design project, with the latter years allowing students to study specific areas in detail.

A second model is to run student projects that involve interdisciplinary collaboration with other courses and industry partners. This approach is necessary to develop a shared language and common goal to handle complex real world problems. A third model is to adopt an approach to education that gives students a self directed and reflective learning role to enable them to tackle the diversity, uncertainty and complexity of design problems (Martinsuo 2009). This may be achieved by adopting a problem based learning (PBL) model where the focus is on real world problems and students learn transferable skills through collaborative problem solving. In PBL the emphasis is on the process as opposed to the outcome and tutors act as facilitators to promote critical and creative thinking and reflection.

All of this creates a major challenge for educators who are faced with broadening the skills of designers but run the risk of designers becoming generalists without specialist skills. Further research is necessary in the area of design education to develop and evaluate teaching strategies that equip students to work in the evolving field of product design.

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