INTERNATIONAL CONFERENCE ON ENGINEERING AND PRODUCT DESIGN EDUCATION
10 & 11 SEPTEMBER 2009, UNIVERSITY OF BRIGHTON, UK

USER-CENTRED RESEARCH METHODS IN POSTGRADUATE TEACHING

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ABSTRACT
Coventry University School of Art and Design has been a leader in postgraduate Automotive Design for over 12 years. Recently, a spread of targeted design MSc courses have been added to the School's portfolio, aimed at migrating people from one field of experience such as engineering, into industrial design. A common feature of these courses is the emphasis placed on research methods underpinning design activity. Project outputs are evaluated against the application of relevant and appropriate design principles with an expectation that the project will embody these methods. Key to this is the encouragement of inter-communication and co-designing activities.
This paper explores the impact of user centred design as part of the MSc learning experience and its role in transition from one area of expertise to another. The benefits of the methods taught to the students are outlined and final project case studies presented, ranging from transport design to intensive care medic devices. These embody a range of user centred research approaches.
Projects are prefaced by a taught research methods and analysis module. This covers quantitative and qualitative approaches as well as statistical analysis, there is an emphasis on ethnographic processes. The data interrogation techniques explored include error analysis, statistical and approximation methodologies, linear and non- linear programming.
The effectiveness of methods for use in student projects will be discussed, both in terms of informing the approach itself but also in terms of resolving the practical constraints that the students face in conducting their work.

Keywords: User-centred research methods, pedagogy, industrial design

1 INTRODUCTION

Coventry University School of Art and Design has been a leader in postgraduate Automotive Design for over 12 years. In the past year a spread of targeted design MSc courses have been added to the School's portfolio. These courses are aimed at helping people migrate from one field of experience such as engineering design into industrial design. The students backgrounds range from classical mechanical engineering through industrial design to fine artists and the social sciences.
A key aspect of the courses' ethos is the encouragement of inter-communication and co-designing activities amongst the student cohort to engage their disparate backgrounds. A common feature of all the Post Graduate courses is the emphasis placed on the research methods that underpin the design activity.
“Design research is cross disciplinary, and often interdisciplinary. In other words, it is conducted by academic researchers from a range of different academic disciplines, in some cases working together to explore a design problem using different perspectives in a coordinated way.” (Cooper and Press Design Council available 12/02/09)
Outputs from the projects are evaluated against the application of relevant and appropriate design principles and there is an expectation that the project will generate exemplars that embody these methods.
This paper explores the impact of user-centred design as part of the learning experience for the MSc students and how it helps them in their transition from one area of expertise to another. The methods taught will be outlined and case studies will be presented which demonstrate the benefits to the students ranging from transport design to intensive care medic devices.

The paper will present a discussion about the most effective delivery of the relevant design research methods that ensure the most effective learning experience for the students and assists in the application of these methods within their final design project.
The projects are prefaced by a taught module on research methods and analysis. This covers both quantitative and qualitative approaches as well as statistical analysis which has a particular emphasis on inclusive and user-centred methods. There is an emphasis on ethnographic processes; the key user-centred design research methods being individual and expert interview techniques, focus groups and cultural probes. The data interrogation techniques explored, include error analysis, statistical and approximation methodologies and other numeric methods such as linear and non- linear programming.
The manifestation of this pedagogic approach can be ascertained through the range of final project subjects from across the different routeways including Design and Transport, Design and Ergonomics and Industrial Product Design.
The paper will outline example case studies of the final projects embodying a range of user-centred research approaches. Effectiveness of methods for use in student projects will be discussed both in terms of their effectiveness in informing the approach itself but also in terms of resolving the practical constraints that the students face in conducting their work. To give examples these practical constraints included working around the ethical issues of studying the user experience in intensive care units through to designing products for distant cultures.

2 DESIGN RESEARCH IN THE COURE STRUCTURE

The course structure is such that it takes students on a journey that passes through shared modules that address ergonomics and research methods. This sharing of modules brings students from different undergraduate backgrounds together. The user-centred design research aspects can be help them understand the interrelationship of differing design skills as well as letting them explore the benefits of co-designing.

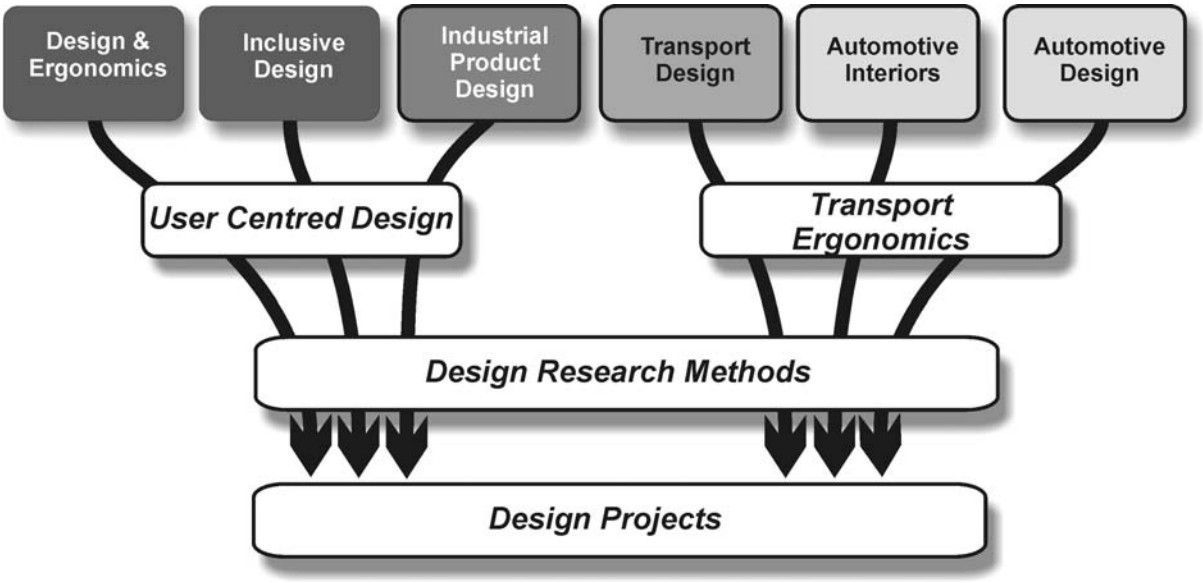

Figure 1. map of course showing flow of different courses through the user-centred design activities

The major project element of all the post-graduate courses is research led, empirical data collection is a required element of their research design. User-centred design research techniques provide a vehicle for carrying out empirical research and as a technique for requirements capture (Jordan 1998) informing the basis of the design specification. There is an explicit expectation that students will demonstrate a clear understanding of human factors aspects of their work, whatever the topic of their personal project.
This being the case, students must be equipped with an appreciation of human factors, ergonomics and appropriate research methods that enable designers to have empathy with their ultimate clients, the users of the things they design.

3 USER-CENTRED DESIGN RESEARCH AS A CORE PROCESS

One of the central tenets of industrial design courses at Coventry University is that design is a human centred process; that whatever the starting point, be it engineering, boat design or automotive styling, people matter.

Concurrently, we believe that, at post-graduate level, the ability to use design research methods to identify a design opportunity or recognise a design problem, is a core study method.

By gaining a phenomenological understanding from working directly with several individuals living their own lives (Creswell 1998) designers develop a closer empathy with their participants, so they can come away feeling that they can say " I understand better what it is like for someone to experience that…" (Polkinghorne 1989)

Both quantitative and qualitative research and analysis methods are introduced, though for the user-centred research activities the emphasis is on qualitative methods. Creswell (1998) defines qualitative study as:

"Qualitative research is an inquiry process of understanding based on distinct methodological traditions if inquiry that explore a social or human problem. The researcher builds a complex, holistic picture, analyses words, report detailed views of informants and conducts the study in a natural setting". It is the qualitative approach that brings our fledgling designers directly to a greater understanding of people and how they inhabit the designed world, hence our emphasis on user-centred research methods.

In addition these user-centred research design approaches are an important aspect of the course because, within some major industrial design consultancies (such as IDEO and PDD) these methods and practices are core work activities and there is an expectation that graduates will have some experience of them. User requirements capture via a range of these methods is also a core ergonomics skill.

Students gain knowledge of appropriate user-centred design and research methods via a combination of subject focused learning activities, some of which are integrated into the learning outcomes of modules. Some specialist routes such as Design and Ergonomics and Inclusive Design study ergonomics within a specifically focused module. These modules teach students a more in-depth background behind the some of the methods and the basic psychological and physiological understanding of human interaction with products. All courses are able to engage in user centred design activities during the Research Methods module.

The specialist module about research methods introduces students to a range of research and analysis techniques and provides opportunities for students to become familiar with and practice aspects of user-centred research. With this in mind we structure the learning to ensure that students understand users as people, not as consumers, customers or people. (Coleman et al 2007)

Students are encourage to use more than one method, combinations of method allow for triangulation of data providing higher levels of validity in circumstances where the numbers of participants might not provide statistically valid data. Three key method groups are explored:

Observation: *Rapid ethnographic methods (Aldersey Williams et al 1999), video analysis, photo diaries, shadowing, direct observation, task analysis.*

Based firmly on ethnographic research principles students are taught a variety of ways to observe people going about their everyday lives.

They start with simple methods such as basic task analysis and user trips. These allow them to observe themselves and other users to record interaction and experience of the product or system under observation. Task analysis is carried out with critical users – which could be the most vulnerable or expert/novice users. In addition to observing specific tasks they are encouraged to consider the broader environment in which the tasks are being carried out. They may do this in the form of developing user scenarios.

Working together in peer groups on set tasks helps them focus their vision, practicing recording their observations and discussing the implications of what has been seen. This prepares them for observing the external world. Visual ethnography and analysis techniques are a key part of extracting data from an observation and can often open unexpected findings. These methods, adapted from anthropology, media and cultural studies, help students to interpret what they have seen.

Questioning: *Interviews, focus groups, user forums, cultural probes (Gaver, Dunne & Pacenti 1999)*

The subtlety of questioning is also taught and whilst the collection of quantitative data in the form of surveys in discouraged as a primary research method, questionnaires are still used to structure interviews and focus groups. On-line qualitative questionnaires with open questions are also used in cases where representative user groups are difficult to find.
Interviews with critical users and expert professionals are encouraged to gain a deeper level of understanding of user requirements and usually tend to be semi-structured in nature.
Photo diaries and cultural probes prove invaluable to gain visual and deeper insights from users in their own lives – sometimes the only way to gather first hand visual/observational data from other countries and cultures.

Empathic modelling: *User trips, role play (imagine and act out), immersive experience, scenario building, personas, pseudo documentary, user screenplays.*

Students are also encouraged to develop empathy with users by the use of a variety of methods including role playing and immersive experience. A range of properties are available to the students to allow them to experience interactions with physical characteristics of other users. A pregnancy suit, false fingernails, glasses that represent a range of visual disturbance and properties that emulate the joint restriction and sensory deprivation associated with aging are amongst the role play kit we have at Coventry University to help this activity. Students are tutored in the both the physical and emotional characteristics of their user to further enhance their experience.
Personas are characters that embody the key physical, social, psychological and emotional characteristics of critical users and are created either as the output of the design research as guidance to the design process or as a starting point to the role play exercise. They can be developed into user scenarios which also have the system elements of the research incorporated into the user stories.

4 CASE STUDIES

The two students whose projects have been presented as case studies were both overseas students studying the 12 month MSc programme. Each of them conducted an initial scoping study to determine the topic of their final research led design project and created a research design which had to include some empirical research activity. It can be seen that both of the students engaged with a range of complementary user-centred research techniques.
The project in Case Study 1 was very much concerned with the emotional deign and ergonomics of a product and it was tackling a potentially difficult area of study. Eliciting information that would give deep insights required a research design that would bring together the views or all the stakeholders. Having conducted expert interviews he gained a better understanding of the ICU context and knowledge of the needs of and constraints on the medical staff.

Case Study 1: Design and Ergonomics MSc

This student undertook a research project that produced a list of ergonomic design guidelines aimed at improving both the patient and relative's experience in the ICU. These critical care environments are often claimed to be austere and "alien" and preliminary research has shown that such emotionally uninviting surroundings only serve as a hindrance in a patient's recovery and, in many cases, aggravate their physical and psychological conditions. In order to understand the needs of patients who are obliged to spend much of their time combating stress and tedium in the ICU, the student examined conclusions derived from interviews with medical staff, patients and family members, surveys, first hand observations, literature reviews and state of the art reviews. This was further supported by an understanding of emotional design and ergonomics principles.

The outcomes of the project were a range of product proposals that helped enhance the emotional experience of the conscious patient within the ICU plus a set of guidelines that related to the design of Intensive Care Environments. The proposal that was taken into a design resolution phase of the project was a multi-functional communication device for patients.

Case Study 2: Transport Design MSc

The aim of this project was to undertake a study investigating how effective solutions for urban transport are in meeting both the user and system needs in this environment. To assess the requirements of the user population the student organised expert interviews, produced, distributed and analysed user questionnaires, undertook direct and video observation of user behaviour patterns and conducted a literary review.

The outcome of the research showed that comfort, private space quality, cleanliness and customization are all considered important by users of public systems and private transport. These characteristics can be reliably achieved to the individual's standard for private transport but are more problematical for a public transport system. This research led the student to brief designing a personal transport vehicle that delivers a sense of personal space and independence and yet also fits in with current/future public transportation

The final design solution presented by the student was a personal transport pod powered by 2 x 35kW brushless in-wheel electric motors. The pod is designed from a carbon-fibre/glass-fibre hybrid composite with biopolymer self-cleaning fabric. The vehicle would run on dedicated pathways to reduce congestion. The vehicles would be obtained via an outright purchase or on a rental basis to minimise the entry price into the system.

By mirroring this approach, using in depth interviews with patients and family members and supplemented with first hand observations, it was possible for him to empathise with the more emotional aspects of the situation within an ICU from the patient's perspective. Due to the length of time needed to go through the ethical approval process required for NHS based research project, the student selected an online survey method as a way of underpinning the data gained from observation and questioning. Whilst the survey was not conducted for statistical accuracy, the questions being of a qualitative nature, it provided data that supported, confirmed and directed his conclusions. The combination of user-centred research methods created deeper insights and resulted in an intuitively

usable design that would solve some of the issues that both patients and medical staff have within the ICU context.

The transport design student in case study 2 was much more future focussed and as such he needed to gain an understanding of people's urban transport and travel preferences in order to produce a viable predictive design. The key to success for his proposed vehicle would be the creation of something that would fulfil individual travellers requirements and yet address the issues of congestion in urban road systems plus the need for carbon footprint reduction. His use of expert interviews, questionnaires with potential users combined with direct and video observation of user behaviour patterns enabled him to understand the emotional attachment people have to personal transport, even in the face of their wish to be 'green' in their travel behaviour and their realisation of the related benefits of mass transportation. Without this people oriented research activity his design proposal would have not picked up on the key aspects of an individual vehicle in terms of comfort, private space quality, cleanliness and customization. Nor would he have gained insights into the ways in which people wanted to be able to use their vehicles - individual flexibility and freedom - that are different from the services that mass transport systems can provide.

Though their project topics were radically different it is easy to see how they each benefited from engaging with user-centred research and design techniques. They all achieved high levels of creativity and design resolution for complex design projects but ones which were grounded by their research activities.

CONCLUSIONS

The application of user-centred research methodologies as a basis for major projects at postgraduate level is proving to be a successful strategy, both from the point of view of the academic success of the student and of the quality of the design solutions presented. The experience of academic staff is that research designs that include user-centred research engage the students effectively in the research for design process. Students have provided unsolicited feedback, on an informal basis, that they gain a better experience of research by undertaking user-centred methods. They indicate that by being introduced to a variety of activities they are able to overcome some of the obstacles to research, such as ethical approval requirements and language barriers.

The Research Methods module is continually being updated to ensure that we provide experiences of user-centred research methods that are beneficial to the students, and that reflect to professional practice. This should mean that all future graduates of the postgraduate industrial design programmes at Coventry University are well prepared to practice as people centred designers.

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