IASDR07
INTERNATIONAL ASSOCIATION OF SOCIETIES OF DESIGN RESEARCH THE HONG KONG POLYTECHNIC UNIVERSITY 12TH TO 15TH NOVEMBER 2007

EXPERIENCE, CONTEXT-OF-USE AND THE USER-PRODUCT INTERACTION DESIGN

Marianella Chamorro-Koc [a], Vesna Popovic [a] , Michael Emmison [b]

[a] School of Design, Faculty of Built Environment and Engineering , Queensland University of Technology - GPO 2434 Brisbane, QLD 4001 Australia

[b] School of Social Science, The University of Queensland - St Lucia, Brisbane QLD 4072 Australia

ABSTRACT

One of the evolving topics in design research is the study of experience as a source of inspiration for the design of more enjoyable user-product interactions. An issue that escapes these studies is the way in which human experience and a product's contextual information trigger users' understanding of a product's use. This paper introduces research that investigates how people's experience influence their understanding of a product's use. Findings of this study are translated into design principles that explain: (i) relationships between aspects of human experience and particular aspects of product usability, and (ii) areas of experience in which designers' and users' concepts of product usability show differences and similarities. The application of these design principles to a design process is trialled with a design tool (ECEDT); the trial verifies that these principles can assist the design of user-product interactions during the early stages of the design process.

Keywords: experience, context-of-use, product design, usability

1. INTRODUCTION

As emerging technologies constantly change the way people interact with products and their physical environment, recent studies have looked at human experience as a source to generate products that engage the user in different ways (Overbeeke 2002; Sengers 2003). Research about the user's experience, emotions, and the issue of enjoyment in the design of user–product interactions, emerged from studies that show an increasing interest in designing 'beyond the object', and in how 'use and users' are considered in existing design processes (Redstrom 2006:123). Experience and context-of-use have been related in previous studies stressing that a product's use —or the user–product interaction— is an event that takes place in a larger context comprising social, cultural, experiential, and other contextual factors that influence how people relate to products (Hekkert and Van Dijk 2001). For instance, generative research techniques have been employed to elicit information from users' experiences in a form that helps designers generate human-centred designs of consumer products within a participatory design approach (Sleeswijk Visser et al. 2005). While these approaches have explored ways to access the users' experience, they have not looked at the ways in which experience influences their understanding of a product's use. This knowledge could inform the product design process and enhance the design of user-product interactions.

This study investigates the preposition that a user's understanding of a product's use is based on his or her experience of using it in a particular context-of-use. This can be illustrated with the example of travellers trying to operate commonly known products or devices in hotel rooms, for example shower knobs. In this type of product, the colour coding, the layout of the knobs, or the way they are turned on and off sometimes reflect the way things are understood in a particular context-of-use. These differences confuse the users and can lead them to operational mistakes when trying to accomplish the intended activity (e.g. failure to set the water temperature). This simple observation is confirmed by previous studies indicating that 'products of design engage humans through their utility as well as their cultural location' (Plowman 2003:30-31), and that designed artefacts are integrated into people's lives in multiple ways of interaction. Such studies indicate that, through experience, users create understanding (Weiser 1993; Hall 1976; Norman 1998). This example highlights the relevance of experience and context of use issues for the design of user-product interactions.

This paper presents research that investigated how people's experience influence their understanding of product usability. An experiment was conducted to investigate this enquiry, and it employed visual representation of concepts as means to elicit aspects of the participant's experience influencing their understanding of a product's use. The study concludes that human experience and context of use influence user-product interactions; experience influences the user-product relationship and broadens people's understanding of a product's context of use. Findings are presented in the form of design principles that explain various relationships between experience, context-of-use and product usability. The following sections introduce issues from relevant current literature, the methodological approach employed and the research design; it discusses the contributions of the design principles to design practice and it presents an exemplar of the application of these principles to a trial design task.

2. THE STUDY OF EXPERIENCE AND THE DESIGN OF PRODUCTS

This study considers two issues from current literature about the topic of experience in the design of products. The first is about design processes in which designers determine the context of use of new product designs based on their individual experience and interpretation of the users' needs (Lorenz 1990; Rassam 1995). The second is about user research (Sanders 2001; Overbeeke 2002; Sengers 2003) that employed visuals as one of the techniques to uncover aspects of the user's experience (Rosch 2002). The following discusses the theoretical background surrounding these issues.

DESIGNERS AND USERS' CONCEPTS

Designing to fit the users' needs has always been the main concern of the design of products and user-product interactions (Redstrom 2006); however, designers and users' concepts of the world they interact with can be very different. This problem is addressed by Norman's concept of 'mental models', which he describes as the 'model that people have of themselves, others, and the environments and the things they interact with' (1988:17). Norman emphasises that life experience is a determining factor in the construction of knowledge; in his view 'experience' is the basis for constructing knowledge about the world. According to Norman, the designer and the user's different life experiences lead to mismatches in the relationship between the system's components, giving rise to errors in the human–artefact interaction. This indicates that designers and users formulate conceptual models about themselves and their environment using their own experience as a source of reference. From this point of view, this

concept concurs with Krippendorf's (2000) theory of product semantics that deals with the issue of users 'making sense of' artefacts within the artefact's context-of-use and the user's everyday experiences. Depending on their individual experience, designers and users therefore have different understandings of the meaning of an artefact. It can be said that people's understanding of things is widely different and it depends on their experience and the context in which they built that experience with the artefact.

In addressing such differences, emerging methods from design studies that include experience and context of use issues, also aim to understand and address the user's needs through different user research techniques. Redstrom states that optimising design based on knowledge about the user has evolved from usability aspects to the interpretation and understanding of experience (2006:127–128). For instance, Jordan's (1998) initial approach to the design of product usability follows the traditional Human Computer Interaction (HCI) tradition and is based on the International Standard Organisation (ISO) definition of usability. His view focusses on user performance with a product and in relation to a particular task in a specific context-of-use. From a different point of view, Sanders' (2001, 2002) user-research aims to enhance the design of products through diverse methods that focus on: (a) facilitating knowledge and experience elicitation from users, and (b) supporting designers' engagement with users' experiences and dreams (Generative Research). Similarly, Hekkert and Van Dijk's study (2001) stresses that a user–product relationship does not take place in isolation but as part of a context; and that such context consists of social, technical, cultural and other factors that influence how people relate to products. While elicitation of the user's experience has been explored through various methods, previous studies do not indicate how human experience influences people's understanding of product use and how this can enhance the design of user-product interactions and product usability.

VISUAL DATA AS SOURCE TO UNDERSTAND HUMAN EXPERIENCE

Visual data have been employed in previous studies to understand human experience when considered as representations of past actions, documentary data, and traces of practical reasoning (Oxman 1990; Rosch 2002; Tang 2002; Dahl 2001). Such studies can be broadly grouped into two types. The first type is related to visuals that are produced for a specific purpose under specific conditions and focuses on the visual content. The second type of study focuses mostly on the cognitive aspects revealed by the process of making the visual data (sketches). Van Leeuwen and Jewitt (2001) further explain two approaches in the study of

images produced during research: (i) the image as representative of who, where, and what of reality and (ii) the image as evidence of how its maker or makers have (re-) constructed reality.

The first approach employs visuals as documentary data that can be analysed with content analysis procedures (Ball and Smith 1992). In these types of studies, visual data can be: (i) advertisements, (ii) sketches (diagrams, maps and signs), and (iii) documentary photographs (Emmison and Smith 2000). Here, visual data are no more than representations of past actions and reduced simplifications of reality that require further corroboration (testimonies) to uncover ambiguous interpretations (Loizos 2000). The second approach documents the process of re-constructing the reality from images. For example, Pasthas (1979) explores the way in which practical reasoning is embedded in the making of maps drawn by laypersons, and how this can provide directions to a particular location. The use of maps in Psathas' study shows that visuals (sketch of a map) can demonstrate (i) the person's solution to the question 'draw a map to our place' and (ii) the person's knowledge (concept) of the world known (location) based on his or her experience. This approach concurs with Collier's (2001) study that explains that visual records are a source for the analysis of human experience, in which 'pattern' and 'meaning' are explored. According to Collier (2001), two different types of interpretation can be made from the analysis of visual records of human experience: (i) examination of the content of images as data and (ii) interpretation of images as vehicles to elicit information not present in the image.

The use of visuals (sketches, diagrams) about an individual's concept of a particular reality is considered suitable for the purpose of this study; however, studies undertaken under this approach have been mostly oriented towards the analysis of the reasoning process embedded in the making of these visuals, and no evidence has been found about the human experience embedded in the concept representation.

3. RESEARCH DESIGN

This study investigated the issues of human experience and context-of-use that are embedded in everyday user–product interactions, and that influence people's understanding of a product's use. The design research aimed to identify:

- Aspects of the user experience that influence people's knowledge of a product's use, as this knowledge has the potential to inform the design process about the particular contextual clues (or factors) that trigger the user's understanding when interacting with products.

- Differences and similarities between users' and designers' concepts about product usability, as this knowledge can inform designers about the ways in which their concepts are different from the users' — thus having the potential to enable designers to address users' concepts of a product's use.

An experiment was conducted to identify these aims by eliciting cues about the participants' individual experience with regards to a product's use, and their concepts of a product's context-of-use (Chamorro-Koc et al. 2005; Chamorro-Koc 2007). Participants were divided into two groups: twenty product users and five product designers. To represent a larger group of users, random sampling was employed to gather users from different cultural background, age and gender. Participants in the design group were industrial design practitioners. The experiment's structure and the questions put to participants were the same for both the users and the designers. The experiment consisted of one-to-one (researcher–participant) sessions and each participant was asked about one product only. Products chosen for the experiment represented various context of use. The setting for the experiment was the Human-Centred Research and Usability Laboratory of the Faculty of Built Environment and Engineering at QUT.

The interpretation of outcomes focussed on identifying relationships between the participants' experience and their knowledge of a product's context-of-use, and on how these are interrelated in their understanding of a product's use. Visual representation of concepts was employed as the main source of reference to the participants' experience and knowledge of a product's use.

METHODS AND TECHNIQUES

Four methods were employed: observation, visual representation of concepts, retrospective verbal report and interview. Visual representation of concepts was employed to elicit the participants' concepts of a product's use, as in this study it was considered that visuals provide

an adequate means to reveal aspects of human experience with regard to product usability (Chamorro-Koc et al. 2005). For instance, Figure 1 shows a user's and a designer's visual representation of a blender; the user's drawing is focussed on details revealing the use of each of its features, whilst the designer's focussed on the different internal parts of three types of blenders.

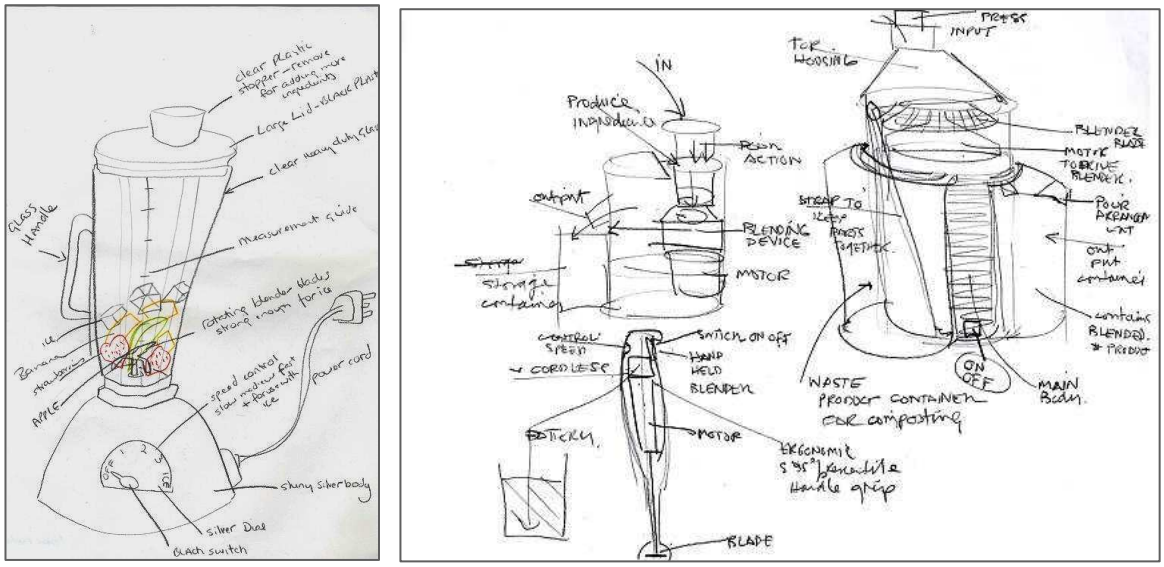

Figure 1: Users (left) and designer's (right) visual representation of a blender (Chamorro-Koc, 2007)

Considering previous studies that found that experience is a subjective event comprehended only by the person who experiences it (Sanders 2001), retrospective reports were employed in this study to allow participants to: (a) explain the product and the experience represented in their drawings, (b) point out any aspects that they could not convey in their drawings, and also to enable the drawing to be understood through the participants' eyes (Chamorro-Koc et al. 2005). Interviews were employed to gain further insights into what the participants 'say' and 'think' (Sanders 2002) about the concepts revealed in visuals and retrospectives. Interviews allowed the researcher to explore each participant's knowledge of a product's use and its context-of-use, through complementary questions on particular aspects that the participant mentioned during the interview. Observations were used to access data that could help to interpret information conveyed in the visual representation of concepts. Figure 2 shows a user participant at the instance she is trying to remember her concept of a juice maker; it shows her concept is related to the use of a squeezer. The observations were video- and audio-taped to support the interpretation of concepts, and to simplify note taking during the sessions.

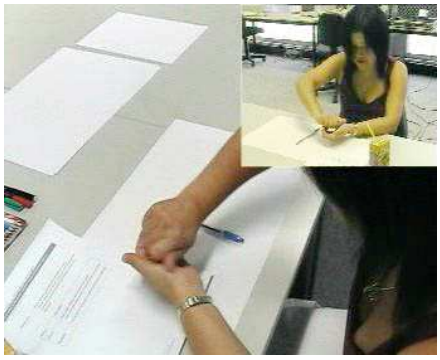

Figure 2: Observation of a participant during a visual representation of concept (Chamorro-Koc, 2007)

The process of data analysis comprised two activities: (a) an iterative process of transcribing the data collected and (b) an interpretation process (Chamorro-Koc et al. 2007). The iterative process of transcribing data led to the identification of emerging categories in relation to aspects of context-of-use and human experience. Table 1 presents these categories.

Table 1: Coding Scheme (Chamorro-Koc et al. 2005)

Categories	Subcategories	Codes
Experience	Features with indication of usage	FE
	Individual experience within context	IEC
	Episodic data	ED
Knowledge	Principle-based concept	PBC
	Description-based concept	DBC
Context-of-use	Intended use	IU
	Situation	ST

The interpretation process was based on the application of the system of categories (Coding Scheme) to code visuals and transcripts from verbal reports (Chamorro-Koc et al. 2005). From the interpretation, a number of relationships between the categories were identified. Figure 3 illustrates the application of the codes to a visual representation of concept. It shows a segment of a participant's drawing of her concept of grass shears in which the code FE (feature with indication of usage) has been applied. It depicts the shape of grass shears' blades, indicates the environment of use by placing the blades (feature) on a grass area, and

provides clues about the intended activity by showing the blades cutting grass.

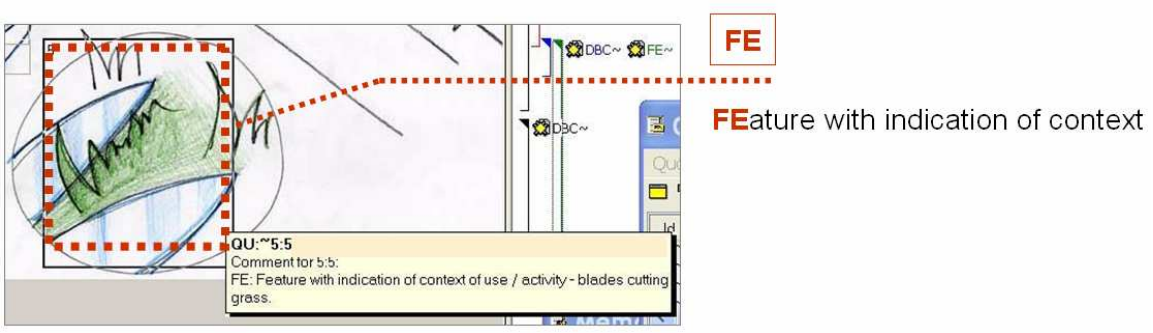

Figure 3: Application of the code FE (Feature with indication of usage) in a segment of a drawing

After the coding, the process of creating memos took place; this activity resulted in two types of memos: commentary and theory (Chamorro-Koc 2007). Theory memos recorded relationships found between the participant's knowledge and experience about a product's use and its context-of-use. The identification of relationships focussed on the 'how' and 'why', and the 'cause-effect' relations in the findings, and on understanding the participant's concepts in regard to context of use and experience. It aimed to observe the nature of the elicited concepts by finding relationships within the dynamics of the elements they convey in their sketches, retrospectives and interviews (Chamorro-Koc 2005).

4. FINDINGS

Findings demonstrate that people's experience, their knowledge of a product's context-of-use, and its usability are interrelated. Figure 4 shows that findings comprise: conceptual principles, causal relationships, and design principles. The relationships found between experience and product usability are the foundation for establishing design principles that are relevant to the design process. These principles explain: (a) aspects of users' experience that influence users' understanding of product usability and (b) similarities and differences between designers' and users' understandings of everyday product usability. While the intention of this paper is to present the design principles, conceptual principles and causal relationships are briefly introduced here.

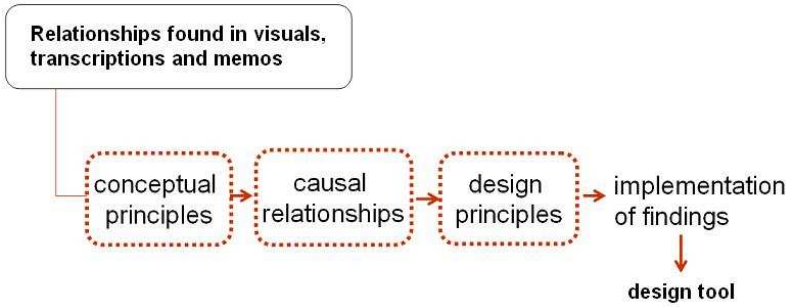

Figure 4: Summary of findings

Conceptual principles about the aspects of the user's experience that influence his or her understanding of product usability are: familiarity, experience from seeing, experience from doing, expert experiences, and cultural background experience. These principles describe relationships found between people's experience and their understanding of product usability such as: intended use, knowledge of features, principles of a product's use, and context-of-use. For example, 'Experience from seeing' (not using the product) leads to inaccurate knowledge of a product's features and its context of use. In contrast, 'Experience from doing' (using the product) generates understanding of a product's context of use and of its features and functions.

Findings about similarities and differences between users' and designers' understanding of everyday product usability are organised into eight conceptual principles. Similarities found between designers and users' concepts of a product's use and context of use state that: (i) lack of experience and familiarity can lead to misconceptions about a product's use; (ii) experience involving episodic knowledge generates good understanding; (iii) cultural background generate strong concepts, and that (iv) expert use in specific domains results in specialised knowledge relevant to a particular context of use. Differences found between users' and designers' concepts of a product's use and context of use state that: (v) users' knowledge of a product's context of use is broader than that of designers, (vi) users refer more to the social context of use while designers focus more on the product's features, (vii) episodic experience generates a catalogue of visual representations in the case of designers, and strong concepts in the case of users, and that (viii) users mainly employ familiarity to understand a product's use.

These findings do more than merely agree with the existing research that has shown that designers' and users' concepts are different; they reveal aspects that have not been addressed by previous studies. The four conceptual principles comparing differences between designers' and users' concepts about a product's use, can contribute to the design process by influencing the way designers design product usability. This new knowledge can (a) assist designers to be aware of the implications of their design decisions and (b) lead them to investigate areas that they might not otherwise deem important, but which matter to the users. In this way, it can influence and enrich the current process of designing product usability.

For ease of comparison, the conceptual principles were translated into 'causal relationships' that explain the cause-and-effect relationships between experience, knowledge, and context-of-use (Chamorro-Koc 2007). They are expressed in a synthesized form that follows the coding scheme (Table 1). Causal relationships explain how different types of experience trigger people's knowledge of a product's use, intended use, and context-of-use, and how this influences their understanding of product usability. For example, the causal relationship, [IEC-a → DBC + FE], indicates that the experience of doing the intended activity (IEC-a) generates knowledge about the product's characteristics (DBC) and its features (FE) in the context-of-use. In this other example, the causal relationship [ED + IEC + ST → DBC + IU + FE] indicates that the user's memory of a particular occasion, added to his individual experience and knowledge of context of a product's use, generates descriptive knowledge of the product characteristics, its intended use and its features in context-of-use.

To make the conceptual principles and causal relationships applicable in design, they were reinterpreted in the form of Design Principles and later applied into a design tool devised to evaluate how these principles contribute to the early stages of a product design task.

5. DESIGN PRINCIPLES

Findings of this study elaborate on the areas of human experience that are related to aspects of product usability, and identify areas in which designers' and users' concepts of a product's use are different. Therefore, these findings have three implications for design practice:

i. In the design of product usability, designers must pay attention to the differences between their own concepts and the users' concepts of a product's use. Designers must also

consider the areas of human experience that trigger the users' understanding of product usability.

ii. The design of product usability must pay attention to the social aspects of a product's use, as findings stress that the social context-of-use provides insightful information for the design of product usability. Reference to diverse aspects or components of the social context-of-use should be included in the design of products to facilitate users' understanding of a product's use.

iii. The design of product usability must investigate users' familiarity with the product's usability. This finding can be connected to other studies that deliver methods to uncover users' familiar knowledge (Blackler et al. 2005). Reference to this should be included in the design of product use in order to assist the user's understanding of product usage, and to prevent potential usability problems.

These implications lead to the definition of Design Principles addressing: (a) the areas in which users and designers' concepts of product usability are different, and (b) the sources of human experience corresponding to aspects of product usability. Table 2 presents the Design principles identifying the aspects in which users' and designers' concepts of product usability are different.

Table 2: Design principles addressing differences between users' and designers' concepts

Areas of differences	Users' concepts	Designers' concepts
Context-of-use	Familiarity with other products supports broad concepts and descriptions of the product's context-of-use.	Knowledge from design domain that might be limited to the designer's experience can lead to limited concepts or hypothetical constructions of a product's context-of-use.
Social context-of-use versus product's features	Concepts of a product's use are related mainly to the social context-of-use.	Concepts of product's use are related mainly to the product's features.
Episodic knowledge	Episodic experience leads to strong concepts about the product's intended use and its context-of-use.	Episodic experience supports concepts that are based on a catalogue of visual representations (from memory) about the product's features.
Expert domain and lack of experience	Familiarity with similar products in user's expert domain support concepts and descriptions of the product's intended use.	Design expert domain and lack of experience lead to hypothetical concepts about the product's use and features, which can be incorrect.

In Table 2, the areas of experience in which designers and users' concepts are different are grouped into four areas: (i) context-of-use, (ii) social context-of-use versus a product's features, (iii) episodic knowledge and (iv) expert domain and lack of experience. These principles can help designers to reflect on how their concepts are different from those of users, and to be aware of the areas that need to be emphasised in the design of product usability. For instance, Table 2 shows that in general, designers pay more attention to the product's features than to context-of-use issues.

Design principles addressing the aspects of human experience that correspond to aspects of product usability are presented in Table 3 and derive from the causal relationships.

Table 3: Design principles related to the areas of human experience corresponding to aspects of product usability

Sources of experience		Aspects of product's usability
Familiarity	→	Inaccurate or incomplete concepts of a product's intended use (IU). This can be associated with a product's description-based concepts (DBC).
Episodic experience	→	Preferred concepts of a product's social context of a product's use (ST-s). This can be associated with knowledge of the product's intended use (IU), features with indication of usage (FE), description-based concepts (DBC) and physical context of a product's use (ST-p).
Cultural background	→	Strong concepts of a product's social context-of-use (ST-s) ingrained in a particular culture/tradition. This can be associated with knowledge of the product's intended use (IU), description-based concept of features in context-of-use (DBC) (FE), and principle-based concepts (PBC).
Expert domain	→	Partial concepts of a product's description-based concepts of features/functions (DBC) (FE) that are focussed on a specific area of expertise. This can be associated with knowledge of the product's intended use (IU), principle-based concept (PBC) and physical context-of-use (ST-p).

Legend: → (generates), IU (Intended use), DBC (Description-based concept), FE (Feature with indication of usage), ST-p (Situation regarding the product's physical context-of-use), PBC (Principle-based concept), ST (Situation), ST-s (Situation regarding the product's social context-of-use).

Design principles presented in Table 3 show four sources of experience that influence people's understanding of product usability. Each of these sources is connected in importance to a particular aspect of product usability. These design principles can guide the design of product usability by highlighting the sources of human experience that are relevant to particular usability aspects of a product design. For example, cultural background generates strong concepts of a product's social context-of-use (ST-s), which is ingrained in a particular

culture or tradition. The user's cultural background can influence his or her understanding of a product's usage and its context-of-use, and can also generate knowledge about the product's intended use, a description of its features in the context-of-use, and principle-based concepts that explain the product's functionalities that correspond to the person's particular cultural environment. These principles also support one of the premises of this study, that 'human experience broadens or limits the user's concepts of a product's use'.

Design principles presented in Tables 2 and 3 can be employed in the early stages of the design process to inform designers about the areas of human experience that must be addressed to support particular aspects of the design of product usability. Consequently, designers can enhance users' understanding of product usability by designing and incorporating clues that appeal to particular areas of the intended users' experience.

6. IMPLEMENTING DESIGN PRINCIPLES

To implement design principles in a manner suitable for a design task, a research application prototype was devised: the Experience and Context Enquiry Design Tool — ECEDT (Chamorro-Koc 2007). The tool was devised to make the design principles usable as part of a design process. The ECEDT was employed to carry out a trial that aimed to verify whether causal relationships bring useful information to the design of product usability. The functionality of ECEDT is based on the causal relationships and the design principles. The objective of ECEDT design is to inform designers about the aspects of human experience that influence the user's knowledge of a product's context of use, and to assist designers in enhancing the design of a product's usability. To do this, ECEDT combines 3 sources of info to deliver references to the user's experience that are relevant to the product being designed: the designer input, a database of causal relationships, and a Web-based search-engine. This is summarised in Figure 5. Outcomes of the tool consist of visuals depicting contextual information of a product's use and related activities that can potentially inform designers about various aspects of use that must be considered as part of the product's characteristics.

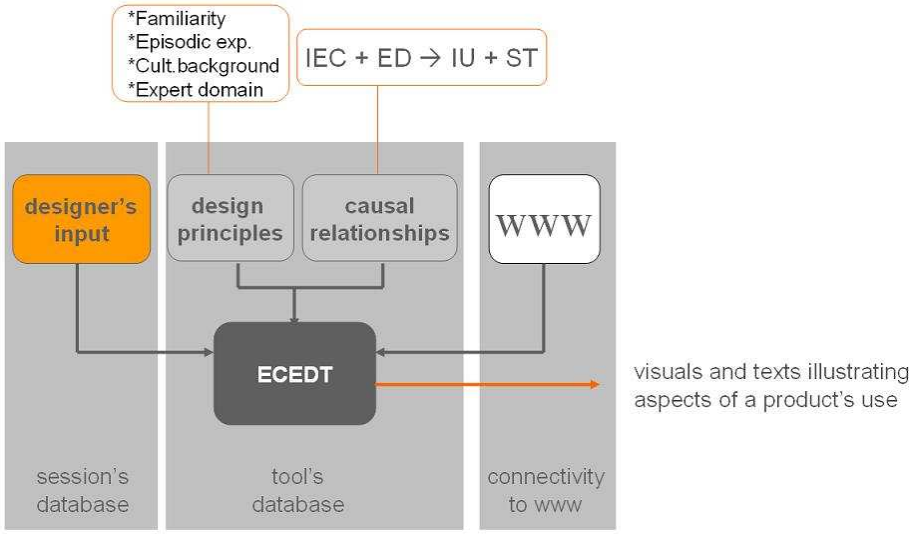

Figure 5: ECEDT engine

Six industrial designers from different cultural backgrounds and residing in Australia (Australia, Korea, China, Zimbabwe, and Botswana) participated in the trial. They were postgraduate students at QUT and design practitioners. A design brief was provided to the designers presenting the design task, the context of the design requirement and the dynamics of the session. The trial was conducted in individual sessions for which the designers were provided with the same design task: to design a barbeque grill to be marketed in Australia and diverse countries overseas, where traditional foods might be cooked on different types of barbeques grills. The trial sessions had two stages. In the first stage the designers were asked to design employing their actual techniques for concept design. A questionnaire about the process undertaken in this stage was subsequently presented to the designers. In the second stage, the designers were asked to design by first employing the ECEDT tool and then initiating concept development. The designers were provided with a demonstration of the ECEDT tool prior to the start of the trial, to familiarise themselves with the tool's interface. The researcher explained the demo, and a conversation about the tool's capabilities and limitations took place during this part of the trial. It was explained that the focus of the trial was to observe the conceptualisation stage of a design project. Another questionnaire took place after the second stage of the trial; this focussed on asking the designers to explain how their design concepts meet the design brief criteria, and how ECEDT contributed or not to this stage of the design process. The trial run took place at the Human-Centred Research and Usability Laboratory, Faculty of Built Environment and Engineering, QUT.

Results of the trial showed that visual information presented by the ECEDT stimulated ideas and inspiration to help designers resolve some usability aspects of their original designs, aspects that they had not considered before. Their responses show that the visual information provided about the user's experience with regard to cultural background, episodic experience and familiarity in relation to how a BBQ grill is used, led the designers to think about the structure of the object and to add features and accessories, and extend their awareness about issues that must be considered in order to address user needs. These results verify that the design principles are applicable to a design task and can assist designers enhancing the design of user-product interface and product usability.

7. CONCLUSIONS

This study was carried out to investigate the aspects of experience and context of use that influence users' and designers' understanding of a products' use, and to investigate the differences between their concepts and their influence on the design of product usability. This study's findings are limited due to the size and characteristics of the sample of participants. Findings presented in the form of design principles about the differences between designers' and users' concepts must be further explored in regard to each of the areas identified, and with consideration given to participant demographics and different areas of expertise. This could lead to new knowledge about other areas of difference between designers and users regarding their understanding of product usability, and to knowledge about other ways in which such differences can influence the design of devices for expert performance in different domains.

Further investigation is required to explore other areas of human experience that might influence people's understanding of a product's use in relation to different types of product categories. This is especially relevant to product development in industries from leading emerging technologies and new applications that challenge people's experiences and interactions with new products. Extending this study to products that embed new technologies can help addressing the latent needs of a global community and the increasing trend of people who constantly commute to live and work overseas, and who are permanently challenged by designs that are difficult to use. Further study is needed to explore whether causal relationships found between experience and product usability are also representative and applicable to the case of users with special needs. Such study could verify or deny these causal relationships, or uncover new ones. Two types of completely different user groups

present an interesting challenge to this study; these users are people with specialised expertise and people with disabilities. Applying this study's methodology to investigate the validity of these causal relationships in these two different groups of users could foster an understanding of how relevant the identified aspects of user experience are for these two types of users in the design of product usability.

The strength of this research is that its contributes to the design field by: addressing an existing gap in knowledge, providing increased detail about the acquisition of knowledge about a product's use, extending knowledge about designers' and users' differences, demonstrating the potential of the methodological approach employed, and by providing a new design tool (ECEDT) for including new knowledge in a design activity.

REFERENCES

Ball and Smith (1992) Analyzing Visual Data. Sage Publications Ltd., California

Blackler, Popovic and Mahar (2005) Intuitive Interaction Applied to Interface Design. In Proceedings International Design Congress - IASDR 2005, Douliou, Taiwan.

Chamorro-Koc, Popovic and Emmison (2004) Context of Use and User Experience, an exploratory study in the product design domain. In: Futureground Conference 2004 Melbourne

Chamorro-Koc, Popovic and Emmison (2005) Visual Representation of Concepts: Exploring users' and designers' concepts of everyday products. In: 2005idc New Design Paradigms Taiwan

Chamorro-Koc, Popovic and Emmison (2007) Thesis: Experience, Context-of-Use and the Design of Product Usability. Brisbane: Queensland University of Technology

Collier (2001) Approaches to Analysis in Visual Anthropology. In Van Leeuwen T and Jewitt C (ed) Handbook of Visual Analysis Sage Publications Ltd. London 35-60.

Dahl, Chattopadhyay and Gorn (2001) The importance of visualisation in concept design. Design Studies 22, 1: 5–26

Emmison and Smith (2000) Researching the Visual. Sage Publications Ltd. London

Hall (1976) Beyond Culture. Anchor Press - Double Day, New York

Hekkert and Van Dijk (2001) Designing from context: foundations and applications of the ViP approach. In: Designing in Context

Jordan (1998) An Introduction to Usability. Taylor & Francis Ltd., London

Krippendorf (2000) On the Essential Contexts of Artifacts or on the preposition that 'Design is Making Sense (of Things)'. In Margolin V and Buchanan R (ed) The Idea of Design The MIT Press. Cambridge 156-184.

Loizos (2000) Video, Film and Photographs as Research Documents. In Bauer M and Gaskell G (ed) Qualitative Researching with Text, Image and Sound Sage Publications Ltd. London 93 -107.

Lorenz (1990) The Design Dimension: the new competitive weapon for product strategy & global marketing. Basil Blackwell Ltd, Oxford

Norman (1988) The Design of Everyday Things. Basic Books, New York

Overbeeke,(2002) Beauty in Usability: Forget Ease of Use! In Green W S and Jordan P (ed) Pleasure with Products: Beyond Usability Taylor and Francis. New York 9 - 17.

Oxman (2002) The thinking eye: visual recognition in design emergence. Design Studies 23, 2: 135-164

Plowman (2003) Ethnography and Critical Design Practice. In Laurel B (ed) Design Research: Methods and Perspectives MIT Press. Cambridge 30-38.

Psathas (1979) Organizational Features of Direction Maps. In Psathas G (ed) Everyday Language: Studies in Ethnomethodology Irvington Publishers Inc. New York 203-225.

Rassam (1995) Design and Corporate Success. University Press, Cambridge

Redstrom (2006) Towards user design? On the shift from object to user as the subject of design. Design Studies 27: 123-139

Rosch (2002) Principles of Categorization. In Levitin D J (ed) Foundations of cognitive psychology: core readings MIT Press. Cambridge 251-269.

Sanders (2001) Virtuosos of the experience domain. In: IDSA Education Conference Boston

Sanders (2002) From User-centered to participatory design approaches. In Frascara J (ed) Design and the Social Sciences: Making Connections Taylor & Francis - Contemporary Trends Institute. New York 1 - 8.

Sengers (2003) The Engineering of Experience. In Blythe M, Overbeeke K, Monk A and Wright P (ed) Funology: From Usability to Enjoyment. Kluewer Academic Press. London

Slesswijk Visser, Stappers, Van der Lugt and Sanders (2005) Contextmapping: experiences from practice. CoDesign 1, 2: 119-149

Tang (2002) Inter-linkages in the design process: a holistic view towards design knowledge and sketches. In: Common Ground: Design Research Society International Conference 2002 London

Van Leeuwen, T.,Jewitt, C., 2001. Handbook of Visual Analysis. Sage Publications Ltd., London

Weiser (1993) Some computer sciences issues in Ubiquitous Computing. Communications of the ACM 36, 7: 75 - 84