Anticipated User Experience in the Early Stages of Product Development

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Dedication

To Margaretha and Kiralee for bringing light into my life.
Keywords

Anticipated User Experience (AUX)
AUX Framework
Design for Experience
Early Stages of Design
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Abstract

People no longer use a product solely as a tool, but more importantly for the pleasurable experiences it provides. Positive user experience, therefore, has increasingly become the goal in designing and developing interactive products. To ensure this goal is reached, user experience assessment should be conducted from the earliest stages of product development. However, the early assessment of user experience is difficult and challenging, as no functional prototypes to be tested are yet available. Moreover, the majority of existing user experience frameworks and evaluation methods have not fully supported the initial design phases.

This research aims to gain a deeper understanding of anticipated user experience to support early assessment of user experience. In this context, anticipated user experience is defined as the experiences and feelings that users expect to have when imagining an encounter with an interactive product or system. The study is driven by two research sub-questions: How do users anticipate experiences with interactive products; and what are the differences between anticipated and real user experiences?

Two qualitative studies were conducted. The first experiment investigated anticipated user experience by asking twenty pairs of participants to individually imagine and sketch a desired product, and to anticipate their experiences with the conceived product. The second experiment explored real user experience by prompting forty participants to individually use a given digital camera over a period of three days, to report their experiences using a diary, and to discuss their experiences with another participant. The first study shows that when anticipating experiences with an imagined product, users perceive the pragmatic (instrumental) quality of the product as the dominant factor that determines their positive future experiences. The second study, however, demonstrates that while the users also mostly focus on pragmatic quality when judging an actual product, it is its hedonic (non-instrumental) quality that contributes more to their positive real experiences. The studies also show that real user experience involves familiarisation and expectation disconfirmation factors, which are not identified in anticipated user experience. The main outcome of this research is the Anticipated User Experience...
(AUX) Framework that describes the processes through which users imagine a desired product and anticipate positive experiences with the conceived product. Furthermore, based on the findings, design recommendations are proposed.

This research provides new knowledge of anticipated user experience. It contributes to the area of design for experience, and concurrently addresses the knowledge gap related to user experience before interaction. The AUX Framework provides a guide to assist designers to identify and prioritise the key factors that need to explore during the early stages of design. The exploration of these factors allows designers to better predict users’ underlying needs and potential contexts related to positive experiences with the designed product. The design recommendations also support the creation of pleasurable interactive products. Thus, the application of these research outcomes can potentially support design for positive experiences from the very outset of product development.
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Statement of Original Authorship

The work contained in this thesis has not been previously submitted to meet requirements for an award at this or any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

Signed:

QUT Verified Signature
Thedy Yogasara

Date:
13 January 2014
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Chapter 1: Introduction

The source of economic value has progressed from extracting commodities to making goods and delivering services, and now to staging experiences (Pine and Gilmore, 1998, 2011). Consumers undeniably desire experiences, and this has forced companies to deliberately design and promote them (Pine and Gilmore, 1998). As a result, the continuing delivery of compelling user experience (UX) must be embedded in companies’ business strategies to help them to compete in consumer markets (Sward and Macarthur, 2007).

More specifically, in the field of user-product interaction, positive user experience has increasingly become a design goal (Mahlke, 2005; Roto, Rantavuo, and Väänänen-Vainio-Mattila, 2009; Sward and Macarthur, 2007; Väänänen-Vainio-Mattila and Wäljas, 2009). Creating products that can integrate into users’ everyday lives, rather than products that simply support their everyday tasks, is a new focus (Kort, Vermeeren, and Fokker, 2007). This is because users no longer merely need a product to be useful and functional; rather, they now demand product experiences that encompass fun, enjoyment, and pleasure (Blythe, Overbeeke, Monk, and Wright, 2004; Jordan, 2000). To ensure a product’s success, therefore, an understanding and assessment of user experience is paramount in the process of product design and development.

This study argues that the assessment of user experience must be conducted as early as possible to facilitate the design for experience. This early assessment, in turn, can support high quality experiences through product use. The research is driven by the aspiration to fill a gap in existing knowledge of anticipated user experience and its
role in assessing user experience in the early stages of product development. In this context, anticipated user experience is defined as “the experiences and feelings that the user expects to occur when imagining an encounter with an interactive product or system” (Yogasara, Popovic, Kraal, and Chamorro-Koc, 2012, p. 2). There is evidence that most existing research focuses on ‘real’ user experience (that is, on actual experience with products). This focus does not fully support the initial stages of the design process. Therefore, the main purpose of this study is to explore how users anticipate their experiences with interactive products, and how this understanding can be utilised to support the early assessment of user experience.

This introductory chapter initially presents the background of this study, and the research problem and questions. It then elucidates the research aim, scope, objectives, and significance. Finally, the thesis structure is outlined.

1.1 RESEARCH BACKGROUND

Within today’s fast-paced and competitive environment, the economic success of product developers depends on their ability to identify consumers’ needs, and to design and develop products that meet those needs. As previously stated, as technologies, markets, and consumers mature, product users begin to seek out products that offer pleasant and engaging experiences. For instance, one may look for a food processor that is not only fully functional and easy to use, but which also, more importantly, is able to provide sensory gratification, pleasant emotions, positive meaning, and support for one’s self-identity.

These experiences increasingly serve as differentiators for people when selecting a particular product from other similar and available products. Providing positive user experience, therefore, has become a key factor in product development so as to generate a product’s competitive advantages (Obrist, Roto, and Väänänen-Vainio-Mattila, 2009; Pine and Gilmore, 1999; Sward, 2006; Väänänen-Vainio-Mattila, Roto, and Hassenzahl, 2008a). The development of interactive products is no longer only a matter of applying features and ensuring their usability; it also has to understand users’ everyday lives and to create products that harmonise with basic human needs (Väänänen-Vainio-Mattila, et al., 2008a).
According to Väänänen-Vainio-Mattila et al. (2008a), there are two fundamental aspects to consider when designing for pleasurable user experience. First, experience-centred design demands an understanding of how to meet the needs for both pragmatic and hedonic qualities of interactive products (Hassenzahl, 2003; Väänänen-Vainio-Mattila, et al., 2008a). Pragmatic quality refers to a product’s perceived ability to support the achievement of behavioural goals (related to usability and functionality); hedonic quality, on the other hand, refers to a product’s perceived ability to support the fulfilment of basic psychological needs such as stimulation, identification, and evocation (Hassenzahl, 2003, 2008). Second, designing for user experience requires iterative evaluations throughout the stages of product development (ISO 13407:1999, as cited in Väänänen-Vainio-Mattila, et al., 2008a). This means that user experience assessment and improvement need to be undertaken from the early phases of the design process. The first requirement facilitates the setting of product development targets, while the second requirement helps to ensure, improve, and attain high quality user experiences from the use of the final product.

In relation to the above requirements, different theories, frameworks, and models have been developed over the last decade to enhance the understanding of user experience (Sections 2.2 to 2.5). These range from basic user experience models (e.g. Forlizzi and Battarbee, 2004; Forlizzi and Ford, 2000; Hassenzahl, 2003; Mahlke, 2005; Roto, 2006; Wright, McCarthy, and Meekison, 2003); theories of pragmatic and hedonic qualities (Diefenbach and Hassenzahl, 2011; Hassenzahl, 2007, 2008); a product experience framework (Desmet and Hekkert, 2007); and social user experience frameworks (Battarbee, 2003; Battarbee and Koskinen, 2005), to theories and models of user experience temporality (Karapanos, Zimmerman, Forlizzi, and Martens, 2009, 2010; Roto, Law, Vermeeren, and Hoonhout, 2011; von Wilamowitz-Moellendorff, Hassenzahl, and Plat, 2006).

Based on understandings provided by these developed theories, models, and frameworks, numerous evaluation methods have also been proposed to enable user experience assessment in the product development process (Chapter 3). Some of these methods adopt traditional product evaluation techniques, such as questionnaires (Laugwitz, Held, and Schrepp, 2008; Thayer and Dugan, 2009), focus groups, interviews, and think-aloud procedures (Jordan, 2000). Another technique uses non-
verbal self-reports that focus on the measurement of users’ emotional responses (Desmet, 2003a; Desmet and Dijkhuis, 2003). Moreover, experience clip (Isomursu, Kuutti, and Väänämö, 2004), narration (Schrammel, Geven, Leitner, and Tscheligi, 2008), experience diary (Karapanos, et al., 2009; Swallow, Blythe, and Wright, 2005), and experience report (Korhonen, Arrasvuori, and Väänänen-Vainio-Mattila, 2010b) have been used to analyse and evaluate user experience related to new technologies. Researchers also employ an approach that combines several methods and instruments to measure users’ total experiences during user-product interaction. This approach includes psychological, physiological, and cognitive measures, as well as facial expression and behavioural (performance) assessments (Hazlett and Benedek, 2007; Mahlke and Lindgaard, 2007; Mandryk, Inkpen, and Calvert, 2006).

Despite the plethora of user experience models and frameworks that have been proposed, most of these are dedicated to gaining an understanding of user experience elicited by the actual interactions between users and functional products. They assume that users must have a certain level of interaction with a product’s features to form their experiences of the product (e.g. Hassenzahl, 2003; Mahlke and Thüring, 2007; Roto, 2006). Roto (2007), for example, stresses that user experience involves a product or service and interaction with that product or service. Little information exists, however, on how user experience can be anticipated or constructed without actual interaction with an end product. This anticipatory aspect of user experience requires systematic exploration in order to support designers in assessing and designing for user experience during the early stages of product development.

The majority of user experience assessment methods also require the assessment to be conducted during or after users’ interactions with existing products (Bargas-Avila and Hornbæk, 2012; Vermeeren et al., 2010). This implies that the evaluation of user experience must be delayed until the late phases of product development when a complete product, or a close to fully functional prototype, becomes available. The identification of design flaws at these final stages of product development is unfavourable for product developers, as it leads to costly late design changes (Magrab, 1997). In view of this, the current approaches to assessing user experience do not, for the most part, support the early phases of the design process. Thus, there is a crucial need to develop methods to enable product designers and developers to
assess user experience in the earliest possible stages of product development so as to avoid expensive amendments and failures.

1.2 RESEARCH PROBLEM

As indicated above, there is a lack of research on how user experience can be assessed in the early phases of the design process when the actual product or working prototype is unavailable. While a few studies have actually touched on this area, further research is needed to address their limitations.

Experience prototyping (Buchenau and Fulton Suri, 2000), Wizard of Oz (Weiss et al., 2009), speed dating and user enactments (Davidoff, Lee, Dey, and Zimmerman, 2007), use before use (Ehn, 2008; Redström, 2008), and social interaction prototyping (Kurvinen, Koskinen, and Battarbee, 2008) are examples of methods already developed to explore design concepts and to assess users’ experiences before their use of the actual product. These methods are valuable for evaluating and generating design ideas, as well as for simulating what it will be like to use the designed product. However, they appear to rely strongly on the use of low-fidelity or computer-simulated prototypes, models, and usage scenarios, through which users encounter design concepts created by designers. This approach is not always applicable as, in the conceptualisation stages of product design, the information required to build such prototypes, models, and scenarios may be inadequate. Moreover, the above methods may be difficult to implement and – as Vermeeren et al. (2010) note with regard to before usage evaluation methods – they may have reliability and validity problems. It also appears that the design concepts and contexts of use in such methods are created by designers with minimal input from users.

This research investigates anticipated user experience to support design for positive experience. It focuses on facilitating designers’ use of user anticipation to conduct early assessment of user experience. To this end, the study empirically explores how users imagine a desired product, and how they anticipate their experiences with the desired product. This exploration includes identifying the characteristics of anticipated user experience. Here, the design concepts and contexts of use are entirely conceived by the users themselves without the use of any prototypes or scenarios. Thus, compared to existing methods, this approach can be conducted
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much earlier in the design process, and can also provide rich design ideas and potential contexts of use that are completely based on users’ real needs and expectations. This deeper understanding of anticipated user experience will, in turn, lay a firm foundation for the development of practical user experience assessment methods that support the initial phases of product development.

1.3 RESEARCH QUESTIONS

Industry undertakes user experience evaluation in order to improve their products. Väänänen-Vainio-Mattila, Roto, and Hassenzahl (2008b) highlight the importance of early and frequent evaluations in a product development process, as the earlier these evaluations can be conducted, the easier it is to modify a product so as to reach its design targets. However, assessing user experience in the very early phases of product development is difficult and challenging, and thus requires more research (Roto, 2007; Roto, et al., 2009; Väänänen-Vainio-Mattila, et al., 2008b).

Existing user experience models, frameworks, and evaluation methods have largely been related to the final stages of product creation in which users can interact with functional products. It is argued, however, that the incorporation of user experience assessment in the initial phases of product design and development can potentially support designers in designing better products to meet users’ experiential needs. Such practice is also essential for preventing design modifications in the very late development stages, which are far more difficult and costly.

Based on the research background and problem (Section 1.1 and Section 1.2), the overall research question is formulated as follows:

**How can designers be supported in assessing user experience in the early stages of product design and development?**

To address this primary research question, two important issues need to be considered. First, in the early stages of product design, neither a functional prototype nor the real context of use is usually available. Consequently, prospective users may only be able to construct an anticipated use or anticipated experience with a conceptual product based on their prior experiences, knowledge, needs, and
Chapter 1: Introduction

expectations. Authorities refer to this as user experience *before usage* (Bargas-Avila and Hornbæk, 2012; Law, Roto, Hassenzahl, Vermeeren, and Kort, 2009; Roto, et al., 2011; Vermeeren, et al., 2010). It has been suggested that episodes beyond the actual usage of a product, including anticipation and recollection, play a central role in forming the holistic user experience (Karapanos, et al., 2009; Norman, 2009; Roto, et al., 2011). In particular, anticipation affects the actual experience when that experience eventually unfolds (Mäkelä and Fulton Suri, 2001; Roto, 2007). Desmet and Hekkert (2007) refer to the anticipation of product use as non-physical interaction, which can result in affective responses. Likewise, Karapanos et al. (2009) posit that anticipating experiences of product use can be more emotional, influential, and memorable than the actual experiences per se.

A number of user experience definitions (e.g. ISO 9241-210, 2010; Sward and Macarthur, 2007) also contain the terms ‘anticipated use’ or ‘anticipated interaction’, indicating that user experience should be explored and assessed not only *during* or *after* interaction, but also *before* the users actually use the product. Vermeeren et al. (2010) concur by stressing that user experience before interaction should be considered as something evaluable. Therefore, this study argues that a deeper understanding of *anticipated user experience* would be advantageous for supporting user experience assessment in the early stages of product development. This understanding requires insights into the way users anticipate experiences with an imagined interactive product, and into the characteristics of these anticipated experiences. However, limited information on these matters exists in the literature (Section 4.2). Filling this knowledge gap, therefore, will assist in answering the main research question.

Second, to effectively assess user experience without involving any working products, it is crucial to distinguish between anticipated and real user experiences. Real experience stems from physical user-product interactions in real contexts, and is unlikely to occur in the early phases of the design process. An understanding of how anticipated user experience differs from actual experience will allow the identification of its unique characteristics. This, in turn, can determine the way in which early assessment of user experience should be conducted. Moreover, this new understanding will indicate important user experience elements that may be missing
in the anticipated experience. This will help to ensure that no essential factors are left out when user experience is assessed according to users’ anticipation. There is, nevertheless, no clear explanation of the differences between anticipated and real user experiences in the existing literature. In a survey involving user experience researchers and practitioners as participants, Law et al. (2009) found that the relationship between anticipated use and real experiences is not well understood. This suggests that more clarification of both ‘anticipated use’ and ‘real experience’ is required. In the case of this study, the differences between anticipated and real experiences must firstly be identified to better address the primary research question.

Figure 1.1 illustrates the aspects and areas of research that have been discussed. These lead to two research sub-questions:

Research sub-question 1: *How do users anticipate experiences with interactive products?*

Research sub-question 2: *What are the differences between anticipated and real user experiences?*

In the following section, the research question and sub-questions are further related and translated to relevant research aims and objectives.
1.4 AIM, SCOPE, AND OBJECTIVES OF THE RESEARCH

This research aims to provide new knowledge of anticipated user experience to support the initial stages of product development. This knowledge will facilitate the design of high quality products that engender positive experiences for their users.

The scope of this study is limited to the area of everyday interactive products (e.g. digital cameras, mobile phones). With regard to the exploration of the characteristics of anticipated and real user experiences, substantial focus is placed on users’ perception of the importance of pragmatic and hedonic qualities, which are fundamental aspects of experience-centred design (Section 1.1). Furthermore, in the present study, the research outcomes are limited to the new understanding of anticipated user experience, user experience frameworks, and design recommendations for researchers and designers. These outcomes are not in the form of practical support for designers yet. A practical tool or method for the early assessment of user experience will be developed in future studies.

In light of the research question and sub-questions (Section 1.3) and the aim and scope of the study, three research objectives are defined:

1. To gain an understanding of how users anticipate their experiences with interactive products. This includes identifying the characteristics of anticipated user experience.

2. To identify the differences between anticipated and real user experiences.

3. To develop a framework and design recommendations for supporting designers in assessing user experience in the early stages of product design and development.

Figure 1.2 shows the components and basic plan of the research according to the defined objectives. As can be seen, the investigations of anticipated and real user experiences are the underpinning steps of this study. The results of these investigations contribute to a comparative analysis of the two experience types. This knowledge, with the inputs of specific findings with respect to each experience category, underlies the development of a framework and design recommendations for supporting the early phases of the design process.
1.5 RESEARCH SIGNIFICANCE

This study contributes to the design for positive user experience. The contribution lies in three areas: (1) providing new knowledge of anticipated user experience in the fields of product design, interaction design, and experience-centred design; (2) addressing the gap within current research with regard to user experience before usage; and (3) addressing the need for user experience assessment in the early phases of product development. Specifically, the study generates a greater understanding of the following aspects: (1) a user’s process of anticipating experiences with interactive products; (2) the characteristics of anticipated user experience; (3) the differences between anticipated and real user experiences, which focus on the key elements of each experience type and on the roles that pragmatic and hedonic qualities play in those experiences; and (4) the essential factors and design recommendations that need to be taken into account in supporting the initial stages of the design process.
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The main outcomes of this research include the sub-category networks that form the Anticipated User Experience (AUX) Framework, and design recommendations that are derived from the findings. These outcomes allow researchers to better understand how users appraise, perceive, and experience an interactive product before actual interactions. They also provide the researchers with a foundational knowledge of anticipated user experience on which future research in the area can build. In addition, this foundational knowledge will inform the development of practical methods for the early assessment of user experience.

The study outcomes will assist and guide product designers and developers in assessing and designing for user experience from the outset of the product development process. In industry, the early assessment of user experience is crucial, since it contributes to potential savings by reducing design changes in the final product development stages. This is supported by the fact that the later the design is changed, the more the product development will cost (Magrab, 1997). In addition, given that positive user experience has become a key competitive factor that enhances a product’s success (Sward, 2006), this study is significant as it supports product designers and developers to deliver more pleasurable products that meet or exceed users’ experiential needs.

1.6 THESIS STRUCTURE

Chapters 2, 3, and 4 review the substantial literature relevant to the primary and sub research questions stated in Section 1.3. They establish a knowledge foundation on which the study is grounded, and serve to identify the knowledge gap in the area of anticipated user experience and early assessment of user experience.

Chapter 2 introduces the notion of user experience, and explores its definitions, theories, models, frameworks, and temporal characteristics. This chapter also explores the roles of pragmatic and hedonic qualities in user experience. It points out that the existing work mainly focuses on user experience during and after product use, and that user experience before use needs more research to support the design for experience in the early stages of product development.
Chapter 3 examines the earlier methods for assessing and designing for user experience, highlighting those that are intended to support the initial stages of the design process.

Addressing the two research sub-questions (Section 1.3), Chapter 4 examines the literature pertaining to anticipation, expectation, expectation disconfirmation, and the roles that they play in user experience.

Chapter 5 presents the research design and methodology used to investigate users’ anticipated and real experiences in order to address the research problem. These are integrated into the research plan, which outlines the study’s two experiments. The procedures for the recruitment of research participants and for the data analysis are also discussed in this chapter.

Chapter 6 explains Experiment One, which explores how users anticipate their experiences with interactive products. It describes the data collection process, which involves co-discovery, sketching, and observation methods. The data analysis, which is based on the developed coding scheme and sub-category co-occurrences, is detailed. This chapter then presents the experiment’s results in the form of the occurrence patterns of categories and sub-categories, the perceived importance of pragmatic and hedonic qualities in anticipating experiences, and the relationships among sub-categories.

Chapter 7 explains Experiment Two, which investigates how users actually experience a real product. The use of experience diary, co-discovery, and observation methods to gather the data is described. As in Chapter 6, the data analysis procedure is then outlined and the experiment’s results are delineated.

Chapter 8 discusses the experiments’ results within the context of the relevant literature, and identifies the research findings and emerging theories. It focuses on the characteristics of anticipated user experience, and on the process through which users anticipate their positive experiences with products. In this chapter, the AUX Framework is introduced and discussed. Further, the characteristics of anticipated and real user experiences are compared and differentiated.
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Chapter 9 discusses the significance of the findings to the field of study. The potential use of the AUX Framework in the design process is explained. In the same chapter, design recommendations related to experience-centred design are proposed and discussed.

Finally, the implications of the research and its contributions to knowledge are outlined in Chapter 10. The limitations of the work are also identified, and future research directions are proposed.

1.7 SUMMARY

As users’ needs shift from usability to positive experiences, product designers and developers are forced to provide users with enjoyable product experiences in order to compete in today’s business environment. To facilitate this provision, the assessment of user experience in the early stages of the design process is required. However, the existing knowledge of user experience assessment in the initial stages of product development is lacking. This research addresses this deficit by investigating the area of anticipated user experience, and then applying this new knowledge to support product designers to assess user experience early in the design process.

Chapter 1 has introduced the research background that justifies the study and contextualises the research problem. The main and sub research questions were then formulated in response to the research problem. This chapter has also described the aim, scope, and objectives of the research. Finally, the research significance and the thesis structure were presented. Chapters 2, 3, and 4 will now review the relevant literature in the study area.
Chapter 2: User Experience

An underlying aim of this research is to provide insights into ways in which user experience assessment in the early stages of product design and development can be supported. The literature relevant to this aim is reviewed in this chapter and in Chapters 3 and 4. The purpose is to examine fundamental theories and frameworks of user experience, and to explore existing approaches for evaluating and designing for user experience. The review serves to establish a firm theoretical foundation for this research and to identify a knowledge gap that needs to be addressed.

This chapter first presents a background to approaches to understanding and creating quality user-product interactions. In so doing, it focuses on the shift from traditional usability to emotional design, and eventually, to experience-centred design. The chapter then provides a summary of recent findings on user experience. These include the notion of pragmatic and hedonic qualities, and the proposed definitions, models, and frameworks of user experience. This is followed by a discussion of the temporal aspects of user experience. Finally, the chapter summary highlights the research gap.

2.1 DESIGN EVOLUTION – BEYOND USABILITY

Until the early 2000s, usability dominated the criteria determining a good interactive product or system design. Usability focuses on tasks, goals, and performances, and is commonly measured by efficiency (e.g. error rate, time on task, mental workload), effectiveness (task completion, output quality), and satisfaction (qualitative and quantitative attitudes) (ISO 9241-11, 1998; Jordan, 1998). The incorporation of
usability as a product design criterion ensures that products are easy to learn and to use, are satisfying to use, and provide the functionality and utility that are highly appreciated by their target users (Rubin, 1994). To support this goal, a number of popular and established usability evaluation methods – including co-discovery, controlled experiment, heuristic evaluation, performance measure, thinking-aloud, observation, questionnaire, interview, focus group, logging actual use, and user feedback (Jordan, 1998; Nielsen, 1993; Popovic, 1999) – have been used to identify and rectify usability deficiencies in products being designed.

During the last decade, however, there has been a significant shift from designing products that are merely functional and usable, to creating products that are also aesthetic and pleasurable. Usability, as a physical and cognitive approach to understanding user-product interaction, has been intensively challenged for its limitations (Blythe, et al., 2004; Green and Jordan, 2002). Jordan (2000) argues that usability has transformed from being a ‘satisfier’ to being a ‘dissatisfier’; in other words, usability that was once regarded as an added value, is now seen as a basic, taken-for-granted product attribute. Using an analogy of Maslow’s hierarchy of human needs, Jordan (1999, 2000) therefore suggests that, in order to holistically address the relationship between products and people, product designers should look beyond functionality and usability to a higher-level user need – the need for pleasure.

Jordan’s (2000) view is supported by many researchers (e.g. Dormann, 2003; Mandryk, et al., 2006) who have pointed to the limitations of traditional usability for new applications. Mandryk et al. (2006), for example, assert that the traditional usability analysis focusing on performance and productivity is not suitable for evaluating entertainment products that place great emphasis on enjoyment and collaboration. Dormann (2003) claims that usability does not incorporate the range of emotions that can be associated with user experience. She points out that the analysis of emotion within usability is very limited, concerning mostly the pleasant-unpleasant dimension. Zimmermann, Gomez, Danuser, and Schär (2006) also concur that various kinds of emotions play an important role in computer-related activities, and that traditional usability has generally disregarded the affective aspects of users and user interfaces.
As the focus on users’ need for pleasure increases, the notion of emotional or affective design has begun to surface. Spillers (2005) argues that emotions control the quality of user-product interaction in the user’s environment, and are directly associated with the evaluation of user experience. Emotions also function in sense-making, and influence users’ interpretation, exploration, and appraisal of user interfaces (Spillers, 2005). Desmet (2002) introduced the concept of product emotion, and explored ways in which to incorporate emotions into product design. His concept is based on the view that all emotional responses are the outcome of an assessment process through which an individual appraises a product as being supportive or unsupportive of one or more of his/her concerns (Desmet, 2002; Desmet and Hekkert, 2002).

Similarly, Norman (2004) demonstrates the importance of emotional design in everyday products by categorising their design qualities into three levels: visceral (appearance), behavioural (pleasure and effectiveness of use), and reflective (self-image, personal satisfaction, memories). Desmet (2003a) goes a step further by developing the Product Emotion Measurement Instrument (PrEmo), a tool used for measuring users’ emotional responses to product design. Furthermore, Zhang and Li (2005) explain the concept of affective quality as the ability of interactive products to change an individual’s emotional state. They argue that affective quality positively impacts on users’ cognitive evaluations of a product, which, in turn, can influence their behavioural intention to use it. Helander and Tham (2003) also emphasise the significance of affect for ergonomics or human factors design by inventing the term ‘hedonomics’.

Moreover, the importance of understanding and fulfilling user emotional needs in product design has been related to the success of a product in the marketplace (Khalid, 2006; Khalid and Helander, 2006). Seva, Duh, and Helander (2007), for example, argue that “emotions are compelling human experiences and product designers can take advantage of this by conceptualizing emotion-engendering products that sell well in the market” (p. 723).

Accordingly, emotions play a crucial role in user-product interaction and have become an essential component in product design. Affective product design also has implications for positive marketing. However, the inclusion of emotional aspects in
product design is still deemed insufficient to cover and understand the entire user experience of products. The human experience factor, therefore, is gaining increasing attention in relation to the design of interactive artefacts.

At a macro level, Pine and Gilmore (1998) posit that “experiences have emerged as the next step in ... the progression of economic value” (p. 97). They distinguish experiences from products and services, and characterise them as a new kind of economic offering that must be explicitly designed and promoted by business organisations. Sward and Macarthur (2007) agree that user experience design needs to be employed and integrated into business strategies so as to create a sustainable competitive advantage in this experience economy.

Within design practice, the notion of user experience opens new and expanded opportunities for product designers. Designers are encouraged to influence not only the feel and appearance of products, but also the quality of experience that users have while encountering the designed world (Fulton Suri, 2003, 2004). Fulton Suri (2003, 2004) emphasises design for experience as a central factor in excellent design. Nevertheless, such design requires a thorough understanding of users – including their activities, feelings, thoughts, goals, aspirations, values, and rituals – within contextual, dynamic, multi-sensory, spatial, and temporal dimensions (Fulton Suri, 2004). This is surely a challenging requisite, and entails multi-method evaluations and cross-disciplinary research.

In brief, user experience as a new and promising approach to understanding and designing user-product interaction has emerged and attracted great research interest from the design fields. The sustainable delivery of engaging experiences through interactive products is increasingly becoming a design goal. To achieve this goal, user experience focuses on a holistic approach, taking into account instrumental and non-instrumental aspects of interactive artefacts (Mahlke, 2005). Thus, beyond usability, design has evolved to a new level. The following sections further discuss this concept of user experience.
2.2 USER EXPERIENCE

The term ‘user experience’ has become a key word in the fields of human-computer interaction (HCI) and product design. Although its definition has not yet reached a solid state, there has been wide agreement that user experience deals with more than functionality and usability (Alben, 1996; Bevan, 2008; Hassenzahl and Tractinsky, 2006; Väänänen-Vainio-Mattila, et al., 2008a; Vermeeren, et al., 2010). The concept of user experience pushes the limits of the traditional usability framework – which is task-based, goal-oriented, and focused mainly on behavioural performances – to include the non-instrumental or hedonic quality of user-product interaction (Bargas-Avila and Hornbæk, 2012; Law, et al., 2009; Law, Roto, Vermeeren, Kort, and Hassenzahl, 2008). User experience focuses on the user and on the construction of positive experiences through emotions, sensations, attitudes, meanings, and values as the outcomes of the interaction with a product or system (Law, et al., 2009; Zimmermann, 2008).

Hassenzahl, Law, and Hvannberg (2006) identify three main attributes that differentiate user experience from the traditional view of usability:

1. **Holistic:** Usability focuses on *pragmatic* aspects of user-product interaction, emphasising users’ tasks and the achievement of those tasks. Meanwhile, user experience offers a more holistic approach by incorporating *hedonic* (non-task related) aspects of the user-product relationship, such as beauty, stimulation, challenge, and self-identification.

2. **Subjective:** Usability strongly relies on *objective* approaches to assessing user-product interaction. Its design recommendations are based on observation (e.g. usability testing, eye tracking), rather than simply on users’ opinions. In contrast, user experience foregrounds *subjective* approaches. It directly looks at the way users experience and judge the products they use.

3. **Positive:** Traditional usability focuses on the *negative* side of the user-product relationship; that is, on problems, obstacles, stress, frustration, and ways to eliminate them. Conversely, user experience highlights the *positive* outcomes of product use and ownership, such as delight, excitement, pride, and personal growth. While usability is still important, it
Chapter 2: User Experience

acts principally to remove potential dissatisfaction, and this does not necessarily results in high levels of satisfaction. User experience, on the other hand, works equally as both dissatisfier and satisfier.

More recently, Hassenzahl (2010) included two more attributes: dynamic (i.e. user experience evolves over time) and situated (i.e. different situations result in different experience). These five attributes form the crucial properties of user experience (Hassenzahl, 2010).

User experience is often regarded as ambiguous (Forlizzi and Ford, 2000); vague, elusive, and transient (Hassenzahl and Tractinsky, 2006); related to a wide range of meanings (Forlizzi and Battarbee, 2004); and as difficult to universally define (Law, et al., 2008). Nevertheless, a large number of studies have been conducted over the last decade to gain a clear understanding of the concept, and to identify its key aspects and scope. These studies have their origins in diverse fields and disciplines, including philosophy, psychology, anthropology, art, design, HCI, business, and the cognitive and social sciences. Despite this, user experience theories and definitions are still evolving, and a unified understanding has not yet been achieved (Law, Hvannberg, and Hassenzahl, 2006; Law, et al., 2009). This is reflected through the extensive collection of user experience definitions that can be seen at www.allaboutux.org/ux-definitions (Roto et al., 2010).

According to Law et al. (2009), there are three factors that impede consensus on a definition of user experience. First, user experience involves a wide range of nebulous and evolving concepts, and these concepts include and exclude particular elements of user experience, depending on the researcher’s interests and background. Second, the scope of user experience analysis is too flexible, ranging from a single aspect of interaction between a user and a product, to all aspects of interaction between multiple users and a company. Lastly, various theoretical models with different foci (e.g. emotion, experience, pleasure, beauty, value, and hedonic quality) disintegrate and complicate the existing body of knowledge of user experience (Law, et al., 2009).

It is important to unify the concepts, models, and theories of user experience to achieve a shared definition and common understanding. This will facilitate practical
applications of user experience, enable scientific discussion across different disciplines, and help to convey the basic understanding of its characteristics and scope (Law, et al., 2009). With respect to this research, a definitive definition of user experience will establish a foundation for developing the frameworks of anticipated and real user experiences. In the future, it will also support the development of practical tools for the early assessment of user experience. Several existing definitions and theories of user experience are explored below.

Experience per se can be defined as the continuous stream of ‘self-talk’ that occurs during moments of consciousness (Forlizzi and Battarbee, 2004; Forlizzi and Ford, 2000) or, as Hassenzahl (2008) explains it, “an ongoing reflection on events, we currently go through” (p.11). Walking on a beach is an example of such an experience. According to Forlizzi and Ford (2000), a singular experience comprises an infinite number of smaller experiences, pertaining to people, products, and contexts. The term ‘experience’, as given above, can refer to general or ‘plain’ experiences, but can also specifically relate to user-product interactions. Roto (2007) indicates that in defining user experience, the distinction between ‘experience’ and ‘user experience’ should be clarified. She argues that user experience must involve a product, service, or system and an interaction (or the possibility of interacting) with it at some point. Hence, watching a solar eclipse is an ‘experience’, not ‘user experience’. Law et al. (2009) support Roto’s (2007) position, with an additional criterion that the interaction occurs through a user interface.

In conjunction with interactive products, the initial concept of user experience can be found in Alben (1996). She delineates experience as all aspects of how users interact with a product; these aspects include physical feeling, an understanding of how the product works, product perception during use, fulfilment of the users’ purposes, and the product’s fitness to the overall context of use. Alben (1996) also provides eight criteria that determine the quality of experience of product use: designers’ understanding of users; effective design process; and the product ought to be learnable, needed, mutable, appropriate, aesthetic, and manageable.

Alben’s (1996) initial notion pioneers the development of more complex and diverse theories and definitions of user experience. For example, Mäkelä and Fulton Suri (2001) propose that user experience is “a result of a motivated action in a certain
context” (p. 387). They explain that “the user’s previous experiences and expectations influence the present experience, and the present experience leads to more experiences and modified expectations” (p. 387). This definition is one of the first to highlight the importance of users’ internal state (i.e. motivation, expectations, and past experiences) and context of use in shaping the whole user experience. Furthermore, it indicates that user experience is not static, but evolves over time.

Focusing on the components of user experience, Hassenzahl and Tractinsky (2006) identify three main perspectives, each of which contributes a facet to the understanding of interaction between users and technology. User experience is described as the intersection of these three facets. These facets consist of emotion (subjective, positive, and acting as antecedents and consequences of product use); beyond the instrumental (aesthetic, hedonic, and holistic); and the experiential (complex, dynamic, unique, situated, and temporally-bounded) (Hassenzahl and Tractinsky, 2006). Thus, user experience is a dynamic, complex, situated, and subjective phenomenon relating to instrumental and non-instrumental aspects of technology use. It is the outcome of a user’s characteristics (e.g. motivation, expectations, and needs), the product’s characteristics (e.g. complexity, functionality, and usability), and the context of use (e.g. organisational or social setting and meaningfulness of the activity) (Hassenzahl and Tractinsky, 2006).

While the above definition considers all underlying aspects of user experience, it appears to not provide clear relationships among these aspects in the construction of user experience. However, results of a recent survey involving many user experience researchers and practitioners (Law, et al., 2009) substantially support Hassenzahl and Tractinsky’s (2006) proposition. The survey reveals that user experience is widely accepted as subjective, dynamic, and context-dependent, and results from various prospective benefits users may gain from a product (Law, et al., 2009).

The definition of user experience provided by the International Organization for Standardization (ISO) – “a person’s perceptions and responses that result from the use and/or anticipated use of a product, system or service” (ISO 9241-210, 2010, clause 2.15) – is also in line with Law et al.’s (2009) finding in terms of the subjectivity of user experience. This is because it focuses user experience on an individual’s perception, which is subjective in nature. Moreover, consonant with
Hassenzahl and Tractinsky’s (2006) understanding, the ISO lists three factors that influence user experience: user, system, and context of use (ISO 9241-210, 2010).

The concept of ‘anticipated use’ in the ISO’s 9241-210 (2010) definition provides an intriguing subject and research opportunity. It suggests the potential value of facilitating user experience evaluations in the early stages of product development. However, this concept needs more research and clarifications (Law, et al., 2009). Bargas-Avila and Hornbæk (2011, 2012) also link anticipated use to user experience measurement before actual use of a product. They note that despite its important role in the area of user experience, the concept of anticipated use and the measurement of user experience before interaction are rarely studied. This research fills this gap by investigating anticipated user experience, with the intention of supporting early assessment of user experience in the product development process.

Another definition extends its roots in User-Centered Design (UCD) to include all aspects relevant to user experience. Here, user experience is defined as the value obtained from interactions (or anticipated interactions) with a product or service and its supporting organisation within the context of use (Sward and Macarthur, 2007). According to the authors, this value can be a real value (e.g. efficiency and effectiveness), a perceived value (e.g. aesthetic, emotion, behaviour, and satisfaction), or their combination. Sward and Macarthur (2007), furthermore, view user experience through five components that form a continuing, closed-loop progression: marketing and awareness, acquisition and installation, product or service use, product support, and removal or end of life.

Similar to the ISO’s 9241-210 (2010) definition, Sward and Macarthur’s (2007) definition contains the term ‘anticipated interaction’. This suggests that user experience should be explored and assessed not only during or after interaction, but also before interaction. Therefore, anticipated interaction and anticipated experience are the central subjects of this research. With respect to the user experience components, anticipated interaction appears to be closely related to the marketing and awareness stage, where the product’s image is formed in a user’s mind (via advertisements, product appearances, etc.) before actual interaction take place.
Desmet and Hekkert (2007) propose a slightly different term: ‘product experience’. This is defined as the whole set of affects evoked by user-product interaction, comprising aesthetic experience, experience of meaning, and emotional experience. Aesthetic experience deals with the indulgence of users’ sensory modalities; experience of meaning stems from a cognitive process by which meanings are attached to the product; and emotional experience involves the feelings and emotional reactions resulting from an interaction (Desmet and Hekkert, 2007). (More details of product experience are presented in Section 2.4.3). The use of the term product experience, however, is negatively critiqued by Law et al. (2009). They argue that the term limits the scope of user experience to commercial products only, and that it tends to stress experience as a product attribute rather than as a user’s subjective feeling. Further, Law et al. (2009) believe that the scope of user experience should include products, systems, objects, and services that a user interacts with through a user interface.

Hassenzahl (2008) defines user experience as “a momentary, primarily evaluative feeling (good-bad) while interacting with a product or service” (p. 12). By that definition, he emphasises the subjectivity and the dynamics of user experience; that is, that it focuses on human feelings instead of product, and is present-oriented and changing over time. Hassenzahl (2008) expands his definition by asserting that positive user experience is derived from the fulfilment of users’ basic personal needs (e.g. autonomy, stimulation, and competency) and social needs (e.g. popularity and relatedness) through the use of a product or service. The fulfilment of these needs – which are called ‘be-goals’ – is only made possible by the hedonic quality of the product or service. Another type of quality, the pragmatic quality, plays a role in making the goals more achievable. In other words, whereas hedonic quality directly affects the creation of positive user experience, pragmatic quality contributes indirectly to the experience by facilitating the fulfilment of hedonic needs or be-goals (Hassenzahl, 2008). Section 2.3 provides further explanation of hedonic and pragmatic qualities.

Through his book, Kuniavsky (2010) defines user experience as the entirety of users’ perceptions while interacting with a product or service. These perceptions encompass efficiency, effectiveness, emotional satisfaction, and the quality of the relationship
with the constituent elements of the product or service (Kuniavsky, 2010). Similarly, Sutcliffe (2010) argues that user experience is users’ appraisal of product quality, which is derived from their experience of using the product, as well as from the product’s attributes that generate effective use and enjoyment. Both definitions are similar in that they focus on the subjective side of the interaction (i.e. on perception and judgment). They also view the product’s quality as consisting of instrumental aspects (i.e. effectiveness and efficiency) and of non-instrumental aspects (i.e. emotional satisfaction and pleasure) that contribute to the experience.

As well as definitions from the perspectives of academic researchers, there are additional user experience definitions from practitioners and industry (e.g. Nielsen Norman Group, 2007), professional groups (e.g. UXnet, 2010), and from the general public (e.g. Wikipedia, 2010):

User experience encompasses all aspects of the end-user's interaction with the company, its services, and its products. The first requirement for an exemplary user experience is to meet the exact needs of the customer, without fuss or bother. Next comes simplicity and elegance that produce products that are a joy to own, a joy to use. True user experience goes far beyond giving customers what they say they want, or providing checklist features. (Nielsen Norman Group, 2007, par. 1)

User experience is the quality of experience a person has when interacting with a specific design. This can range from a specific artifact, such as a cup, toy or website, up to larger, integrated experiences such as a museum or an airport. (UXnet, 2010, par. 1)

User experience (UX) is about how a person feels about using a system. (Wikipedia, 2010, par. 1 )

The first definition is clearly drawn from an industrial perspective due to the components included: the company, its products or services, and its customers. Its focus is on designing for good user experience in order to produce successful products or services. The second definition is based on a design perspective, and its scope goes beyond interactive everyday artefacts. The last definition emphasises the subjective aspect (i.e. the user’s feelings) of user-system interactions.

Nearly all definitions introduced in this section (and summarised in Table 2.1) appear to be in agreement on several characteristics of user experience. First, they agree that
user experience covers more than usability and functionality of interactive products; it extends beyond the instrumental aspects of user-product interaction. Second, they agree that user experience approaches the analysis of user-product interaction holistically, taking into account all aspects that can affect the interaction. Lastly, they agree that user experience is dynamic (changing over time), subjective (mainly relying on user perception), and context-dependent (situated).

In Table 2.1, ‘UX components’ refer to subject, object, and other elements that play a key part in generating the experience. ‘How UX is created’ evaluates how the experience is brought about, as indicated by each definition. Finally, ‘time focus’ interprets the possible temporal states in which user experience occurs; that is, before, during, and after interacting with the product or service. As can be seen, with respect to the temporal state or interaction stage, all definitions highlight the experience during an actual interaction with the product or system. Only a few, however, touch on the subject of anticipated interaction or experience before usage, and no further explanations regarding this subject are provided. Also, of the 27 user experience definitions listed at www.allaboutux.org/ux-definitions (Roto, Lee, et al., 2010), less than 15% consider the influence of anticipated use in the construction of user experience. Again, this indicates a research gap in the area of user experience before usage, and this gap needs to be addressed.

Section 2.4 furthers this basic understanding of user experience by analysing a number of user experience models and frameworks to explore the way in which it is constructed, its specific elements, and their interrelationships. Prior to this, however, Section 2.3 discusses the important roles of pragmatic and hedonic qualities in user experience.
<table>
<thead>
<tr>
<th>Source</th>
<th>UX Definition</th>
<th>UX Components</th>
<th>How UX is Created</th>
<th>Time Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alben (1996, p. 12)</td>
<td>“All the aspects of how people use an interactive product: the way it feels in their hands, how well they understand how it works, how they feel about it while they’re using it, how well it serves their purposes, and how well it fits into the entire context in which they are using it.”</td>
<td>People, interactive product, and context of use.</td>
<td>Physical and subjective feelings, ease of use, purpose achievement, and situational fitness of product use.</td>
<td>During interaction.</td>
</tr>
<tr>
<td>Mäkelä and Fulton Suri (2001, p. 387)</td>
<td>“A result of a motivated action in a certain context. The user’s previous experiences and expectations influence the present experience, and the present experience leads to more experiences and modified expectations”</td>
<td>Motivation, action, and context.</td>
<td>Consequence of a motivated action in a certain context, influenced by expectations and past experiences.</td>
<td>Before, during, and after interaction.</td>
</tr>
<tr>
<td>Hassenzahl and Tractinsky (2006, p. 95)</td>
<td>“A consequence of a user’s internal state (predispositions, expectations, needs, motivation, mood, etc.), the characteristics of the designed system (e.g. complexity, purpose, usability, functionality, etc.) and the context (or the environment) within which the interaction occurs (e.g. organisational/social setting, meaningfulness of the activity, voluntariness of use, etc.).”</td>
<td>User’s internal or psychological state, system’s characteristics, and context.</td>
<td>Outcome of the interaction of all components of user experience.</td>
<td>During and after interaction.</td>
</tr>
<tr>
<td>ISO 9241-210 (2010, clause 2.15)</td>
<td>“A person’s perceptions and responses that result from the use and/or anticipated use of a product, system or service.”</td>
<td>Person and product, system, or service.</td>
<td>Perceptions and responses resulting from interactions or anticipated interactions.</td>
<td>Before, during, and after interaction.</td>
</tr>
<tr>
<td>Sward and Macarthur (2007, p. 36)</td>
<td>“The value derived from interaction(s) [or anticipated interaction(s)] with a product or service and the supporting cast in the context of use (e.g., time, location, and user disposition).”</td>
<td>User (implied), product or service, its supporting cast, and context of use.</td>
<td>Value derived from interactions or anticipated interactions.</td>
<td>Before and during interaction.*</td>
</tr>
<tr>
<td>Desmet and Hekkert</td>
<td>“The entire set of affects that is elicited by the interaction between a user and a product, including the degree to which all our senses are gratified (aesthetic experience), the meanings we attach to the product (experience of meaning) and the feelings and emotions that are elicited (emotional experience).”</td>
<td>User and product.</td>
<td>Gratified senses, attached meanings, and emotions brought about by interactions.*</td>
<td>During and after interaction.*</td>
</tr>
<tr>
<td>Reference</td>
<td>Definition</td>
<td>Relevant Terms</td>
<td>Timeframe</td>
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</tr>
<tr>
<td>Hassenzahl (2007, p. 59)</td>
<td>“A momentary, primarily evaluative feeling (good-bad) while interacting with a product or service.”</td>
<td>User (implied) and product or service.</td>
<td>Momentary, evaluative feelings stemming from interactions. During interaction.</td>
<td></td>
</tr>
<tr>
<td>Kuniavsky (2010, p. 14)</td>
<td>“The totality of end-users’ perceptions as they interact with a product or service. These perceptions include effectiveness (how good is the result?), efficiency (how fast or cheap is it?), emotional satisfaction (how good does it feel?), and the quality of the relationship with the entity that created the product or service (what expectations does it create for subsequent interactions?).”</td>
<td>End-user and product or service.</td>
<td>All perceptions (including effectiveness, efficiency, emotional satisfaction, and relationship quality) generated by interactions. During interaction.</td>
<td></td>
</tr>
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</table>
Table 2.1 Summary of User Experience (UX) Definitions (continued)

<table>
<thead>
<tr>
<th>Source</th>
<th>UX Definition</th>
<th>UX Components</th>
<th>How UX is Created</th>
<th>Time Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sutcliffe (2010, p. 3)</td>
<td>“User’s judgement of product quality arising from their experience of interaction, and the product design qualities while engender effective use and pleasure.”</td>
<td>User’s judgment and product qualities.</td>
<td>Judgment resulting from interactions; effective use and pleasure engendered by product features.</td>
<td>During interaction.</td>
</tr>
<tr>
<td>Nielsen Norman Group</td>
<td>“All aspects of the end-user’s interaction with the company, its services, and its products. The first requirement for an exemplary user experience is to meet the exact needs of the customer, without fuss or bother. Next comes simplicity and elegance that produce products that are a joy to own, a joy to use. True user experience goes far beyond giving customers what they say they want, or providing check list features.”</td>
<td>End-user or customer, company, product, and service.</td>
<td>Meeting users’ exact needs, creating a joy of using and owning, and offering beyond users’ expectations.*</td>
<td>During interaction.*</td>
</tr>
<tr>
<td>UXnet (2010, par. 1)</td>
<td>“The quality of experience a person has when interacting with a specific design. This can range from a specific artifact, such as a cup, toy or website, up to larger, integrated experiences such as a museum or an airport.”</td>
<td>Person and the specific design of various objects.</td>
<td>Quality of experience gained from interactions.*</td>
<td>During interaction.*</td>
</tr>
</tbody>
</table>

Note: Several entries in “How UX is created” and “Time Focus” columns (indicated by *) refer to Law et al. (2009).
2.3 PRAGMATIC AND HEDONIC QUALITIES IN USER EXPERIENCE

Rather than only focusing on the pragmatic, instrumental aspects of user-product interactions, user experience also places great emphasis on the hedonic, non-instrumental aspects of the interactions (Bargas-Avila and Hornbæk, 2012; Hassenzahl and Tractinsky, 2006; Law, et al., 2009). Consequently, pragmatic and hedonic qualities of interactive products play a fundamental role in the formation of user experience. Understanding users’ underlying need for both qualities has been a key in creating good products and thus enhancing a company’s success (Roto, 2007).

Hassenzahl (2003, 2008, 2010) argues that pragmatic quality refers to a product’s perceived capacity to support the fulfilment of behavioural or do-goals (e.g. sending a text message, finding specific information on a website). Thus, it inextricably relates to the product’s functionality and usability. In contrast, hedonic quality refers to the product’s perceived potential to facilitate the achievement of psychological well-being or be-goals (e.g. being popular, being competent, being related to others) (Hassenzahl, 2003, 2008, 2010). It relates to the users’ pleasure of ownership and use of the product. Hedonic quality can further be linked to three main drivers: stimulation (novelty, personal growth, development of knowledge and skills); identification (self-expression and communication of identity to relevant others through product possession, relatedness); and evocation (provoking memories, symbolising) (Hassenzahl, 2003). Hassenzahl (2008, 2010) strongly argues that the achievement of be-goals, which is directly supported by hedonic quality, is the major source of positive user experience.

Likewise, Mahlke and Thüring (2007) distinguish two types of qualities: instrumental (equivalent to pragmatic) and non-instrumental (equivalent to hedonic). They regard instrumental quality as the perceived support the product provides and its ease of use (e.g. controllability, effectiveness, and learnability). It is, therefore, associated with the product’s usability and usefulness. On the other hand, non-instrumental quality relates to the product’s look and feel (e.g. visual aesthetic, haptic quality, and identification). This quality derives from the product’s attractiveness and appeal (Mahlke and Thüring, 2007), and is considered to be the quality aspect that focuses on user needs that go beyond goals, tasks, and their efficient fulfilment.
Mahlke and Lindgaard (2007). Mahlke and Thüring (2007) argue that both types of qualities influence users’ emotional reactions while using a product (Section 2.4.2).

There has been much empirical research into how pragmatic and hedonic qualities influence and shape user experience. For instance, Hassenzahl (2004) studied the interplay between perceived usability, hedonic attributes, and two overall evaluative judgments of product quality (i.e. goodness and beauty). He found that goodness is mainly influenced by goal-oriented, pragmatic attributes (usability and utility), whereas beauty is largely influenced by self-oriented, hedonic attributes (identification). Hassenzahl, Diefenbach, and Göritz (2010) investigated the links between affect, needs, and product perception. They found that need fulfilment was related to positive affect, which had a stronger relationship with hedonic quality than with pragmatic quality. Moreover, the need fulfilment was significantly related to hedonic quality perceptions, but only weakly linked to pragmatic ones (Hassenzahl, et al., 2010). Thus, their finding supports the notion that hedonic quality directly contributes to the creation of positive experience, whereas pragmatic quality simply facilitates the fulfilment of needs by removing barriers (Hassenzahl, 2008, 2010).

Partala and Kallinen (2012) also suggest that the most satisfying user experiences are primarily related to hedonic aspects of the experiences, with the psychological needs for self-esteem, competency, and autonomy as the most salient aspects. On the other hand, the most unsatisfying experiences mainly provide insights into pragmatic aspects, but often provide no information about the hedonic and social aspects of the experiences (Partala and Kallinen, 2012).

With regard to product preference, Hassenzahl, Schöbel, and Trautmann (2008) demonstrate that motivational orientation (i.e. a promotion or prevention focus) impacts product evaluation and choice. They confirm that while hedonic products are more preferable to users in a promotion focus than to those in a prevention focus, the reverse is true for pragmatic products. In choice situations, individuals tend to choose pragmatic alternatives over hedonic alternatives, even when they consider the hedonic alternatives to have higher value (Chitturi, Raghunathan, and Mahajan, 2007; Diefenbach and Hassenzahl, 2011; Okada, 2005). As argued by Diefenbach and Hassenzahl (2011) and Okada (2005), this phenomenon (the so-called ‘hedonic dilemma’) is caused by the individuals’ need to justify their choice. Since it is easier
to justify pragmatic attributes than it is to justify hedonic attributes, people tend to overemphasise the pragmatic and fail to appreciate and choose the hedonic. Diefenbach and Hassenzahl (2011) propose two ways in which to lessen the effect of this ‘hedonic dilemma’: (1) by improving the justifiability of hedonic choice and (2) by manipulating the need for justification by framing the choice context.

In relation to temporal aspects of user experience due to its dynamic and context-dependent characteristics, the relative dominance of different pragmatic and hedonic qualities of a product changes over time (e.g. Karapanos, Hassenzahl, and Martens, 2008; Karapanos, et al., 2009). The perceived pragmatic and hedonic qualities may also improve, deteriorate, or remain stable over prolonged experience (Kujala, Roto, Väänänen-Vainio-Mattila, Karapanos, and Sinnenä, 2011; von Wilamowitz-Moellendorff, et al., 2006). More details of this aspect are provided in Section 2.5.

2.4 USER EXPERIENCE MODELS AND FRAMEWORKS

Due to the complex nature of user experience, a valid and cohesive model or framework is needed to clarify its key components and their interrelationships in the creation of the experience. This model or framework will facilitate a better understanding of user experience and, in turn, help transform theory into practice. For instance, the framework could support the development of practical user experience assessment methods. To date, numerous user experience models and frameworks have been developed. Law and van Schaik (2010) group these into measurement and structural models. The measurement models (e.g. van Schaik and Ling, 2008, 2011) are used to measure user experience constructs, providing a sound basis for assessing user experience. Meanwhile, the structural models (e.g. Hassenzahl, 2003; Roto, 2007) are used to determine causal relationships between the constructs, thus helping to understand, predict, and reason about user experience processes that are useful for system design.

Blythe, Wright, McCarthy, and Bertelsen (2006) distinguish the existing user experience frameworks and theoretical approaches into those originating from the social and psychological sciences (e.g. Hassenzahl, 2003; Jordan, 2000; Norman, 2004) and those having roots in the arts and humanities perspectives (e.g. Forlizzi and Battarbee, 2004; Forlizzi and Ford, 2000; McCarthy and Wright, 2004a).
Moreover, to characterise the frameworks, Blythe, Hassenzahl, Law, and Vermeeren (2007) propose five analytical aspects and their bipolar dimensions: theory (reductive–holistic), purpose (evaluation–development), method (quantitative–qualitative), domain (work based–leisure based), and application (personal–social).

Other authorities (e.g. Forlizzi and Battarbee, 2004; Zimmerman, Forlizzi, and Koskinen, 2009) categorise the models and theoretical approaches into product-centred, user-centred, and interaction-centred. Product-centred models provide basic applications for design practice through information about types and issues of experience that are important to consider in the design and evaluation of products or systems (e.g. Alben, 1996; Jääskö and Mattelmäki, 2003). In contrast, user-centred models focus on the users who interact with the products, thus helping designers to understand users’ actions and relevant aspects of their experience (e.g. Hassenzahl, 2003; Mäkelä and Fulton Suri, 2001). Finally, interaction-centred models emphasise the function of products in connecting designers’ intentions and users’ needs, focusing on usage situation and how users engage with the products (e.g. Forlizzi and Ford, 2000; Wright, et al., 2003). Similar to this categorisation, but based on different perspectives (e.g. temporality and dynamics of user experience), van Vliet and Mulder (2006) identify product-centred, process-centred, interaction-centred, and empirically-grounded models of user experience.

2.4.1 Early Models and Frameworks of User Experience

One of the earliest frameworks for understanding experience relating to user-product interaction was developed by Forlizzi and Ford (2000). They distinguish three kinds of experiences: experience, an experience, and experience as story. They also include four components in the framework to represent the dimensions of experience: sub-consciousness, cognition, narrative, and storytelling. Forlizzi and Ford (2000) posit that shifts from one component to another provide useful information regarding the types of user-product interactions and the types of experiences that designers might design for. For example, the shift from a sub-conscious experience to a cognitive one may signify that users are having difficulties when interacting with a product, because they need to think during the process. This shift, on the other hand, could also indicate a learning process or skill development (Forlizzi and Ford, 2000). In conjunction with the framework, the authors identify elements of a user-product
interaction that influence the experience: users, products, and their surrounding aspects (e.g. context of use, and social and cultural factors).

The Forlizzi and Ford’s (2000) framework serves as the basis for a more recent one developed by Forlizzi and Battarbee (2004). Built on the interaction-centred approach, this framework focuses on user-product interactions and the resulting experiences, situated within a social context. Forlizzi and Battarbee (2004) form the framework by classifying types of user-product interactions (i.e. fluent, cognitive, and expressive) and types of experiences (i.e. experience, an experience, and co-experience). Fluent user-product interactions are automatic and well-learned (e.g. using a spoon for eating). Cognitive user-product interactions require the user to think how to use the product, resulting in either understanding or confusion and mistakes (e.g. interacting with a ticket machine in a foreign country). Expressive user-product interactions help create a relationship between the user and product (e.g. setting the home screen for computers) (Forlizzi and Battarbee, 2004). These three types of interactions in a certain context generate three types of experiences.

Forlizzi and Battarbee (2004) give details that experience is a continuous flow of ‘self-talk’ during the interaction (e.g. doing light housekeeping). Meanwhile, an experience can be verbalised or named, has a definite duration, and may encourage emotional and behavioural changes (e.g. watching a football game). Lastly, co-experience – which is based on the work of Battarbee (2003) – is related to social contexts. Here, experiences, emotions, and meanings are created together or shared with other people (e.g. playing a video game with friends).

By definition, the fluent interaction in Forlizzi and Battarbee’s (2004) framework is comparable with the sub-conscious experience in Forlizzi and Ford’s (2000) framework, while the cognitive interaction is equivalent to the cognitive experience. It is interesting that both frameworks highlight the active changes in the experience dimensions or interaction states to understand how users experience interactions with a product. For example, in Forlizzi and Battarbee’s (2004) framework, users’ experiences shift dynamically between fluent, cognitive, and expressive interactions as they take place. However, the specific relationships between the interactions and the experiences are not completely clear, in terms of which interaction causes which experience. As a result, the interactions and the experiences seem to act
independently. Additionally, the concept of co-experience is still contentious since many researchers believe that user experience is rather personal. While conceding that the experience may be influenced by, or shared with, other people, Law et al. (2009) argue that the experience is still within each individual; only an individual can feel and experience. The notions of ‘experience’ and ‘an experience’ in both frameworks also appear not to focus on user experience, as their meanings can relate to general experiences, such as walking in a park or watching a sunset. As discussed previously, user experience should involve a product, system, or service, and interactions with it via user interfaces (Law, et al., 2009; Roto, 2007).

**2.4.2 User Experience Models with Pragmatic and Hedonic Qualities**

In his seminal work, Hassenzahl (2003) discusses four key components of his user experience model: (1) product features, (2) perceived product character, (3) usage situation, and (4) consequences. According to this model (Figure 2.1), when encountering a product, users will perceive its features (content, presentation, functionality, and interactional style) and translate them into the apparent product character. Here, the product is judged along two different attributes: pragmatic and hedonic qualities (Section 2.3). In the next interaction process, the perceived product character generates consequences, which encompass the product’s appeal evaluation (e.g. bad, good, attractive), emotional consequences (e.g. pleasure, satisfaction), and behavioural consequences (e.g. longer duration of product use). The usage situation plays a role in determining the consequences; that is, different situations of use (e.g. goals of product use) lead to different consequences (Hassenzahl, 2003).

![Figure 2.1 Key Components of User Experience Model](Based on Hassenzahl, 2003, p. 32)
Hassenzahl (2003) views the usage situation as two distinct interaction types: goal and action modes. The goal mode is the practical mode in which a product is used as a means to achieve the set goals; in the action mode, on the other hand, a product is used for exploration and entertainment. Furthermore, in relation to his user experience model, the author asserts that the apparent product character and the consequences are subjective and momentary; they may change over time and are dependent on the users’ personal standards and expectations.

Hassenzahl’s (2003) model is clear and straightforward. It is useful since it provides more definite user experience elements, as well as their clear functional relationships. The model concurs with most existing definitions of user experience and helps to explicate how the experience is constructed. It may allow user experience researchers to establish measurement criteria for each of its components; this, in turn, can lead to a better assessment of user experience with interactive products. The AttrakDiff™ (User Interface Design GmbH, 2010) instrument, for example, has been developed to measure the perceived pragmatic and hedonic qualities of products, and to conduct user experience studies that are based on Hassenzahl’s (2003) model (e.g. Hassenzahl, 2004; Karapanos, et al., 2008).

By integrating various aspects relevant to the experience of user-product interactions, Mahlke (2005) proposes a basic user experience process model. It comprises a complex interplay of five elements: (1) system qualities, (2) cognitive part, (3) affective reactions, (4) emotional consequences, and (5) judgments and behavioural consequences. The system qualities affect the cognitive part, which is information processing on experience dimensions. This cognitive part results in perceived instrumental and non-instrumental qualities, which then lead to emotional consequences and users’ judgments and behaviours. The system qualities also determine users’ affective reactions, which, in turn, impact on the cognitive part, emotional consequences, and partially on the consequences of the experience. Finally, the emotional consequences themselves influence users’ judgments and usage behaviour (Mahlke, 2005). Unlike Hassenzahl’s (2003), this model shows more complicated inter-component relationships. Additionally, the distinction between affective reactions and emotional consequences is not well defined although their interactions with other user experience elements are explicitly described.
Built on the earlier model (Mahlke, 2005), Mahlke and Thüring (2007) offer a comprehensive, yet more logical framework of user experience. They emphasise the integration of perceived instrumental and non-instrumental qualities and users’ emotional reactions as the three core elements of user experience (Figure 2.2). Two other constituents of the framework are interaction characteristics and overall appraisal of system quality. This framework is also discussed in Thüring and Mahlke (2007), and refined in Mahlke (2007). In this framework, the interaction characteristics are influenced by user attributes, product features, and usage contexts. The emotional responses are regarded as episodes of subjective feelings accompanied by specific motor expressions and physiological signals. Lastly, the system appraisal can take the form of usage behaviour, global judgments, and decisions on alternatives (Mahlke and Thüring, 2007). An explanation of instrumental and non-instrumental qualities is given in Section 2.3.

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Figure 2.2 User Experience Framework
(Based on Mahlke and Thüring, 2007, p. 916)

This framework is based on two assumptions. First, user experience occurs concurrently with user-system interactions, and significantly affects the judgment of the system. Second, user experience can be defined via discrete elements and their
specific relationships. Such relationships, as suggested by Mahlke and Thüring (2007), can be described as follows (Figure 2.2): user experience is acquired during the course of user-system interaction, in which the interaction characteristics develop perceptions of instrumental and non-instrumental qualities of the system. These perceived qualities are expected to influence users’ emotional responses. Finally, the three core components of user experience collectively produce the actual consequences of the experience; that is, overall judgments of the system resulting in usage behavior and preferences for alternative systems.

Although it sheds more light on the nature of user experience, the framework might not cover all possible causal relationships among its components. For example, it has been suggested that perceived non-instrumental quality (e.g. aesthetics) influences the perceived instrumental quality (e.g. usability) of interactive products (Tractinsky, Katz, and Ikar, 2000). Relevant to this, Thüring and Mahlke (2007) recognise the possibility of feedback loops and mutual influences among the components instead of one-way relationships. Also, with respect to this research, the framework seems to focus only on user experience gained during the actual interactions, thus overlooking the experience that may occur before or after the interactions.

In comparison to Hassenzahl’s (2003) model, Mahlke and Thüring’s (2007) model shows both similarities and differences in some aspects. For example, pragmatic quality is equivalent to instrumental quality, and hedonic quality is equivalent to non-instrumental quality. Likewise, the consequences are comparable with the overall judgments. The models differ, however, in the way in which components interrelate. Hassenzahl (2003), for instance, considers usage context as the moderator between the apparent product character and consequences, whereas Mahlke and Thüring (2007) consider it to be inherent in the interaction characteristics that affect the perceived system quality. In addition, Hassenzahl (2003) seems to identify emotional responses as an actual consequence, rather than as an integral component of user experience. Thus, despite the similarities in terms of the constituents of user experience, researchers tend to differ in interpreting the way in which user experience is constructed, and the way in which its elements interrelate.
2.4.3 Additional User Experience Models and Frameworks

McCarthy and Wright (2004a, 2004b) present a foundation for considering and evaluating technology as experience. They propose a framework for analysing and understanding the felt experience of users engaging in activities with, or through, technological products. It comprises four inter-connected threads of experience and six sense-making processes (Table 2.2). Wright et al. (2003) assert that the four threads are not to be viewed as basic and separable components of experience because “experience cannot be reduced to fundamental elements but only exists as relations” (Dewey, as cited in Wright, et al., 2003, p. 46). Furthermore, it is stressed that the experience is not an instant phenomenon, but constructed actively through a reflexive and recursive process of sense-making (McCarthy and Wright, 2004a, 2004b; Wright, et al., 2003). The authors note that the six distinct sense-making processes interrelate in a non-linear way (in terms of cause and effect).

Roto (2006) adopts the user experience components suggested by Hassenzahl and Tractinsky (2006), and uses empirical research on mobile web browsing experience to establish a set of user experience building blocks. Three user experience components – system, context, and user – and their attributes construct these building blocks. Roto (2006) stresses that the system component includes not only the product being used, but also all parts of the system that are involved in and affect the interaction (i.e. objects, services, people, and infrastructures). The context component is everything that is not part of the system but influences the user experience. It defines the physical or environmental, social, temporal, and task contexts for the experience. Lastly, the user component comprises the needs, expectations, prior experiences, emotional states, and resources of the person who interacts with the system (Roto, 2006). These three components build a framework, which depicts that, within a particular context, interactions between user and system generate perceptions of the system. These perceptions affect user experience, which, in turn, loops back to the user’s state, thus emphasising the subjectivity of user experience (Roto, 2006).
Table 2.2 The Four Threads and Six Sense-making Processes of Experience (McCarthy and Wright, 2004a, 2004b; Wright, et al., 2003; Wright, Wallace, and McCarthy, 2008)

<table>
<thead>
<tr>
<th>Experience Threads</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compositional</td>
<td>Aspect concerned with the narrative structure of an experience; how elements of an experience collectively and structurally form the whole experience.</td>
</tr>
<tr>
<td>Sensual</td>
<td>Aspect concerned with individuals’ sensory engagement with an environment, which leads to a tangible and visceral character of experience that is formed prior to the reflective process (e.g., the look and feel of a product).</td>
</tr>
<tr>
<td>Emotional</td>
<td>Aspect concerned with one's judgments (e.g., disappointment, delight) that attribute an importance to things or other people relating to his/her desires and needs.</td>
</tr>
<tr>
<td>Spatio-temporal</td>
<td>Aspect concerned with the effects of space-time quality and sense on the experience (e.g., space is perceived as confined and cloistering when frustrated).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sense-making Processes</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticipating</td>
<td>Envisaging what experience to gain with a product, affected by expectations, possibilities, past experiences, and ways of making sense that are brought to the current situation.</td>
</tr>
<tr>
<td>Connecting</td>
<td>The immediate, pre-attentive, and pre-linguistic response to the first encounter with a product or situation, in which the encounter is experienced without giving meaning to it.</td>
</tr>
<tr>
<td>Interpreting</td>
<td>The process of giving meaning to the unfolding experience and relating the experience to one’s goals, hopes, fears, and prior experiences. It may involve reflecting on and modifying the expectations to be more in line with the actual experience.</td>
</tr>
<tr>
<td>Reflecting</td>
<td>Evaluating and making judgments about the experience as it unfolds, and giving a value to that experience.</td>
</tr>
<tr>
<td>Appropriating</td>
<td>Making the new experience one’s own by relating and fitting it to previous experiences, sense of self, and anticipated experiences. One’s sense of self may be altered as a consequence of the experience.</td>
</tr>
<tr>
<td>Recounting</td>
<td>Reliving the experience by describing it to oneself and others to find new meanings and possibilities in the experience, and to gain new values from it.</td>
</tr>
</tbody>
</table>

More recently, Roto (2007) considers the above framework as representing user experience during actual interaction. She argues that, from a product creation perspective, it is important to take into account user experience outside of the interaction stage. This enables the determination of long-term attitudes and emotional attachment to a product, rather than simply the fleeting emotions experienced during interaction. Hence, user experience is interpreted as a series of phases consisting of expected user experience, user experience during interaction, and overall user experience (Roto, 2007). Expected user experience is the experiences and expectations before actual interaction, and is shaped by advertisements, brand image, other people’s opinions, and prior experiences with similar products. It impacts on the actual user experience, as the goodness of this experience is judged against the expectations. Meanwhile, overall user experience represents long-term, on-going experience with a product, which, in turn, is continuously forming new expected user
experience (Roto, 2007). Roto’s (2007) proposition is in accordance with this research in that it highlights the key role of expected or anticipated user experience in the design and creation of interactive products.

In the context of mobile technology use, Hiltunen, Laukka, and Luomala (2002) suggest that user experience is the result of a multiplication of five main factors: utility, usability, availability, aesthetics, and offline issues. They also consider users’ expectations as a fundamental aspect that underlies user experience formation. As described by Hiltunen et al.’s (2002) framework, the expectations direct users’ information gathering (i.e. the issues users focus on) and interpretation while using a product. This information gathering produces product perceptions that cover the five main factors above, which then lead to the emotional interpretation of the product use. This interpretation forms user experience, which, in turn, affects and modifies future expectations. This framework is in line with Roto’s (2006, 2007) in terms of the roles that expectations and perceptions play in user experience. However, while Hiltunen et al. (2002) recognise the influence of usage context in user experience, this factor is not clearly reflected in their framework.

The framework of product experience has been introduced by Desmet and Hekkert (2007). Product experience is viewed as all possible affective experiences elicited by user-product interactions, and involve aesthetic experience, experience of meaning, and emotional experience (Desmet and Hekkert, 2007) (Section 2.2 explains the meanings of these experience components). To illustrate, a person may get pleasure from looking at the beautiful design of a just bought car (aesthetic experience); the person is proud of having the car because it symbolises personal success (experience of meaning); and the person experiences satisfaction when the car size suits his/her family needs (emotional experience). The three components or levels of product experience are conceptually distinct and have their own lawful underlying processes; they, nevertheless, are closely interrelated and a particular experience level may engender the others (Desmet and Hekkert, 2007). While the authors acknowledge the reciprocal relationships between all product experience levels, the framework highlights the elicitation of emotional experiences by aesthetic experiences and experiences of meaning during user-product interactions. This may be because the framework is based on Russell’s circumplex model of core affect (Russell, as cited in...
Desmet and Hekkert (2007), by which product experience is represented as “a change in core affect that is attributed to human-product interaction” (Desmet and Hekkert, 2007, p. 59). Hence, the product experience framework is heavily derived from emotion research and emotional aspects of user experience.

Another user-product experience framework that focuses on emotional aspects was developed by Forlizzi, DiSalvo, and Hanington (2003). This framework involves user, product or object, and two types of emotional responses (i.e. emotional statement and emotional experience). According to the authors, emotional statement, which is short and reflexive, does not include cognitive process in its construction. It is more dependent on information about the self, and less representative of the environment (Forlizzi, DiSalvo, et al., 2003). This is what Norman (2004) refers to in describing the visceral level of emotional design. In contrast, emotional experience, which is sustained and reflective, needs cognitive participation in the creation of the experience. It is more representative of the events occurring in the environment, and less dependent on the self (Forlizzi, DiSalvo, et al., 2003). This is comparable to Norman’s (2004) reflective level of emotional design. In this framework, interactions between users and products within the environment form an emotional experience. The products represent three emotional functions: (1) stimuli for new experiences, (2) extenders of present experiences, and (3) proxies for prior experiences. The products also shape the emotional experience through specific qualities, namely interaction level, capability to evoke satisfying experience, physical characteristics, utility, and style (Forlizzi, DiSalvo, et al., 2003).

Kort, Vermeeren, and Fokker (2007) draw on, and combine, several existing user experience frameworks – for example, Desmet and Hekkert’s (2007) and McCarthy and Wright’s (2004a) – to establish a new framework. This framework is also discussed in Vermeeren, Cremers, Kort, and Fokker (2008) and in Pals, Steen, Langley, and Kort (2008). It comprises three concentric circles. The outer circle represents design elements; that is, the product’s constituents and features that can be manipulated by designers to define an intended product character (Kort, et al., 2007). The middle circle represents user experience aspects (i.e. aesthetic aspects, compositional aspects, and aspects of attributed meaning) that are characterised by the design elements. Aesthetic aspects are related to a product’s capability to provide
sensual gratification for the users (Desmet and Hekkert, 2007); compositional aspects are associated with usability, pragmatic, and behavioural attributes of an interactive product; and aspects of meaning are experience aspects that help realise the users’ higher level goals (e.g. self-expression and personal development) by making the users ascribe meaning to the product (Kort, et al., 2007). Each type of the three experience aspects can result in specific emotions represented by the inner circle (Kort, et al., 2007).

In this framework, the generation of experiences is described as a process moving from the outer circle to the inner one. According to Kort et al. (2007), design elements, moderated by sense-making processes, elicit user experience aspects and their corresponding emotions. Sense-making is a non-linear process that brings user experience to life; it encompasses six processes including anticipation, connecting, interpreting, reflecting, appropriating, and recounting (Table 2.2). Through these sense-making processes, Kort et al. (2007) highlight the dynamics of users’ experiences, in that they constantly change over contexts and time.

Table 2.3 summarises the user experience frameworks and models that have been discussed earlier. The examples draw from a large pool of existing frameworks and models already proposed to provide a better understanding of user experience. The components, the construction process of user experience, and the time focus (interaction phases) of each framework and model are outlined. Despite their dissimilar and potentially conflicting theoretical foundations, it becomes evident that the models and frameworks have at least one thing in common: instead of focusing on usability and performance, they place great emphasis on all aspects of user-product interaction and on users’ well-being.

Table 2.3 shows that, in terms of interaction stages, the majority of the models and frameworks have a main focus on user experience created during actual interactions. They seem to overlook the experience before the interactions, the understanding of which is potentially valuable for assessing user experience in the early stages of the design process. It is this oversight, and the need for this understanding that is the justification for this research. In the following section, the temporal aspects of user experience are explored.
Table 2.3 Summary of User Experience Models and Frameworks

<table>
<thead>
<tr>
<th>Source</th>
<th>User Experience Components</th>
<th>How User Experience is Constructed</th>
<th>Time Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forlizzi and Ford (2000)</td>
<td>• Three kinds of experiences: experience, an experience, and experience as story.</td>
<td>The shifts between each of the components (experience dimensions) unfold the types of user-product interactions and types of experiences felt by the user.</td>
<td>During actual interaction.</td>
</tr>
<tr>
<td></td>
<td>• Four components representing experience dimensions: subconsciousness, cognition, narrative, and storytelling.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Influences on experience: user, product, and their surrounding aspects (e.g. context of use, social and cultural factors).</td>
<td>The shifts between each of the components (experience dimensions) unfold the types of user-product interactions and types of experiences felt by the user.</td>
<td></td>
</tr>
<tr>
<td>Forlizzi and Battarbee (2004)</td>
<td>• Three types of user-product interactions: fluent, cognitive, and expressive.</td>
<td>The three types of user-product interactions in a certain context of use result in three types of experiences. When a user interacts with a product, the user’s experiences flow dynamically between fluent, cognitive, and expressive interaction as they take place.</td>
<td>During actual interaction.</td>
</tr>
<tr>
<td></td>
<td>• Three types of experiences: experience, an experience, and co-experience.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hassenzahl (2003)</td>
<td>• Product features (content, presentation, functionality, interactional style).</td>
<td>When encountering a product, a user will perceive product features and construct the apparent product character consisting of pragmatic and hedonic attributes. This apparent product character, moderated by a specific usage situation, generates various consequences.</td>
<td>During actual interaction.</td>
</tr>
<tr>
<td></td>
<td>• Apparent product character: pragmatic qualities (manipulation) and hedonic qualities (stimulation, identification, evocation).</td>
<td></td>
<td>Highlighting the momentary aspect of user experience.</td>
</tr>
<tr>
<td></td>
<td>• Usage situation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Consequences (judgments on product’s appeal, emotional and behavioural consequences).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mahlke (2005)</td>
<td>• System qualities.</td>
<td>The cognitive part is affected by system qualities. This cognitive part, comprising perceived instrumental and non-instrumental qualities of the system, leads to emotional and other experience consequences. The system qualities also influence affective reactions, which, in turn, affect the cognitive part, emotional consequences, and partially other consequences. The emotional</td>
<td>During actual interaction.</td>
</tr>
<tr>
<td></td>
<td>• Cognitive part, which results in perceptions of instrumental and non-</td>
<td></td>
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<tr>
<td>------------------------</td>
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<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>Interaction characteristics, which are affected by system properties, user characteristics, and task or context.</td>
<td>Perceived instrumental qualities (e.g. effectiveness, learnability).</td>
<td>Perceived non-instrumental qualities (e.g. aesthetic quality, identification).</td>
<td>Consequences have a direct influence on judgments and behavioural consequences.</td>
</tr>
<tr>
<td>Emotional reactions (subjective feelings, facial expressions, and physiological reactions).</td>
<td>Appraisal of the system (e.g. overall judgments, usage behaviour).</td>
<td>The interaction characteristics generate perceived instrumental and non-instrumental qualities of the system. These perceived system qualities independently contribute to the user’s emotional responses. Both types of perceived qualities, together with the emotional reactions (all three are referred to as the components of user experience), then collectively influence the user’s overall appraisal of the system.</td>
<td>During actual interaction.</td>
</tr>
<tr>
<td>Source</td>
<td>User Experience Components</td>
<td>How User Experience is Constructed</td>
<td>Time Focus</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>-------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Forlizzi, DiSalvo et al. (2003)</td>
<td>• User.</td>
<td>Interactions between users and products within a particular environment result in two emotional</td>
<td>• During actual interaction.</td>
</tr>
<tr>
<td></td>
<td>• Product, which embraces:</td>
<td>responses: emotional statement and emotional experience. While emotional statement is short and</td>
<td>• Recognising product’s emotional functions pertaining to past, current, and new</td>
</tr>
<tr>
<td></td>
<td>➢ Emotional functions (stimuli for new experience, extenders of current experience, and</td>
<td>reflexive, emotional experience is sustained and reflective.</td>
<td>experiences.</td>
</tr>
<tr>
<td></td>
<td>proxies for previous experience).</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>➢ Product characteristics (interaction level, satisfying experience, physical attributes,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>style, and utility).</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Emotional statement and emotional experience.</td>
<td></td>
<td></td>
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<tr>
<td>Wright et al. (2003)</td>
<td>• Four threads of experience: compositional, sensual, emotional, and spatio-temporal.</td>
<td>User experience includes four intertwined threads of experience. The experience itself is</td>
<td>Before, during, and after actual interaction.</td>
</tr>
<tr>
<td>McCarthy and Wright (2004a, 2004b)</td>
<td>• Six sense-making processes: anticipating, connecting, interpreting, reflecting,</td>
<td>constructed reflexively and recursively through six non-linear, inter-connected sense-making</td>
<td></td>
</tr>
<tr>
<td>Wright et al. (2008)</td>
<td>appropriating, and recounting.</td>
<td>processes.</td>
<td></td>
</tr>
<tr>
<td>Roto (2006, 2007)</td>
<td>• User, which covers needs, resources, emotional states, experiences, and expectations of</td>
<td>Within a particular context, interactions between user and system create perceptions of the system.</td>
<td>• During actual interaction.</td>
</tr>
<tr>
<td></td>
<td>the person who interacts with the system.</td>
<td>These perceptions result in user experience, which, in turn, loops back and reshapes the user’s</td>
<td>• Highlighting phases of user experience (UX): expected UX (before interaction), UX during</td>
</tr>
<tr>
<td></td>
<td>• System, which includes all products, objects, services, people, and infrastructures</td>
<td>state.</td>
<td>interaction, and overall UX (beyond interaction).</td>
</tr>
<tr>
<td></td>
<td>involved in the interaction.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Context (physical, social, temporal, and task).</td>
<td></td>
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<tr>
<td>Source</td>
<td>Key Aspects</td>
<td>Description</td>
<td>Timeframe</td>
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<td>----------------------------</td>
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<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>Hiltunen et al. (2002)</td>
<td>• Expectation.</td>
<td>Expectations direct users’ information gathering and interpretation while using a product. The information gathering produces product perceptions, which then lead to emotional interpretation of the product use. This interpretation forms user experience, which, in turn, affects and modifies future expectations.</td>
<td>Before, during, and after actual interaction.</td>
</tr>
<tr>
<td></td>
<td>• Information gathering.</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>• Perceptions of utility, usability, availability, aesthetics, and offline issues of the product.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Interpretation.</td>
<td></td>
<td></td>
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<td></td>
<td>• User experience.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desmet and Hekkert (2007)</td>
<td>• User.</td>
<td>Interactions between users and products elicit a set of affective responses: aesthetic experience (sensual gratification), experience of meaning (meaning attachments to the product), and emotional experience (evoked feelings and emotions).</td>
<td>During actual interaction.</td>
</tr>
<tr>
<td></td>
<td>• Product.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Emotional experience.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Aesthetic experience.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Experience of meaning.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kort et al. (2007)</td>
<td>• Design elements.</td>
<td>The design elements through six non-linear processes of sense-making produce user experience encompassing three aspects (compositional, aesthetic, and attributed meaning). Subsequently, the three user experience aspects may elicit specific emotional responses and feelings.</td>
<td>Before, during, and after actual interaction.</td>
</tr>
<tr>
<td>Vermeeren et al. (2008)</td>
<td>• Sense-making processes: anticipating, connecting, interpreting, reflecting, appropriating, and recounting.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pals et al. (2008)</td>
<td>• User experience aspects consisting of compositional, aesthetic, and attributed meaning aspects.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Emotions.</td>
<td></td>
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</table>
2.5 TEMPORAL ASPECTS OF USER EXPERIENCE

There are two different categories of studies pertaining to temporal aspects of user experience. The first category explores the timing of the generation and assessment of user experience (before, during, and after interactions), and the timeframe (past, present, and future) that the analysis of user experience should cover (e.g. Bargas-Avila and Hornbæk, 2011; Law, et al., 2009; Roto, et al., 2011; Vermeeren, et al., 2010). The second category of studies investigates how user experience changes and develops over time, particularly in prolonged product use (e.g. Karapanos, et al., 2009; Kujala, et al., 2011; von Wilamowitz-Moellendorff, et al., 2006).

In relation to the first category of studies, Roto et al. (2011) conceptualise a series of time spans of user experience:

1. Anticipated user experience – imagining experience before usage. This relates to indirect experience through expectations created from previous experiences and other sources of information.

2. Momentary user experience – experiencing during usage. This relates to specific emotions and feelings elicited during interaction.

3. Episodic user experience – reflecting on an experience after usage. This relates to the assessment of a specific usage episode.

4. Cumulative user experience – recollecting multiple periods of use over time. This relates to global perceptions of the product after many periods of use and non-use.

Roto et al. (2011) stress that focusing on different time spans of user experience results in different information about the experience, thus placing different demands on design and evaluation. In a similar vein, Vermeeren et al. (2010) classify user experience evaluation methods based on the attribute period of experience, which comprises five variables: before usage, momentary, single episode, short-term usage, and long-term usage. Thus, it can be suggested that the understanding of each time span or period of experience allows more accurate assessment of user experience, and helps with the setting and achievement of specific design targets.
The nature of user experience – which is dynamic, context-dependent, and subjective (Hassenzahl and Tractinsky, 2006; Law, et al., 2009) – underlies the second category of studies of temporal aspects of user experience. As user experience is a continuing process, a single use situation is inadequate to represent the whole experience (Kujala, Minge, Pohlmeier, and Vogel, 2012). Moreover, it is the long-term experience that determines user loyalty and ongoing use of a product (Kujala, et al., 2011). Designing for such experience requires designers to understand and measure how users’ experience and their relationship with a product change over time (Karapanos, et al., 2010; Kujala, et al., 2011). For this reason, Vermeeren and Kort (as cited in Pals, et al., 2008) suggest that user experience evaluation tools should enable in situ measurements and measurements in different contexts, as well as support longitudinal studies and continuous or timed measurements.

A number of studies have demonstrated that users’ perception of a product’s quality dimensions changes over time (e.g. von Wilamowitz-Moellendorff, et al., 2006). Several others have also shown how the relative importance of those quality dimensions shifts throughout different phases of product use (e.g. Karapanos, et al., 2008; Karapanos, et al., 2009). For example, von Wilamowitz-Moellendorff et al. (2006) investigate the dynamics of quality perceptions of mobile phones by using a retrospective interview technique that reconstructs changes in user experience over more than a year period. The changes in the perceived qualities over time were measured by addressing two pragmatic (i.e. utility and usability) and three hedonic (i.e. stimulation, beauty, and identification) quality dimensions. The authors discovered that pragmatic perceptions continued to be steady (utility) or improved (usability) over time. In contrast, all hedonic perceptions (especially stimulation) declined. Utility and stimulation, which focus on the self, were both influenced by increasing familiarity with the product; on the other hand, beauty and identification, which are related to social aspects, were affected by comparisons with other people’s products (von Wilamowitz-Moellendorff, et al., 2006).

Karapanos et al.’s (2008) study reveals that during early experiences with a product, the product’s perceived goodness was primarily determined by pragmatic dimensions (utility and usability). After four weeks of use, however, the goodness of the product was prominently formed on the basis of a hedonic dimension (identification).
Furthermore, while stimulation largely shaped judgments of the product’s beauty in the first week of use, over time its influence on the product’s perceived beauty deteriorated (Karapanos, et al., 2008). Accordingly, it is argued that in long-term experience, aspects of product ownerships, rather than of product use, play a more significant role in integrating the product into the user’s everyday life (Karapanos, et al., 2008). Nonetheless, as also acknowledged by the authors, this study only measured the users’ perceptions at two discrete points in time (the first and the fourth week), rather than measuring them repeatedly over a continuous period. Hence, the dynamics of user experience presented may be limited.

In response to the above limitation and to explore how the quality of user experience develops over time, Karapanos et al. (2009) conducted a longitudinal study over a five-week period, monitoring six participants during the purchase and usage of the Apple iPhone. They found that the product qualities that evoked positive early experiences would be replaced by different qualities to motivate ongoing use of the product. Hedonic aspects (e.g. novelty) that mainly shaped the first experiences of use faded away quickly, and the product’s ability to be meaningful in users’ lives increasingly became the main factor that formed long-term experiences (Karapanos, et al., 2009).

The authors go a step further by proposing a conceptual model of user experience temporality as comprising three sequential forces: increasing familiarity, functional dependency, and emotional attachment. These forces contribute to the shift of users’ experience across three distinct stages of the product adoption process: orientation, incorporation, and identification (Karapanos, et al., 2009). In each stage, different quality dimensions are valued: (1) the early orientation to the product is largely influenced by stimulation and learnability qualities; (2) the incorporation of the product in users’ daily lives is characterised by long-term usability and usefulness; and (3) the identification with the product is dominated by the product’s abilities to partake in users’ personal and social experiences (Karapanos, et al., 2009).

Lightweight alternatives to laborious and time consuming longitudinal studies of user experience temporality have been recently proposed. They include the use of iScale (Karapanos, et al., 2010) and UX Curve (Kujala, et al., 2011) methods. The iScale employs sketching, and aims to retrospectively elicit users’ most impactful
experiences in the form of experience narratives. Karapanos et al. (2010) used this method to study the changes of users’ experiences with mobile phones over the first six months of use. The results mostly confirm their previous finding (in Karapanos, et al., 2009) regarding the changes of four perceived qualities – innovativeness, learnability, long-term usability, and usefulness – over time. They also show that the majority of users’ experiences (75%) were related to the first month of product use.

Similar to iScale, UX Curve is a retrospective technique that asks users to draw a curve delineating how their experiences with a product have evolved from the first time of use until the present (Kujala, et al., 2011). Focusing on attractiveness, ease of use, utility, and degree of usage aspects, Kujala et al. (2011) employed the UX Curve to investigate the quality of prolonged experiences with mobile phones and the factors that improve or deteriorate the experiences over time. They found that the attractiveness curves produced the highest number of reasons explaining the changes of user experience, and that these reasons seemed to focus on hedonic aspects (e.g. beauty, stimulation, and pleasure). Furthermore, Kujala et al. (2011) suggest that the improving perceived attractiveness of a product over time pertained to users’ satisfaction and willingness to recommend the product to others.

### 2.6 SUMMARY

User experience is becoming more widely accepted as an indicator of the quality of user-product interaction. It is also increasingly becoming a design goal. However, the definition, theory, and scope of user experience are still evolving, and a unified understanding has not yet been reached (Law, et al., 2009). This fact is reflected in the diverse range of definitions, models, and frameworks presented in this chapter.

There is, however, general agreement that user experience is subjective, context-dependent, and dynamic (Hassenzahl and Tractinsky, 2006; Law, et al., 2009). Another key attribute that characterises user experience and differentiates it from usability is its holistic attribute. That is, user experience includes not only instrumental aspects (e.g. functionality and ease of use), but also includes non-instrumental aspects (e.g. aesthetics, emotion, and self-expression). Hassenzahl (2003, 2008) refers to instrumental aspect as pragmatic quality, and to non-instrumental aspect as hedonic quality (Section 2.3). He argues that hedonic quality
contributes directly to positive user experience, whereas pragmatic quality only acts as a ‘barrier remover’.

This chapter presented a picture of known definitions, models, and frameworks of user experience (Section 2.2 and Section 2.4), all of which appear to generally regard user experience as a result of using products or systems. In other words, user experience is viewed as being constructed during or after actual interactions between users and products or systems. For example, models from Hassenzahl (2003) and Mahlke and Thüring (2007) both assume that the perception of a product’s qualities is the outcome of repeated interactions between users and the product’s features (Section 2.4.2). Hence, the notion of user experience before interaction or anticipated experience is still widely disregarded. While acknowledging that there are some exceptions to this disregard (e.g. ISO 9241-210, 2010; Roto, 2007; Sward and Macarthur, 2007), it is concluded that existing definitions, models, and frameworks of user experience do not, for the most part, support the early stages of product development, during which interactions with an actual product (prototype) are not possible. This is the identified knowledge gap that is addressed in this study.

This research explores both anticipated (before interaction) and real (during and after interaction) user experiences. Therefore, the temporal aspects of user experience become relevant. Roto et al. (2011) distinguish four sequential time spans: anticipated, momentary, episodic, and cumulative user experience (Section 2.5). In relation to this research, anticipated experience belongs to the first time span, while real experience belongs to the three other spans. A focus on different time spans produces different information about the experience, thus placing different demands on design and evaluation (Roto, et al., 2011). The dynamics of user experience also cause the relative importance of quality dimensions to change over time; for example, improving or deteriorating (e.g. Karapanos, et al., 2009; von Wilamowitz-Moellendorff, et al., 2006).

The next chapter reviews and discusses various methods and approaches for evaluating user experience. The evaluation methods that can support the early stages of product development are highlighted.
Chapter 3: User Experience Assessment

Chapter 2 has reviewed diverse definitions, theories, models, and frameworks of user experience. Its temporal characteristic was also discussed. The chapter provided a theoretical foundation for developing an understanding of user experience. At the same time, it identified the research gap that is addressed in this study. Chapter 3 now explores the existing methods and approaches currently used for user experience evaluation. Its focus is both on those used for assessing users’ experiences before actual interactions, and those used in the early stages of product development.

3.1 USER EXPERIENCE ASSESSMENT METHODS

User experience assessment methods play a vital role in the product development process to ensure the achievement of the product’s goals (Roto, Obrist, and Väänänen-Vainio-Mattila, 2010). The assessment or evaluation of user experience systematically improves the product and, thus, the experience (Ketola and Roto, 2009; Väänänen-Vainio-Mattila, et al., 2008a).

In order to establish a systematic procedure for evaluating user experience, Roto et al. (2009) outline four steps that need to be performed: (1) obtaining a good understanding of user experience, (2) defining user experience metrics, (3) developing user experience evaluation methods based on these metrics, and (4) integrating user experience evaluations into the product development process. Additionally, in the product development setting, user experience evaluation should attend to the causal relationship between the experience and the product; that is, to how the examined product influences the measured experience (Väänänen-Vainio-
Mattila, et al., 2008b). This is to help in identifying the product’s elements that need to be modified in order to improve the whole experience.

The requirements for user experience evaluation methods in the industrial context are partially different from those that apply in the academic context. In industry, the main requirements for the methods are practicality, utility, and simplicity. In contrast, the academic context focuses more on the scientific rigour of the methods. Fundamentally, as asserted by Law (2011), user experience measures need to be meaningful, valid, and useful. As the result of the UXEM workshop, Väänänen-Vainio-Mattila et al. (2008b) summarised and listed the requirements for practical methods of user experience evaluation in product development:

- Fast, lightweight (i.e. requiring fewer resources), and cost-efficient for quick iterative evaluations.
- Valid, reliable, and repeatable.
- Requiring a low level of expertise to apply.
- Applicable to different types of products.
- Applicable to concept ideas, prototypes, and final products (to assist in understanding how user experience develops through the stages of product development).
- Generating comparable outcomes (both qualitative and quantitative).
- Useful to different departments and multi-disciplinary teams in a company.
- Suitable for various phases of product lifecycle.
- Suitable for different target user groups.

It is stressed that user experience evaluation is significantly different from usability evaluation. While the latter focuses on task completion and performance measures (efficiency and effectiveness), the former also places emphasis on hedonic aspects of product use, and on users’ feelings, motivations, and expectations with respect to using a designed product in various contexts (Obrist, et al., 2009; Roto, Obrist, et al., 2010). Consequently, objective measures, such as number of errors and task completion time, are not accurate predictors of user experience. Rather, subjective measures (e.g. emotions and judgments), which take contexts of use, temporal aspects, and other non-instrumental factors into account, should be included. For example, by highlighting the dynamic and situated characteristics of user experience,
Vermeeren and Kort (as cited in Pals, et al., 2008; Vermeeren, et al., 2008) recommend that user experience assessment instruments should include:

- Collection of both quantitative data (what users do) and qualitative data (what users think and experience), using both objective and subjective techniques.
- Unobtrusive capture of data in order not to influence the user experience.
- Enabling of continuous or timed measurements and longitudinal studies.
- Support for contextual or in situ measurements to obtain information that reflects users’ experiences in their actual everyday lives.

In response to the needs for user experience evaluation, a multitude of methods and techniques have been proposed. Many of them have their roots in traditional usability methods, but are extended to capture hedonic, emotional, and experiential aspects of user-product interactions. They cover, for example, attitude scales, co-discovery, focus groups, think aloud protocols, reaction checklists, field observations, interviews, immersion, expert appraisal, property checklists (Jordan, 1999, 2000), experience diaries (Karapanos, et al., 2009), and questionnaires (Hassenzahl, 2004; Laugwitz, et al., 2008; Thayer and Dugan, 2009).

More recent methods include visual techniques (Forlizzi, Gemperle, and DiSalvo, 2003; McDonagh, Bruseberg, and Haslam, 2002; Sleeswijk Visser, Stappers, van der Lugt, and Sanders, 2005), emotion measurements (Desmet, 2003a; Desmet and Dijkhuis, 2003), facial expression assessment (Hazlett and Benedek, 2007; Kaiser and Wehrle, 2001), and psycho-physiological techniques (Mahlke and Thüring, 2007; Mandryk, et al., 2006).

Other methods for investigating user experience include experience sampling or experience diary using electronic devices (Intille, Rondoni, Kukla, Ancona, and Bao, 2003; Isomursu, et al., 2004; Swallow, et al., 2005), narrations or storytelling (Geven, Schrammel, and Tscheligi, 2006; Korhonen, et al., 2010b; Schrammel, et al., 2008), and retrospective sketching for evaluating the dynamic of user experience over time (Karapanos, et al., 2010; Kujala, et al., 2011). Roto, Lee et al. (2010) created a comprehensive list of 82 user experience evaluation methods along with their descriptions. This list is available at http://www.allaboutux.org/all-methods.
With a large number of user experience evaluation methods available, the selection of appropriate methods for particular needs or purposes becomes crucial (Law, 2011). The methods’ categorisation assists designers and researchers in this regard. Roto, Obrist et al. (2010) have categorised the existing methods into seven groups: (1) lab studies with individuals, (2) lab studies with groups, (3) short field studies, (4) longitudinal field studies, (5) surveys, (6) expert evaluations, and (7) mixed methods. Vermeeren et al. (2010) have built on this categorisation by classifying the methods into a number of main categories (e.g. type of collected data, information source, period of experience, and location), each of which consists of several sub-categories.

To illustrate, the user experience measurement conducted by Mahlke and Thüring (2007) belongs to the ‘lab studies with individuals’ and ‘mixed methods’ categories. Based on their user experience framework (Section 2.4.2), Mahlke and Thüring (2007) employed a combination of methods to assess all user experience components and their interrelationships. The methods collected users’ subjective information (via questionnaires), physiological responses, facial expressions, and behavioural data. Several computer-simulated portable digital audio players, differing in their usability and visual aesthetics, were used as stimuli. The authors discovered that usability (instrumental) and aesthetics (non-instrumental) factors affected users’ emotional reactions, and that usability had a greater impact on both users’ emotions and their overall judgments. They also found that visual aesthetics had no significant impact on emotional reactions in terms of motor expressions and physiological responses.

Another example is the context-aware experience sampling tool (Intille, et al., 2003), which belongs to the ‘short field studies’ or ‘longitudinal field studies’ categories. This method enables researchers to perform experience sampling studies using mobile computing devices, and to gather data from users in specific situations that are detected by sensors. Intille et al. (2003) specify that the tool allows data sampling directly through questioning the users, and indirectly through the carried sensor devices (e.g. by automatically recording the user’s location via GPS to provide data about the context of use). This method can be useful for longitudinal user experience studies, since the mobile device can be attached to the study participants for days or weeks, and the changes in context can be recorded from time to time. Thus, the
dynamic or temporal aspects of user experience can be effectively captured, especially when evaluating user experience after product purchase.

The two methods explained above assess users’ experience while or after they use the product or system, as do most others that have been proposed. Only a small percentage of the existing methods can be utilised to evaluate user experience before usage (Bargas-Avila and Hornbæk, 2012; Vermeeren, et al., 2010). In line with the specific theme of this research – that is, anticipated user experience and early assessment of user experience – the next section focuses on discussing the methods and approaches that are intended for assessing user experience in the period before interactions, and in the early stages of the design process.

### 3.2 USER EXPERIENCE ASSESSMENT IN THE EARLY PHASES OF PRODUCT DEVELOPMENT

As argued in Chapter 1, in an industrial or business setting, it is crucial to conduct user experience evaluation at the earliest possible stages of product development. This is to direct the development process to its targets, and to ensure the creation of positive experiences through the developed products. Early and iterative evaluations also help to avoid expensive and difficult design modifications in the later stages of development (Väänänen-Vainio-Mattila, et al., 2008b).

However, the initial phases of product development are challenging for user experience evaluation, as functional prototypes are usually unavailable for testing during these stages. The preliminary product concepts that do exist at this point can also be difficult for potential users to understand and evaluate (Väänänen-Vainio-Mattila, et al., 2008b). Because actual user-product interactions in real contexts cannot occur, Roto et al. (2009) note two main challenges in early evaluation of user experience. First, the absence of interaction with the designed product results in incomplete experience of the product. Second, while user experience is greatly context-dependent, its early evaluation suffers from losing many contextual components of the experience, such as the social and physical contexts of product use. Consequently, more research is needed to develop a solution to overcome these challenges.
The situation described above is exacerbated by the lack of user experience evaluation methods that can support the early phases of product development. Thus, the evaluation is commonly postponed until working prototypes become available. Recently, Vermeeren et al. (2010) collected, categorised, and analysed 96 user experience evaluation methods. Based on the criterion ‘product development phase’, they found that only 25% of all methods can be used in the conceptual design phase, and 22% in the non-functional prototype phase. Meanwhile, based on the criterion ‘period of experience’, only 22% of the methods are able to evaluate user experience in the period before usage (e.g. property checklist, Kansei engineering, repertory grid, and immersion) (Vermeeren, et al., 2010). The strengths of the methods in this category (before usage) are mainly related to their practicability, whereas their weaknesses lie in their scientific quality issues (reliability and validity) (Vermeeren, et al., 2010).

Bargas-Avila and Hornbæk (2011) also systematically reviewed 66 user experience studies that were published during the period 2005-2009. They discovered that studies that measure user experience before interaction are rare – only 20% of the studies surveyed; and, of these, only 36% are related to anticipated use. Thus, it is concluded that the evaluation of user experience before interaction is still generally overlooked.

Despite this difficulty, many researchers are convinced that user experience can be assessed both in the period before interaction and in the early stages of product development. As user experience is inherently dynamic, Vermeeren et al. (2010), for example, assert that user experience before interaction should be regarded as something evaluable. Related to this, Law (2011) also strongly believes that user experience is measurable and can be predicted with a satisfactory degree of accuracy. Roto et al. (2009) argue that user experience evaluation focuses on the potential value and meaning of the product concept itself. Therefore, with only a rough product concept available in the early development stages, the evaluation is already possible through assessing the value of the outcome of anticipated interactions (Roto, et al., 2009). The following paragraphs review and discuss relevant examples of methods and approaches pertaining to the early evaluation of user experience.
With no functional prototype available during the early development phases, potential users need to imagine how they use the product concept in their daily lives. The immersion technique (Jordan, 2000) is one of the methods that can benefit from using imagined interactions to evaluate user experience of initial product concepts. Chattratichart and Jordan (2003) propose a discount technique called ‘Virtual Immersion’, which requires designers to imagine themselves as their target users and to live the users’ experience in their mind. Thus, as part of the product development process, designers try to anticipate and assess the users’ experience of the product being designed through empathising with them. While this method is fast, less costly (requiring no users), and easy to implement, its validity may be questionable. This is because the accuracy of its results greatly depends on the designers’ knowledge and perceptions of their target users, including their needs, expectations, and motivations. In this research, therefore, users themselves anticipate or imagine their experiences with a product concept, thus enhancing the data accuracy.

Roto et al. (2009) also discuss the use of two lightweight methods, expert evaluation and remote online evaluation, for evaluating user experience of early product concepts. Expert evaluation involves no end-users, and is usually conducted as a heuristic evaluation (e.g. Väänänen-Vainio-Mattila and Wäljas, 2009). This method is suitable for evaluating futuristic concepts, the relevance of which ordinary users may not be able to see in their current contexts. Using this method, experts can also provide quick feedback on design ideas that are still not clearly described. The method relies on the experts’ ability to evaluate user experience as a subjective construct, and to predict how users will experience a certain concept (Roto, et al., 2009).

The second method, remote online evaluation, allows the quick and efficient transmission of early concept ideas to participants in various geographic locations to obtain their feedback. This method, therefore, can also help to obtain data related to cultural issues in the early phases of product development. The potential problems of this method, however, include participants’ low engagement with the evaluation, and the difficulty of gaining the same deep qualitative understanding that is achieved using face-to-face methods (Roto, et al., 2009).
A few studies focus on users’ expectations to assess potential user experience of novel future technologies. For instance, Heikkinen, Olsson, and Väänänen-Vainio-Mattila (2009) conducted focus group sessions with various types of users to explore their expectations of the experience of haptic interaction with mobile devices. With no prototypes of the research subject available, they employed several different usage scenarios that functioned as stimuli to elicit group discussion and expectations of experiences with the examined technology. A similar study was conducted in relation to designing mobile mixed reality services (Olsson, Ihamäki, Lagerstam, Ventä-Olkkonen, and Väänänen-Vainio-Mattila, 2009). Both studies seem to concentrate on identifying user needs, requirements, important experiential factors, and relevant issues in designing a specific future technology. The research in this thesis, on the other hand, focuses more on how potential users anticipate their experiences with the designed product, in order to identify the construction and characteristics of anticipated user experience.

An established method commonly used for evaluating early product concepts is prototyping. In the field of experience-centred design, Buchenau and Fulton Suri (2000) introduced experience prototyping, a technique that emphasises the active (rather than passive) participation of designers, users, and clients in personally appreciating the experience of a product or system through prototypes. An experience prototype can be created from any objects, using any means – including low-tech methods and improvisation with basic materials – to represent the experience of using the product or system being designed (Buchenau and Fulton Suri, 2000). For example, a pager is used to simulate automatic defibrillating shocks, and a video camera and monitor are utilised to relive the experience of handling a remotely operated vehicle (ROV).

Buchenau and Fulton Suri (2000) point out three critical design activities in which experience prototyping is useful: (1) understanding existing user experience and context, (2) exploring and evaluating design alternatives, and (3) communicating design ideas. Thus, experience prototyping is closely related and directly contributes to the product design process. Since a prototype is intended to represent an actual product, the understanding of existing and future experiences, along with other
feedback gained from the evaluation of experience prototypes, could be translated into product specifications that support pleasurable user experience.

Kurvinen et al. (2008) apply the concept of experience prototyping to social context by arguing that a prototype is not just a representation of a product or technology, but encompasses both the representation and the social interaction formed jointly by participants. They demonstrate that prototyping the way in which individuals interact with each other via technologies provides insights into how people invent ways of using these technologies in ordinary social contexts. Kurvinen et al. (2008) stress that the purpose of prototyping social interaction is to provide a better understanding of the social phenomena pertaining to product or system ideas. In turn, this could facilitate the design of interactive technologies for social interaction in everyday life.

Another method that could support early assessment of user experience is speed dating (Davidoff, et al., 2007). This method enables rapid exploration and comparison of multiple design concepts, including their interactions and contextual elements, without requiring any functional prototypes. It structures lightweight comparisons of the concepts, which help to reveal subtle contextual risk factors and to define ways to address them. Speed dating consists of two main steps: need validation and user enactments (Davidoff, et al., 2007). In need validation, various paper storyboards are presented to a group of potential users to synchronise the needs observed by designers, with the needs perceived by users. To conduct user enactments, a matrix containing critical design issues, and brief dramatic scenarios addressing the combinations of these issues, are developed. The users then enact a certain role while walking through the scenarios within a low-cost, low-fidelity simulation of the intended setting (Davidoff, et al., 2007). The authors demonstrate the application of the speed dating method to the design of a smart home.

Gegner and Runonen (2012) developed the Anticipated eXperience Evaluation (AXE) approach for evaluating early product concepts with potential users. This approach was designed to obtain information on how users might experience and perceive a product concept at early design stages, and to elicit design ideas and suggestions from the users to refine the concept (Gegner and Runonen, 2012). As described by the authors, AXE consists of three main steps: concept briefing, concept evaluation, and data analysis. Concept briefing familiarises the users with a product
concept through concept description and narratives, and may include the use of low-fidelity prototypes. Concept evaluation uses image pairs as interview stimuli to facilitate participants’ reflection and expression of their experiences, attitudes, and perceptions of the tested product concept. Lastly, in data analysis the data are coded using four categories: perceived product features (e.g. functionality and presentation), associated attributes (i.e. pragmatic and hedonic attributes), anticipated consequences (i.e. attractiveness and behavioural change), and a category related to information for potential improvements.

While Gegner and Runonen (2012) used a laboratory environment to test a product concept, Sproll, Peissner, and Sturm (2010) introduced the UX Concept Testing approach that involves real environments to explore the potential experiences of new products. This approach enables users to imagine experiences in their everyday lives without an actual product or prototype, and to generate ideas for features and improvements of product concepts.

The UX Concept Testing comprises four steps: concept briefing, field experience, user interviews, and data analysis (Sproll, et al., 2010). The concept briefing introduces a product concept via exemplary product experiences (e.g. scenario-based or theatre-based concept presentation) and mental exercises. In the field experience, stimulated by situations in their daily routines, users imagine how the product concept can fulfil their needs. They immediately report their experiences, together with their needs and ideas towards the concept, through voice memos or written diaries. Interviews are then conducted based on the reports. Results of data analysis are presented in the form of a dart chart, which describes the ‘distance’ of need fulfilment items from the original core concept. Sproll et al. (2010) suggest that testing specific concepts is more suitable for evaluating user experience of the core concept. In contrast, testing abstract concepts leads to more innovative ideas, and is more suitable for discovering new product potentials for a positive user experience.

In line with the principle of user-centred design that focuses on understanding users’ needs and values, methods such as cultural probe (Gaver, Boucher, Pennington, and Walker, 2004; Gaver, Dunne, and Pacenti, 1999) are developed to understand users, and to generate design ideas in the early stages of concept design. The cultural probe method, which is an artist-designer approach, asks subjects to capture their thoughts...
and experiences using a provided kit that contains several items such as a camera, maps, postcards, and media diary. It is intended to elicit inspirational responses in the form of participants’ scrappy hints about their ideas and lives (Gaver, et al., 2004). This method values vagueness, exploration, and subjective interpretation (Gaver, et al., 2004). It does not focus on commercial products, but on new understandings of technology (Gaver, et al., 1999). Therefore, cultural probe acts more as a tool that provides inspiration for designers, rather than evaluating existing products. While it can be valuable for the initial design process, this method may result in very abstract information that is difficult to analyse. It is also likely that different researchers or designers will interpret the data differently.

Nearly all methods presented in this section are developed for exploring and comparing early design concepts, and for assessing user experience before use of an actual system, in a cost-effective manner. They are useful for evaluating design ideas, simulating what it might be like to use the designed system, and identifying design opportunities. However, most of these methods seem to heavily rely on the use of low-fidelity prototypes, models, and usage scenarios, through which potential users encounter novel design concepts created by designers. Accordingly, they require a design team’s ability and creativity to translate many design aspects into appropriate scenarios and prototypes.

The point of interest in this research is centred more on the potential of users’ anticipation and imagination to support user experience assessment in the early stages of product development. This research, therefore, explores the ways in which users anticipate their experiences with a desired future product without the use of scenarios or prototypes, where the design concepts and usage contexts are entirely conceived by the users themselves. Hence, this approach beneficially complements the existing methods, in that it can be used much earlier in the development process. Moreover, rich design ideas and potential usage situations that are completely based on users’ expectations and preferences can be obtained.
3.3 SUMMARY

As positive user experience has become the goal of most product development projects, the assessment or evaluation of user experience is critical to ensure these projects reach their targets. User experience evaluation systematically improves the product being designed, and thus improves the delivered experiences (Ketola and Roto, 2009). However, assessing user experience is not easy due to the multiple aspects that need to be taken into account. User experience goes beyond usability; its evaluation, therefore, includes not only pragmatic measures (efficiency and effectiveness) but, more importantly, measures of hedonic and experiential dimensions (e.g. emotions, feelings, aesthetics, motivations, and expectations) (Obrist, et al., 2009; Vermeeren, et al., 2010). Moreover, to be applicable in an industrial setting, user experience evaluation methods need to meet various requirements (Section 3.1); for example, they need to be valid, fast, lightweight, and suitable for different types of products and different stages of product development (Väänänen-Vainio-Mattila, et al., 2008b).

Numerous user experience evaluation methods have been proposed and categorised (e.g. Roto, Lee, et al., 2010; Vermeeren, et al., 2010), covering qualitative and quantitative methods with a range of foci (e.g. emotions, contexts of use, hedonic quality, and temporal aspects of user experience). Most of these methods, nonetheless, evaluate user experience during or after actual interactions with a functional product (Bargas-Avila and Hornbæk, 2011; Vermeeren, et al., 2010), thus implying that user experience evaluations are commonly conducted during the final phases of product development when working prototypes are available.

User experience evaluation, however, should be conducted as early as possible in the product development process. This is because the foundation for positive user experience is laid during the concept design stage (Roto, et al., 2009). Another reason is that the delayed evaluation can lead to difficult and expensive design changes in the last stages of the development, and to unachieved project targets. Therefore, more research is required to gain insights into how user experience can be assessed in the initial phases of the development process. This research includes the investigation of users' anticipated experience, in consideration of the fact that the actual experience with working prototypes cannot be tested (Law, et al., 2009).
Chapter 3: User Experience Assessment

A limited number of methods that support early assessment of user experience generally depend on the employment of usage scenarios and low-fidelity prototypes (Section 3.2). Those that are related to anticipated user experience, or that employ users’ anticipation and expectations as the main approach, are rare. Deeper research in this area has the potential to acquire new knowledge to support the early assessment of user experience.

The following chapter now discusses the concepts of anticipation and expectation in more detail, including the role that they play in user experience. Aspects related to expectation disconfirmation are also examined.
Chapter 4: Anticipation and Expectation

Anticipation and expectation of product use play an important role in user experience. They influence users’ satisfaction, feelings, interactions, and perceptions when the actual experience with the product takes place (Hiltunen, et al., 2002; Mäkelä and Fulton Suri, 2001; Roto, 2007). In the early phases of product development, users can only anticipate or imagine their experiences with product concepts, as no functional prototypes are available. This research argues that this anticipated experience or experience before interaction can be valuable for supporting early assessment of user experience in the design process.

The need to investigate users’ anticipation of their experiences with products is reflected in the research sub-questions (Section 1.3). With regard to these sub-questions, this chapter explores theories of anticipation, and then discusses these further in the context of user experience. In addition, since the study also examines users’ real experience (as reflected in the second sub-question), this chapter reviews the subject of expectation disconfirmation, and focuses on its influences on product perception.

4.1 ANTICIPATION

People can and often do anticipate their future experiences and emotions. From the perspective of anticipatory behaviour, Glasersfeld (in Butz, Sigaud, and Gérard, 2003b) notes that “on the conceptual level, to anticipate means to project into what lies ahead a mental representation abstracted from past experience” (p. v). Authorities agree that individuals can learn to anticipate the consequences of certain
events or acts by reflecting on previous and current experiences (Baumeister, Vohs, DeWall, and Zhang, 2007; Glasersfeld, 1998). This is based on the belief that the experiential world exhibits some regularity, allowing one to anticipate that things will work in the future in the same way that they have worked in the past (Glasersfeld in Butz, et al., 2003b). Here, as suggested by Glasersfeld (1998), three types of anticipation are involved:

1. Anticipation as the implicit expectations that are a precondition in various actions (e.g. when walking down a stairway in the dark).
2. Anticipation in the form of an expectation of a particular future experience, which is created by observing a current situation.
3. Anticipation of a desired goal, event, or situation, along with the effort to achieve it by creating its cause.

With respect to this study, the second and third forms of anticipation are relevant to the context of anticipated user experience.

It has been suggested that anticipation contributes to current behaviour. Baumeister et al. (2007) posit that people often make decisions, select their actions, and adjust their behaviour according to anticipated emotions that are based on the combination of past emotional outcomes and present affect. As they learn to anticipate response (e.g. future emotions), they might change their behaviour to pursue the desired response or to circumvent the undesirable one (Baumeister, et al., 2007). Huron (2006), however, argues that anticipating an outcome evokes specific emotions, and it is these current emotions that may motivate behavioural adjustments that can increase the possibility of future favourable outcomes. In both views, the altered behaviour is deemed to produce constructive results. As an illustration, a student anticipating the sadness of failing his exams may be encouraged to study harder; this encouragement and this effort, in turn, help him to actually pass the exams. In view of this phenomenon, the anticipation of emotional outcomes may be more important in guiding behaviour than the actual, felt emotion (Baumeister, et al., 2007).

Related to the notion that anticipation influences and guides behaviour, Butz, Sigaud, and Gérard (2003a) define anticipatory behaviour as “a process, or behavior, that does not only depend on past and present but also on predictions, expectations, or
beliefs about the future” (p. 3). Thus, anticipation is not simply a mere thought about the future, but is about the impact of an expectation or prediction on actual, present behaviour (Butz, et al., 2003a). It is asserted that people modify their behaviour according to predictions or expectations of a future event, and this behaviour includes “actual decision making, internal decision making, internal preparatory mechanisms, as well as learning” (Butz, et al., 2003a, p. 1).

Anticipation can also have a significant impact on current emotion and subjective well-being. When imagining results of a future event, one can palpably experience positive or negative emotions, as if those results have already occurred (Huron, 2006). The emotions elicited by anticipation involve five functionally different physiological systems: imagination, tension, prediction, reaction, and appraisal (Huron, 2006). These emotions, which are referred to as ‘anticipatory affects’ (MacLeod and Conway, 2005), contribute, in turn, to current welfare. As Elster and Loewenstein (1992) argue, individuals are able to derive positive utility from anticipating favourable events, and to sustain negative emotional consequences from anticipating future undesirable experiences; thus, people can repetitively experience the hedonic effect of future events before they actually take place. Likewise, MacLeod and Conway (2005) note that anticipation of positive future experiences is an important element of current subjective well-being; that is, thinking about experiencing pleasurable future outcomes (e.g. achieving personally meaningful goals) generates good feelings (e.g. happiness).

Besides anticipation, retrospection can affect present emotions (Elster and Loewenstein, 1992; Norman, 2009; van Boven and Ashworth, 2007). However, van Boven and Ashworth (2007) find that anticipation is more evocative than retrospection. Their study demonstrates that people tend to have more intense emotions when anticipating, than when remembering emotional experiences that are positive, negative, routine, and purely hypothetical. It is also identified that the imagination of a hypothetical future experience generates about the same intensity of current emotion as the anticipation of an actual future experience (van Boven and Ashworth, 2007). The fact that anticipation engenders greater emotional arousal than retrospection can be caused by discrepancies between the ways people think about future and past experiences. First, people tend to expect that they will experience
more extreme emotions during future events than the emotions they remember experiencing during past events. Second, people tend to mentally simulate future experiences more extensively than they simulate past experiences (van Boven and Ashworth, 2007). The former phenomenon is specifically explored in the areas of affective forecasting and rosy prospection.

Wilson and Gilbert’s (2003, 2005) studies of affective forecasting – people’s expectations about their emotional responses to future events – demonstrate that people typically show an impact bias; that is, they anticipate their future emotional reactions to be more intense and enduring than they actually turn out to be. In other words, they overestimate the intensity and duration of their emotional responses to future experiences. Similarly, the theory of rosy prospection (Mitchell, Thompson, Peterson, and Cronk, 1997) suggests that people’s expectations of personally meaningful events are more positive and enjoyable than the actual experiences when they occur.

The first cause of the impact bias is focalism: people’s tendency to overestimate how much attention will be given to a future focal event, and the tendency to underestimate the effects of other future events on their thoughts and feelings (Wilson and Gilbert, 2005; Wilson, Wheatley, Meyers, Gilbert, and Axsom, 2000). This is in line with the notion of focusing illusion (Schkade and Kahneman, 1998), which indicates that a focus on the core attributes of future experiences at the expense of other attributes leads to an exaggeration of the perceived effects of these core attributes. The second cause is people’s ignorance of how readily they will make sense of novel experiences at the time of their occurrence (Wilson and Gilbert, 2005). One of the forms of this ignorance is immune neglect, where people are unaware of their psychological immune system that combats threats to affective well-being; thus, they fail to anticipate how quickly they will psychologically cope with negative future events in a way that speeds their emotional recovery (Gilbert, Pinel, Wilson, Blumberg, and Wheatley, 1998).

All phenomena pertaining to anticipation discussed above are believed to apply to users’ anticipation of future experiences with products. Because anticipation affects current behaviour, emotion, and well-being, it can also influence users in selecting and purchasing a product, in interacting with the product, and in perceiving their
experiences with it. Thus, the projection of user experience based on anticipation can be useful information that supports user experience assessment in the early stages of product design. The fact that anticipation is more evocative than retrospection, and the tendency of future experiences to be mentally simulated more extensively than past experiences, adds to the value of anticipation in supporting the early assessment of user experience. In addition, the finding that people anticipate future experiences to be more intense and durable than they actually turn out to be can inspire designers to design products that exceed users’ expectations. Designers could, for example, provide numerous novel features that surprise users, and offer ‘limitless’ possibilities for them to discover and explore during their use of the product.

4.2 ANTECIPATION IN USER EXPERIENCE

In the design domain, anticipation and expectation have been acknowledged as important aspects of user experience. Users’ expectations, built on past experiences and various sources of information, affect their current and actual experience; this experience, in turn, generates modified expectations and more future experiences (Hiltunen, et al., 2002; Mäkelä and Fulton Suri, 2001; Roto, 2007). Hiltunen et al. (2002) argue that expectations shape users’ experience by directing their attention when they are using a product, thus deeply affecting their perceptions of and interaction with the product. Moreover, expectations produce a set of criteria against which the quality of the product is judged (Hiltunen, et al., 2002; Roto, 2007).

Karapanos et al. (2009) set anticipation as an additional facet of the dynamics of user experience over time. This facet represents users’ anticipation of an experience that leads to the formation of expectations before any actual user-product interaction occurs. Less in line with previous work (e.g. Lindgaard and Dudek, as cited in Karapanos, et al., 2009), which suggests that a priori expectations significantly influence the construction of overall evaluative judgments, Karapanos et al. (2009) found that actual experience with a product is only slightly affected by a priori expectations. These expectations were identified as evolving during the actual experience, particularly expectations that were related to the importance of certain features of the product. Disconfirmed expectations also became less pertinent to users’ satisfaction over time, as they adjusted their perceived experience to their
expectations (Section 4.3 provides more discussion regarding expectation disconfirmation). Despite the finding that the actual experience had a greater impact on overall satisfaction judgments than a priori expectations, Karapanos et al. (2009) believe that anticipation is a vital element of user experience. They even speculate that anticipating experiences of product use can be more affective, important, and memorable than the experiences themselves.

Also, McCarthy and Wright (2004a, 2004b) incorporate anticipation as a constituent of the six sense-making processes in their framework of experience with technology (Section 2.4.3). Here, anticipation refers to the possibilities, expectations, and ways of making sense that are related to relevant past experience (McCarthy and Wright, 2004b). To illustrate, one may have particular expectations of an on-line store based on his/her prior experiences with the ‘real’ shop of the same company. Pursuing this further, most user experience researchers and practitioners agree that expectations and earlier experiences affect the subsequent experiences (Law, et al., 2009; Roto, 2006, 2007; Väänänen-Vainio-Mattila, et al., 2008b). According to Wright et al. (2003), anticipation does not simply occur prior to an experience, rather it continues into the experience; this is because the emotional and sensual aspects of the anticipation influence the following parts of the same experience. They claim that “it is the relation between our continually revised anticipation and actuality that creates the space of experience” (p.49).

In their product experience framework, Desmet and Hekkert (2007) assert that human-product interaction includes not only instrumental and non-instrumental interactions, but also non-physical interaction that refers to recalling, anticipating, or fantasising about product use. An example of anticipating interaction is ‘I expect this tablet computer to respond nicely when I slide my finger on its screen’. In accordance with the discussion of anticipatory emotions in Section 4.1, Desmet and Hekkert (2007) point out that potential outcomes of an interaction can also be imagined, anticipated, or fantasised about, which, in turn, can evoke emotional responses. Wright et al. (2003) also argue that the act of anticipating an experience can generate a sensation of anxiety or excitement due to the possibilities for action or outcome offered by the experience.
With respect to user experience before actual product use, anticipation and expectation have been linked to the formation of anticipated use (Law, et al., 2009), anticipated interaction (Sward and Macarthur, 2007), expected experience (Roto, 2007), and anticipated experience (Roto, et al., 2011; Yogasara, Popovic, Kraal, and Chamorro-Koc, 2011; Yogasara, et al., 2012). They are considered valuable for enhancing the understanding of holistic user experience (Roto, 2007; Roto, et al., 2011), and for facilitating design for experience in the early stages of product development (Law, et al., 2009; Yogasara, et al., 2011, 2012).

However, despite the recognition of the role anticipation plays in user experience, only a few studies focus on anticipated user experience and on its use in design for experience. Heikkinen, Olsson, and Väänänen-Vainio-Mattila (2009), for example, conducted focus group sessions involving multiple categories of users to gain insights into their expectations of the experience of haptic interaction with mobile devices. A similar study was also conducted to explore users’ expectations of their experience with mobile mixed reality services (Olsson, et al., 2009). With no prototype available, they employed several different usage scenarios that stimulated group discussion and elicited users’ expectations. While they can contribute to design for experience in the early phases of the design process, Heikkinen et al.’s (2009) and Olsson et al.’s (2009) studies basically focus on identifying users’ needs and other factors related to designing very specific technologies. Hence, their studies may have limited scope and are not intended to develop methods of early assessment of user experience applicable to a broad range of products. Furthermore, unlike this research, they do not investigate the characteristics of the expected experience, nor do they explore how potential users anticipate their experiences with the product to be designed.

4.3 EXPECTATION DISCONFIRMATION

Users often have expectations of a new product’s characteristics and of their experiences with that product. Once they actually interact with the product, however, their expectations may be exceeded, met, or disappointed. How these expectations are fulfilled shapes the users’ perceptions of, and their holistic experiences with, the product.
There has been extensive research on the effects of expectation disconfirmation on perceived product quality and users’ satisfaction (e.g. Anderson, 1973; Oliver, 1976, 1977; Olshavsky and Miller, 1972; Scharf and Volkmer, 2000). Oliver (1977) concisely expresses the central meaning of expectation disconfirmation: “one’s expectations will be negatively disconfirmed if the product performs more poorly than expected, confirmed if the product performs as expected, and positively disconfirmed if performance is better than anticipated” (p. 480). Olshavsky and Miller (1972) found that individuals’ evaluations of product performance tend to be assimilated into their expectations, regardless of whether they are positively or negatively disconfirmed. In other words, people with a high expectation will perceive the quality of the product in question to be higher than will people with a realistic or no prior expectation. Equally, people with a low expectation will rate the product quality lower than will those with a realistic or no expectation (Olshavsky and Miller, 1972). However, contradictory findings do exist. For instance, Cardozo (1965) reports that a negative disconfirmation of one’s expectation results in an unfavourable product rating.

To resolve these conflicting results, four psychological theories explaining the impacts of disconfirmed expectations on perceived product quality and users’ satisfaction have been proposed (Anderson, 1973; Scharf and Volkmer, 2000):

1. The assimilation (cognitive dissonance) theory suggests that people will minimise the disparity between expected and experienced product performance by altering their product perception in order for it to coincide with their expectations. It is assumed that individuals seek cognitive consonance, and that a disconfirmed expectation produces cognitive dissonance (psychological discomfort) (Festinger, as cited in Anderson, 1973). The undesirable state of cognitive dissonance is reduced by using the assimilation strategy. This can explain why the confirmation of expected outcomes usually evokes a positive emotional reaction, even if the expected outcome is not favourable (Huron, 2006).
2. *The contrast theory* posits that the difference between expected and actual outcomes of product performance will be augmented by users: if the product performs worse (better) than expected, the users will evaluate the product as less satisfying (more satisfying) than they would if they had no prior expectations.

3. *The generalised negativity theory* supposes that any difference (regardless of the direction of the discrepancy) between the product received and the product expected will generate a generalised more negative judgment than if user expectations are confirmed.

4. *The assimilation-contrast theory* assumes that people have latitudes or ranges of acceptance and rejection within their perception. A slight discrepancy between actual product performance and users’ expectations that is within the range of acceptance will create a tendency for users to assimilate their evaluation into their expectations. In contrast, if the disparity is so high that it is within the range of rejection, users will tend to exaggerate the difference between their product perception and prior expectations (contrast effect).

Hence, it can be seen that Olshavsky and Miller’s (1972) study illustrates the assimilation theory, whereas Cardozo’s (1965) finding demonstrates the contrast theory. In comparison, Anderson’s (1973) experiment (using a ballpoint pen) supports the assimilation-contrast theory to some extent. Participants in this study assimilated their product evaluations into their expectations until a high expectancy extreme when the contrast effect occurred (Anderson, 1973). In addition, Scharf and Volkmer’s (2000) study of the effect of olfactory product expectations on the olfactory product experience also established evidence for the validity of the assimilation-contrast theory. However, it may be difficult to determine which theory is most valid. The effects of disconfirmed expectancy on perceived product performance may vary, depending on ego involvement and attitudinal commitment to the product, as well as on the type, complexity, and value of the product.

Thayer and Dugan (2009) acknowledge the value of expectation disconfirmation theory in user experience design by claiming that it can be applied in assessing not only user satisfaction, but also specific components of user experience. They
recommend the collection and analysis of comparative data on users’ expectations and real experiences, which can then be related to the specific experience goals of the product being designed. This is to determine if the users’ expectations are confirmed, positively disconfirmed, or negatively disconfirmed. Positive disconfirmation can provide insights into specific user experience elements that can evoke users’ unexpected pleasure, whereas negative disconfirmation can identify product attributes that need to be improved to enhance the overall user experience (Thayer and Dugan, 2009). Based on the results, trade-offs and decisions can be made by product designers when designing each user experience element for the product (Thayer and Dugan, 2009). To collect useful data on users’ real experiences, nonetheless, a satisfactory experience prototype is required to accurately represent the intended product performance and experience. This can be a challenging requisite during the early stages of the design process, as information and resources to build such a prototype may be insufficient.

4.4 SUMMARY

From the literature, it can be inferred that anticipation is an influential aspect of human experience. It affects current behaviour (Baumeister, et al., 2007; Butz, et al., 2003a), current emotion (Huron, 2006; van Boven and Ashworth, 2007), and present well-being (Elster and Loewenstein, 1992; MacLeod and Conway, 2005). Thus, through anticipation, people are capable of both vividly envisaging and presently feeling their future experiences. In relation to user experience, this capability can considerably influence users’ anticipation of their future experiences with interactive products. It has also been suggested that users’ anticipation, along with their past experiences, shapes their actual experiences with products by determining their perceptions of and interactions with the products, as well as their overall satisfaction judgments (Hiltunen, et al., 2002; Mäkelä and Fulton Suri, 2001; Roto, 2007; Wright, et al., 2003).

The users’ extensive mental simulation of future experiences and felt anticipatory emotions provide an approximation of user experience before actual interaction with the product. Hence, this anticipated experience offers advantageous opportunities to assess user experience in the early stages of the design process when functional
prototypes are usually unavailable. Moreover, it can provide useful information to serve as a foundation for the successful development of products with high quality user experience (Olsson, et al., 2009). However, research that focuses on anticipated user experience is lacking. More and deeper studies in this area will increase the prospect of gaining new knowledge to support design for experience from the outset of the product design and development process.

Users have expectations of future experiences with a particular product, which can be confirmed, positively disconfirmed, or negatively disconfirmed when the actual experience unfolds. The disconfirmed expectations affect the users’ appraisal of the product, and shape their satisfaction and perceived experience. The effects of expectation disconfirmation on product perceptions can be explained by four psychological theories: assimilation, contrast, generalised negativity, and assimilation-contrast (Anderson, 1973; Scharf and Volkmer, 2000). In experience-centred design, data on users’ disconfirmed expectations could help designers in making the right decisions and trade-offs with respect to the user experience attributes of the product being designed (Thayer and Dugan, 2009).

This chapter concludes the series of literature review chapters that identify the knowledge gap and provide theoretical foundations for this research. The following chapter outlines the research design, encompassing the research approach and methods, the research plan, the research participants, and the data analysis procedure.
Chapter 5: Research Design

As described earlier, this study is concerned with the importance of user experience assessment in the early stages of product development. It seeks to support designers in delivering positive consumer experiences with interactive products. The substantial literature reviewed in the previous chapters identified three main gaps in the research to date:

1. The majority of user experience frameworks and evaluation methods focus on user experience that occurs during or after actual interactions with functional products; anticipated user experience, which involves no real user-product interactions, has been scarcely accommodated.

2. There is limited research that specifically investigates anticipated user experience and its role in designing and developing interactive products.

3. Methods that employ users’ anticipated experience as a basis for early assessment of user experience are rare.

Based on the identified gaps, the research question and sub-questions were formulated in Section 1.3, and research aims and objectives were given in Section 1.4. These are summarised in Figure 5.1, in conjunction with the research approaches that are discussed in this chapter.
Figure 5.1 Research Question, Sub-questions, Objectives, and Approaches
This chapter delineates the research design employed for exploring anticipated and real user experiences in order to solve the research problems. First, it begins by introducing and justifying the qualitative research approach used in this study. Second, it explains and justifies the selected research methods. Third, the chapter describes the overall plan for the empirical work, followed by descriptions of product selection and participant recruitment. Lastly, the procedure and method of data analysis are presented.

5.1 RESEARCH APPROACH AND METHODS

This study employed a qualitative research approach, as it is capable of capturing users’ anticipated and felt experiences and emotions with respect to the use of interactive products. This approach is also useful in answering the ‘how’ and ‘why’ questions pertaining to user-product interactions. According to Strauss and Corbin (1998), qualitative research can refer to studies about people’s lived experiences, feelings, emotions, and behaviours. It enables investigators to explore users’ core experiences, to identify how meanings are created, and to discover (rather than evaluate) variables (Corbin and Strauss, 2008). Marshall and Rossman (1999) concur that qualitative research is interpretative, pragmatic, and grounded in people’s lived experiences. Therefore, qualitative methods can acquire complex information about individuals’ thought processes, feelings, and emotions, which are difficult to explore by using more conventional (e.g. quantitative) methods (Strauss and Corbin, 1998).

In the qualitative paradigm, theories are developed by using inductive reasoning to create a deep understanding of the meaning of data that are gathered from a rich context-bound situation (Creswell, 2003; Silverman, 2005). Thus, qualitative research methods can be used to learn about subjects that have not been well understood, or to gain novel understandings of areas that are already well understood (Stern, as cited in Strauss and Corbin, 1998). In the case of this study, qualitative methods were used to develop new knowledge about anticipated user experience.

In the context of user-product interaction, quantitative methods have been considered less informative for designers than qualitative methods, especially with respect to transforming the findings derived from quantitative data into a product’s features and functions. Kanis, Weegels, and Steenbekkers (1999) refer to previous studies to
demonstrate the limitations of quantitative research in supporting the design of usable consumer products. They conclude that the summative measures resulting from quantitative analysis (e.g. performance time and numbers of errors) provide little information about actual problems in user-product interaction and, consequently, are not particularly useful in generating specific design recommendations.

Kanis et al. (1999) argue that, to inform product design, it is essential to conduct in-depth studies into actual product use in a natural context; this is best achieved through observations enhanced by the user’s clarifications of that use. It is this observational research practice that makes the qualitative approach more useful and enlightening for the design fields. Additionally, Kanis and Green (2000) suggest that there are two criteria for observational research to support usage-oriented design: (1) a focus on user activities when using a product, and (2) a clear relationship between these observed activities and design recommendations for the product’s features and functions. The authors assert that qualitative research is effective in meeting these requirements.

The use of qualitative methods is evident in user experience research. For example, to identify, analyse, and evaluate users’ experiences in using technology or interactive products, researchers have applied the following methods: narrative and storytelling interviews (Geven, et al., 2006; Gruen, Rauch, Redpath, and Ruettinger, 2002; Schrammel, et al., 2008), co-discovery (Jordan, 2000), observation (Väätäjä, 2010), various types of experience diaries (Isomursu, et al., 2004; Karapanos, et al., 2009; Korhonen, et al., 2010b; Swallow, et al., 2005), probe techniques (Jääskö and Mattelmäki, 2003), sentence completion tools (Nurkka, Kujala, and Kemppainen, 2009), and generative tools (including sketching techniques) (Sanders, 2000; Sleeswijk Visser, et al., 2005; Stappers and Sanders, 2004). Some of these methods have been described in Chapter 2. As well as demonstrating the usefulness of the qualitative approach in user experience studies, this pool of methods provides a source for determining suitable methods for this research.

To address the research question and sub-questions, and to maintain the research rigour, this study utilised a methodological triangulation approach (Denzin, 1989)
Chapter 5: Research Design

that encompassed four qualitative methods: co-discovery, visual representation (sketching), experience diary, and observation. These selected methods were deemed appropriate to achieve the objectives of this research. The justifications for their selection are explained in Sections 5.1.1, 5.1.2, 5.1.3, and 5.1.4.

Each of the study's experiments comprised a combination of three of the above methods (Section 5.2). According to Denzin (1989), the triangulation of methods is one of the soundest strategies for theory construction. In this approach, several different methods complementarily compensate for the possible limitations and weaknesses of a single method (Flick, 2009; Potter, 1996). For instance, visual data from observation offer participants’ body language information that is not evident from verbal co-discovery data. Furthermore, the meaning of data from one method can be cross-checked with that from the others, thus helping to validate data interpretation. The next four sections discuss the methods used.

5.1.1 Co-discovery

Co-discovery is a user experience exploration method that involves two participants collaboratively discussing a product or concept and its use, while the researcher observes (Jordan, 2000). Communicating with another participant is more comfortable and natural than thinking aloud without a partner (Dumas and Redish, 1999; Nielsen, 1993). The paired participants also have less test anxiety and feel less pressure to express their views, because they do not directly talk to the investigator (Jordan, 2000; Wilson, 2004), as is the case in one-to-one interviews. The co-discovery method, therefore, generates more comments and opinions about users’ thoughts and expectations, and reveals more experiential information related to product use (Dumas and Redish, 1999; Hackman and Biers, 1992; Jordan, 2000).

Hackman and Biers (as cited in Dumas and Redish, 1999) have evaluated the co-discovery technique and verified that it produces valuable data that contribute insight into the design. Zhao, Popovic, Ferreira, and Xiaobo (2007), for instance, have used a co-discovery protocol to explore the future travel needs of elderly Chinese drivers to assist in the design of vehicles for older adults in China.
For the above reasons, the co-discovery method was deemed suitable for exploring anticipated and real user experiences, and was used in Experiment One and Experiment Two of this research. In Experiment One, this method was employed to gather rich data about participants’ imagination of a desired product, and about their anticipation of interactions and experiences with the imagined product (Chapter 6). By analysing the participants’ verbalisations, the researcher gained insight into the user’s process of anticipating experiences with interactive artefacts, and determined the characteristics of this anticipated experience. Meanwhile, in Experiment Two, co-discovery sessions were conducted to obtain retrospective information regarding participants’ experiences, emotions, and perceptions of their actual interactions with a given interactive product (Chapter 7). This information, together with experience diary data, served as a basis for deriving the characteristics of real user experience.

5.1.2 Visual Representation (Sketching)

Sketching or drawing, a type of visual representation technique, was also employed in this study. It has been demonstrated that there is a connection between sketching and experience; thus, the use of visuals can access and portray aspects of user experience (Chamorro-Koc, Popovic, and Emmison, 2008, 2009). This is because people accumulate visual references of their experiences (Chamorro-Koc, 2008). As suggested by Collier (2001), visual information is a source of human experience analysis, through which meanings and patterns can be identified. As research data, every component of a visual record can be a significant source of knowledge when analysed (Collier, 2001).

Previous studies have used visuals not only to explore people’s imagination and perception (Arnheim, 1993; Baskinger and Nam, 2006; Kavakli and Gero, 2001), but also to gain insight into their concepts and perspectives (Chamorro-Koc, 2008; Sleeswijk Visser, et al., 2005). In addition, visuals have been applied in design research as one of the generative tools to elicit users’ past, current, and future experiences (including memories, feelings, emotions, needs, expectations, and dreams), and to uncover users’ ideas regarding scenarios and contexts of product use (Sanders, 2000; Sleeswijk Visser, et al., 2005; Stappers and Sanders, 2004).
Sketching tasks were included in Experiment One’s co-discovery sessions to better capture participants’ desired product concepts, and to obtain further experiential data, such as pictorial descriptions of perceived experiences, procedures, and situations of product use (Chapter 6). More importantly, sketching also functioned as a means of making an imagined product more concrete, thus assisting participants to anticipate their interactions and experiences with their product concept. Moreover, the use of visuals was helpful in allowing participants to express thoughts that they might otherwise have found difficult to verbalise during the discussion. Information derived from participants’ sketches also supported the analysis of textual data, by helping the researcher in interpreting and coding their verbal responses.

To help clarify meaning, oral explanations (i.e. retrospective verbal report) were a part of participants’ sketching tasks. This step was important in helping the researcher to more effectively interpret the drawings. It also allowed participants to indicate any aspects that could not be conveyed through their sketch (Chamorro-Koc, et al., 2009).

5.1.3 Experience Diary

An experience diary can be defined as questionnaire-like forms that are given to participants for them to record their experiences with a product over a period of time (e.g. days or weeks) (Jordan, 2000). A major advantage of this method is its ability to provide insight into the changes in user experience over time (Jordan, 2000; Karapanos, et al., 2009). The use of diaries also allows user experience data to be captured from the real contexts of product use (Swallow, et al., 2005).

The experience diary used in this research was based on the Day Reconstruction Method (DRM) (Kahneman, Krueger, Schkade, Schwarz, and Stone, 2004b) that has been adapted and used for user experience research in a longitudinal setting (Karapanos, et al., 2009). The DRM was originally designed for investigating how people experience their various life activities and situations (Kahneman, et al., 2004b; Stone et al., 2006). At the end of a reported day, or at the beginning of the following day, DRM asks participants to recall their experiences by reconstructing activities or events that occurred as a sequence of episodes. Then, for each episode, they are asked to explain the situation and feelings that they experienced (Kahneman,
et al., 2004b). Reconstructing the episodes and contexts of daily activities helps the participants to evoke episodic (specific and recent) memories, thus minimising retrospective bias and errors when reporting on their experiences (Schwarz, Kahneman, and Xu, 2009).

In user experience research, DRM enables users to focus on the perceived product quality within a particular episode of experience, thus reducing the likelihood of reports that are based on their general opinion of the product (Karapanos, et al., 2009). Other advantages offered by this method include: (1) minimum disruptions to users’ normal activities, (2) lower participant burden and a more complete account of activities than is typical for experience sampling methods, and (3) combined assessment of activities and subjective experiences (Kahneman, Krueger, Schkade, Schwarz, and Stone, 2004a; Kahneman, et al., 2004b).

Karapanos et al. (2009) adapted the DRM to explore how user experience develops over time. On a daily basis over a period of several weeks, they asked participants to reconstruct all their activities that related in some way to the product of interest (this procedure is called *day reconstruction*). The participants were then asked to choose and write stories about the three most impactful experiences of the day (this procedure is called *experience narration*). These two procedures were adopted in this research.

The experience diary method was employed in Experiment Two to investigate the characteristics of real user experience (Chapter 7). By means of the diaries, participants reported their daily experiences of using a given interactive product for a period of three days. Because they had used it in actual, spontaneous contexts (rather than in a laboratory or controlled situation) over a considerable period of time (rather than a brief interaction), it was expected that participants would report accurate real experiences with the product. Moreover, by adopting the DRM, the participants were likely to avoid describing their general beliefs about the product and their experiences. Reports from the experience diaries were combined and analysed with the co-discovery data to generate the end results.
5.1.4 Observation

Observation involves a systematic and objective process of viewing and recording behavioural patterns and occurrences in a laboratory or naturalistic settings (Tan, 2004). Through observation, people’s complex actions and interactions can be discovered, documented, interpreted, and described (Marshall and Rossman, 1999). One positive point of this method is that, by evaluating actions in situ, information that reaches beyond individuals’ self-interpretations and personal views about their behaviours and attitudes can be obtained (Gray, 2009). Hence, observational data can be used to supplement and validate participants’ comments.

With respect to participants’ awareness and the researcher’s role, this research used overt, non-participant observation (Gray, 2009). In this approach, the participants were aware of being observed, and the researcher did not work or act alongside them to respond to the experiment tasks. This observation was used as a complementary technique to acquire additional data that might be lacking in participants’ verbal responses, diaries, and sketches. These extra data included, for example, participants’ gestures when expressing their ideas, and their actions when pretending to use an imaginary product. As Flick (2009) asserts, combining or triangulating observation with other sources of data enhances the expressiveness of the collected data.

Actions and behaviours of participants were observed when partaking in the co-discovery sessions (Experiment One and Experiment Two). Video recordings were utilised rather than live observation, so that the experiment sessions could be viewed multiple times in greater detail. This also ensured that nothing was overlooked. The resulting observational information facilitated the interpretation and analysis of verbal or textual data.

5.2 RESEARCH PLAN

To address the research question and sub-questions, a research plan was established, which structured the research methodology into logical and manageable phases. The plan (Figure 5.2) consisted of five major stages: (1) Experiment One, (2) Experiment Two, (3) Comparative analysis, (4) Framework and design recommendations, and (5) Conclusions.
The first stage of the research, Experiment One, was designed to investigate how users anticipate their future experiences with interactive products. This stage comprised the phases of pilot study, main data collection, data analysis, and findings. The pilot study entailed experiment trials with six participants, followed by initial
data analysis. It was conducted to test the selected research methods, to validate the
designed data analysis approach, and to develop an initial coding scheme. The results
from the pilot study helped to adjust and improve the experiment procedure and
instruments before the main data collection began. Moreover, the initial coding
scheme guided and facilitated the future data analysis in the main study.

For collecting the data, Experiment One employed a triangulation of methods that
included co-discovery, visual representation (sketching), and observation. Using the
co-discovery method, participant pairs were asked to imagine and discuss a specific
desired product, to draw and clarify their product concept, and to anticipate and share
their future experiences with the imagined product. Concurrently, the co-discovery
sessions were video-recorded for observations. An in-depth explanation of the
experiment procedure follows in Section 6.1. Transcribed verbal data were coded and
analysed using ATLAS.ti, while visual data were used to support the verbal data
analysis (Section 6.2.1). Relationships among the elements of anticipated user
experience were also identified (Section 6.2.2). Experiment One provided two
outcomes: (1) the user’s process of anticipating future experiences with products, and
(2) the characteristics of anticipated user experience.

The second research stage, Experiment Two, was intended to explore the
characteristics of real user experience. This stage encompassed four phases that were
identical to those of the previous stage. The data collection utilised three methods
including experience diary, co-discovery, and observation. Participants were asked to
use a given product over a period of three days. On each day, they reported the three
most impactful experiences that related to the product, via a provided experience
diary. They were then paired to share and discuss their experiences in co-discovery
sessions. These sessions were observed using video recordings. Section 7.1 explains
the experiment procedure in greater detail. All verbal data were coded and analysed
using ATLAS.ti, and supported by information from the observations (Section 7.2.1).
Furthermore, relationships among the elements of real user experience were defined
(Section 7.2.2). The outcomes of Experiment Two were (1) the user’s process of
forming actual experiences with products, and (2) the characteristics of real user
experience. These outcomes served the next research stage, which differentiated
between anticipated and real user experiences.
In the third stage of the research, the outcomes from Experiment One and Experiment Two were synthesised, interpreted, and discussed. Comparative analysis was then conducted by integrated collation and interpretation of these outcomes to identify the differences between anticipated and real user experiences (Section 8.2). The results of this stage contributed to the development of the Anticipated User Experience (AUX) Framework and design recommendations.

Based on all findings from the previous stages, the fourth research stage focused on addressing the main research question concerning ways in which to support early assessment of user experience. The AUX Framework, which consisted of two related sub-category networks, was developed for conveying the understanding of anticipated user experience to designers and researchers (Section 8.1.3). Design recommendations derived from the findings were also proposed. These recommendations, together with the AUX Framework, aimed to support and guide designers in assessing and designing for user experience in the early phases of product development (Chapter 9). In addition, these recommendations and this framework were formulated with a view to being applicable to the design of interactive products in general.

The final research stage formulated the overall findings and concluded the study (Chapter 10). The results were further discussed to highlight the research implications and contributions. The focus was on transferring the new knowledge generated to its applications. Moreover, the research question and sub-questions were used as criteria to evaluate whether the study objectives had been accomplished. Next, limitations of the research design, methods, and outcomes were assessed, and possible remaining gaps in the research area were considered. Finally, potential directions for future studies were suggested.

5.3 PRODUCT SELECTION

Compared to usability research, which mainly focuses on computer systems and software design (e.g. Lallemand, 2011; Nielsen, 1993), the field of user experience has been increasingly dealing with the design and evaluation of a broader range of interactive products (Hassenzahl, et al., 2010). An interactive product is defined as consisting of three elements: user, system, and interaction (Dix, Finlay, Abowd, and
Beale, 2003; Maeng, Lim, and Lee, 2012), and is viewed as “a cyclic process where users and systems have conversations” (Maeng, et al., 2012, p. 449). This definition suggests that the interaction or conversation between users and systems is the essential component that differentiates interactive products from their non-interactive counterparts. Interactive products generally focus on, or relate to, complex technology systems such as computer software, mobile gadgets, and other electronic devices (Wrigley, 2011). Researchers have used, for example, smart phones (Swallow, et al., 2005; Väätäjä, 2010), portable media players (Mahlke, 2007), digital cameras (Mäkelä and Fulton Suri, 2001), and interactive TV set-top boxes (Karapanos, et al., 2008) as the subjects of their studies to enhance their understanding of user experience.

Interactive products are closely related to experience design, as they are a means of engendering and shaping experiences through their content, functionality, appearance, and interaction with users (Hassenzahl, 2010). This interaction, which encompasses a temporal dimension and a strong focus on action, is a key aspect in creating experiences (Hassenzahl, 2010). Maeng et al. (2012) also agree that the interactive aspect of a product determines the quality of user experience.

For these reasons, this study also used an interactive product as a stimulus through which users could anticipate their future experiences (Experiment One), and with which to have real experiences (Experiment Two). In this case, digital cameras were selected as representative of a large variety of interactive products. This product category was deemed appropriate, because the use of digital cameras involves users, systems (hardware and software), and interaction (the exchange of input and output via user interfaces). As mentioned earlier, this interaction component creates and influences users’ experiences.

Moreover, digital cameras are popular interactive devices that have become a part of many people’s lives. Users’ familiarity to a product category can assist them to conceive and explore new concepts, and to experience and appraise an actual artefact, of this product category. Thus, the use of digital camera suited the designed experiments of this research. In addition, the reasonable level of complexity of digital cameras satisfied the study requirements. The literature also indicates that
various research in design and user experience fields have used digital cameras as the study subject (e.g. Blackler, 2008; Buchenau and Fulton Suri, 2000; Lawry, Popovic, and Blackler, 2011; Mäkelä and Fulton Suri, 2001).

Since digital cameras were considered representative, they were the only product category selected and used in this research. The alternative – using an approach that involves many product categories, and allows participants to freely choose their own favourite devices, as in Arrasvuori et al. (2010) – could result in the study of uncommon products (e.g. a metal detector), and too broad a range of product types.

In Experiment One, participants needed to imagine a product with which they could anticipate their experiences (here, the participants played a role as both users and designers). For this purpose, they were not provided with design concepts, usage scenarios, or prototypes of the product, but were simply informed of the kind of product being designed (i.e. a digital camera). In Experiment Two, on the other hand, participants were provided with an actual digital camera (a Samsung ST600) for the purpose of evoking their real experiences.

5.4 RESEARCH PARTICIPANTS

The following sections describe the techniques and process of recruiting participants for Experiment One and Experiment Two, including details of the screening questionnaire.

5.4.1 Sampling Techniques

For each experiment, 40 participants were recruited by using a combination of the purposeful sampling strategy (snowball sampling) (Patton, 2002) and the volunteer sampling technique (Morse, 1991; Teddlie and Yu, 2007). Purposeful sampling provides insightful and in-depth information about the phenomenon of interest, because information-rich sources that suit the study are selected (Coyne, 1997; Patton, 2002). Meanwhile, volunteer sampling provides a greater diversity of participants, and thus widens the potential range of participant information and experience available to the investigator (Morse, 1991).
The sample size was determined according to its feasibility and to its ability to provide rich and representative data. The determined number of (40) participants was in accordance with Morse (1998) who proposes that qualitative research should involve a sample size of approximately 30 to 50, depending on informational redundancy or saturation. Moreover, in the field of product design, researchers have typically included between 25 and 36 participants in their qualitative studies (e.g. Chamorro-Koc, 2008; Wrigley, 2011; Zhao, et al., 2007).

Two criteria for recruiting the participants were that they needed to be at least 18 years old and familiar with the selected interactive product used in the study (i.e. digital cameras). The age requirement was based on previous product design research related to interactive products (Chamorro-Koc, 2008; Lawry, et al., 2011). Furthermore, it is based on the fact that people aged 18 years and over have more buying power that allows them to purchase and use interactive products more frequently (Axelsson, 2010; McNeal and Yeh, 1997).

At the same time, the second criterion was also important due to participants’ role in this study. The tasks of conceiving and sketching a desired product concept in Experiment One require participants to have a dual role as users and designers. Therefore, to effectively imagine the selected product, and to explore aspects of user experience with the imagined product, the participants must have some level of knowledge about that product. This knowledge also assists them to experience and appraise the actual product given in Experiment Two. The above criteria were assessed using a screening questionnaire (Section 5.4.2).

The recruiting process was begun by selecting and inviting a small number of participants from the researcher’s social network. After being informed of the participant criteria, they were then asked to recommend other potential candidates or to ask their acquaintances to participate in the study. Through this process, new participants were recruited and included in the sample pool; in turn, they became the basis for further participant recruitment (snowball sampling) (Patton, 2002). This sampling technique was subsequently combined with advertising (via fliers and electronic mailing-lists), which asked interested individuals to voluntarily participate in the study (volunteer sampling) (Morse, 1991). The sampling frame for this
volunteer sampling was the staff and students of Queensland University of Technology. Recruited participants were then provided with the Participant Information Pack (Appendix A).

5.4.2 Screening Questionnaire

The screening questionnaire was employed to gather demographic and product familiarity information from the participants in order to assess their suitability for the study. This questionnaire was developed by adopting the Technology Familiarity Questionnaire created by Blackler (2008), and the screening questionnaire used by Wrigley (2011). Blackler (2008) specifically designed the Technology Familiarity Questionnaire to determine a technology familiarity score for each participant. A higher score indicated a higher level of exposure to, and depth of knowledge of, certain products being investigated (Blackler, 2008).

The screening questionnaire utilised in this research consisted of two parts (Appendix B). The first part comprised questions that pertained to participants’ demographics and personal background (gender, age group, education level, occupation, and nationality). While age group was used as one of the participant suitability criteria, the other demographic data were useful in determining whether participants constituted a representative cross-section of the community.

The second part of the questionnaire asked participants about their experience and familiarity with digital cameras (ownership history, level of expertise, depth of use, and frequency of use). This product familiarity information from each participant was transformed into a total score, based on a pre-established scoring system (Appendix C). This score was then assessed against a threshold value to determine whether a participant was suitable for the study (i.e. they have the necessary familiarity with the selected product). The maximum possible total score was 30, and the hypothetical minimum was 1. The minimum total score of 15 was set as the threshold value. Appendix C provides an example of how the score was calculated.

Appendix D contains the complete data on the participants’ demographics and familiarity with digital cameras, including their product familiarity total scores. A summary of these data is presented in Table 5.1.
### Table 5.1 Participants’ Demographics and Product Familiarity Data

<table>
<thead>
<tr>
<th>Participants’ Profile</th>
<th>Experiment One</th>
<th>Experiment Two</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>45%</td>
<td>42.5%</td>
</tr>
<tr>
<td>Female</td>
<td>55%</td>
<td>57.5%</td>
</tr>
<tr>
<td>Age group (years old)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>18-25 to 56+</td>
<td>18-25 to 56+</td>
</tr>
<tr>
<td>Median</td>
<td>26-35</td>
<td>Between 26-35 and 36-45</td>
</tr>
<tr>
<td>Mode</td>
<td>26-35</td>
<td>26-35</td>
</tr>
<tr>
<td>Academic qualification</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school</td>
<td>7.5%</td>
<td>5%</td>
</tr>
<tr>
<td>Certificate IV</td>
<td>0%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Diploma</td>
<td>2.5%</td>
<td>0%</td>
</tr>
<tr>
<td>Associate degree</td>
<td>2.5%</td>
<td>0%</td>
</tr>
<tr>
<td>Bachelor degree</td>
<td>25%</td>
<td>32.5%</td>
</tr>
<tr>
<td>Postgraduate diploma</td>
<td>0%</td>
<td>5%</td>
</tr>
<tr>
<td>Master degree</td>
<td>52.5%</td>
<td>52.5%</td>
</tr>
<tr>
<td>PhD degree</td>
<td>10%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Nationality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>American:</td>
<td>2.5%</td>
<td>American:</td>
</tr>
<tr>
<td>Australian:</td>
<td>30%</td>
<td>Australian:</td>
</tr>
<tr>
<td>Brazilian:</td>
<td>5%</td>
<td>British:</td>
</tr>
<tr>
<td>Burmese:</td>
<td>5%</td>
<td>Chinese:</td>
</tr>
<tr>
<td>Canadian:</td>
<td>5%</td>
<td>Indian:</td>
</tr>
<tr>
<td>Chinese:</td>
<td>2.5%</td>
<td>Indonesian:</td>
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<tr>
<td>Croatian:</td>
<td>2.5%</td>
<td>Iranian:</td>
</tr>
<tr>
<td>Filipino:</td>
<td>2.5%</td>
<td>Irish: 2.5%</td>
</tr>
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<td>Indonesian:</td>
<td>20%</td>
<td>Malaysian:</td>
</tr>
<tr>
<td>Iranian:</td>
<td>5%</td>
<td>New Zealand.2.5%</td>
</tr>
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<td>Malaysian:</td>
<td>7.5%</td>
<td>Serbian:</td>
</tr>
<tr>
<td>New Zealand:</td>
<td>2.5%</td>
<td>Taiwanese:</td>
</tr>
<tr>
<td>Serbian:</td>
<td>2.5%</td>
<td>Thai: 2.5%</td>
</tr>
<tr>
<td>Thai: 7.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ownership history</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ownership</td>
<td>All participants owned at least one digital camera</td>
<td>All participants owned at least one digital camera</td>
</tr>
<tr>
<td>Average period of ownership</td>
<td>5.8 years</td>
<td>7.5 years</td>
</tr>
<tr>
<td>Average number of cameras purchased in the last 5 years</td>
<td>2 cameras</td>
<td>1.8 cameras</td>
</tr>
<tr>
<td>Average level of expertise based on self-appraisal (1 = novice, 7 = expert)</td>
<td>4.2</td>
<td>4.75</td>
</tr>
<tr>
<td>Depth of product use</td>
<td>Using all features by checking the manual</td>
<td>22.5%</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Frequency of product use</th>
<th>Using as many features that can be found</th>
<th>45%</th>
<th>42.5%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Using just enough features to get by</td>
<td>30%</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td>with</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Limited use of product</td>
<td>2.5%</td>
<td>0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency of product use</th>
<th>At least once a week</th>
<th>40%</th>
<th>42.5%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>At least once a month</td>
<td>35%</td>
<td>35%</td>
</tr>
<tr>
<td></td>
<td>Once every few months</td>
<td>25%</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>Only ever used it few times</td>
<td>0%</td>
<td>2.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Product familiarity total score</th>
<th>Range</th>
<th>15-28</th>
<th>15-27</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>21.3</td>
<td>22</td>
</tr>
</tbody>
</table>

5.5 DATA ANALYSIS PROCEDURE

This section explains the technique and process of data analysis for generating the study results. Both Experiment One and Experiment Two produced two types of data: textual and visual. Table 5.2 outlines the descriptions and functions of these two types of data. All verbal data from the co-discovery sessions were transcribed verbatim, while information from the experience diaries was extracted and organised into transcripts. These textual data were used as a principal source of the research findings, whereas visual data (sketches and video recordings) were used to support the analysis and interpretation of the textual data. The analysis process was assisted by ATLAS.ti software (Scientific Software Development GmbH, 2011), which allowed more efficient data organisation and coding.

Table 5.2 Types and Functions of Experiment Data

<table>
<thead>
<tr>
<th>Type of Data</th>
<th>Form of Data</th>
<th>Description</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textual</td>
<td>Co-discovery transcripts (20 sets from each experiment)</td>
<td>Transcribed verbal responses of participant pairs to co-discovery tasks. In Experiment One, these included participants’ verbal explanation of their sketch.</td>
<td>In Experiment One, co-discovery transcripts were the primary data for exploring how users anticipate their experiences with interactive products, and for identifying the characteristics of anticipated user experience. In Experiment Two, co-discovery transcripts were used for</td>
</tr>
</tbody>
</table>
Chapter 5: Research Design

<table>
<thead>
<tr>
<th>Experience diary transcripts (40 sets, Experiment Two only)</th>
<th>Participants’ reports of their daily experiences of using a given digital camera over a period of three days.</th>
<th>Experience diary data were combined with Experiment Two’s co-discovery transcripts to explore real user experience, and to identify its characteristics.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sketches in co-discovery (40 sets, Experiment One only)</td>
<td>Participants’ sketches of their desired digital camera concept, including their perceived interactions and experiences with that product concept.</td>
<td>Sketches were used to support textual data analysis.</td>
</tr>
<tr>
<td>Observational data from video recordings (20 sets from each experiment)</td>
<td>Video recordings of the co-discovery sessions, capturing participants’ conversations, facial expressions, gestures, and actions.</td>
<td>Observational data were used to support textual data analysis.</td>
</tr>
</tbody>
</table>

The qualitative content analysis technique was employed to analyse the textual data. Content analysis is a research method for creating valid and replicable inferences from data to the contexts of their use (Krippendorff, 2004). With its ability to identify core consistencies and meanings underlying qualitative data (Patton, 2002), content analysis is aimed at creating new insights, and enhancing understanding and knowledge, of the phenomenon under study (Downe-Wamboldt, 1992; Krippendorff, 2004). The central idea of this analysis technique is to organise large amounts of text into much fewer, manageable content categories (Weber, 1990); this involves a structured classification process of coding and determining patterns or themes (Hsieh and Shannon, 2005).

Thus, the content analysis technique was found suitable for this research, as it was able to manage and categorise a substantial amount of textual data resulting from Experiment One and Experiment Two. More importantly, this technique also supported information extraction and data interpretation that led to new knowledge of anticipated user experience and enhanced understanding of real user experience.

Since the research literature on anticipated user experience is limited, and the study goal was to generate new knowledge, the inductive or conventional content analysis approach was applied to the data from Experiment One. In this approach, the
categories were entirely derived from the data, rather than being built from a

The data analysis of Experiment Two also used the same approach despite the
availability of an extensive number of theories on real user experience. The
**inductive**, rather than the **deductive**, approach was used because the purpose of
Experiment Two was to identify the differences between anticipated and real user
experiences, as opposed to testing the existing theories or variables per se.
Furthermore, the researcher intended to remain open to new or unexpected
categories. However, the formation of some categories in the data analysis of
Experiment Two was based on the results from Experiment One.

The outcome of the content analysis is categories (including relationships among
them) that explain the phenomenon of interest (Elo and Kyngäs, 2008). Hence, by
using this analysis method, the building blocks of anticipated and real user
experiences could be discovered through categories emerging from the data. These
building blocks, in turn, contributed to the identification of the characteristics of
these two types of experiences. Further, by developing relationships among these
categories, the researcher could gain an understanding of how users anticipate their
future experiences with product use.
Chapter 5: Research Design

Figure 5.3 Data Analysis Process: Experiment One and Experiment Two

The data analysis of Experiment One and Experiment Two consisted of two main phases (Figure 5.3), which were based on the work of Busch et al. (2005), Elo and Kyngäs (2008), and Hsieh and Shannon (2005). The first phase, data coding, began with repetitive readings of each transcript to become immersed in, and to make sense of, the data. The transcripts were then read more thoroughly to begin the open coding process (Strauss and Corbin, 1998). Here, text segments that seemed to hold key
concepts relevant to aspects of user experience were highlighted, and notes or keywords were written. As this activity progressed, headings for codes emerged. After open coding of three transcripts, the headings were collected and organised into sub-categories and codes. These sub-categories were grouped into broader, higher-order categories according to their similarities or relationships. The categories, sub-categories, and codes were subsequently translated into an initial coding scheme, in which the scope of interpretation for each sub-category was defined.

Using the initial coding scheme, the first three transcripts were re-coded and the remaining ones were coded. The coding scheme was iteratively revised to accommodate new emergent sub-categories or codes, and to make necessary refinements of the existing ones, including their scope of interpretation. In other words, the coding scheme constantly evolved until all data were included and the categories and sub-categories were saturated. The final coding schemes for the data from Experiment One and Experiment Two are presented in Section 6.2.1 and 7.2.1 respectively.

In parallel with the coding process, important information pertaining to the research question and sub-questions was extracted and recorded. Furthermore, during this data coding, information from participants’ sketches (for Experiment One only) and video recordings facilitated the interpretation of the texts, and the selection of their correct codes. This visual information also supported the data transcription and open coding stages. Examples of how visual data supported the textual data analysis can be found in Section 6.2.1.

Once the coding process had been completed, to ensure coding consistency and to enhance the reliability of data analysis, the coding process was repeated several times at intervals of five to eight weeks. The breaks allowed for a fresh perspective, not only to reflect on the analysis process, but also to verify that the coding scheme had been correctly applied and that the coder’s understanding of the categories or sub-categories did not change over the time.

The second phase of analysis was the conduct of relational analysis to explore meaningful relationships among the sub-categories identified (Busch, et al., 2005). The type of relational analysis used was proximity analysis, which was concerned
with the co-occurrence of the sub-categories or codes in the data (Busch, et al., 2005; Morse and Field, 1995). Two or more codes that were assigned to the same text segment, or to parts of the text that overlapped, were identified. The co-occurring codes and their associated texts were then explored to develop relationships among the codes. Finally, these codes (sub-categories) and their associations were represented visually via networks or conceptual maps that served to explain the overall meaning of the data (Busch, et al., 2005). In Experiment One particularly, these sub-category networks formed the AUX Framework, which elucidated the way in which users anticipate their experiences with interactive products. In Experiment Two, on the other hand, they represented the user’s process of experiencing an actual product. Chapters 6 and 7 elaborate the data analysis procedure for each experiment.

Following the completion of the data analyses for Experiment One and Experiment Two, the results were synthesised and further analysed to differentiate between anticipated and real user experiences. Relevant criteria were determined as a basis for this comparative analysis. An example of these criteria was the importance of pragmatic and hedonic product qualities perceived by users in their anticipated and real experiences. Based on the analysis outcomes, design recommendations were proposed to support early assessment of, and design for, user experience.

### 5.6 SUMMARY

This chapter highlighted the research methodology and plan that were designed to explore anticipated and real user experiences. The selected research approach and methods have been introduced and justified. These methods included co-discovery, visual representation (sketching), experience diary, and observation. The research plan has also been outlined in its five stages: (1) Experiment One, (2) Experiment Two, (3) Comparative analysis, (4) Framework and design recommendations, and (5) Conclusions.

Furthermore, the choice of a specific category of interactive products for this study (i.e. digital cameras) was explained. This chapter then delineated the process of participant recruitment, which covered the sampling techniques employed (i.e. snowball and volunteer samplings) and the screening questionnaire used. Lastly, the
chapter detailed the data analysis procedure, which consisted of data coding and relational analysis phases.

Chapter 6 now focuses on Experiment One, which has been introduced in this chapter. The details of the experiment design and procedure are described, and are followed by an in-depth explanation of the data analysis. The results of Experiment One are then presented.
Chapter 6: Experiment One

The previous chapter defined the plan and methodology of this research, which were designed for exploring anticipated and real user experiences in order to address the research problems. Experiment One and Experiment Two were included as major parts of the research plan.

This chapter focuses on Experiment One, which was undertaken to empirically investigate the first research sub-question:

*How do users anticipate experiences with interactive products?*

Two objectives underlay this experiment. First, the experiment aimed to examine the user’s process of anticipating future experiences with products, as it is argued that this understanding can support design for experience in the early stages of product development. Second, it sought to identify the characteristics of anticipated user experience, which would contribute to the next stage of the research that is designed to determine the differences between anticipated and real user experiences.

This chapter delineates the data collection process in Experiment One, detailing the experiment procedure and the apparatus used. Analysis of the collected data is then explained, and results of the experiment are presented.

6.1 DATA COLLECTION

For collecting the data, Experiment One employed a combination of three of the methods outlined in Section 5.1: co-discovery, visual representation (sketching), and
Chapter 6: Experiment One

observation methods. The role of each method and the reason for its selection has been discussed in Sections 5.1.1, 5.1.2, and 5.1.4. The entire data collection process took five months in 2010. Table 6.1 summarises the details of Experiment One.

Table 6.1 Experiment One: Summary

<table>
<thead>
<tr>
<th>Experiment Aspects</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Objectives**     | • To investigate how users anticipate experiences with interactive products.  
                     • To identify the characteristics of anticipated user experience. |
| **Methods**        | Co-discovery, visual representation (sketching), and observation. |
| **Setting**        | People and Systems Laboratory, Queensland University of Technology (Gardens Point Campus, Brisbane, Australia). |
| **Apparatus**      | Task cards, a digital audio recorder, digital video recorders, tripods, sketch papers, and drawing tools. |
| **Experiment procedure** | In a co-discovery session, two participants were asked to individually imagine a desired digital camera and to collaboratively explore and discuss their product concepts. In the next task, they were instructed to pretend to use and interact with their imagined digital camera. This was followed by their exchanges of views.  
                     • Subsequently, participants were asked to individually draw a sketch of their digital camera concept, including other information related to their perceived interactions and experiences with that product concept. They then explained their sketch to each other.  
                     • The last task was for participants to contemplate and share their perceived future experiences and feelings pertaining to the anticipated use of their imagined digital camera.  
                     • Observation of the experiment session (through video recordings) was conducted to support verbal data analysis. |
| **Time**           | Sixty minutes (maximum). |
| **Participants**   | • Forty participants, paired into 20 groups.  
                     • Representing product users of different categories of gender, age, cultural background, and experience in using digital cameras.  
                     • Selection criteria: at least 18 years old, and familiar with digital cameras. |

### 6.1.1 Apparatus

All experiment sessions were conducted in the People and Systems (PAS) Laboratory located at the Queensland University of Technology, Australia. Figure 6.1 depicts the laboratory setting for the experiment.
Chapter 6: Experiment One

A series of task cards, each of which contained one or two instructions (Appendix E), were used to prompt participant discussion and sketching activities. The task cards were printed on A5 paper, and the instructions were numbered. A suggested time allocation for each task was printed in a different colour. The cards, sorted according to the sequencing of the tasks, were positioned face down on the table.

For the sketching tasks, each participant was provided with a sheet of 35x27cm sketch paper, a rubber, 2B pencils, colouring pencils, markers, and highlighters. Extra sketch papers were available if needed.

Each experiment session was recorded using digital audio and video recorders. Two Canon Legria HF21 video cameras with tripods were used. One camera was positioned front-left of the participants, diagonally facing them. Another camera was to the front-right of them (Figure 6.1). With these camera positions, each participant’s face and gestures could be clearly captured. Additionally, a Nokia E63 phone was used as a digital audio recorder for backup data. It was placed in the centre of the table to capture the conversation during the experiment.
6.1.2 Procedure

The recruitment of participants for this experiment has been explained in Section 5.4. The participants were randomly paired. Where possible, however, those who were friends or acquaintances were assigned to the same group, so that they would feel less inhibited and be more spontaneous in expressing and exchanging their ideas (Jordan, 2000). Each group was then scheduled to take part in the experiment.

Each pair of participants were invited into the experiment room (Figure 6.1) and asked to introduce themselves if they were not already acquainted. They read the participant information sheets, had any questions answered, and then signed the consent form. Then, the researcher gave a brief introduction about the study aim, and outlined the experiment tasks. Any questions from the participants were addressed and, when they were ready, all recording devices were activated and the experiment began.

Experiment tasks were delivered on task cards. Participants received a new card after completing all tasks specified on their previous one. The first task was for each participant to imagine a desired digital camera and to conceive their product’s model, appearance, functions, features, and other characteristics (the reasons for the use of digital cameras in this experiment have been given in Section 5.3). Both participants then explored and discussed their individual product concepts. In this task, the participants played a role as both product users and designers.

The second task was to pretend and imagine that they were using and interacting with their imagined digital camera, and to exchange ideas about these anticipated interactions. For the third task, the participants were asked to individually draw a sketch of their product concept, including their perceived interactions and experiences with it. This was followed by a shared verbal explanation of the sketches to clarify their meaning, as illustrated in Figure 6.2. In this sketching task, the participants, again, had a dual role as users and designers. Finally, the participants were prompted to reflect on, and then to share, the anticipated experiences and feelings that they would have during their interactions with the imagined digital camera. After this last task was completed, the participants were thanked for their participation. The whole session lasted between 35 and 60 minutes.
During the experiment, the participants were required to talk to each other. It was emphasised that the researcher would simply give them the tasks or any necessary prompts, and then passively observe the session. In this way, the researcher’s comments that could influence the participants’ responses to the tasks could be minimised.

All aspects of the experiment were observed during the session. However, more detailed observations were possible on viewing the video recordings of the experiment. These supported the transcription and analysis of verbal data.

**6.2 DATA ANALYSIS**

The data analysis, which has been outlined in Section 5.5, encompassed data coding and relational analysis phases. This section describes the application of these techniques to the data gathered during Experiment One to generate the study results. The coding scheme developed is introduced and explained.

**6.2.1 Data Coding**

This phase of analysis organised the textual data (Appendix F) into categories and sub-categories and, at the same time, extracted important information relevant to the first research sub-question. The categories and sub-categories that emerged during the analysis were related to users’ ideas about a desired digital camera, and to their
Chapter 6: Experiment One

anticipation of interactions and experiences with that desired product. Therefore, these categories and sub-categories helped to identify the user’s process of anticipating experiences with interactive products. They, together with the initial coding scheme developed during the pilot study, underlay the final coding scheme, which comprised four categories (i.e. Product Characteristic, Experience, Emotion, and Context) and fourteen sub-categories (Table 6.2). This coding scheme is indispensable in consistently classifying the participants’ responses throughout the analysis. The four colours in Table 6.2 denote the four categories. These colours are used in the sub-category networks (Chapter 8).

In the coding process, texts were interpreted according to the coding scheme. Individual themes were used as the unit of analysis; in other words, the articulations of an idea were the focus (Minichiello et al., as cited in Zhang and Wildemuth, 2009). Thus, a text chunk of any size (word, phrase, sentence, or paragraph) could be assigned a code, provided that the chunk captured a single theme or concept pertinent to the study (Weber, 1990; Zhang and Wildemuth, 2009). Moreover, more than one code could be applied to the same text segment, depending on information about aspects of user experience embedded in that segment. It is this coding rule that enabled the relational analysis through the co-occurrences of sub-categories or codes (Section 6.2.2).

Figure 6.3 Application of Desired Product Characteristics (DPC) and Intended Use (IU) Sub-categories to Textual Data [Participant #34]

Figure 6.3 illustrates how the coding scheme was applied to textual data. The highlighted text segment captured a participant’s desire for the camera to be small and portable. Therefore, based on the scope of interpretation of the sub-categories presented in Table 6.2, the Desired Product Characteristics (DPC) sub-category was coded to this segment. Next, Intended Use (IU) was applied to the second text segment, as it described the purpose and situation of camera usage, that is, for use
during social activities. Representative examples of the application of the other sub-categories or codes are shown in Appendix G.

Table 6.2 Experiment One: Coding Scheme

<table>
<thead>
<tr>
<th>Categories</th>
<th>Sub-categories</th>
<th>Codes</th>
<th>Scope of Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product Characteristic</strong></td>
<td>Desired Product Characteristics</td>
<td>DPC</td>
<td>All aspects of a product that a user wants or expects, embracing features, functions, pragmatic and hedonic qualities, post-purchase services, and accessory items.</td>
</tr>
<tr>
<td></td>
<td>Dislike(s)</td>
<td>DL</td>
<td>a) Things a user dislikes about a product.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>b) Negative judgment of, or negative attitude to, a product, its particular features, or its related aspects.</td>
</tr>
<tr>
<td></td>
<td>Favourable Existing Characteristics</td>
<td>FEC</td>
<td>The existing feature, function, or characteristic of a product that is positively judged by the user.</td>
</tr>
<tr>
<td><strong>Experience</strong></td>
<td>Positive Anticipated Experience</td>
<td>PAX</td>
<td>The pleasant situations, events, and feelings that a user anticipates experiencing in relation to using and interacting with a product.</td>
</tr>
<tr>
<td></td>
<td>Negative Anticipated Experience</td>
<td>NAX</td>
<td>The unpleasant conditions, incidents, and feelings that a user anticipates experiencing with regard to using and interacting with a product.</td>
</tr>
<tr>
<td></td>
<td>Positive Prior Experience</td>
<td>PPX</td>
<td>The past pleasurable circumstances, occasions, and feelings experienced by the user, associated with product usage or with broader pertinent aspects of the product.</td>
</tr>
<tr>
<td></td>
<td>Negative Prior Experience</td>
<td>NPX</td>
<td>The past undesirable situations, occurrences, and feelings experienced by the user due to usage problems with a product or other product-relevant issues.</td>
</tr>
<tr>
<td></td>
<td>Experiential Knowledge</td>
<td>XK</td>
<td>a) A user’s understanding of a product and other product-relevant aspects based on his/her domain knowledge, acquired mostly through the user’s own and others’ previous experiences.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>b) Encompassing product analogy: ideas about product features inspired by, and adapted from, features or capabilities of other comparable products.</td>
</tr>
<tr>
<td><strong>Emotion</strong></td>
<td>Positive Anticipated Emotion</td>
<td>PAE</td>
<td>The pleasurable emotions that a user anticipates experiencing as a consequence of using and interacting with a product.</td>
</tr>
<tr>
<td></td>
<td>Negative Anticipated Emotion</td>
<td>NAE</td>
<td>The undesirable emotions that a user anticipates occurring as a result of using and interacting with a product.</td>
</tr>
<tr>
<td></td>
<td>Positive Prior Emotion</td>
<td>PPE</td>
<td>The pleasant emotions that took place in the user’s past product-related experience.</td>
</tr>
<tr>
<td></td>
<td>Negative Prior Emotion</td>
<td>NPE</td>
<td>The unpleasant emotions that were felt by the user in a prior experience with a particular product.</td>
</tr>
<tr>
<td><strong>Context</strong></td>
<td>Intended Use</td>
<td>IU</td>
<td>The usage purposes of a product that refer to environments of use, personal needs, social needs, and events or circumstances. These include usage procedures of specific product features or functions, and ways in which the user interacts with the product.</td>
</tr>
<tr>
<td></td>
<td>User Characteristics</td>
<td>UC</td>
<td>a) A person’s perception of his/her characteristics as a product user based on self-appraisal of his/her preferences, physical attributes, expertise, and experiences in using a specific product.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>b) User qualities that are believed appropriate for using a particular product or product feature.</td>
</tr>
</tbody>
</table>
Chapter 6: Experiment One

The exploration of the characteristics of anticipated user experience was partially based on Hassenzahl’s (2003, 2008) user experience model. The use of this model in this exploration aimed to examine the perceived importance of pragmatic and hedonic product qualities in the users’ experiences. To enable this examination, relevant sub-categories or codes under the Product Characteristic and Experience categories were given two additional attributes related to pragmatic and hedonic qualities (Table 6.3). Pragmatic quality is linked to usability, including ease of use, learnability, usefulness, efficiency, and performance; it mainly serves to facilitate task accomplishment (Hassenzahl, 2003). Conversely, hedonic quality is associated with stimulation, identification, and memory evocation; it supports the fulfilment of users’ psychological and basic needs, such as self-expression, personal development, and sense gratification (Hassenzahl, 2003).

<table>
<thead>
<tr>
<th>Categories</th>
<th>Sub-categories</th>
<th>Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Characteristic</td>
<td>Desired Product Characteristics</td>
<td>Desired Pragmatic Quality</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Desired Hedonic Quality</td>
</tr>
<tr>
<td></td>
<td>Dislike(s)</td>
<td>Negative Pragmatic Quality</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Negative Hedonic Quality</td>
</tr>
<tr>
<td></td>
<td>Favourable Existing Characteristics</td>
<td>Positive Pragmatic Quality</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Positive Hedonic Quality</td>
</tr>
<tr>
<td>Experience</td>
<td>Positive Anticipated Experience</td>
<td>PAX (pragmatic)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PAX (hedonic)</td>
</tr>
<tr>
<td></td>
<td>Negative Anticipated Experience</td>
<td>NAX (pragmatic)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NAX (hedonic)</td>
</tr>
</tbody>
</table>

These attributes were coded concurrently with their parent sub-category, depending on information about pragmatic and hedonic aspects manifest or implied in the coded text. For instance, the highlighted text in Figure 6.3, which had been coded with DPC, was also coded with the Desired Pragmatic Quality attribute, since the described product qualities (small and portable) were related to efficiency and ease in using the product to achieve certain tasks. In contrast, the text segment in Figure 6.4 was assigned a hedonic attribute, along with its parent sub-category, Positive Anticipated Experience. This was because the text represented a user’s expected meaningful experience of being socially connected to others by taking good photos and sharing them with friends and family. Hence, the experience was not related to the product’s usability, but to its ability to fulfil the user’s basic social needs.
As discussed in Section 5.1.2, the use of sketching in Experiment One aimed primarily to make the product concept that was conceived by participants more concrete, thus assisting them to anticipate their interactions and experiences with their product concept. Furthermore, participants’ sketches supported the coding and analysis of textual data by facilitating a better interpretation of their responses, and by providing extra information. To demonstrate, by looking at the icons and touch-screen concepts depicted in a participant’s sketch (Figure 6.5), it was found that the desired camera features were inspired through the participant’s experiential knowledge of smartphones (product analogy). This information helped to establish a relationship between the Desired Product Characteristics (DPC) and Experiential Knowledge (XK) sub-categories; that is, XK inspires DPC. The use of the colour pink for the camera concept might also indicate the desired hedonic qualities of uniqueness and femininity. This information, thus, helped to decide between pragmatic and hedonic attributes during the data coding.
Besides sketches, observational data (video recordings) supported the interpretation and analysis of the textual data. By observing the participant's gestures while he was describing his desired camera features (Figure 6.6), it was identified that he knew exactly where to find specific features on his product concept and how to operate them. Hence, his preference for the camera features was likely to be based on his experiential knowledge of his own cameras. This observation, accordingly, supported the inference that users’ experiential knowledge influences their conception of desired product characteristics.

Figure 6.6 Participant’s Gestures Observed through Video Recordings [Participant #17]

6.2.2 Relational Analysis

After completing the data coding, the relational (proximity) analysis was carried out to determine how sub-categories co-occurred in the data, in order to identify and define the connections among them. This analysis was conducted on the basis that: (1) the sub-categories represent important factors of anticipated user experience, and (2) by developing relationships among the sub-categories, conceptual maps can be constructed to understand the user’s process of anticipating experiences with products.

A sub-category co-occurs with another if it is applied to text segments that overlap with any text segments coded to the second sub-category. Figure 6.7 is an example of how the Desired Product Characteristics (DPC) sub-category co-occurred with Positive Anticipated Experience (PAX). It can be seen that the bordered text segment was also coded with Intended Use (IU), meaning that DPC also co-occurred with IU.
Chapter 6: Experiment One

There could be multiple co-occurrences of two sub-categories. All pairs of co-occurring sub-categories and their co-occurrence numbers were identified using the ATLAS.ti’s co-occurrence tool, and are shown in a matrix (Appendix H).

In order to determine the relationship between these sub-categories, all corresponding pairs of overlapping text segments were analysed, and their association interpreted. For instance, as seen in Figure 6.7, a user wanted a built-in feature of image filters that would allow him to directly apply image effects without using computer editing software (representing DPC). This produced an anticipation of pleasurable experience: he could enjoy the stimulating activities of playing with colour effects when taking pictures (representing PAX). From these text segments, it was noted that the desired product feature (DPC) acted as a stimulus for engendering positive anticipated experiences (PAX). Hence, the relationship between the two sub-categories was interpreted as ‘DPC engenders PAX’. This relationship was confirmed by checking its consistency over the other overlapping DPC- and PAX-coded text segments.

It is worth noting that the types of relationships emerging among the fourteen sub-categories were mostly directional. In other words, one sub-category was the ‘prime mover’ of another, such as ‘XK inspires DPC’ and ‘DPC engenders PAX’. Few pairs of sub-categories, however, produced a bidirectional relationship or an equal influence on each other.

In addition, although all pairs of the co-occurring sub-categories could be identified, only the most important ones were analysed, so as to avoid extremely complicated sub-category networks and irrelevant outcomes. The most relevant sub-categories were selected, and relationships between these sub-categories and each of the other
co-occurring sub-categories were then determined (Section 6.3.3). Finally, the established relationships were represented visually using nodes and arrows, which created conceptual maps or networks of sub-categories (Chapter 8).

6.3 RESULTS

By applying the coding scheme to textual data, extracting information during the coding, and performing the relational analysis, the results of Experiment One emerged. These results include the occurrence patterns of categories and sub-categories, the perceived importance of pragmatic and hedonic qualities in anticipating experiences, and the relationships among sub-categories.

6.3.1 Occurrences of Categories and Sub-categories

The coding of 20 sets of textual data produced a total of 2504 coded text segments. By counting the frequencies of each code applied to these texts, and grouping them into their corresponding categories, the occurrences of categories were determined.

Figure 6.8 illustrates that Product Characteristic (38.5%) is the predominant category. This suggests that in anticipating future experiences, users in this study heavily focus on their expectations, needs, and preferences for a desired product, as well as on their likes and dislikes of existing products. Experience and Context categories then follow, with proximate scores of 30.6% and 26.2% respectively. This indicates the substantial roles of experiential knowledge, prior experiences, and situations of product use in envisaging a desired product and future experiences. The Experience category also subsumes positive and negative anticipated experiences as the outcomes of the envisaging process.

Meanwhile, the Emotion category was expected to have a significant score, as emotions are considered to be closely intertwined with human experience (McCarthy and Wright, 2004a). However, its occurrence was considerably low (4.8%) compared to the other categories. This could be caused by the subjective, intangible, and fleeting nature of emotions, which could make it difficult for participants to recall, anticipate, and verbalise the emotions occurring during their experiences.
To explore this result more deeply, the categories were disaggregated into their sub-categories. Figure 6.9 exhibits the occurrences of each sub-category. The percentage of occurrence is obtained based on the fraction of text segments coded with a specific sub-category to the total number of text segments. The bar chart describes the pattern of participants’ responses in relation to imagining a desired digital camera, and to anticipating interactions and experiences with the imagined product.
Desired Product Characteristics (27.6%) is the most dominant response, followed by Intended Use (21%). The next most common sub-categories are Experiential Knowledge (11.1%) and Positive Anticipated Experience (10.7%), which rank closely together. Dislike(s) (8%), User Characteristics (5.3%), and Negative Anticipated Experience (4.6%) are the three other most common sub-categories. These are followed by Negative Prior Experience (3.1%), Positive Anticipated Emotion (3%), and Favourable Existing Characteristics (2.8%), which are very close in the occurrence hierarchy.

Lastly, a group of sub-categories with relatively similar occurrences come in the lowest positions: Positive Prior Experience (1%), Negative Prior Emotion (0.8%), Negative Anticipated Emotion (0.6%), and Positive Prior Emotion (0.3%). The above occurrence pattern of sub-categories contributes to the identification of characteristics of anticipated user experience, and is discussed in Chapter 8. These occurrences of sub-categories are also used as a criterion in selecting sub-categories for the relational analysis in Section 6.3.3.

6.3.2 Pragmatic and Hedonic Aspects of Product Characteristics and User Experience

The pragmatic and hedonic qualities of products are essential factors that influence the experience of product use (Hassenzahl, 2003, 2008). For this reason, this study analysed users’ perceptions of the importance of each quality for their desired products and anticipated experiences. The pragmatic and hedonic attributes (Table 6.3) that had been assigned to the data were quantified. Figure 6.10 presents the occurrences of pragmatic and hedonic aspects evident or implied in participants’ responses regarding product characteristics and experiences. The percentage of occurrence is calculated based on the ratio of pragmatic-coded text segments to hedonic-coded text segments for a specific sub-category. Pragmatic quality appears to be markedly more dominant than hedonic quality in both Product Characteristic and Experience categories.

When conceiving a desired product, or evaluating existing ones, participants in this study perceived pragmatic quality (e.g. ease of use, performance, and portability) as more important than its hedonic counterpart (e.g. aesthetic value and ability to
improve the users’ skills). This is seen in the occurrences of pragmatic attributes in Desired Product Characteristics (DPC), Favourable Existing Characteristics (FEC), and Dislike(s) (DL) sub-categories, which range from 74.4% to 92%. Similarly, in anticipating positive experiences with products (Positive Anticipated Experience [PAX]), or anticipating negative ones (Negative Anticipated Experience [NAX]), the pragmatic quality of the products was perceived to have a greater role. That is, 60.5% in PAX and 87.2% in NAX.

In Figure 6.10, it is noticed that the positive sub-categories (i.e. FEC and PAX) have a higher proportion of hedonic attribute compared to their negative counterparts (i.e. DL and NAX). Specifically, hedonic score in FEC is 25.6%, compared to only 8% in DL. Then, the score is 39.5% in PAX, against 12.8% in NAX. The above results provide important information to identifying the characteristics of anticipated user experience. Their implication is discussed in Sections 8.1.2, 8.2.2, and 9.2.

### 6.3.3 Relationships among Sub-categories

Four sub-categories considered the most important and relevant to the study were selected. Two sub-categories were selected based on their dominant occurrence in the data; the other two were selected based on their relevance to the research.
question. Then, relationships between these sub-categories and each of the other co-occurring sub-categories were developed. The purpose of this selective exploration was to concentrate on more specific concepts, and to obtain more meaningful results.

The first sub-category, *Desired Product Characteristics* (DPC), was selected for two reasons: its predominant occurrence in the data and its vital role in engendering anticipated experiences (Section 6.3.1). Next, *Intended Use* (IU), the second most dominant response, was selected. This sub-category referred to the purposes, situations, and procedures of product use. IU set the contexts for the conceptualisation of a desired product, and for the anticipation and recollection of users’ experiences. As user experience is dependent on context (Hassenzahl and Tractinsky, 2006; Law, et al., 2009), it was necessary to include IU in developing the sub-category relationships.

Besides the occurrence hierarchy, the research question was used as the basis for the sub-category selection. It guided the researcher to focus on the most relevant sub-categories in order to effectively address the inquiry. Based on the first research sub-question, ‘anticipated experience’ was the central element of this study. Hence, *Positive Anticipated Experience* (PAX) and *Negative Anticipated Experience* (NAX) were included as part of the main sub-categories for the relational analysis.

**Relationships between Desired Product Characteristics and Other Sub-categories**

*Desired Product Characteristics* (DPC) co-occurs with nine other sub-categories, as presented in Table 6.4, along with their percentages of co-occurrences. The higher the percentage, the more frequent the co-occurrence between two sub-categories; this suggests a stronger relationship between them. For example, the co-occurrence between DPC and *Intended Use* (IU) has the highest percentage score of 58.6%. It stands out significantly from the other scores, indicating that the purposes and situations of product use are the major influences in conceiving a desired product. These percentages of co-occurrence were used as a basis for determining the ranking or hierarchy of sub-category relationships.

Based on their co-occurrences, relationships between DPC and the nine sub-categories were developed and presented in Table 6.4. Figure 6.7 has previously illustrated how the relationship ‘DPC engenders PAX’ was determined.
### Table 6.4 Relationships between Desired Product Characteristics (DPC) and Nine Sub-categories

<table>
<thead>
<tr>
<th>Co-occurring Sub-categories</th>
<th>Ranking</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>IU</td>
<td>1 (58.6%)</td>
<td><strong>IU underlies and defines DPC:</strong> Usage purposes, perceived interactions, and situations of use form a basis for the ideation of a desired product. Intended use also makes the desired product concept more tangible and detailed, by defining how its features are operated or used.</td>
</tr>
<tr>
<td>XK</td>
<td>2 (19.5%)</td>
<td><strong>XK inspires DPC:</strong> Users’ experiential knowledge – acquired from learning, prior experiences, and familiarity with analogous artefacts – provides ideas for conceptualising desired product characteristics.</td>
</tr>
<tr>
<td>PAX</td>
<td>3 (7.3%)</td>
<td><strong>DPC engenders PAX:</strong> The imagined desired product acts as a principal stimulus in generating positive anticipated experiences with that product.</td>
</tr>
<tr>
<td>UC</td>
<td>4 (6.4%)</td>
<td><strong>UC influences DPC:</strong> Users’ characteristics affect their preferences for a product, their perceptions of their ability to use a product, and their perceptions of how they will use a product; thus, users’ characteristics determine their desired product characteristics.</td>
</tr>
<tr>
<td>NAX</td>
<td>5 (3.2%)</td>
<td><strong>NAX inspires DPC:</strong> Negative anticipated experiences with problematic products inspire product characteristics that are perceived to be useful in avoiding undesirable future experiences.</td>
</tr>
<tr>
<td>DL</td>
<td>6 (2.3%)</td>
<td><strong>DL inspires DPC:</strong> Dislike of certain product features produces a need for their removal, improved versions, or new substitutes.</td>
</tr>
<tr>
<td>FEC</td>
<td>7 (1.8%)</td>
<td><strong>FEC is part of DPC:</strong> Favourable characteristics of existing products contribute to the constituents of a desired product.</td>
</tr>
<tr>
<td>NPX</td>
<td>8 (0.5%)</td>
<td><strong>NPX inspires DPC:</strong> Negative prior experiences with products underlie ideas for product characteristics that are perceived as being able to prevent the re-occurrence of unpleasant experiences.</td>
</tr>
<tr>
<td>PAE</td>
<td>9 (0.5%)</td>
<td><strong>DPC engenders PAE:</strong> The desired product is a stimulus to evoke positive anticipated emotions related to the prospective use of that product.</td>
</tr>
</tbody>
</table>

Legend: DL (Dislike[s]), FEC (Favourable Existing Characteristics), IU (Intended Use), NAX (Negative Anticipated Experience), NPX (Negative Prior Experience), PAE (Positive Anticipated Emotion), PAX (Positive Anticipated Experience), UC (User Characteristics), XK (Experiential Knowledge)

### Relationships between Intended Use and Other Sub-categories

*Intended Use (IU)* co-occurs with most other sub-categories (Table 6.5); it influences nearly every factor in the process of imagining desired products and anticipating experiences. IU co-occurs most frequently with *Desired Product Characteristics* (DPC) (41.5%), and then with *Positive Anticipated Experience* (PAX) (26.7%). These notably high scores (compared to the others) denote a particularly close relationship between IU and the two sub-categories.
Table 6.5 Relationships between *Intended Use* (IU) and Eleven Sub-categories

<table>
<thead>
<tr>
<th>Co-occurring Sub-categories</th>
<th>Ranking</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPC 1 (41.5%)</td>
<td>See Table 6.4</td>
<td></td>
</tr>
<tr>
<td><strong>IU sets contexts of PAX:</strong></td>
<td></td>
<td>Intended use establishes the contexts of positive anticipated experience by setting the situations, purposes, and procedures of product use. It also determines how users will interact with the product within the experience.</td>
</tr>
<tr>
<td>PAX 2 (26.7%)</td>
<td></td>
<td><strong>IU sets contexts of NAX:</strong></td>
</tr>
<tr>
<td>NAX 3 (9.3%)</td>
<td></td>
<td>Intended use sets the contexts of negative anticipated experience by defining the situations, purposes, and procedures of product use. It also defines perceived user-product interactions within the experience.</td>
</tr>
<tr>
<td>X K 4 (7.4%)</td>
<td></td>
<td><strong>IU characterises XK:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intended use that is mainly related to purposes and procedures of product use describes and characterises users’ experiential knowledge.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>XK influences IU:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Experiential knowledge of comparable artefacts creates product analogy, and influences users’ perception of how they will use their desired product.</td>
</tr>
<tr>
<td>NPX 5 (4.2%)</td>
<td></td>
<td><strong>IU sets contexts of NPX:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Purposes and situations (e.g. time and place) of product use set the contexts of negative past experiences with the product.</td>
</tr>
<tr>
<td>UC 6 (4.2%)</td>
<td></td>
<td><strong>UC influences IU:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>User characteristics affect the usage purposes of a product, as well as the situations and ways in which it will be used.</td>
</tr>
<tr>
<td>DL 7 (3.9%)</td>
<td></td>
<td><strong>DL influences IU:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Users’ dislike of certain characteristics of a product influences how they will use the product.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>IU sets contexts of DL:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intended use describes the purposes and situations of product use in which the dislikes of a product become a problem or cause difficulties for its users.</td>
</tr>
<tr>
<td>FEC 8 (1.6%)</td>
<td></td>
<td><strong>IU underlies FEC:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intended use, encompassing purposes and procedures of product use, underlies why certain characteristics of existing products are favoured.</td>
</tr>
<tr>
<td>PPX 9 (0.6%)</td>
<td></td>
<td><strong>IU sets contexts of PPX:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Purposes and situations of product use set the contexts of positive prior experiences with the product.</td>
</tr>
<tr>
<td>PAE 10 (0.3%)</td>
<td></td>
<td><strong>IU sets contexts of PAE:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intended use sets the situations of product use in which users’ positive emotions are anticipated to occur.</td>
</tr>
<tr>
<td>PPE 11 (0.3%)</td>
<td></td>
<td><strong>IU sets contexts of PPE:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intended use describes the purposes and situations of product use</td>
</tr>
</tbody>
</table>
Chapter 6: Experiment One

Legend: DL (Dislike[s]), DPC (Desired Product Characteristics), FEC (Favourable Existing Characteristics), NAX (Negative Anticipated Experience), NPX (Negative Prior Experience), PAE (Positive Anticipated Emotion), PAX (Positive Anticipated Experience), PPE (Positive Prior Emotion), PPX (Positive Prior Experience), UC (User Characteristics), XK (Experiential Knowledge)

Figure 6.11 illustrates the co-occurrence between IU and PAX sub-categories. It describes how a user anticipated his positive experience of undertaking adventurous activities while in possession of a digital camera that was highly capable, yet robust enough to survive in extreme conditions (representing PAX). He situated the experience by imagining a trip involving hiking and skiing down mountains, and arriving at the top of a mountain where the camera was purposefully used to capture breathtaking scenery (representing IU). Hence, the emerged relationship between the two sub-categories was interpreted as ‘IU sets contexts of PAX’. The complete relationships between IU and the other sub-categories are summarised in Table 6.5.

**Figure 6.11 Co-occurrence between Intended Use (IU) (highlighted) and Positive Anticipated Experience (PAX) (bordered) Sub-categories [Participant #31]**

**Relationships between Positive Anticipated Experience and Other Sub-categories**

Six sub-categories co-occur with Positive Anticipated Experience (PAX), as shown in Table 6.6. The co-occurrence between PAX and Intended Use (IU) has the highest score of 52.5%; this is indicative of the important function of intended use of a product in envisaging positive experiences. The co-occurrence with Positive Anticipated Emotion (PAE) holds the next place with a score of 30.4%; this signifies that emotions are also an inseparable component of user experience. Examples of how to define the relationships between PAX and the other sub-categories can be
seen in the explanations of Figure 6.7 and Figure 6.11. Table 6.6 presents the six defined relationships.
Table 6.6 Relationships between Positive Anticipated Experience (PAX) and Six Sub-categories

<table>
<thead>
<tr>
<th>Co-occurring Sub-categories</th>
<th>Ranking</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>IU</td>
<td>1</td>
<td>(52.5%) PAX is part of PAX:</td>
</tr>
<tr>
<td>PAE</td>
<td>2</td>
<td>(30.4%) Positive anticipated emotions are often embedded in the user’s positive anticipated experience, and augment the experience's nuance and intensity.</td>
</tr>
<tr>
<td>DPC</td>
<td>3</td>
<td>(10.1%) See Table 6.4</td>
</tr>
<tr>
<td>UC</td>
<td>4</td>
<td>(3.8%) UC influences and sets contexts of PAX:</td>
</tr>
<tr>
<td>XK</td>
<td>5</td>
<td>(2.5%) XK supports PAX:</td>
</tr>
<tr>
<td>FEC</td>
<td>6</td>
<td>(0.6%) FEC engenders PAX:</td>
</tr>
</tbody>
</table>

Legend: DPC (Desired Product Characteristics), FEC (Favourable Existing Characteristics), IU (Intended Use), PAE (Positive Anticipated Emotion), UC (User Characteristics), XK (Experiential Knowledge)

Relationships between Negative Anticipated Experience and Other Sub-categories

As is the case with the Positive Anticipated Experience (PAX) sub-category, Negative Anticipated Experience (NAX) co-occurs with six other sub-categories (Table 6.7). The co-occurrence with Intended Use (IU) generates, again, the highest frequency proportion (54.7%), which prominently outperforms the other scores.

Through Figure 6.12, the interpretation of relationship between NAX and Negative Anticipated Emotion (NAE) sub-categories is demonstrated. In this example, a user anticipated that she would feel frustrated when using a digital camera with a complex, nested menu system (representing NAE). Here, she expected to experience difficulties in finding a feature she wanted to use, and to become lost inside the menu system (representing NAX). It was noted that the negative emotion was embedded within the negative experience. Therefore, the way in which NAX and NAE were connected was interpreted as ‘NAE is part of NAX’. Table 6.7 explains all relationships between NAX and the six sub-categories.
Table 6.7 Relationships between Negative Anticipated Experience (NAX) and Six Sub-categories

<table>
<thead>
<tr>
<th>Co-occurring Sub-categories</th>
<th>Ranking</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>IU</td>
<td>1 (54.7%)</td>
<td>See Table 6.5</td>
</tr>
<tr>
<td>NAE</td>
<td>2 (17.0%)</td>
<td>Negative anticipated emotions are often embedded in the user’s negative anticipated experience, and accentuate the experience.</td>
</tr>
<tr>
<td>DPC</td>
<td>3 (13.2%)</td>
<td>See Table 6.4</td>
</tr>
<tr>
<td>XK</td>
<td>4 (7.5%)</td>
<td>Users’ experiential knowledge of a product and other product-relevant aspects underlies negative anticipated experiences related to perceived product problems.</td>
</tr>
<tr>
<td>DL</td>
<td>5 (5.7%)</td>
<td>Users’ dislike of certain characteristics of a product generates negative anticipated experiences with the product.</td>
</tr>
<tr>
<td>UC</td>
<td>6 (1.9%)</td>
<td>Users’ characteristics determine how they envisage problems and difficulties when using a product, influencing the content of negative anticipated experiences with the product.</td>
</tr>
</tbody>
</table>

Legend: DL (Dislike[s]), DPC (Desired Product Characteristics), IU (Intended Use), NAE (Negative Anticipated Emotion), UC (User Characteristics), XK (Experiential Knowledge)

**Networks of Sub-categories**

As mentioned earlier, the relationships among sub-categories can help to build an understanding of how users anticipate their experiences with interactive products. Thus, they help to address the first research sub-question. This role of the sub-category relationships is explained and discussed in Section 8.1.3.

The sub-category relationships and their rankings, presented in Tables 6.4, 6.5, 6.6, and 6.7, are the foundation for developing conceptual maps in the form of two sub-
category networks. The first network represents the user’s process of imagining or conceiving a desired product. This network is constituted of the Desired Product Characteristics (DPC) sub-category and its co-occurring sub-categories (Table 6.4). The second network represents the user’s process of anticipating positive experiences with a desired product. It comprises the Positive Anticipated Experience (PAX) sub-category and its six co-occurring sub-categories (Table 6.6).

These two networks form the Anticipated User Experience (AUX) Framework (Figure 8.1), which is the main outcome of this research. This framework is described and discussed in Section 8.1.3, and its significance related to experience-centred design in the early stages of product development is explained in Section 9.3.

6.4 SUMMARY

This chapter described how Experiment One was conducted to investigate anticipated user experience. It explained the procedures of data collection, which involved co-discovery, sketching, and observation methods. The process of data analysis consisted of data coding and relational analysis, through which the coding scheme and relationships among sub-categories were developed.

Experiment One produced three main results: (1) important elements of anticipated user experience in the form of categories and sub-categories, (2) perceived importance of pragmatic and hedonic qualities in anticipating future experiences with products, and (3) relationships among the sub-categories. These results can be summarised as follows:

- A desired product and intended use of a product are the most dominant aspects in the formation of anticipated user experience (Section 6.3.1).
- The pragmatic quality of a product is perceived to be a dominant factor that influences both positive and negative anticipated user experiences. At the same time, the hedonic quality is considerably more valued in positive than in negative anticipated experience (Section 6.3.2).
- The Desired Product Characteristics sub-category co-occurs and forms relationships with nine other sub-categories. Meanwhile, the Positive
Chapter 6: Experiment One

*Anticipated Experience* sub-category co-occurs and forms relationships with six sub-categories (Section 6.3.3).

Through these sub-category relationships, it is found, for example, that a desired product is the primary stimulus for engendering users’ positive anticipated experiences. These relationships, together with their rankings, become the foundation for developing the Anticipated User Experience (AUX) Framework in Section 8.1.3.

These results addressed the first research sub-question pertaining to the characteristics of anticipated user experience, and to the user’s process of anticipating positive experiences with products.

The next chapter reports on Experiment Two, which is designed to explore the characteristics of real user experience. Its results are combined and compared with those of Experiment One in order to answer the second research sub-question.
Chapter 7: Experiment Two

This chapter presents the second stage of the research, namely Experiment Two. As seen in Chapter 6, Experiment One produced results related to the characteristics of anticipated user experience and the user’s process of anticipating positive experiences with interactive products. Meanwhile, Experiment Two was undertaken to identify the characteristics of real user experience in order to address the second research sub-question:

What are the differences between anticipated and real user experiences?

Knowledge of these differences leads to the development of strategies and recommendations to support early assessment of user experience in the process of product design.

This chapter describes the process of data collection in Experiment Two, introducing the apparatus and procedure used for the experiment. Analysis of the collected data is then outlined, and is followed by an explanation of the results.

7.1 DATA COLLECTION

The most important difference between Experiment One and Experiment Two was in the use of an actual product. While Experiment One focused on participants’ anticipated experiences with an imagined digital camera concept, Experiment Two explored participants’ actual experiences with a real digital camera.

To gather the data, Experiment Two employed a combination of three methods that was slightly different to the combination used in Experiment One. The methods used
were co-discovery, experience diary, and observation – each of which has been explained and justified in Sections 5.1.1, 5.1.3, and 5.1.4, respectively. The data collection was conducted from July to December 2011. Table 7.1 gives a summary of Experiment Two.

Table 7.1 Experiment Two: Summary

<table>
<thead>
<tr>
<th>Experiment Aspects</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Objectives**     | • To identify the characteristics of real user experience.  
                    • To investigate the differences between anticipated and real user experiences. |
| **Methods**        | Experience diary, co-discovery, and observation. |
| **Setting**        | • Experience diary sessions took place in participants’ own environments (e.g. home, workplaces, beaches, parks).  
                    • Co-discovery and observation sessions were conducted in the People and Systems Laboratory, Queensland University of Technology (Gardens Point Campus, Brisbane, Australia). |
| **Apparatus**      | Experience diaries, digital cameras, task cards, a digital audio recorder, digital video recorders, and tripods. |
| **Experiment procedure** | • In the experience diary session, each participant was asked to use a given digital camera over a period of three days. At the end of each day, they were asked to reconstruct their activities of the day and then, using a provided experience diary, to report the three most impactful experiences that related to the digital camera.  
  • In a co-discovery session, a pair of participants was asked to share their experiences of using the digital camera, covering the overall experience, the most impactful experiences, the purposes of product use, perceptions of the product, and fulfillment of their expectations.  
  • Observation of the co-discovery session through video recordings was conducted to support verbal data analysis. |
| **Time**           | • Experience diary: 3 days of camera usage.  
                    • Co-discovery and observation: 30 minutes. |
| **Participants**   | • Forty participants individually took part in the experience diary session. They were then paired to participate in the co-discovery and observation sessions.  
                    • The participants represented product users of different categories of gender, age, cultural background, and experience in using digital cameras.  
                    • Selection criteria: at least 18 years old, and familiar with digital cameras. |
Chapter 7: Experiment Two

7.1.1 Apparatus

As mentioned earlier, to investigate real user experience with interactive products, Experiment Two involved the use of a digital camera (the reasons for selecting this product category have been discussed in Section 5.3). The experiment used a point-and-shoot camera, as this camera type would be more familiar to all user categories than the DSLR one. Specifically, the Samsung ST600 digital camera was selected due to its unique features of front display and large touch-screen panel (Figure 7.1). The camera was provided to participants in its original box, accompanied by an AC adapter/USB cable, rechargeable battery, 4GB memory card, strap, camera case, and user manual CD-ROM.

![Samsung ST600 Digital Camera](http://www.samsung.com/us/photography/digital-cameras/EC-ST600ZBPBUS-gallery)

For reporting their experiences of using the digital camera, the participants were provided with an experience diary (Appendix I). The diary consisted of four main parts: (1) experiment procedures, (2) instructions for filling out the diary, (3) blank tables for reconstructing experiences, and (4) blank boxes for reporting the most significant experiences of the day. The diary was given in both physical and electronic (Microsoft Word file) forms.

The co-discovery sessions were conducted in the People and Systems Laboratory at the Queensland University of Technology, Australia. The laboratory setting is shown in Figure 7.2. To prompt the participants’ discussion in the co-discovery session, a series of task cards, each of which contained one or two instructions or questions (Appendix E), were utilised. The cards were set on A5 paper. They were positioned face down on the table, ordered according to the sequence of tasks.
Each co-discovery session was captured using digital audio and video recorders. Two Canon Legria HF S21 video cameras with tripods were positioned to front-left and front-right of the participants (Figure 7.2) to clearly capture each participant’s face and gestures. For the purpose of creating backup data, an iPhone was set in the centre of the table and used to record the participants’ discussion.

7.1.2 Procedure

Forty participants participated in Experiment Two (their recruitment process and profile were described in Section 5.4 and Appendix D). Eleven of these participants had also participated in Experiment One (the use of the same participants was considered valid, as the two experiments were separated by approximately one-year interval). It was ensured that no participants had used the Samsung ST600 digital camera before (although they might have used similar or prior models), so that each could experience the use of a new product. The participants first took part in the experience diary session, before participating in the co-discovery session. During a briefing, they were given an experience diary together with a Samsung ST600 digital camera and its auxiliary items. They were introduced to the research aim and the experiment procedure, and were informed how to fill out the experience diary. Any questions from the participants were addressed and informed consent (Appendix A) was obtained.
Chapter 7: Experiment Two

**Experience Diary Session**
The procedure for the experience diary session was adopted from the Day Reconstruction Method (Kahneman, et al., 2004b; Karapanos, et al., 2009). Participants were asked to explore and use the given digital camera over a period of three days. This was done in their own environments (e.g. home, workplaces, and recreational sites) without the presence of the researcher. No specific usage requirements – such as camera settings, objects captured, and time of use – were given, so that the participants could experience the product use in natural, actual, and spontaneous contexts.

At the end of each day, participants were required to perform two tasks: reconstructing and reporting their experiences. In experience reconstruction, they recalled their activities during the day as a sequence of contiguous episodes. They then recorded, in a table in their experience diary (Appendix I), all episodes that related in some way to the digital camera. A short title, starting and finishing times, location, and a brief note about what happened and how they felt were recorded for each experience episode. Next, in experience report, participants selected the three most significant experiences (either positive or negative) from their list of the day’s episodes. For each of the selected episodes, they were asked to write a story, describing in detail their experiences with the digital camera.

In relation to the session duration, the three-day period was considered a sufficient time for the participants to experience and become familiar with the given product. At the same time, it was also deemed suitable in terms of the time feasibility of the study. However, participants who had difficulties in completing the tasks in three consecutive days were able to take extra days to do so. In other words, a participant might take a week to complete the experience diary, reporting his/her experiences of using the camera on any three days of that week.

**Co-discovery Session**
Once the experience diary stage was accomplished, the completed diary and the digital camera were returned to the researcher. The participants were then paired and scheduled to participate in the co-discovery session. As in Experiment One, participants who were friends or acquaintances were prioritised to be partnered in
order to encourage rich discussion between them (Jordan, 2000). This co-discovery session was intended to clarify the contents of the submitted diaries, so that they could be interpreted more accurately. More importantly, it was used to gain additional information, including any participant opinions, expectations, experiences, and feelings that had not been incorporated in the diaries.

In the session room (Figure 7.2), the two participants were asked to introduce themselves if they were not already acquainted. The overview of the tasks was then explained to them. It was stressed that they would mostly communicate with each other during the session, while the researcher would take the role of passive observer. This was to minimise any researcher remarks that might influence their discussion. In addition, the participants were informed that they could consult their diary and interact with the Samsung ST600 camera to help them explain and illustrate their stories. After answering any questions the participants had, all recording instruments were turned on and the session began.

Through a series of task cards (Appendix E), the participants were prompted to share, discuss, and compare their responses to the following topics: (1) overall experience with the provided camera, (2) the most impactful experiences (either positive or negative) that in some way related to the camera, (3) purposes and procedures of the camera use, (4) feelings and impressions of the camera, and (5) perception of their experiences compared to their expectations or anticipation. Figure 7.3 illustrates two participants exchanging their experiences in a co-discovery session. The session lasted between 17 and 45 minutes. The participants were then thanked for their contributions.

Observation of the participants’ activities during the co-discovery session was conducted by viewing the video recordings. The observation supported the interpretation and analysis of verbal data, by identifying the participants’ gestures that supported and enriched their comments. This observation might also provide behavioural information that could be linked to the participants’ experiences with the given digital camera.
7.2 DATA ANALYSIS

The collected data from experience diaries (i.e. reports of the most significant experiences) were organised and converted into transcripts. Similarly, verbal data from the co-discovery sessions were transcribed verbatim (Appendix F), and then combined with the experience diary transcripts for further analysis. The technique and procedure of data analysis (Section 5.5) that were used in Experiment One were also used in Experiment Two. The ATLAS.ti software was employed to assist the analysis process. This section outlines the data coding and relational analysis phases. The established coding scheme is introduced and described.

7.2.1 Data Coding

This analysis phase classified the textual data into categories and sub-categories. Six categories – Context, Emotion, Experience, Product Quality, Familiarisation, and Expectation Disconfirmation – and sixteen sub-categories were identified and then transformed into a coding scheme (Table 7.2). While a number of these categories and sub-categories were derived entirely from the Experiment Two data (e.g. Familiarisation), some others were adopted from the Experiment One results (e.g. Context) and from the existing theories (e.g. Expectation Disconfirmation). The coding scheme was also informed by the initial coding scheme developed in the pilot
study. The six colours in Table 7.2 are used to represent the six categories in the sub-category networks (Chapter 8).

Table 7.2 Experiment Two: Coding Scheme

<table>
<thead>
<tr>
<th>Categories</th>
<th>Sub-categories</th>
<th>Codes</th>
<th>Scope of Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product Quality</strong></td>
<td>Desired Product Characteristics</td>
<td>DPC</td>
<td>All aspects of a product that a user wants or expects, embracing features, functions, pragmatic qualities, hedonic qualities, and auxiliary items.</td>
</tr>
<tr>
<td></td>
<td>Dislike(s)</td>
<td>DL</td>
<td>The dissatisfaction with and dislikes of a product that mainly relate to its weaknesses, limitations, and poor performance. These are based on the user's negative judgments of the product's quality.</td>
</tr>
<tr>
<td></td>
<td>Favourable Product Characteristics</td>
<td>FPC</td>
<td>The product’s qualities, features, and performance that a user likes, based on his/her positive judgments of the product.</td>
</tr>
<tr>
<td><strong>Experience</strong></td>
<td>Positive Experience</td>
<td>PX</td>
<td>The pleasant situations, events, and feelings experienced by the user when using and interacting with a product.</td>
</tr>
<tr>
<td></td>
<td>Negative Experience</td>
<td>NX</td>
<td>The unpleasant conditions, incidents, and feelings experienced by the user due to usage problems with a product or other product-relevant issues.</td>
</tr>
<tr>
<td></td>
<td>Experiential Knowledge</td>
<td>XK</td>
<td>A user’s relevant prior experiences and knowledge, mostly related to comparisons between the tested product and other similar products. This also describes the user's skills and knowledge in using relevant technologies.</td>
</tr>
<tr>
<td><strong>Emotion</strong></td>
<td>Positive Emotion</td>
<td>PE</td>
<td>The pleasant emotions that are felt by the user when experiencing the use of a product.</td>
</tr>
<tr>
<td></td>
<td>Negative Emotion</td>
<td>NE</td>
<td>The undesirable emotions that are felt by the user when experiencing the use of a product.</td>
</tr>
<tr>
<td><strong>Context</strong></td>
<td>Intended Use</td>
<td>IU</td>
<td>The usage purposes of a product that refer to environments of use, personal needs, social needs, and events or circumstances. These include usage procedures of specific product features or functions, and how the user interacts with the product.</td>
</tr>
<tr>
<td></td>
<td>User Characteristics</td>
<td>UC</td>
<td>A person's perception of his/her characteristics as a product user based on self-appraisal of his/her preferences, physical attributes, expertise, and experiences in using a product.</td>
</tr>
<tr>
<td><strong>Familiarisation</strong></td>
<td>Exploration and Learning</td>
<td>EL</td>
<td>A user’s process of becoming familiar with a product by exploring and playing with its features, testing or experimenting, reading the instruction manual, and asking other users.</td>
</tr>
</tbody>
</table>
|                             | Discovery                                  | DV    | a) The features or capabilities that are found by the user when exploring a product, including the way in which these features create a new way of using the product.  
b) A user's discovery of previously unclear or confusing function of a feature, how it works, and how to find and operate it. |
|                             | Usage and Learnability Problem             | ULP   | A user’s problems in using a product due to difficulties in understanding certain features of the product: what their functions are, how they work, how to find them, and how to use them. |
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Table 7.2 Experiment Two: Coding Scheme (Continued)

<table>
<thead>
<tr>
<th>Expectation Disconfirmation</th>
<th>PED</th>
<th>A user’s judgment that the product’s qualities and performance are better than anticipated.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive Expectation</td>
<td>PED</td>
<td>A user’s judgment that the product’s qualities and performance are better than anticipated.</td>
</tr>
<tr>
<td>Disconfirmation</td>
<td>NED</td>
<td>A user’s judgment that the product’s qualities and performance are poorer than expected.</td>
</tr>
<tr>
<td>Negative Expectation</td>
<td>NED</td>
<td>A user’s judgment that the product’s qualities and performance are poorer than expected.</td>
</tr>
<tr>
<td>Disconfirmation</td>
<td>NuED</td>
<td>A user’s judgment that the product’s qualities and performance meet his/her expectations.</td>
</tr>
<tr>
<td>Neutral Expectation</td>
<td>NuED</td>
<td>A user’s judgment that the product’s qualities and performance meet his/her expectations.</td>
</tr>
</tbody>
</table>

The application of the coding scheme to participants’ reports and comments was very similar to the process described in Section 6.2.1. Appendix G provides examples of how the textual data were interpreted according to the coding scheme, and how each sub-category or code was applied to the data. As with Experiment One, the data analysis also focused on the pragmatic and hedonic aspects of the product and how these shaped the users’ experiences. The pragmatic and hedonic attributes (Table 7.3), accordingly, were coded alongside the sub-categories that belonged to Experience and Product Quality categories (with the exception of the Experiential Knowledge sub-category).

Table 7.3 Experiment Two: Pragmatic and Hedonic Attributes

<table>
<thead>
<tr>
<th>Categories</th>
<th>Sub-categories</th>
<th>Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Quality</td>
<td>Desired Product Characteristics</td>
<td>Desired Pragmatic Quality</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Desired Hedonic Quality</td>
</tr>
<tr>
<td></td>
<td>Dislike(s)</td>
<td>Negative Pragmatic Quality</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Negative Hedonic Quality</td>
</tr>
<tr>
<td></td>
<td>Favourable Product Characteristics</td>
<td>Positive Pragmatic Quality</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Positive Hedonic Quality</td>
</tr>
<tr>
<td>Experience</td>
<td>Positive Experience</td>
<td>Pragmatic Positive Experience</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hedonic Positive Experience</td>
</tr>
<tr>
<td></td>
<td>Negative Experience</td>
<td>Pragmatic Negative Experience</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hedonic Negative Experience</td>
</tr>
</tbody>
</table>

Figure 7.4 Hedonic Positive Experience [Participant #26]
Figure 7.4 illustrates a user's positive experience in using the given digital camera, where the use of its particular feature was stimulating (provided a sense of fun), engendered a feeling of relatedness (e.g. when she took photographs with her grandson), and created pleasurable memories (by providing memorable visual records of events). In this experience, the hedonic quality of the camera played a greater role in shaping the user's positive experience, as it facilitated the fulfilment of her psychological needs. Thus, the *Hedonic Positive Experience* attribute was assigned to the text. Other examples of the application of these pragmatic and hedonic attributes can be seen in Appendix G.

Throughout the data coding, important information and relevant findings were derived and recorded. Meanwhile, observational data from video recordings were used to support and facilitate the interpretation and coding of the data. These have been explained and illustrated in Section 6.2.1.

### 7.2.2 Relational Analysis

As in Experiment One, the relational (proximity) analysis was conducted once the data coding was completed. The relational analysis procedure has been largely described in Section 6.2.2. This analysis phase identified the co-occurrences among sub-categories to determine and define their relationships. Since the sub-categories represented the key factors of real user experience, developing conceptual maps of their relationships could characterise the experience.

The co-occurrence matrix in Appendix H exhibits the frequency of co-occurrences between pairs of sub-categories. One or more co-occurrences between two sub-categories indicate that there may be a connection between them. A higher co-occurrence number signifies a stronger relationship between the two sub-categories. The details and results of the relational analysis are given in Section 7.3.3.

### 7.3 RESULTS

This section presents the results of data analysis, including the occurrences of categories and sub-categories, the pragmatic and hedonic aspects perceived in real
user experience, and the relationships among sub-categories that characterise the experience.

7.3.1 Occurrences of Categories and Sub-categories

The experience diaries produced 342 experience reports, with an average of 8.6 reports per participant. Each report contained information about a specific episode of experience, which included some or all of the following details: the situations of product use, events that occurred, activities that the participants undertook, their personal feelings, and their impressions of the product during that episode. Meanwhile, the participants’ responses to the co-discovery tasks produced 20 transcripts of textual data. The coding of the experience diary and co-discovery data using the coding scheme generated 2561 coded text segments. The occurrences of categories and sub-categories associated with these text segments are represented in Figure 7.5 and Figure 7.6.

![Figure 7.5 Occurrences of Categories](image)

Based on Figure 7.5, the dominance of the *Product Quality* category (32.1%) shows that, when actually experiencing product use, users in this study tend to extensively evaluate and judge the product’s quality and performance. This is manifested by their likes and dislikes of the product, and their expectations for its improvement. Next,
the high occurrence of the Context category (23.1%) indicates that the purposes and situations of product use have a great impact on the formation of the users’ experiences. Again, this is in line with the existing theory that user experience is context-dependent (Hassenzahl and Tractinsky, 2006; Law, et al., 2009).

The experience with an actual new product involves the users’ inevitable process of becoming accustomed to the product. This is reflected in the Familiarisation category (17.1%), which embraces product exploration, the discovery of features and functions, and usage problems. With a nearly identical score to that for the Familiarisation category, Experience (17%) ranks fourth in the category hierarchy. This category represents positive and negative events and feelings related to product use, as well as users’ relevant prior experiences and knowledge.

The last two categories with the lowest occurrence scores are Emotion (7.5%) and Expectation Disconfirmation (3.1%). As a consequence of encountering a product, users feel both positive and negative emotions and, at the same time, perceive the product as meeting, exceeding, or falling below their expectations. The participants, however, only infrequently reported how their expectations of the product and their experiences with it were fulfilled.

Figure 7.6 Occurrences of Sub-categories
Consistent with the pattern of category occurrences, sub-categories that are related to users’ evaluation of the tested product dominate the sub-category occurrences (Figure 7.6). In the case of this study, Favourable Product Characteristics (16.8%) is the leading sub-category, and Dislike(s) (11.8%) is the third most common sub-category. However, Desired Product Characteristics (3.4%) holds only tenth place in the sub-category occurrences. This sub-category mainly relates to users’ expectations of better versions of the tested product after they have evaluated it.

Intended Use (16.2%) is the second most common sub-category, whereas User Characteristics (7%) is the sixth; these two sub-categories constitute the Context category. Positive Experience (5%) and Negative Experience (3%), as the outcomes of experiencing a product, rank eighth and twelfth respectively in the occurrence hierarchy. The above occurrence pattern of sub-categories provides input for identifying the characteristics of real user experience (this is discussed in Section 8.2). This occurrence pattern is also used as a basis for selecting sub-categories for the relational analysis in Section 7.3.3.

7.3.2 Pragmatic and Hedonic Aspects of Product Quality and User Experience

The quantification of pragmatic and hedonic attributes (Table 7.3) coded to the data underlay the occurrence patterns of these attributes in users’ appraisal of a product’s quality and their experiences with the product (Figure 7.7). With regard to product quality, participants perceived the product’s pragmatic attributes to be more important than its hedonic attributes. This is indicated by the much higher occurrences of pragmatic aspects than hedonic aspects in the Desired Product Characteristics, Favourable Product Characteristics, and Dislike(s) sub-categories, with scores for pragmatic aspects ranging from 84.7% to 95.1%.

In relation to user experience, however, the hedonic quality of a product appears to have a greater influence in shaping the users’ positive experiences, as more than 65% of the reported positive experiences are related to hedonic aspects (Figure 7.7). In contrast, only 19.5% of the reported negative experiences are related to hedonic aspects; this suggests that the negative experiences are mainly attributable to the users’ perception of poor pragmatic quality of a product.
As in Experiment One, each positive sub-category always contains a higher proportion of hedonic attribute than does its negative counterpart. In particular, the Favourable Product Characteristics sub-category holds 15.3% of hedonic attribute, whereas Dislike(s) holds only 4.9%. Likewise, the hedonic attribute scores 65.5% in Positive Experience, compared to 19.5% in Negative Experience. The above occurrence patterns of pragmatic and hedonic attributes shapes the characteristics of real user experience (Section 8.2.2). The implication of this knowledge for design for experience is discussed in Section 9.2.

7.3.3 Relationships among Sub-categories

As in the previous experiment, several of the most important and relevant sub-categories were selected as the central sub-categories for the relational analysis. The intention of this focus on the selected sub-categories was to gain more meaningful and more relevant outcomes. Each of the other sub-categories that co-occurred with the selected sub-categories was identified, and their relationships were then defined.

The primary basis for selecting the sub-categories was the second research sub-question: *What are the differences between anticipated and real user experiences?* To answer this sub-question, the characteristics of real user experience must be first determined, and then compared with the characteristics of anticipated user
experience, which has been identified in Experiment One. Hence, on this basis, the most relevant sub-categories selected were *Positive Experience* (PX) and *Negative Experience* (NX).

The third sub-category selected was *Intended Use* (IU), because of its essential role in shaping the user experience. This was based on three indicators. First, IU co-occurred with the most other sub-categories (Appendix H), thus suggesting its influence on almost all factors of real user experience. Second, IU had a substantial number of occurrences in the data (the second highest), as depicted in Figure 7.6. Lastly, the results of Experiment One had already shown the significance of IU in the construction of users’ anticipated experiences; thus, the same result was expected in the construction of users’ real experiences.

*Favourable Product Characteristics* (FPC) was included as the last central sub-category. This was because FPC was the leading sub-category (Figure 7.6), establishing it as an essential factor in real user experience. Furthermore, as has been highlighted in Chapter 6, user experience places emphasis on positive aspects of user-technology interaction (Hassenzahl, 2010; Hassenzahl, et al., 2006). Thus, this notion underlay the selection of FPC. The next sections outline the co-occurrences and relationships between the four selected sub-categories and the other sub-categories.

**Relationships between Positive Experience and Other Sub-categories**

The *Positive Experience* (PX) sub-category co-occurs with eight other sub-categories. These are listed in Table 7.4, alongside their relationships with PX. The rankings of these relationships – which are determined based on co-occurrence percentages – are also presented. A higher ranking denotes a stronger relationship between two sub-categories.

Figure 7.8 illustrates the co-occurrence between PX and *Favourable Product Characteristics* (FPC) sub-categories, and the way in which their relationship was developed. In this example, the use of the ‘voice memo’ feature of a camera (representing FPC) generated pleasurable stimulation and the experience of feeling like a journalist, which the user aspired to being (representing PX). Accordingly, the relationship between the two sub-categories was interpreted as ‘FPC engenders PX’.
This relationship was confirmed across the other overlapping FPC- and PX-coded text segments. It was identified, however, that a number of these overlapping text segments produced another relationship: ‘PX forms FPC’. Therefore, FPC and PX formed a bidirectional relationship.

Table 7.4 Relationships between Positive Experience (PX) and Eight Sub-categories

<table>
<thead>
<tr>
<th>Co-occurring Sub-categories</th>
<th>Ranking</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>IU</td>
<td>1 (44.5%)</td>
<td>IU sets contexts of PX: Intended use establishes the contexts of users’ positive experiences by setting the situations, purposes, and procedures of product use. It also determines how the users interact with the product within the experiences.</td>
</tr>
<tr>
<td>FPC</td>
<td>2 (19.2%)</td>
<td>FPC engenders PX: Having or using favourable and liked product features generates positive experiences for the users.</td>
</tr>
<tr>
<td>PX forms FPC:</td>
<td></td>
<td>PX forms FPC: Positive experiences with particular product features form positive appraisals of these features and enhance the product’s appeal.</td>
</tr>
<tr>
<td>PE is part of PX:</td>
<td>3 (18.5%)</td>
<td>PE is part of PX: Positive emotions are often embedded in the users’ positive experience, and intensify and enrich the experience.</td>
</tr>
<tr>
<td>DV is a source and facilitator of PX:</td>
<td>4 (5.5%)</td>
<td>DV is a source and facilitator of PX: The discovery of interesting and unexpected product features, how to use them, and how they work is in itself a positive experience, as it engenders excitement, satisfaction, and a sense of achievement. This discovery also encourages product use that can produce positive experiences.</td>
</tr>
<tr>
<td>UC influences PX:</td>
<td>5 (4.8%)</td>
<td>UC influences PX: Users’ characteristics (e.g. experienced vs. less experienced) determine how they perceive and use a product, thus influencing their positive experiences with the product.</td>
</tr>
<tr>
<td>EL is a source and facilitator of PX:</td>
<td>6 (3.4%)</td>
<td>EL is a source and facilitator of PX: The activity of exploring and learning a new product can be a positive experience in itself, by providing fun and stimulation for the users. Exploring and learning also enable the users to discover and use new features that can lead to positive experiences.</td>
</tr>
<tr>
<td>XK contributes to PX:</td>
<td>7 (2.7%)</td>
<td>XK contributes to PX: Based on users’ prior experiences and knowledge, comparing the product being used with similar products (usually those with lower quality) contributes to the construction of the users’ positive experiences.</td>
</tr>
<tr>
<td>PX engenders PED:</td>
<td>8 (1.4%)</td>
<td>PX engenders PED: Positive experiences with a product can lead to users’ judgment that the product’s quality or performance, and their experiences with it, exceed their expectations.</td>
</tr>
</tbody>
</table>

Legend: DV (Discovery), EL (Exploration and Learning), FPC (Favourable Product Characteristics), IU (Intended Use), PE (Positive Emotion), PED (Positive Expectation Disconfirmation), UC (User Characteristics), XK (Experiential Knowledge)
Figure 7.8 Co-occurrence between *Positive Experience* (PX) (highlighted) and *Favourable Product Characteristics* (FPC) (bordered) Sub-categories [Participant #10]

### Relationships between Negative Experience and Other Sub-categories

Seven sub-categories co-occur with *Negative Experience* (NX). The relationships between NX and these seven sub-categories were defined and ranked (Table 7.5).

<table>
<thead>
<tr>
<th>Co-occurring Sub-categories</th>
<th>Ranking</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>IU</td>
<td>1 (36.3%)</td>
<td><strong>IU sets contexts of NX:</strong> Intended use sets the contexts of users’ negative experiences by creating the situations and purposes of product use, as well as by determining the users’ interactions with the product within the experiences.</td>
</tr>
<tr>
<td>NE</td>
<td>2 (31.9%)</td>
<td><strong>NE is part of NX:</strong> Negative emotions are often embedded in the users’ negative experience, and augment the intensity of the experience.</td>
</tr>
<tr>
<td>ULP</td>
<td>3 (13.2%)</td>
<td><strong>ULP engenders NX:</strong> Difficulties and problems in understanding and using a product generate negative experiences for the users.</td>
</tr>
<tr>
<td>DL</td>
<td>4 (7.7%)</td>
<td><strong>DL engenders NX:</strong> Product features that are perceived as poor quality or that fail to meet users’ needs (and are thus disliked) engender negative experiences related to the use of those features.</td>
</tr>
<tr>
<td>XK</td>
<td>5 (4.4%)</td>
<td><strong>XK contributes to NX:</strong> Negative experiences with a product are created by the discordance between the product’s performances or responses and the users’ expectations resulting from previous experiences and knowledge.</td>
</tr>
<tr>
<td>NED</td>
<td>6 (3.3%)</td>
<td><strong>NX engenders NED:</strong> Through negative experiences with a product, users can form the judgment that the product’s quality or performance, and their experiences with it, do not meet their expectations.</td>
</tr>
<tr>
<td>UC</td>
<td>7 (3.3%)</td>
<td><strong>UC influences NX:</strong> Users’ characteristics determine their interest, perceptions, interactions, and difficulties in using a product, thus influencing their negative experiences with the product.</td>
</tr>
</tbody>
</table>

Legend: DL (Dislike[s]), IU (Intended Use), NE (Negative Emotion), NED (Negative Expectation Disconfirmation), ULP (Usage and Learnability Problem), UC (User Characteristics), XK (Experiential Knowledge)
Figure 7.9 exemplifies the co-occurrence and the establishment of the relationship between NX and *Usage and Learnability Problem* (ULP) sub-categories. In this example, the difficulties in remembering various functions of a camera, and problems in using its touch-screen feature (representing ULP), led to the user’s negative experience of feeling frustrated and anxious when trying to take pictures of her granddaughter (representing NX). Hence, the two sub-categories formed a directional relationship: ‘ULP engenders NX’.

![Figure 7.9 Co-occurrence between Negative Experience (NX) (highlighted) and Usage and Learnability Problem (ULP) (bordered) Sub-categories [Participant #38]](image)

**Relationships between Intended Use and Other Sub-categories**

*Intended Use* (IU) co-occurs with all other sub-categories, with the exception of *Positive Expectation Disconfirmation*. The entire relationships between IU and the fourteen sub-categories are summarised in Table 7.6, together with the hierarchy of these relationships.

An example of the co-occurrence and the relationship identification between IU and *Exploration and Learning* (EL) sub-categories is shown in Figure 7.10. In this example, taking pictures of children under a backlight condition (representing IU) was used as a means of experimenting with the camera’s features and capabilities (representing EL). Therefore, the relationship between the two sub-categories was defined as ‘IU facilitates EL’.

![Table 7.6 Relationships between Intended Use (IU) and Fourteen Sub-categories](image)
### Chapter 7: Experiment Two

<table>
<thead>
<tr>
<th>Co-occurring Sub-categories</th>
<th>Ranking</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FPC</strong> (14.3%)</td>
<td>2</td>
<td><em>IU underlies FPC:</em> Intended use – encompassing the purposes, situations, and procedures of product use – underlies the reason that certain features of a product are positively judged and liked by its users.</td>
</tr>
<tr>
<td><strong>NX</strong> (13.9%)</td>
<td>3</td>
<td><em>IU underlies DL:</em> Intended use forms the purposes, procedures, and situations of product use in which the problems and weaknesses of a product emerge, and result in users’ dislikes of the product.</td>
</tr>
<tr>
<td><strong>UC</strong> (8.0%)</td>
<td>6</td>
<td><em>UC influences IU:</em> Users’ characteristics (e.g. preferences, motivations, skills) determine the purposes of product use, as well as the way and the situations in which they use the product.</td>
</tr>
<tr>
<td><strong>DPC</strong> (5.5%)</td>
<td>7</td>
<td><em>IU underlies DPC:</em> The usage purposes, as well as the intended situations and procedures of product use, underlie users’ expectations of a product.</td>
</tr>
<tr>
<td><strong>XK</strong> (5.0%)</td>
<td>8</td>
<td><em>XK influences IU:</em> Users’ experiential knowledge, obtained mainly from prior experiences with similar products, determines how they use and interact with a specific product.</td>
</tr>
<tr>
<td><strong>DV</strong> (1.3%)</td>
<td>9</td>
<td><em>DV influences IU:</em> The discovery of unexpected features or new ways of using a product affects the interactions between the users and the product.</td>
</tr>
<tr>
<td><strong>ULP</strong> (1.3%)</td>
<td>10</td>
<td><em>ULP influences IU:</em> Difficulties in using and understanding particular product features affect how users use and interact with the product (e.g. using alternative features to accomplish their purposes of product use).</td>
</tr>
</tbody>
</table>

Table 7.6 Relationships between *Intended Use (IU)* and Fourteen Sub-categories (continued)

147
### Co-occurring Sub-categories

<table>
<thead>
<tr>
<th>Intended Use (IU)</th>
<th>Ranking</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>NE</td>
<td>11 (0.8%)</td>
<td>IU contextualises and causes NE: Intended use establishes the situations and purposes of product use in which users’ negative emotions occur. The situations and purposes of product use themselves may bring about negative emotions.</td>
</tr>
<tr>
<td>NED</td>
<td>12 (0.8%)</td>
<td>NED influences IU: The presence of product features or performances that do not meet users’ expectations affects how they use and interact with the product.</td>
</tr>
<tr>
<td>NuED</td>
<td>13 (0.8%)</td>
<td>IU influences NuED: The situations and purposes of product use influence whether the product is judged as falling below the users’ expectations.</td>
</tr>
<tr>
<td>PE</td>
<td>14 (0.4%)</td>
<td>IU sets contexts of PE: Intended use sets the purposes and situations of product use in which users’ positive emotions occur.</td>
</tr>
</tbody>
</table>

Legend: DPC (Desired Product Characteristics), DV (Discovery), DL (Dislike[s]), EL (Exploration and Learning), FPC (Favourable Product Characteristics), NE (Negative Emotion), NED (Negative Expectation Disconfirmation), NX (Negative Experience), NuED (Neutral Expectation Disconfirmation), PE (Positive Emotion), PX (Positive Experience), ULP (Usage and Learnability Problem), UC (User Characteristics), XK (Experiential Knowledge)

Figure 7.10 Co-occurrence between Intended Use (IU) (highlighted) and Exploration and Learning (EL) (bordered) Sub-categories [Participant #2]

**Relationships between Favourable Product Characteristics and Other Sub-categories**

Favourable Product Characteristics (FPC) co-occurs with eight other sub-categories. These are presented in Table 7.7, in conjunction with the established relationships and their rankings. Figure 7.8 has previously exemplified how FPC and Positive Experience (PX) sub-categories co-occurred, and how their relationship was interpreted.

Table 7.7 Relationships between Favourable Product Characteristics (FPC) and Eight Sub-categories
Chapter 7: Experiment Two

<table>
<thead>
<tr>
<th>Co-occurring Sub-categories</th>
<th>Ranking</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>PE</td>
<td>1 (22.0%)</td>
<td><strong>FPC engenders PE:</strong> A product’s features or performances that are positively judged and liked by users elicit their positive emotions.</td>
</tr>
<tr>
<td>IU</td>
<td>2 (18.7%)</td>
<td>See Table 7.6</td>
</tr>
<tr>
<td>PX</td>
<td>3 (15.4%)</td>
<td>See Table 7.4</td>
</tr>
<tr>
<td>XK</td>
<td>4 (14.8%)</td>
<td><strong>XK contributes to FPC:</strong> Product comparison based on users’ prior knowledge and experiences with comparable technologies contributes to the users’ positive judgments of the characteristics of the product being used.</td>
</tr>
<tr>
<td>EL</td>
<td>5 (11.5%)</td>
<td><strong>EL identifies FPC:</strong> Through exploring and learning about a product, users identify the product’s features and performances that they like and positively appraise.</td>
</tr>
<tr>
<td>UC</td>
<td>6 (10.4%)</td>
<td><strong>UC influences FPC:</strong> Users’ characteristics (e.g. needs, preferences, expertise) determine which characteristics of a product are liked or perceived as favourable.</td>
</tr>
<tr>
<td>PED</td>
<td>7 (4.4%)</td>
<td><strong>PED forms FPC:</strong> Users’ discovery of product characteristics that exceed their expectations generates positive appraisals of these characteristics and of the product overall.</td>
</tr>
<tr>
<td>DV</td>
<td>8 (2.7%)</td>
<td><strong>DV engenders FPC:</strong> The discoveries of interesting and unexpected product features produce a set of features that are positively judged and liked by the users.</td>
</tr>
</tbody>
</table>

Legend: DV (Discovery), EL (Exploration and Learning), IU (Intended Use), PE (Positive Emotion), PED (Positive Expectation Disconfirmation), PX (Positive Experience), UC (User Characteristics), XK (Experiential Knowledge)

**Networks of Sub-categories**

Using and interacting with a product result in positive and negative user experiences. The sub-category relationships outlined in Tables 7.4, 7.5, 7.6, and 7.7 provide a basis for developing two sub-category networks that delineate how positive and negative user experiences are constructed. The first network comprises *Positive Experience* (PX), as the central sub-category, and eight other sub-categories that co-occur with it (Figure 8.2). The eight interrelated sub-categories represent important factors that construct and shape users’ positive experiences with interactive products.

The second network is constituted of *Negative Experience* (NX) and its seven co-occurring sub-categories (Figure 8.3). These seven sub-categories play a significant role in the formation of users’ negative experiences. Both networks contribute in
creating an understanding of the characteristics of real user experience, and in identifying the differences between this experience and anticipated user experience. These are discussed in Sections 8.2.3 and 9.4.

7.4 SUMMARY

This chapter explained Experiment Two, which was conducted to explore users’ real experience with a product. The procedures of data collection, involving experience diary, co-discovery, and observation methods, were described in detail. As in Experiment One, the data analysis encompassed the stages of data coding and relational analysis. In this analysis, a relevant coding scheme was developed.

The main results of Experiment Two can be organised into three areas: (1) important factors of real user experience in the form of categories and sub-categories, (2) perceived importance of pragmatic and hedonic qualities in experiencing a product, and (3) relationships among the factors (sub-categories). The results can be summarised as follows:

- *Favourable product characteristics, intended use* of product, and *dislike* of particular product features are the most dominant aspects of experiencing an actual product (Section 7.3.1). This suggests that users’ judgments of product quality and the situations and purposes of product use prominently influence real user experience.

- In judging the overall quality of a product, users in this research mostly focus on its pragmatic attributes rather than its hedonic attributes. The users’ negative experiences are also mainly related to the product’s pragmatic issues. However, their positive experiences are predominantly influenced by the hedonic quality of the product (Section 7.3.2).

- There are four central sub-categories – *Positive Experience, Negative Experience, Intended Use,* and *Favourable Product Characteristics* – each of which forms relationships with its co-occurring sub-categories (Section 7.3.3). These relationships, together with their rankings, serve as a basis for developing two sub-category networks that describe the construction of positive and negative user experiences (Section 8.2.3).
Chapter 7: Experiment Two

The above results provide key information in defining the characteristics of real user experience. This knowledge, in turn, contributes to identifying the differences between this experience and anticipated user experience (Section 8.2).

The following chapter discusses and compares the results of Experiment One and Experiment Two in the context of the existing literature. It also highlights the main findings of this research.
Chapter 8: Findings and Discussion

Chapters 6 and 7 described how Experiment One and Experiment Two were designed and conducted, and covered methods of data collection and analysis. Results of the experiments have been presented, including emerged categories and sub-categories, the perceived importance of pragmatic and hedonic aspects of product quality, as well as relationships among the sub-categories.

This chapter delves deeper into the experiment results to formulate the findings with respect to the two research sub-questions, and to identify the emerging theories. Based on Experiment One’s results, the chapter identifies and discusses how users anticipate their experiences with a desired product, and the characteristics of this anticipated user experience. Meanwhile, based on Experiment Two’s results, the chapter analyses and discusses the formation and characteristics of real user experience to differentiate between it and anticipated user experience.

8.1 ANTICIPATED USER EXPERIENCE

This section discusses the findings and interpretations of the Experiment One results, which cover three areas: (1) the role of products in engendering anticipated experiences, (2) the perceived importance of pragmatic and hedonic qualities of products, and (3) the user’s process of anticipating positive experiences. The discussion is directed to answer the first research sub-question (Section 1.3). In addition, the results and their interpretations are compared to findings in the relevant existing literature.
8.1.1 Products as Stimuli for Engendering Anticipated User Experience

*Desired Product Characteristics* (DPC), as the leading sub-category (Figure 6.9), emerged from the participants’ responses to almost all tasks in Experiment One. This denotes the strong influence of users’ needs and expectations on the process of anticipating experiences with a future product. Among other characteristics, DPC encompassed preferred product functions, features, performance, appearance, weight, after-sales services, and accessory items. It covered both pragmatic aspects (e.g. ease of use, usefulness, and portability) and hedonic aspects (e.g. colour, elegance, and product image) of the product. As a whole, DPC represented a desired product, as envisaged by users.

A *desired* product forms a primary basis for the construction of users’ anticipated experiences (Table 6.4). However, *existing* products (that is, those owned by users or available on the market) can also generate anticipated experiences, in addition to eliciting memories of prior experiences. The existing products were represented by users’ likes and dislikes of them (*Favourable Existing Characteristics* and *Dislike[s]* sub-categories). As Roto (2007) stresses, user experience involves a product and an interaction (or the possibility to interact) with it. Expectations about the product, engendered from brand image, advertisements, public opinion, and previous experiences with similar artefacts, form expected user experience (Roto, 2007; Roto, et al., 2011). Roto’s assertion supports the experiment results that products serve as stimuli for eliciting anticipated user experience. The difference is that the desired product in this study was conceived by the users themselves, rather than being prompted by advertisements or prototypes.

Desmet (2003b) established that products and their interplay with users’ concerns and appraisals evoke emotional experiences. Users’ encounters with these products include non-physical interactions, such as remembering, anticipating, or fantasising about their use (Desmet, 2003b; Desmet and Hekkert, 2007). Experiment One shows that imagining or remembering interactive products and their use engenders two types of anticipated experience: positive and negative (Table 6.6 and Table 6.7). Positive anticipated experience refers to the pleasant situations, feelings, and values that users expect to result from using the imagined or remembered products. Opposite reactions are true for negative anticipated experience.
It was discovered in this research that users’ *positive* anticipated experiences are almost exclusively related to the *imagined (desired)* product. It is somewhat natural that when imagining a desired product, users will mainly conceive an ideal product concept that satisfies their needs. Consequently, anticipating interactions with such a concept will most likely evoke positive anticipated experiences and diminish the negative ones. This is congruent with the notion of ‘rosy prospection’ (Mitchell, et al., 1997), which points out that people tend to anticipate events as more positive and enjoyable than they actually turn out to be. Schkade and Kahneman (1998) recognise such a phenomenon as the ‘focusing illusion’, which is caused by people’s focus on core aspects of the event without regard for other attributes. In this case, users may focus on the perfection of their product concept and tend to overlook problems, disappointment, and other less positive views of their prospective experiences with the desired product.

In contrast, *negative* anticipated experiences are mostly associated with *existing* products. When thinking about products that are readily available, participants had a propensity to recall and to focus on the products’ problems, weaknesses, and other negative aspects leading to undesirable anticipated experiences. Schrammel et al. (2008) used narration to analyse user experiences and emotions elicited by current technology. They found that users reported considerably more negative than positive experiences when recalling their encounters with technology. The negative experiences were also expressed using more intense emotional terms (Schrammel, et al., 2008).

Figure 6.9 also confirms this outcome by showing that the negative sub-categories pertaining to existing products (*Dislike[s]*, *Negative Prior Experience*, and *Negative Prior Emotion*) occur more frequently than their positive counterparts (*Favourable Existing Characteristics*, *Positive Prior Experience*, and *Positive Prior Emotion*). Schrammel et al. (2008) consider this fact to be linked to the concept of ‘negativity bias’ as suggested by Cacioppo and Gardner (as cited in Schrammel, et al., 2008). From a natural selection perspective, Cacioppo and Gardner (1999) posit that individuals tend to respond more strongly to negative than to positive stimuli, because the perceived consequences of experiencing negative events are far greater than the perceived consequences of failing to experience positive events.
The above discussion highlights an emerging theory that ‘a desired product acts as a principal stimulus in engendering users’ positive anticipated experiences, whereas existing products tend to stimulate negative anticipated experiences’ (Yogasara, et al., 2011). Karapanos et al. (2009), for example, selected the Apple iPhone as a product of study. Participants who were considering purchasing this product were asked to report on their anticipation before any actual use. About three-quarters of their expectations were related to opportunities for positive experiences, and the remainder to worries about negative consequences (Karapanos, et al., 2009). While the iPhone in their study was an existing product desired by potential users, the desired product in this research was an imaginary artefact conceived by participants. In both cases, the desire of having or using the product seemed to significantly heighten the construction of positive anticipated experiences.

8.1.2 Perceived Importance of Pragmatic and Hedonic Qualities

Users perceive product quality based on two different dimensions: pragmatic and hedonic (Hassenzahl, 2003). These quality dimensions shape the users’ experience when encountering a product. Pragmatic quality of a product is perceived as the product’s ability to facilitate the accomplishment of behavioural goals (do-goals), whereas hedonic quality is built on a perception of the product’s capacity to support the achievement of non-utilitarian goals (be-goals) and pleasure (Hassenzahl, 2003, 2008) (an in-depth explanation of pragmatic and hedonic qualities is presented in Section 2.3). This section discusses how users perceive these pragmatic and hedonic dimensions in conceiving a desired product and in anticipating their experiences.

As Figure 6.10 indicates, in imagining a desired product and in assessing existing products, users in this study perceive pragmatic quality as far more important than hedonic quality. However, it is also shown that hedonic quality is more appreciated when users consider their likes, than when they consider their dislikes, of the existing products. This implies that users tend to choose product utility and usability over non-utilitarian qualities, such as innovativeness and beauty. Nevertheless, this non-utilitarian value can actually have an important part to play in making the product more favourable to the users.
Extensive research in the marketing domain has revealed that in choice contexts or pre-consumption decisions, consumers tend to have a greater preference for pragmatic (utilitarian) alternatives over hedonic alternatives (e.g. Chitturi, et al., 2007; Kivetz and Simonson, 2002; Okada, 2005). These studies, however, are more related to goods and services in general, such as opera tickets (hedonic) and grocery vouchers (utilitarian). Only recently did Diefenbach and Hassenzahl (2011) introduce this phenomenon into the field of Human-Computer Interaction.

While hedonic quality is highly valued, users are more likely to choose pragmatic quality because of their need to justify their choice (Diefenbach and Hassenzahl, 2011; Okada, 2005). As hedonic benefits of product use are more difficult to quantify and justify than pragmatic benefits, the potential of hedonic quality to be focused on and chosen by users tends to diminish (Diefenbach and Hassenzahl, 2011). Analogous with Jordan’s (2000) hierarchy of needs, Chitturi et al. (2007) believe that a required level of functionality must be satisfied or exceeded before consumers assign greater importance to hedonic rather than pragmatic attributes. In a similar vein, Kivetz and Simonson (2002) propose that due to a sense of guilt, consumers prefer pragmatic to hedonic goods until they believe that they deserve to indulge in hedonic experiences.

In this research, both positive and negative anticipated user experiences embrace the pragmatic and hedonic aspects of product quality. The anticipated experiences that were related to the digital cameras’ pragmatic attributes pertained mainly to users’ activities to capture high-quality pictures without difficulties or hassles. Meanwhile, the three hedonic attributes proposed by Hassenzahl (2003) were reflected in the users’ positive anticipated experiences:

- **Stimulation**: having playful and fun experiences through camera use; developing photography skills using the desired camera.
- **Identification**: being proud of using a unique and stylish camera; being socialised and connected by sharing photos with others.
- **Evocation**: bringing back memories of beautiful moments and experiences through pictures; having nostalgia for the ‘good old times’ through photography.
The hedonic aspects of positive anticipated experiences also included other feelings of psychological well-being as an expected consequence of using the desired camera, such as being confident, feeling satisfied, and having a sense of achievement. In negative anticipated experiences, on the other hand, the hedonic aspects involved unfavourable psychological states, such as feelings of dissatisfaction, insecurity, and lack of spontaneity when using the existing digital cameras.

This demonstrates that, besides perceiving a product’s character in terms of its pragmatic and hedonic attributes, users are able to anticipate how these attributes will affect their positive and negative experiences with the product. Hassenzahl (2007) believes that experience influences and modifies product perceptions, so that the measures of pragmatic and hedonic dimensions will portray an outline of the experience. Thus, although they might change during actual experiences, perceived pragmatic and hedonic aspects of users’ anticipated experiences can be used to better predict, describe, and assess the users’ potential experiences. This information, in turn, is useful for the early stages of the design process.

Figure 6.10 denotes that the pragmatic quality of product is fundamental in both positive and negative anticipated experiences; it is perceived as more important than its hedonic counterpart. This suggests that users perceive excellent pragmatic quality as a main prerequisite for having positive experiences with products. Equally, inferior pragmatic quality is perceived as a major source of potential negative experiences.

Using the UX Curve to explore long-term user experience, Kujala and colleagues (2011) show that user experience that improves over time is driven by more positive pragmatic reasons, rather than by positive hedonic ones. Likewise, user experience that deteriorates over time is caused by more negative pragmatic issues, than by negative hedonic ones (Kujala, et al., 2011). While focused on long-term user experience and based on users’ retrospective reports, Kujala et al.’s (2011) study introduces a parallel result that users perceive pragmatic aspects as a dominant factor that influences their positive and negative experiences with products.

However, Figure 6.10 shows that the occurrence of hedonic attributes in positive anticipated experience is about three times higher than in negative anticipated
experience. This implies that users pay less attention to the hedonic quality of product when considering future negative experiences. In contrast, when anticipating positive experiences with a desired product, users give considerably more focus to its hedonic quality. This finding is supported by Partala and Kallinen’s (2012) study that analysed users’ descriptions of recent experiences with technologies in terms of elicited emotions, psychological needs, and contextual factors. They discovered that personally meaningful (hedonic) aspects of experience, such as stimulation, identification, and self-esteem, were salient in the most satisfying user experiences, but rather absent in the most unsatisfying ones.

Based on the above discussion, it can be inferred that users appreciate the hedonic factors more when they anticipate or recall something positive about their products and experiences. Accordingly, hedonic factors appear to play a greater role in engendering users’ positive experiences than their negative experiences. These findings generate another emerging theory that ‘in the process of anticipating experiences with interactive products, pragmatic quality is perceived to be crucial to avoiding future negative experiences. Although it is also perceived as the main factor for constructing future positive experiences, pragmatic quality alone might actually not be enough. The hedonic quality of product seems to be essential in ensuring that the product will generate positive experiences for the users’.

This is congruous with Hassenzahl’s (2008, 2010) argument that the achievement of be-goals or basic psychological needs is the prime source of positive experience with interactive products. Thus, positive experience is directly attributed to hedonic quality, whereas pragmatic quality only contributes indirectly by facilitating the fulfilment of be-goals (Hassenzahl, 2008). Hassenzahl et al. (2010) went further to support this notion by analysing a large number of users’ reports regarding positive experiences with technologies. They found a direct relationship between need fulfilment (e.g. relatedness, competence, stimulation) and positive emotional experience, and that need fulfilment was more strongly linked to hedonic quality perceptions than to pragmatic ones. Chitturi, Raghunathan, and Mahajan (2008) also conclude that, while perceived fulfilment of pragmatic needs merely evokes customer satisfaction, perceived fulfilment of hedonic needs evokes customer delight.
8.1.3 AUX Framework: A User's Process of Anticipating Positive Experiences with Interactive Products

The first research sub-question is addressed via the Anticipated User Experience (AUX) Framework (Figure 8.1). This framework consists of two related sub-category networks that delineate the processes through which users imagine a desired product and anticipate positive experiences with that product. The sub-category relationships in Tables 6.4, 6.5, 6.6, and 6.7 are the foundation of these two networks.

The first network focuses on describing the conceptualisation process of a desired product, and Desired Product Characteristics (DPC) is the outcome of this process. Therefore, this network excludes Positive Anticipated Emotion (PAE) and Positive Anticipated Experience (PAX) sub-categories, as they are engendered by DPC (that is, DPC is their antecedent) (Table 6.4). PAE and PAX sub-categories are incorporated in the second network.

Users anticipate both positive and negative experiences of product use. However, in addressing the first research sub-question, the study focuses on the construction of positive anticipated experience (PAX). This is because the goal of experience-centred design is to create enjoyable products that deliver positive experiences for users. Moreover, user experience emphasises positive aspects of user-product interaction, rather than negative aspects and their removal (Bargas-Avila and Hornbæk, 2011; Hassenzahl, 2010; Hassenzahl, et al., 2006).

In addition to the rankings of relationships between the key (outcome) sub-categories (i.e. DPC and PAX) and their co-occurring sub-categories, weights are attached to all connections in the framework. These weights represent global closeness among the sub-categories in the two networks. Table 8.1 explains how the relationship weights for the first network are determined. Weights for the second network are calculated using the same way.
Table 8.1 Relationship Weight Calculation for the First Network of the AUX Framework

<table>
<thead>
<tr>
<th>Sub-category Relationship</th>
<th>Number of Co-occurrence (taken from Appendix H)</th>
<th>Relationship Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPC - NPX</td>
<td>1</td>
<td>(1/306) * 100 = 0.3</td>
</tr>
<tr>
<td>DPC - FEC</td>
<td>4</td>
<td>(4/306) * 100 = 1.3</td>
</tr>
<tr>
<td>DPC - XK</td>
<td>43</td>
<td>14.1</td>
</tr>
<tr>
<td>DPC - UC</td>
<td>14</td>
<td>4.6</td>
</tr>
<tr>
<td>DPC - DL</td>
<td>5</td>
<td>1.6</td>
</tr>
<tr>
<td>DPC - IU</td>
<td>129</td>
<td>42.2</td>
</tr>
<tr>
<td>DPC - NAX</td>
<td>7</td>
<td>2.3</td>
</tr>
<tr>
<td>UC - NAX</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>XK - NAX</td>
<td>4</td>
<td>1.3</td>
</tr>
<tr>
<td>IU - XK</td>
<td>23</td>
<td>7.5</td>
</tr>
<tr>
<td>IU - FEC</td>
<td>5</td>
<td>1.6</td>
</tr>
<tr>
<td>IU - NPX</td>
<td>13</td>
<td>4.2</td>
</tr>
<tr>
<td>IU - UC</td>
<td>13</td>
<td>4.2</td>
</tr>
<tr>
<td>IU - DL</td>
<td>12</td>
<td>3.9</td>
</tr>
<tr>
<td>IU - NAX</td>
<td>29</td>
<td>9.5</td>
</tr>
<tr>
<td>DL - NAX</td>
<td>3</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>306</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Legend: DL (Dislike[s]), DPC (Desired Product Characteristics), FEC (Favourable Existing Characteristics), IU (Intended Use), NAX (Negative Anticipated Experience), NPX (Negative Prior Experience), PAE (Positive Anticipated Emotion), PAX (Positive Anticipated Experience), UC (User Characteristics), XK (Experiential Knowledge)

Conceiving a Desired Product

As depicted in the AUX Framework (Figure 8.1), seven interconnected factors operate as motives or stimuli that lead to the conception of a desired product (DPC). Nearly half of these are negative aspects (i.e. Dislike[s], Negative Prior Experience, and Negative Anticipated Experience) that pertain mainly to pragmatic issues with existing products. These negative factors inspire desired product features perceived to be enjoyable and useful in avoiding negative experiences. Meanwhile, features from available products that users judge positively (i.e. Favourable Existing Characteristics [FEC]) are the only positive factor, and they become parts of the desired product concept.

Based on the relationship ranking, the negative factors generally rank higher than the positive factor. This indicates that the negative factors, overall, have a greater influence than does the positive factor on the ideation of a desired product. As has been discussed in Section 8.1.1, the ‘negativity bias’ (Cacioppo and Gardner, 1999) can create a user’s tendency to recall or focus on product weaknesses and related undesirable experiences when considering interactions with available technologies.
Chapter 8: Findings and Discussion

Furthermore, purposes and situations of product use (Intended Use [IU]) underlie and define the desired product concept. Not only does IU produce the highest relationship ranking and weight, it also has the most number of connections with other factors. This suggests its vital role in the whole process of conception of the desired product,
and also suggests that the evaluation, selection, and formation of desired product characteristics are strongly dependent on the perceived contexts of product use.

Researchers have confirmed that contexts, such as mode of use, influence users’ perceptions and judgments of interactive products (e.g. Hassenzahl and Ullrich, 2007; van Schaik and Ling, 2009). Hassenzahl, Schöbel, and Trautmann (2008) also demonstrate that users’ motivational orientation (promotion or prevention focus) of product use impacts their appraisal and choice of interactive products.

Experiential Knowledge (XK) has the second highest relationship ranking and weight, which indicates XK as the second most important factor. It represents users’ knowledge of specific products and users’ familiarity with comparable artefacts, thus inspiring ideas for a desired product. This is to some extent supported by Zhou and Nakamoto’s (2007) report that users’ prior knowledge of a product category (product familiarity) affects their preferences for the new products. Specifically, experienced users prefer unique new products to enhanced ones, and the opposite is true for inexperienced users (Zhou and Nakamoto, 2007). Hence, in the case of this study, experienced users can use their superior knowledge of existing products and analogous artefacts to produce concepts of a new and unique product.

Lastly, User Characteristics (UC) ranks fourth in the relationship hierarchy. This factor represents users’ attributes (e.g. preferences, needs, competence, and physical attributes) that influence the formation of a desired product. Hartmann, Sutcliffe, and De Angeli (2008) have revealed that judgment and choice of quality attributes (e.g. functionality and aesthetics) are contingent upon the user’s background in addition to context and task.

Anticipating Positive Experience
The second network in the AUX Framework (Figure 8.1) structures the process of anticipating positive user experience via seven components. A desired product (DPC), which incorporates favourable existing features (FEC), engenders positive anticipated experiences (PAX) and positive anticipated emotions (PAE). DPC ranks third in the relationship hierarchy (Table 6.6). Nevertheless, in terms of its function, it acts as a principal stimulus for engendering PAX (as discussed in Section 8.1.1). In sixth ranking, FEC plays a smaller role in engendering PAX.
The Intended Use (IU) factor, which sets the contexts of the anticipated experiences and anticipated emotions, holds the first position in the relationship hierarchy. This underpins the notion that context of use is a fundamental element of user experience, along with user characteristics and the product itself (Bargas-Avila and Hornbæk, 2011; Forlizzi and Ford, 2000; Hassenzahl and Tractinsky, 2006; Korhonen, Arrasvuori, and Väänänen-Vainio-Mattila, 2010a; Roto, et al., 2011). According to Roto et al. (2011), user experience “may change when the context changes, even if the system does not change” (p. 10). This context refers to a combination of environmental, temporal, social, and task contexts for the experience (Roto, 2006). In the second network of the AUX Framework, IU refers to purposes, situations, environments, and perceived interactions of product use within the anticipated experiences (as illustrated in Figure 6.11).

PAE is frequently embedded in PAX. PAE refers to pleasant emotions that are expected to occur as the outcome of using a desired product, as demonstrated in the comment below:

... it gives some opportunities to take better photos about something that we have imagined to take ... photo of a tiger or lion that is running, and you can have this, you can experience this dream ... eventually your life will be happier when you can capture what you like and then you get that and remember the memories. [Participant #15]

Despite its low occurrence in the data (Figure 6.9), PAE is the second most prominent factor in anticipating positive experiences, as signified by its relationship ranking (Table 6.6) and weight. This highlights the emotions as an inseparable part of user experience (Desmet and Hekkert, 2007; Hassenzahl, et al., 2010; McCarthy and Wright, 2004a; Norman, 2004). While emotions are mostly regarded as a consequence of product use (Desmet and Hekkert, 2002; Hassenzahl, 2003), they are also viewed as an antecedent and mediator of technology use (Hassenzahl and Tractinsky, 2006). Mahlke (2007) stresses that the emotional responses resulting from human-technology interaction are an integral part of user experience, and not a consequence of the experience. Similarly, Desmet and Hekkert (2007) consider the whole set of affects evoked by user-product interaction as the core of product experience.
User Characteristics (UC) takes the fourth position in the relationship ranking. UC is based on individuals’ self-appraisal of their characteristics as product users, and covers their mental attributes (e.g. skills, needs, motivation) and physical attributes (e.g. being left-handed, having poor eyesight). This factor determines how a desired product will be used and what this product will be used for, thus influencing and setting the contexts of positive anticipated experiences. For instance, a participant with poor eyesight anticipated a satisfying experience in still being able to take good pictures using a special feature on his desired digital camera if he had forgotten his spectacles.

The literature agrees that experience is shaped by the user’s characteristics (Forlizzi and Ford, 2000; Hassenzahl and Tractinsky, 2006; Roto, et al., 2011). Roto (2006, 2007), for example, provides a list of user attributes that are believed to affect the felt experience. These attributes include motivation, needs, expectations, attitudes, prior experiences, mental and physical resources, and emotional state (mood).

The last factor, Experiential Knowledge (XK), holds the second lowest score in the relationship hierarchy. Users utilise their experiential knowledge to obtain information about a product of interest, and to make comparisons with experiences of using analogous artefacts. Hence, XK supports users in constructing their positive anticipated experiences with a desired product. To illustrate, by referring to her knowledge and experiences in using an iPhone’s camera, a participant anticipated affective connectedness with her family by sending pictures directly using her desired digital camera.

In the literature, XK is rarely regarded as a distinct factor of user experience, but is normally considered as a part of user characteristics (e.g. Arhippainen and Tähti, 2003; Mahlke and Thüring, 2007; Roto, 2007). Researchers might also combine this factor with users’ previous experiences (e.g. Kankainen, 2003; Mäkelä and Fulton Suri, 2001). The role of XK here is in line with Roto et al.’s (2011) argument that users can have an expected experience through expectations created by advertisements, brand image, demonstrations, others’ opinions, and prior experiences with similar technologies.
In relation to existing frameworks, the AUX Framework can be compared with the Technology Acceptance Model (TAM) (Davis, 1989). TAM assesses perceived usefulness (PU) and perceived ease of use (PEOU) as predictors of individuals’ intention to use technology, and their usage behaviour. According to this model, a user who encounters a technological system will form two types of beliefs (i.e. PU and PEOU), which determine their intention to use and actual use of that system (Davis, 1989). Thus, while TAM is used to predict users’ acceptance of technology, the AUX Framework can be used to predict users’ positive experiences of a desired product. Based on TAM, designers can control and improve PU and PEOU to enhance product use. Meanwhile, by exploring factors of the AUX Framework, designers can obtain valuable information to design for positive user experience.

The significance and the use of the AUX Framework in relation to user experience assessment in the initial stages of product development will be discussed specifically in Chapter 9.

8.2 REAL USER EXPERIENCE AND ANTICIPATED USER EXPERIENCE: A COMPARISON

In accordance with the second research sub-question, this section focuses on differentiating between the characteristics of anticipated and real user experiences. The results of Experiment One and Experiment Two are compared and discussed.

8.2.1 Categories and Sub-categories

Based on the categories resulting from Experiment One and Experiment Two (Figure 6.8 and Figure 7.5), the main difference between anticipated and real user experiences is the occurrence of the *Familiarisation* and *Expectation Disconfirmation* categories in users’ real experience. As users encounter an actual new product, familiarisation is a natural process undertaken to get used to, and to become proficient with, the product. Users’ experiences with an actual product also allow their expectations to be met, exceeded, or disappointed. In contrast, since anticipated user experience involves only an imagined product concept, no product familiarisation process and expectation fulfilment take place in such an experience.
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The familiarisation process, indicated mainly by the *Exploration and Learning* and *Usage and Learnability Problem* sub-categories (Figure 7.6), constitute a considerable portion of the reported real experiences. This is due to the nature of the initial stages of new product use, where users need to learn how to use the product, to explore its features, and to experiment with its capabilities. Karapanos et al. (2009) refer to this as the ‘orientation’ phase in which users have their first product experience, which is permeated by feelings of excitement and frustration as they experience its novel features and encounter usability problems. In similar vein, von Wilamowitz-Moellendorff et al. (2006) consider familiarisation as a “self-oriented process of learning and habituation” (p. 77). They find that familiarisation is a major factor in the dynamics of user experience, in that it produces positive and negative changes in the perceived quality of products over time.

Meanwhile, users might experience expectation disconfirmation because they can form expectations of a new product and of their experiences with it, before encountering the product. According to Hiltunen et al. (2002), these expectations affect the users’ experiences by directing their attention during product use and by forming a set of criteria against which the product’s performance and quality are assessed. During and after actually interacting with the product, the users’ expectations may be met (confirmed), exceeded (positively disconfirmed), or upset (negatively disconfirmed). The expectation disconfirmation contributes to the users’ overall judgment of the product’s quality and performance, and also affects their satisfaction and subsequent experiences with the product. As Mäkelä and Fulton Suri (2001) state, users’ expectations influence their actual experience, and their actual experience modifies these expectations. Hiltunen et al. (2002) also argue that expectations have a powerful influence on users’ feelings about product and experience, with the result that discrepancies between expectations and actual experience can evoke various emotions.

Users, however, infrequently report how their expectations are fulfilled when experiencing the product. This is illustrated by the three expectation disconfirmation sub-categories that have the lowest occurrences in the data (Figure 7.6). This, to some extent, supports Karapanos et al.’s (2009) finding that users’ a priori expectations tend to change during their actual experiences with the product, and that
disconfirmed expectations appear to have less influence on the users’ satisfaction over time. In other words, users seem to adapt their perceived experiences to their expectations.

The low number of expectation disconfirmations reported can be explained by the assimilation-contrast theory (Anderson, 1973; Scharf and Volkmer, 2000), which posits that individuals have ranges of acceptance and rejection within their perceptions. When the gap between expectations and actual product performance is small enough for it to fall within the acceptance zone, users tend to assimilate the discrepancy by altering their product perceptions to make their expectations and the actuality more consonant (assimilation effect). In contrast, when the gap between expectations and product performance becomes too large, it will fall within the rejection zone, creating the users’ tendency to amplify the disparity (contrast effect) (Anderson, 1973; Scharf and Volkmer, 2000). Hence, users might not express their disconfirmed expectations unless the deviation between their actual experiences and their expectations is large enough to trigger the contrast effect.

Further, with regard to real user experience, users tend to judge and perceive product quality and its effect on their experiences, not only when encountering a product for the first time (mostly visually), but also during and after actually interacting with it. They constantly report their likes, dislikes, and positive and negative appraisals of the product. This is represented by the Favourable Product Characteristics and Dislike(s) sub-categories that rank first and third respectively in the sub-category occurrences (Figure 7.6). On the other hand, in relation to anticipated user experience, users tend to focus on imagining a desired product that is perceived to be able to produce positive experiences. This is denoted by Desired Product Characteristics being the leading sub-category (Figure 6.9). Thus, it is highlighted that conceiving and anticipating are the core activities in anticipating experiences with products, whereas perceiving and evaluating are the central behaviours in experiencing actual products.

Another difference between anticipated and real user experiences worth noting is the emotions anticipated or felt by users. Through actual experience with a product, users express more felt emotions, as compared to the number of anticipated emotions.
reported when anticipating their experiences (Figure 6.9 and Figure 7.6). This suggests that when experiencing a real product, users more easily recognise and identify their emotions, as they are actually feeling them.

8.2.2 Pragmatic and Hedonic Aspects of Anticipated and Real User Experiences

In real user experience, it is evident that when judging a product, users often focus on the pragmatic quality of the product (e.g. learnability, ease of use, portability, and performance) rather than its hedonic quality (e.g. ability to stimulate exploration and fun, and ability to facilitate self-expression). As can be seen in Figure 7.7, more than 84% of users’ positive appraisals of the product are related to its pragmatic aspects. Likewise, about 95% of their negative judgments are related to perceived poor pragmatic quality of the product. Moreover, based on their perceptions of the product’s quality, users might expect better or improved product attributes. These attributes, again, are more related to pragmatic (92%) than to hedonic aspects. Hence, users perceive pragmatic quality, rather than hedonic quality, as the primary attribute that determines the goodness of a product.

As has been discussed in Section 8.1.2, users’ preferences for pragmatic over hedonic alternatives have been recognised in consumer research (Chitturi, et al., 2007; Kivetz and Simonson, 2002; Okada, 2005) and user experience research (Diefenbach and Hassenzahl, 2011). This phenomenon has been linked to the users’ need to justify their choice (Diefenbach and Hassenzahl, 2011; Okada, 2005).

Although product judgment is strongly driven by perceived pragmatic product quality, users’ positive experiences, in contrast, are more associated with hedonic aspects (65.5%). This fact leads to an important theory: ‘while users tend to focus on the product’s pragmatic factors when consciously and cognitively judging it, it is the product’s ability to facilitate the fulfilment of their hedonic needs that plays a larger role in creating their positive experiences’. For example, the most salient positive user experiences in this study are related to the camera’s ability to provide fun, excitement, and stimulation, as well as to its ability to facilitate pleasurable social experiences and connectedness with others.
Chapter 8: Findings and Discussion

The literature supports this finding. Partala and Kallinen (2012), for example, identify that the feelings of competence and autonomy, which are aspects of users’ hedonic needs, are highly prominent in the most satisfying user experiences. As emphasised by Hassenzahl (2008, 2010), the fulfilment of hedonic or basic needs (e.g. autonomy, competency, self-expression) generates positive experiences with interactive products. Therefore, hedonic quality contributes directly to positive user experience, whereas pragmatic quality provides indirect support for basic needs by removing barriers to their fulfilment (Diefenbach and Hassenzahl, 2011; Hassenzahl, 2008; Hassenzahl, et al., 2010). Kujala et al.’s (2011) study of the dynamics of user experience, however, shows a somewhat incongruous result: positive pragmatic reasons given for improved user experience over time are much more dominant than positive hedonic reasons. This could be due to the fact that articulating pragmatic reasons is easier than articulating hedonic ones (Diefenbach and Hassenzahl, 2011), and thus users tend to put more emphasis on pragmatic attributes.

With respect to negative experiences, inferior pragmatic quality perceived by users is a primary source (80.5%) of negative experiences in using a product. Partala and Kallinen (2012), for instance, found that users’ report of their most unsatisfying experiences with technology are more related to pragmatic problems, and are often uninformative regarding hedonic aspects of their experiences. Similarly, Kujala et al. (2011) demonstrate that usability and utility issues are the main reasons for user experience deteriorating over time. In other words, a product’s performance in accomplishing its main functions and in facilitating the fulfilment of users’ task goals is indispensable in diminishing negative user experience. Nevertheless, as Figure 7.7 and Hassenzahl et al. (2006) suggest, the absence of pragmatic problems might not be enough to create positive experiences.

A comparison and discussion of the results of Experiment One and Experiment Two related to pragmatic and hedonic aspects of user experience (Section 6.3.2, Section 7.3.2, Figure 6.10, and Figure 7.7) can be recapitulated as follows:

1. Users greatly pay more attention to pragmatic aspects of a product when conceiving, conceptualising, and describing their desired interactive product.
2. In perceiving product quality, users have a great propensity to see pragmatic quality as more important than hedonic quality. This occurs irrespective of whether the users are recalling their own products, thinking of those available on the market, or evaluating an actual one being used.

3. The real positive experiences comprise more experiences related to hedonic aspects (65.5%) than those related to pragmatic aspects. In contrast, anticipated positive experiences consist of more experiences associated with pragmatic aspects, albeit those related to hedonic aspects generate a considerably high proportion of occurrences (39.5%).

4. Both anticipated and real negative user experiences are more related to pragmatic aspects of product.

5. Positive experiences and positive product judgments tend to have a higher proportion of hedonic aspects compared to their negative counterparts.

Thus, the comparison shows almost perfectly consistent results; that is, product judgment, product conception, and negative user experience are more related to pragmatic aspects. In addition, hedonic aspects receive more attention in positive than in negative product appraisals, and play a greater role in positive than in negative user experiences. The only difference is that positive anticipated experiences contain more pragmatic than hedonic experiences, whereas the reverse is true for positive real experiences. The implications of these similarities and difference are discussed in Chapter 9.

8.2.3 The Formation of Real User Experiences

Using and interacting with a product result in positive and negative user experiences. The sub-category relationships outlined in Tables 7.4, 7.5, 7.6 and 7.7 provide a basis for developing two sub-category networks (Figure 8.2 and Figure 8.3) that delineate the construction of these experiences. Facilitated by these two networks, the discussion of the formation of real user experience focuses on differentiating between it and anticipated user experience.
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Note: the nodes’ colours represent the six categories in the coding scheme, numbers in parentheses represent the weights (global closeness) of sub-category relationships, and numbers in square brackets represent the ranking of relationships between the key sub-category and co-occurring sub-categories.

Figure 8.2 Sub-category Network Representing the Construction of Positive User Experience

Note: the nodes’ colours represent the six categories in the coding scheme, numbers in parentheses represent the weights (global closeness) of sub-category relationships, and numbers in square brackets represent the ranking of relationships between the key sub-category and co-occurring sub-categories.

Figure 8.3 Sub-category Network Representing the Construction of Negative User Experience

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As in the AUX Framework, the weight for each sub-category relationship is determined and added to the real user experience networks. An example of how these weights are calculated can be seen in Table 8.1.

**Positive Experience**

Figure 8.2 shows how eight factors are related in forming positive user experiences with an actual product. There are three stimuli that engender positive experiences. According to the relationship ranking and weights, *Favourable Product Characteristics* (FPC) is the main stimulus of enjoyable experiences. This is followed by *Discovery* (DV) and *Exploration and Learning* (EL). Compared to Experiment One’s results, the liked features of existing products (*Favourable Existing Characteristics*) only act as a secondary stimulus in engendering positive anticipated experiences, whereas a desired product (*Desired Product Characteristics*) acts as the principal stimulus (Figure 8.1). A desired product concept does not play any role in positive real experiences, since users focus on the actual product being used.

The use of product features that are positively appraised and liked by users (FPC) engenders positive experiences, as these features meet or exceed the users’ preferences and needs, and serve to accomplish their goals. The relationship between FPC and positive experience is reciprocal. Pleasurable experiences elicited by the use of certain features can produce users’ positive judgments and liking for those features. Thüring and Mahlke (2007) have proposed that user experience results in overall appraisal of the product, and thus impacts on usage behaviour and preferences for alternative products. However, they do not discuss the inverse relationship; that is, how product appraisal can affect user experience.

The discovery of new, interesting, or unexpected product features and ways to use them (DV) generates excitement, satisfaction, and a sense of achievement. This discovery, therefore, becomes a form of positive user experiences (mostly hedonic). It also motivates product use that can lead to more pleasurable experiences. Korhonen et al. (2010a) define discovery as “finding something new or unknown” (p. 5), and include it as part of the core (central, meaningful) experiences that articulate playful experiences with interactive products. Discovery is found to be one
of the most common core experiences elicited from users’ immediate interaction with a personal product (Arrasvuori, et al., 2010; Korhonen, et al., 2010a). The following excerpt illustrates how discovery can evoke positive feelings and experiences:

There is a feature in this camera that you control the function using your gesture ... I didn’t actually know about it until I found out how to use it by accident. So when I actually figured it out how to use it, I was actually quite excited, I was showing people, ‘Hey, see this, I can do this …’ So I was actually quite happy with myself that I found this out and I was quite surprised with the camera to be able to do this ... I mean that’s the point, the moment when I discovered it, that was good. The fact that it’s something that I found out myself, it makes me quite happy. [Participant #29]

Exploring a new product and learning how to use it (EL) can be a source of positive experiences, as they provide stimulation and fun. Schrammel et al. (2008) identify exploration as one of the key factors for positive experiences, and find that exploration in itself is experienced as a satisfying activity. Like discovery, exploration is a core experience in the playful experience categorisation (Arrasvuori, et al., 2010; Korhonen, et al., 2010a). Product exploration can also be categorised as an action-mode of product use (Hassenzahl, 2003), in which specific usage goals are absent, and efficiency and effectiveness are not important. Hassenzahl and Ullrich (2007) note that in product use without instrumental goals, users value spontaneous interaction, and this is accompanied by positive emotion and favourable product evaluation. The exploration and learning activities discussed above also allow users to discover and use new or unknown features and possibilities that can result in enjoyable experiences. Moreover, in relation to positive hedonic experience, these activities can serve in the fulfilment of users’ needs for personal growth and competency (Hassenzahl, 2003; Hassenzahl, et al., 2010).

In anticipating positive experience with an imagined product, no discovery, learning activity, or product exploration takes place, since users do not interact with an actual product. Furthermore, because users imagine and already know what features will be incorporated in their desired product and how they will work, they do not expect any exploration, learning, and discovery to occur in their anticipated interaction with the product. Consequently, these activities are not anticipated as sources of positive experiences.
For the same reason, another factor that is missing in positive anticipated experience is *Positive Expectation Disconfirmation* (PED); that is, users’ finding that the product performance and characteristics exceed their expectations. Through actual positive experiences, users might identify that the product works and looks better, contains more innovative features, or is easier to use than expected. Thus, their expectations are positively disconfirmed. As has been touched on in Section 8.2.1, PED contributes to positive product appraisal, enhances users’ satisfaction, and influences their next experiences with the product.

Research in the marketing domain has demonstrated the effects of expectation disconfirmation on perceived product performance and quality, as well as on consumers’ satisfaction and experience (Anderson, 1973; Oliver, 1976, 1977; Olshavsky and Miller, 1972; Scharf and Volkmer, 2000). Thayer and Dugan (2009) note that PED can represent users’ unanticipated delight with particular aspects of experiencing a product. They value the description of expectation disconfirmation as a means of assessing specific components of user experience. This, in turn, helps designers to make decisions and trade-offs when designing each component of the user experience for the product (Thayer and Dugan, 2009).

In relation to *Experiential Knowledge* (XK) in the formation of positive user experience, users largely use their prior experiences and knowledge to make comparisons between the product being used and similar products (usually with older models or models of lower quality). This comparison enhances favourable perceptions of the product and contributes to the construction of positive experiences. However, this constructive comparison might cease after a certain period of use. As von Wilamowitz-Moellendorff et al. (2006) discovered, in reconstructing changes in their experiences of using a mobile phone over an extensive period of time, users always compare their phone with others’ better phones or with new ones. This comparison results in a deteriorated perception of the owned product, especially of its hedonic attributes (identity and beauty). Thus, it is suggested that, during the initial stages of product use, product comparisons based on users’ experiential knowledge can promote positive user experience. However, during the later stages of product use, product comparisons tend to deteriorate product perception and experience.
In anticipating positive experience, users apply their experiential knowledge in adopting and incorporating positive features of similar products into their desired product concept. In addition, they create analogies between pleasurable experiences in using comparable technologies and their anticipated experiences with the desired product. They assume that the positive experiences with the analogous technologies will also occur when using their desired product concept. Hence, XK, in this case, supports the construction of positive anticipated experience (Figure 8.1).

The last three factors – Intended Use (IU), Positive Emotion (PE), and User Characteristics (UC) – have similar relationships and order of ranking to those of the equivalent factors in the formation of positive anticipated experience (Figure 8.1). IU, which ranks first in the relationship hierarchy, sets the contexts of users’ positive experience by establishing the situations, purposes, and procedures of product use. PE, which ranks third, often occurs within the experience; it is thus considered as part of positive experience. Finally, UC, which holds the fifth position, determines the perception and use of a product; it consequently influences users’ positive experiences with the product.

**Negative Experience**

The formation of negative user experience involves seven factors, as depicted in Figure 8.3. Based on the relationship ranking and weight, Usage and Learnability Problem (ULP) is the main source of negative experience, whereas Dislike(s) (DL) is the secondary source. In anticipating future experiences, DL (that is, existing products’ features that users judge negatively) acts as the only source of negative anticipated experience (Table 6.7).

As shown by the example in Figure 7.9, difficulties and problems in using and understanding a product (ULP) elicit frustration and, in particular contexts, engender negative user experiences. This supports Partala and Kallinen’s (2012) finding that the most unenjoyable user experiences are generally accompanied by direct emotional responses that stem from pragmatic (usability and utility) problems. Karapanos et al. (2009) also identify that learnability problems are the major cause of dissatisfying experiences during the initial phase of using a new product.
ULP usually diminishes with increased familiarity with a product. Studies of the dynamics of user experience demonstrate that experiences related to a product’s learnability problems decrease over time; simultaneously, perceived ease-of-use and perceived usability of the product tend to improve (Karapanos, et al., 2009, 2010; von Wilamowitz-Moellendorff, et al., 2006). However, issues related to long-term usability can still be a dominant source of dissatisfying experiences over prolonged product use (Karapanos, et al., 2009, 2010). ULP does not occur in the formation of negative anticipated experience, because there is no users’ encounter with an actual product; thus, they cannot report their difficulties in using and familiarising themselves with the product.

In real experiences with a product, the DL factor develops a bidirectional relationship with negative experience (Figure 8.3). Product features that are perceived as low quality and not meeting users’ needs lead to unenjoyable experiences related to their use. At the same time, negative experiences with particular features of a product can form negative appraisals of those features and diminish the product’s appeal. This is in line with the consequences of user experience modelled by Mahlke (2007) and Thüring and Mahlke (2007). Compared to the process of anticipating future experiences, DL develops a one-way relationship with negative anticipated experience: DL engenders negative anticipated experience (Table 6.7).

In addition to ULP, Negative Expectation Disconfirmation (NED) is another factor that does not emerge in negative anticipated user experience. Whereas negative anticipated experience with existing products inspires desired product characteristics (Figure 8.1), negative real experience can form users’ judgment that the product’s performance or quality falls short of their expectations (Figure 8.3). NED can indicate certain areas of the product that designers need to focus on more in order to enhance the overall user experience (Thayer and Dugan, 2009).

In the construction of negative anticipated experience, users’ experiential knowledge of existing products (XK) forms perceived problems related to those products, and thus underlies negative anticipated experiences with the products (Table 6.7). Users’ XK can also produce expectations of how a new product will perform or respond. When actually experiencing a new product, the dissonance between these
expectations and the product’s actual performance or responses can result in dissatisfying experiences. In this way, XK contributes to the occurrence of users’ negative experiences (Figure 8.3).

The final three factors – Intended Use (IU), Negative Emotion (NE), and User Characteristics (UC) – develop similar relationships and order of ranking to those of the equivalent factors in the construction of negative anticipated experience (Table 6.7). IU, which holds the first position in relationship ranking and weight, plays a role in setting the contexts of users’ negative experiences. Meanwhile, NE ranks second in the relationship hierarchy, indicating it as an inseparable part of negative experience. Finally, UC, which ranks last, influences users’ negative experiences by determining their interest in, perceptions of, and interactions with a product.

The differences between anticipated and real user experiences that have been discussed in this section contribute to the development of recommendations for experience-centred design. These recommendations are explained in Chapter 9.

8.3 SUMMARY

This chapter identified and discussed the findings and emerging theories resulting from Experiment One and Experiment Two. The discussion of these findings and theories addressed the two research sub-questions in the context of the existing literature.

The findings derived from Experiment One’s results comprised the way users anticipate their experiences and the characteristics of anticipated user experience. Regarding the latter finding, it was highlighted that a desired product acts as a principal stimulus in engendering users’ positive anticipated experiences. On the other hand, existing products, as stimuli, tend to generate negative anticipated experiences (Section 8.1.1). Moreover, pragmatic quality is perceived as the main factor that determines both positive and negative future experiences with a product. Although perceived as less influential than pragmatic quality, hedonic quality appears to have a greater potential in engendering positive than negative anticipated experiences (Section 8.1.2). The former finding, which was represented by the AUX Framework (Figure 8.1), directly addressed the first research sub-question. The AUX
Framework delineates the processes through which users imagine a desired product and anticipate positive experiences with the conceived product. These processes were discussed in depth in Section 8.1.3.

The above findings are summarised in Figure 8.4, which describes the stimuli of anticipated user experience and other factors that play a role in the construction of that experience. Figure 8.4 also illustrates that anticipated user experience comprises two types of experience – positive and negative – each of which is related to both pragmatic and hedonic aspects of product.

The findings derived from Experiment Two’s results included the characteristics and the formation process of real user experience. These are summarised in Figure 8.5, which explains the stimuli of user experience, together with other factors that contribute to the formation of the experience. Through an encounter with a product, users can feel positive and negative experiences that relate to pragmatic and hedonic aspects of the product. These experiences can result in users’ expectations of being positively and negatively disconfirmed. The experiences might also form users’ positive and negative appraisals of the product. A more detailed description of the formation of positive and negative user experiences was presented in Section 8.2.3.
In the light of the above findings, the second research sub-question was addressed by comparing anticipated user experience with real user experience. One of the main differences between these two types of experience is the occurrence of the familiarisation process (discovery, exploration and learning, usage and learnability issues) and expectation disconfirmation in real user experience (Section 8.2.1 and Section 8.2.3). Another important difference is that users’ positive anticipated experiences are more related to pragmatic aspects of a product, whereas positive real experiences are more related to its hedonic aspects. This indicates that, while the users perceive pragmatic quality as more important for creating their positive future experiences, it is the hedonic quality that has more influence in eliciting their actual pleasurable experiences (Section 8.2.2). More differences have been discussed and summarised in Table 8.2.

Chapter 9 discusses the significance of the research findings related to design for experience in the early stages of product development. In addition, relevant design recommendations are introduced and discussed.
Table 8.2 Differences between Anticipated and Real User Experiences

<table>
<thead>
<tr>
<th>Anticipated User Experience</th>
<th>Real User Experience</th>
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<tbody>
<tr>
<td><strong>Categories and sub-categories</strong></td>
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| No familiarisation process and expectation disconfirmation occur in the formation of anticipated user experience. | • A familiarisation process takes place to get used to the product.  
• Through actual experience, users’ expectations can be confirmed, positively disconfirmed, or negatively disconfirmed. |
| **Central activities or behaviour** | |
| Users focus on conceiving a desired product and on anticipating experiences with the imagined product. | Users focus on judging and perceiving the product quality and how it affects their experiences. |
| **Pragmatic and hedonic aspects** | |
| Positive anticipated experience is more related to pragmatic aspects of product. | Positive actual experience is more related to hedonic aspects of product. |
| **Stimuli of positive experience, ordered according to relationship ranking** | |
| 1. Desired product characteristics | 1. Favourable product characteristics |
| 2. Favourable existing characteristics | 2. Discovery |
| **Sources of negative experience, ordered according to relationship ranking** | |
| Dislike(s) | 1. Usage and learnability problems |
| 2. Dislike(s) | |
| **Factors influencing positive experience, ordered according to relationship ranking** | |
| 1. Intended use | 1. Intended use |
| 2. Positive anticipated emotion | 2. Favourable product characteristics (bidirectional relationship) |
| 3. Desired product characteristics | 3. Positive emotion |
| 4. User characteristics | 4. Discovery |
| 5. Experiential knowledge | 5. User characteristics |
| 6. Favourable existing characteristics | 6. Exploration and learning |
| **Factors influencing negative experience, ordered according to relationship ranking** | |
| 1. Intended use | 1. Intended use |
| 2. Negative anticipated emotion | 2. Negative emotion |
| 3. Desired product characteristics | 3. Usage and learnability problems |
| 4. Experiential knowledge | 4. Dislike(s) (bidirectional relationship) |
| 5. Dislike(s) | 5. Experiential knowledge |
| 6. User characteristics | 6. Negative expectation disconfirmation |
| 7. User characteristics | |
Chapter 9: Significance of Findings and Design Recommendations

Chapter 8 identifies and discusses the research findings and emerging theories with respect to anticipated and real user experiences. These findings and theories, which include the AUX Framework, answer the two research sub-questions.

This chapter discusses the significance of the findings and theories with a focus on the main research question:

*How can designers be supported in assessing user experience in the early stages of product design and development?*

In addition, recommendations to support designers in assessing and designing for user experience are proposed.

Early assessment of user experience is crucial, since the earlier it can be conducted, the cheaper and easier it is to improve the product being designed (Väänänen-Vainio-Mattila, et al., 2008b). However, to assess user experience at the beginning of the product creation process is difficult and challenging (Roto, 2007; Väänänen-Vainio-Mattila, et al., 2008b), because no functional prototypes are generally available to allow actual user-product interactions to be evaluated. In addition, complex factors – including emotions, contexts of use, and users’ expectations – must be considered.

The findings of this research offer new knowledge for designers to gain more understanding of user experience via user anticipation. This, in turn, can support user experience assessment prior to actual use of a working prototype or product. The
comparison between anticipated and real user experiences also provides new insights. These include how the experiences differ, what elements are missing in the anticipated experience, and what aspects should be considered in using anticipated experience data for supporting the early design stages.

9.1 DESIGN IDEAS FROM ANTICIPATED USER EXPERIENCE

Designers’ understanding of positive and negative anticipated user experience can help them to identify users’ underlying needs (pragmatic and hedonic) before any product concepts are created. This will promote the design of products that produce pleasurable experiences for their users. For example, a user anticipates positive experiences of sending pictures to his family directly from his digital camera. Designers can derive from this information that the user’s underlying needs are ease of sharing pictures (pragmatic) and being connected to loved ones (hedonic). These needs can then be translated into a product concept, such as a Wi-Fi enabled camera.

As previously discussed in Section 8.1.1, positive anticipated experiences are largely related to users’ desired or conceived product concepts. Therefore, by exploring users’ positive anticipated experiences, designers can better predict product characteristics that are able to facilitate the fulfilment of users’ behavioural (pragmatic) goals and be- (hedonic) goals. Equally, exploring users’ negative anticipated experiences, which are mainly associated with existing products, can assist designers to identify undesirable product attributes that prevent enjoyable user experiences. The key point is that anticipated user experience is beneficial for the early stages of product design, in that it provides rich design ideas and an understanding of users’ concerns and expectations of their experiences.

Designers need to bear in mind, however, that the imagined use of products can differ from their actual use, and that users’ anticipated experiences of those products can differ from their felt experiences. This is the case even if the product is exactly designed according to the users’ expectations. This is because users might value and appropriate the designed product in entirely unpredicted ways (Ehn, 2008). Moreover, people have a tendency to anticipate their future experiences to be more intense than their actual, felt experiences are (Baumeister, et al., 2007; Wilson and Gilbert, 2005).
The above discussion leads to the first design recommendation: product designers should benefit from using anticipated user experience data as a basis for their design. However, they should strive to exceed the product requirements indicated in that anticipated experience, as this will help to close the gap between users’ actual and anticipated experiences of using the product.

9.2 DESIGNERS’ FOCUS ON PRAGMATIC AND HEDONIC QUALITIES

The findings of this research reveal that users perceive the pragmatic or instrumental quality (e.g. usability) of a product as essential, and this perception significantly influences them when anticipating future experiences with a product (Section 8.1.2). This is particularly true when anticipating negative experiences. It is evident, however, that when envisaging future positive experiences, users have an increased attention to the product’s hedonic or non-instrumental value that can fulfil their basic psychological needs (e.g. for competence in using new technologies).

The above finding implies that user experience assessment that focuses on negative experience with existing products can result in an overemphasis on pragmatic aspects of the experience. This could mislead designers during the initial phases of a new product’s development. Alternatively, by exploiting users’ positive anticipated experiences with a desired product, designers can gain more insight into hedonic aspects of the experience, which are arguably more important for experience-driven design (Hassenzahl, 2008).

In terms of pragmatic and hedonic aspects, the findings related to real user experience mostly support those related to anticipated user experience (Section 8.2.2). In users’ real experience, the pragmatic quality of product emerges as the main key to forming users’ perceptions of the product (e.g. good or bad). In particular, poor pragmatic quality greatly increases negative judgments of the product, as users consider poor pragmatic quality as the main source of their negative experiences. This is true for both real and anticipated user experiences. Meanwhile, hedonic quality has more influence in forming positive than negative product perceptions. In other words, good hedonic quality is appreciated and contributes more significantly to positive judgments of the product, while low hedonic quality less significantly influences users’ negative judgments.
Based on this understanding, the second design recommendation is suggested: by providing excellent pragmatic quality (e.g. functionality, performance, and usability), designers can improve users’ positive perceptions and minimise their negative judgments of the designed product. At the same time, designers can further enhance these positive perceptions by incorporating superior hedonic quality into the design (e.g. enhanced appearance, image, and novelty).

The only difference between anticipated and real user experiences in this context is that positive anticipated experiences contain more pragmatic than hedonic experiences, whereas positive real experiences comprise more hedonic than pragmatic experiences (Section 8.2.2). This suggests that although users consider or anticipate pragmatic aspects of a product as the larger contributor to their future positive experiences, their actual positive experiences are mainly related to its hedonic aspects. Thus, it can be inferred that, while users cognitively and consciously perceive pragmatic quality as an indicator of a good product and as a means of achieving positive experiences, it is the product’s ability to fulfil their hedonic needs that mainly contributes to their pleasurable experiences. This concurs with previous studies, which conclude that users highly value and greatly desire hedonic attributes, yet tend to overemphasise and choose pragmatic attributes because they are more justifiable (Diefenbach and Hassenzahl, 2011; Okada, 2005). This finding also supports the notion that hedonic quality contributes directly to users’ positive experiences (Hassenzahl, 2008).

Therefore, the third design recommendation is proposed: during the early stages of product design, rather than focusing only on users’ negative anticipated experiences and their prevention, designers should focus more on users’ positive anticipated experiences in order to better identify users’ underlying hedonic needs. (This recommendation is also based on the interpretation explained in the second paragraph of this section). This focus is in line with design for experience, which places emphasis on positive aspects of user-product interaction, and on the inclusion of hedonic (non-instrumental) aspects of experience (Bargas-Avila and Hornbæk, 2011; Hassenzahl, 2010; Hassenzahl and Tractinsky, 2006; Mahlke, 2007).
It is still undeniably important to address the pragmatic needs indicated in negative anticipated experiences in order to avoid users’ dissatisfaction and unpleasant experiences. However, the findings of this research confirm that it is the fulfilment of hedonic needs that ensures the creation of positive user experience with interactive products. Accordingly, the fourth design recommendation can be formulated as follows: designers should incorporate pragmatic and hedonic attributes into their designs in the appropriate proportions, and should be cautious not to be misled by possible user bias towards pragmatic product attributes.

### 9.3 UTILISING THE AUX FRAMEWORK

The main significance of this research is the Anticipated User Experience (AUX) Framework (Figure 8.1). This framework consists of two related networks, which identify the processes through which users conceive a desired product and anticipate their positive experiences with that product. Through this framework, important factors and their interrelationships in the anticipation of user experience can be better understood.

#### 9.3.1 Exploring the Factors of the AUX Framework

Focusing on and exploring each factor of the networks in the AUX Framework can generate rich design ideas and insights into users’ underlying needs and expectations. These ideas and insights will support early assessment of user experience and will promote design for pleasurable experience. The first network – a user’s process of conceiving a desired product – guides designers to better identify the following useful design aspects:

1. Product attributes that need to be included in the design and those that need to be removed or improved. These are derived from *Favourable Existing Characteristics* and *Dislike(s)* factors.

2. Negative prior and negative anticipated experiences that are related to existing designs. These data provide input to the new product design to prevent negative experiences with the final product.
3. Intended uses that underlie the characteristics of the desired product. These facilitate the discovery of users’ underlying needs, which interactive products are required to fulfil.

4. User characteristics that influence the desired product concept. These support designers in determining suitable target users or target markets for the product being designed.

5. Users’ experiential knowledge that generates ideas for the characteristics of the desired product. This experiential knowledge can result in product analogies that inspire new features for the product being designed based on the attributes of comparable products or technologies.

6. More details regarding users’ pragmatic needs and the required pragmatic quality of the desired product. These are mainly explored through the Negative Anticipated Experience factor.

Meanwhile, the second network in the AUX Framework – a user’s process of anticipating positive experience – assists and directs designers to gain more information about the following aspects:

1. Potential contexts of users’ positive experiences that are established by intended uses of the desired product according to user characteristics. This information is valuable since context and user characteristics are the core facets of user experience besides the product itself (Hassenzahl and Tractinsky, 2006). Designers will be better able to foresee the purposes and situations of product use that underlie enjoyable experiences for particular user characteristics.

2. Positive anticipated emotions embedded in the anticipated experience. These support designers in predicting users’ positive affective responses in using the product being designed.

3. Product characteristics that are expected to engender pleasurable experiences for the users. These are the outcome of the users’ process of conceiving a desired product (as depicted in the first network). This information contributes to the new product design.
4. Users’ experiential knowledge that supports the construction of positive anticipated experience. This helps designers in understanding and using users’ prior knowledge and experience to design for pleasurable experiences.

5. Users’ hedonic needs and the required hedonic quality of the product. These data can be derived and interpreted from users’ positive anticipated experiences with their desired product. Information related to hedonic aspects of the product is essential for its design, as the fulfilment of users’ hedonic needs will directly enhance their positive experience (Hassenzahl, 2010).

In the AUX Framework, the ranking and weight of each factor’s relationships with the desired product and positive anticipated experience can help designers to prioritise the most influential factors during the design process. For example, Intended Use, Positive Anticipated Emotion, and Desired Product Characteristics factors respectively have the closest connections with users’ positive anticipated experience, as indicated by their highest positions in the relationship hierarchy (Table 6.6). This information implies that these factors greatly influence the formation of positive anticipated experience, and designers’ exploration of these factors can generate the most relevant and valuable information about the experience. Therefore, designers can proportionally invest their time and effort in exploring the factors of the AUX Framework according to their relationship ranking and weights.

The AUX Framework also offers a new insight into how factors of anticipated user experience link and what effect they have on each other. These relationships can assist the development of an efficient design approach and, as earlier mentioned, the prioritisation of the factors in the early assessment of user experience. To illustrate, the framework shows that Intended Use (IU) is one of the factors that have the most relationships with other factors. By simply exploring this factor with users, valuable data related to other factors that are linked to IU – such as User Characteristics, Experiential Knowledge, Desired Product Characteristics, and Positive Anticipated Experience – can be simultaneously obtained. This exploration, therefore, can save designers’ resources during the assessment process. Moreover, the understanding of types of relationships among the factors allows designers to decide which factors they need to focus on to obtain the targeted information. For instance, to obtain data
about negative anticipated experience, designers should also investigate users’ dislikes of existing designs, as these two factors have a close causal relationship.

The above discussion produces the fifth design recommendations: in conducting early assessment of user experience, designers should use the AUX Framework to identify and prioritise factors that they need to explore. The identification and exploration of these factors provide design ideas and understanding of users’ basic needs related to their positive experiences. Meanwhile, the prioritisation of these factors can assist designers in managing the use of their design resources. The indicated relationships among the factors also can help designers to have an efficient approach to the assessment.

9.3.2 Illustration of the Application of the AUX Framework

A hypothetical scenario of how the AUX Framework might be applied in the design process is described as follows: during the early phases of developing a new smart phone, a designer uses the second network of the AUX Framework to assist him in assessing user experience of the phone being designed. The designer, together with prospective users, starts with exploring the Intended Use of the phone, as this factor has the strongest relationship with positive anticipated experience and has the most connections with other factors (Figure 9.1). The designer spends the largest portion of his design resources to explore this Intended Use factor. This exploration allows him to predict potential usage contexts that build enjoyable experiences with the phone. This information is then translated into the design.

In the next step, the designer focuses on exploring the Positive Anticipated Emotion factor, as it is connected with Intended Use and also ranks second in the relationship hierarchy. Through this process, he can foresee the positive emotional responses that constitute the pleasurable experiences of using the phone. The designer aims to support these emotions in his design.

The designer can then explore Desired Product Characteristics, which ranks third in the relationship hierarchy. In conjunction with the information derived from Intended Use, the designer identifies the phone’s attributes that fit the indicated usage contexts and, in turn, can engender users’ positive emotions and experiences. The following
factors are then explored according to their relationship ranking, relationship weights, and connections with other factors. Through these explorations, the designer can gain insights into all aspects that construct positive experiences of using the designed phone.

**Figure 9.1 Prioritisation of the Factors of the AUX Framework**

### 9.4 DIFFERENCES BETWEEN ANTICIPATED AND REAL USER EXPERIENCES: AN IMPLICATION

The factors of positive anticipated experience, their relationships, and their relationship ranking (Table 6.6 and Figure 8.1) can be compared with those of positive real experience (Table 7.4 and Figure 8.2). This comparison produces relatively consistent outcomes, with the exception of the *Favourable Product Characteristics* (FPC) factor in terms of its rank and main role (Section 8.2.3).

The comparison also reveals three factors that are missing in the formation of positive anticipated experience: *Discovery* (DV), *Exploration and Learning* (EL), and *Positive Expectation Disconfirmation* (PED). DV and EL facilitate and engender positive user experience (Figure 8.2). Discovery and exploration have also been categorised as part of playful experience in using technology (Arrasvuori, et al., 2010; Korhonen, et al., 2010a), and can, of themselves, be a satisfying experience for the users (Schrammel, et al., 2008). Meanwhile, PED, as the outcome of positive
experience, forms positive product appraisals and can elicit users’ delight and pleasant emotions.

Users do not usually envisage these three aspects when anticipating their experiences with a desired product, since they themselves conceive the features, performance, and quality of the product. Accordingly, the last design recommendation is proposed: in drawing on users’ anticipated experiences to support early assessment of user experience, designers should include and consider the three missing factors (i.e. discovery, exploration and learning, and positive expectation disconfirmation), due to their important roles in the construction of positive experience.

Although users might not anticipate any aspects of discovery, exploration, and expectation disconfirmation as part of their positive experience, designers should aim to create ‘endless’ possibilities for exploration and discovery in their products. They should also aim to design novel features and quality that exceed users’ expectations. Strategies that can be employed include providing products that allow personal customisation, as well as flexibility for the addition and combination of software or hardware that creates new uses of the products. A fitting example would be the Apple iPhone with its open-ended system that offers copious options for application software. This is in line with Mäkelä and Fulton Suri’s (2001) argument that product design should support users’ creativity in order to induce pleasurable experiences.

The comparison between negative anticipated and negative real experiences (Table 6.7 and Table 7.5) reveals two factors that do not emerge in the anticipation of negative user experience: Usage and Learnability Problem (ULP) and Negative Expectation Disconfirmation (NED). Apart from Dislike(s), ULP is also a source of negative experience (Figure 8.3). Meanwhile, NED is a possible outcome of negative experience. Again, designers should consider these two missing factors when using negative anticipated experience data to support the early stages of product development. This contributes to preventing future negative user experience, as these factors can provide additional input to the design of products that are easy to learn and use, and which match or exceed users’ expectations.
9.5 GENERAL FRAMEWORK OF ANTICIPATED AND REAL USER EXPERIENCES

The theoretical contribution of this research is the new knowledge of anticipated user experience and how it differs from real user experience. To recapitulate the study results and to make it easier for researchers and designers to navigate among the components of the two types of experiences, a general framework of anticipated and real user experiences (Figure 9.2) has been developed. This framework is based on the coding schemes (Table 6.2 and Table 7.2), the sub-category networks (Figure 8.1, Figure 8.2, and Figure 8.3), and the co-occurrence matrix (Appendix H).

The top part of the framework describes how the categories in anticipating user experience relate. First, product characteristics that are conceived or remembered engender anticipated experiences and anticipated emotions. Second, anticipated and prior experiences, as well as anticipated and prior emotions, inspire desired product characteristics or produce users’ appraisals of existing products. Third, emotion is part of user experience. Lastly, product characteristics, experiences, emotions, and their relationships are influenced by contexts that are established by intended use and user characteristics.

The availability of functional prototypes or products allows real user experiences to occur. The bottom part of the framework delineates that, under the context set by intended use and user characteristics, five categories of real experience interact. The use of product features with their perceived quality evokes users’ experiences and emotions, and can produce expectation disconfirmation. Conversely, the experiences and disconfirmed expectations can form users’ judgments on particular features of the product. Further, the familiarisation process also acts as the stimulus of users’ experiences, emotions, product appraisals, and disconfirmed expectations. Expectation disconfirmation is one of the outcomes of real user experiences; it is usually accompanied by positive or negative emotions. Finally, the emotions themselves are part of the experiences.

The general framework above accommodates all aspects that have been agreed to be the most prominent factors influencing user experience: product or system properties, user characteristics, context, and emotion (Bargas-Avila and Hornbæk, 2011; Desmet
This framework is expected to facilitate the understanding and actions of user experience researchers and designers in relation to experience-centred design in the early stages of product development.

Figure 9.2 General Framework of Anticipated and Real User Experiences
Chapter 9: Significance of Findings and Design Recommendations

9.6 SUMMARY

This chapter discussed the significance of the findings, with the focus on answering the main research question. This significance included three areas: (1) information of users’ underlying needs (pragmatic and hedonic) and design ideas that are derived from anticipated user experience, (2) guidance for designers in relation to their focus on pragmatic and hedonic qualities of products, and (3) intended utilisation and hypothetical application of the AUX Framework to support the early phases of design.

Based on the findings, several design recommendations were developed to support designers in assessing and designing for user experience in the early stages of product development. These recommendations can be summarised as follows:

1. Designers should explore users’ anticipated experiences, as the information derived from this exploration can help them to predict users’ underlying needs (both pragmatic and hedonic), and to obtain rich design ideas. However, as people tend to anticipate their future experience to be more positive and intense than actual experience, designers should strive to exceed the product requirements indicated in the anticipated experience.

2. Designers should provide excellent pragmatic quality in order to improve users’ positive perceptions and minimise their negative judgments of the designed product. Concurrently, designers can further enhance these positive perceptions by incorporating superior hedonic quality into the design. These positive product perceptions and judgments, in turn, can improve the overall user experience with the product.

3. Assessment that focuses on negative anticipated experience can result in an overemphasis on pragmatic aspects of the experience, and this can mislead designers during the initial design phases. Therefore, in the early stages of product development, designers should focus on assessing positive, rather than negative, anticipated user experience in order to gain more insight into hedonic aspects of the experience, which are arguably more important for experience-driven design.
4. Users perceive pragmatic quality as an indicator of a good product and as a means of achieving positive experiences. However, it is the product’s ability to fulfil their hedonic needs that mainly creates their pleasurable experiences. Accordingly, designers should incorporate pragmatic and hedonic attributes into their designs in the appropriate proportions, and should be cautious not to be misled by users’ possible bias towards the pragmatic aspects of the product.

5. Focusing on and exploring each element of the AUX Framework can support early assessment of user experience and promote design for pleasurable experience. Designers should use this framework to identify and prioritise factors that they need to explore. The indicated relationships among the factors help the designers to have an efficient approach to assessment, and can thus save their resources during the assessment process.

6. There are several factors that influence real user experience, but which are not indicated in anticipated user experience (e.g. discovery, exploration and learning, and expectation disconfirmation). In drawing on users’ anticipated experiences to support the early design phases, designers should include and consider these missing factors, due to their important roles in the construction of positive experience.

In addition, a general framework of anticipated and real user experiences (Figure 9.2) was developed to assist designers and researchers to navigate among the factors of the two types of experiences.

The next chapter concludes this thesis. It covers the implications of the research findings, its contributions to knowledge, its limitations, and directions for future studies.
Chapter 10: Conclusions

This study explores anticipated user experience with interactive products and how it differs from the real experience. The main aim is to apply this knowledge to support early assessment of user experience. Thus, this research responds to the need of product designers and product developers for evaluations of user experience during the early stages of product development. It also addresses the lack of knowledge of user experience that occurs before actual interaction with products (Section 2.2). The outcomes of this research contribute to design for positive experience, and can foster the creation of pleasurable products for users.

The main research question (Section 1.3) was broken down into two research sub-questions to provide better direction and focus for the study:

1. How do users anticipate experiences with interactive products?

2. What are the differences between anticipated and real user experiences?

The first sub-question has been addressed in Chapters 6 and 8, with the definition of sub-category relationships, and the development of the Anticipated User Experience (AUX) Framework. This framework delineates how users conceive a desired product and anticipate their positive experiences with that product. There are six interrelated factors that play an important role in the formation of positive anticipated experience: Intended Use, Positive Anticipated Emotion, Desired Product Characteristics, User Characteristics, Experiential Knowledge, and Favourable
Chapter 10: Conclusions

Existing Characteristics (ordered according to their importance). The findings arising from addressing the first sub-question were discussed in Section 8.1.

In relation to the second sub-question, Chapters 7 and 8 focused on the development of sub-category relationships and networks that depict the formation of positive and negative real user experiences. The differences between anticipated and real user experiences were discussed in Section 8.2, and highlighted the absence of familiarisation process and expectation disconfirmation in anticipated experience.

The stimuli that engender each type of the experiences were also compared. In addition, the difference in how a product’s perceived pragmatic and hedonic qualities influence anticipated and real user experiences was explained.

With respect to the main research question, the significance of all findings and their contribution to early assessment of user experience were presented in Chapter 9. Design recommendations were proposed, and the potential application of the AUX Framework in the early phases of product development was discussed.

This chapter concludes this thesis by recapitulating central elements of the study. It firstly describes the implications of the findings, and then identifies and explains their contributions to knowledge in the field. The limitations of this study are then presented, and potential future research directions are discussed.

10.1 IMPLICATIONS

The findings of this study have important implications for the areas of product design and design for experience pertaining to the early stages of product development. The research outcomes – including the new knowledge of anticipated user experience, the new knowledge of differences between anticipated and real user experiences, the AUX Framework, and the design recommendations – provide support and guidance for designers to conduct early assessment of user experience in the design process. Such a practice could ensure the creation of enjoyable products, avoid expensive design modifications, and promote the products’ success in the market.
Chapter 10: Conclusions

10.1.1 Implications of the Understanding of Anticipated User Experience

This research shows that users’ positive anticipated experiences are largely related to an imagined, desired product concept, whereas negative anticipated experiences are mostly related to existing products owned by the users or available on the market (Section 8.1.1). In addition, both positive and negative anticipated experiences are contextualised by the intended use of product.

This understanding implies the need for designers to explore these anticipated experiences and the intended use of product during the early stages of product design, in order to identify users’ underlying needs and potential contexts of use. Positive anticipated experiences, in particular, offer rich design ideas that stem from users’ expectations, and thus support designers to better predict product characteristics that can facilitate the fulfilment of users’ pragmatic and hedonic goals. Negative anticipated experiences, on the other hand, indicate parts of the current experience or current product design that need to be improved. Hence, the understanding and exploration of users’ anticipated experiences will promote design for enjoyable user experience from the start of the product development process.

The research findings also demonstrate that anticipated user experience is significantly influenced by users’ tendency to perceive the pragmatic quality of products as more important than their hedonic quality (Section 8.1.2). In other words, users’ anticipated experiences are more related to pragmatic than hedonic aspects of products. This is particularly more evident in their negative anticipated experiences. However, it is discovered that when anticipating positive experiences, users have an increased appreciation to the products’ hedonic quality that can fulfil their basic psychological needs.

This understanding implies that designers’ focus on negative anticipated experiences can result in an overemphasis on pragmatic aspects of products, and thus can mislead them during the early phases of product development. It also implies that designers need to exploit users’ positive anticipated experiences in order to gain more insight into hedonic aspects of products, which have been argued as more valuable for experience-centred design (e.g. Hassenzahl, 2008).
10.1.2 Implications of the AUX Framework

The main outcome of this research is the AUX Framework (Figure 8.1). This framework contains two related sub-category networks that describe the users’ process of conceiving a desired product, and how they anticipate positive experiences with the imagined product. The AUX Framework has important implications for both design research and the design industry.

With respect to design research, components of the framework and their relationships can guide researchers in identifying and investigating key factors that construct positive anticipated user experience. Furthermore, the relationship rankings and weights embedded in the framework provide information about the most important factors in the construction of the experience. For example, the Intended Use, Positive Anticipated Emotion, and Desired Product Characteristics factors were found to have the closest relationships with users’ positive anticipated experience. This fact implies that the exploration of these factors can generate the most relevant and useful information about the experience. The use of the AUX Framework by researchers, in turn, can be a basis for obtaining a better understanding of user experience, and for developing new methods for user experience assessment in front-end design processes.

In the design industry, focusing and exploring each component of the AUX Framework can provide designers with rich design ideas and insights into users’ underlying needs and expectations. Moreover, this exploration can allow designers to identify several useful design aspects: sources of positive experiences, the required pragmatic and hedonic product qualities, potential contexts of experience, potential emotions embedded within the experience, and suitable target users for the product being designed. These outcomes will support designers in assessing and designing for user experience during the early stages of product design. In addition, the relationship hierarchy and weights, and the connections among the components, all of which are identified in the framework, guide designers to prioritise the most significant user experience factors during the design process. This prioritisation helps them to better allocate their design resources, and to have an efficient approach, in exploring and assessing the components of the framework (as explained in Section
9.3.1). The hypothetical application of the AUX Framework was illustrated in Section 9.3.2.

10.1.3 Supporting Design for Experience Using the Design Recommendations

The understanding of the characteristics of anticipated and real user experiences, and of the differences between them, generates implications that are translated into several recommendations for designers (Chapter 9). These recommendations support the assessment of, and design for, user experience in the early stages of design. Their summary is presented below.

Designers should explore anticipated user experience and use the outcome as the basis for their design and assessment of user experience. However, they should strive to exceed the product requirements indicated in that anticipated experience.

As mentioned earlier, exploring anticipated user experience can provide rich design ideas and an understanding of users’ underlying needs. However, people tend to anticipate their future experiences to be more positive and intense than the actual experiences when they occurs (Section 4.1). Therefore, designers should close this gap by providing product experiences that exceed users’ expectations.

Designers should provide pragmatic product quality to improve users’ judgments of the designed product. They also should provide hedonic quality to further enhance these positive product perceptions.

This recommendation is derived from the finding that a product’s poor pragmatic quality greatly increases users’ negative perceptions of the product. In contrast, poor hedonic quality less significantly influences users’ negative perceptions; the hedonic quality contributes more significantly to forming positive judgments of the product.

During the early stages of product development, rather than focusing only on negative anticipated user experience, designers should focus more on positive anticipated experience in order to gain more understanding of users’ hedonic needs. Designers should incorporate pragmatic and hedonic attributes into their designs in the appropriate proportions, and should be cautious not to be misled by users’ possible bias towards the pragmatic aspects of a product.
These two recommendations are based on the finding that in anticipating experiences of product use, users emphasise the product’s pragmatic quality (e.g. usability, utility, and performance) as the major contributor to their positive experiences. However, their positive real experiences are actually more dominated by hedonic aspects of the product (e.g. its ability to fulfil their need for self-expression and personal development) (Section 8.2.2).

The understanding of the roles that pragmatic and hedonic qualities play in creating users’ product perceptions and experiences can assist designers in assessing user experience during the early stages of the design process. Specifically, it enables designers to better recognise both the required pragmatic and hedonic aspects derived from users’ anticipated experiences, and to include them into the design in a more balanced way. This understanding will also prevent designers from being misled by users’ possible bias for a product’s pragmatic attributes.

The difference between users’ perceived and actual experience with respect to the influence of pragmatic and hedonic product qualities should be an important factor in designers' decisions to accept or reject concept alternatives. For example, designers should focus on how to meet users’ hedonic needs, even though the users’ anticipation may be more related to pragmatic aspects of the product. They should consider how both pragmatic and hedonic attributes can be used as a vehicle for meeting these hedonic needs, and thus generate users’ enjoyable experiences with the designed product.

*When conducting early assessment of user experience, designers should use the AUX Framework to identify and prioritise factors that they need to explore.*

As has been explained in Section 10.1.2, the exploration of the components of the AUX Framework can generate useful information to support early assessment of user experience. Furthermore, this framework can assist designers in managing the use of their design resources during the assessment.

*In drawing on anticipated user experience to support the initial phases of product development, designers should include and consider the following factors: Discovery, Exploration and Learning, and Positive Expectation Disconfirmation.*
It was found that the above factors are not indicated in anticipated user experience. However, they play an important role in the formation of positive real user experience; for example, the discovery of a particular feature when using a product can be a source of positive experience. Thus, these factors should be included and considered in the early stages of design.

### 10.2 CONTRIBUTIONS TO KNOWLEDGE

This study generates new knowledge pertaining to the fields of product design and design for experience. It provides a contribution to the important area of anticipated user experience, which is complementary to the evaluation of actual user experience with functional products. It also responds to the need for user experience assessment in the early phases of product development (Law, et al., 2009; Väänänen-Vainio-Mattila, et al., 2008a, 2008b; Vermeeren, et al., 2010).

The understanding of anticipated user experience emerging from this study fills the gap in the knowledge of user experience before interaction. Although a number of authorities consider ‘anticipated use’ or ‘anticipated interaction’ as part of user experience (e.g. ISO 9241-210, 2010; Sward and Macarthur, 2007), this subject has not been previously studied in depth. Moreover, the majority of existing research focuses on understanding and measuring user experience during or after actual product use (Law, et al., 2009; Vermeeren, et al., 2010). Thus, the assessment of user experience before interaction seems to be still widely overlooked (Bargas-Avila and Hornbæk, 2011).

This lack of knowledge of user experience before interaction has implications for the design industry, where user experience assessment tends to be delayed until the late stages of product development – a point at which design modifications are more difficult and expensive. Answers to the first and second research sub-questions establish a foundation to support user experience assessment in the early phases of the design process.

Significant outcomes of this research, with respect to the two research sub-questions, include the followings: (1) key categories and sub-categories of anticipated and real user experiences (Table 6.2 and Table 7.2); (2) relationships among the sub-
categories and hierarchies of these relationships (Section 6.3.3 and Section 7.3.3); (3) the AUX Framework (Figure 8.1); (4) characteristics of anticipated user experience (Section 8.1.1 and Section 8.1.2); and (5) an understanding of the differences between anticipated and real user experiences (Section 8.2).

As explained before, the AUX Framework facilitates a new understanding of the processes by which users conceive a desired product and anticipate positive experiences with that product. This framework – which is constituted by the key sub-categories, their relationships, as well as rankings and weights of these relationships – provide guidance for researchers and designers to explore essential elements of anticipated user experience. This exploration, in turn, supports the early stages of product development. The new understanding of the characteristics of anticipated and real user experiences, which is translated into design recommendations, also contributes to the field of experience-centred design. For example, the understanding of the roles that pragmatic and hedonic product qualities play in both types of the experiences could assist designers in incorporating the appropriate proportions of these qualities into their designs.

In the researcher’s view, this is the first known study in the user experience area that has involved an in-depth investigation of anticipated user experience, and linked it to user experience assessment in the early stages of product design. Furthermore, to the best of the researcher’s knowledge, no other research has developed specific relationships among the factors of anticipated user experience, or has compared anticipated and real user experiences. Thus, this study enriches and contributes to the evolving knowledge of user experience and experience-centred design. Specifically, in terms of time spans of user experience (Roto, et al., 2011), it adds to the understanding of user experience before product usage.

As discussed in Section 8.2.2, this study found that users tend to focus on the pragmatic quality of a product, and perceive it as the main source of their positive experiences. However, their actual positive experiences are more influenced and caused by hedonic aspects of the product. This result strengthens the existing position argued by Hassenzahl (2008, 2010) that the fulfilment of hedonic needs is the source of pleasurable user experiences. The current study’s use of a qualitative
approach is also a contribution in that it has broadened and enriched the nature of the enquiry. This is because previous work on the role of hedonic quality in creating positive experiences was commonly conducted using only quantitative approaches (e.g. Chitturi, et al., 2008; Hassenzahl, 2008; Hassenzahl, et al., 2010).

As its major methodological contribution, this study provides an original coding scheme for anticipated user experience (Table 6.2). This scheme consists of four categories (i.e. \textit{Product Characteristic, Experience, Emotion, and Context}), fourteen sub-categories, and scopes of interpretation that provide a basic standpoint for the in-depth exploration of users’ anticipated experiences with interactive products.

The study’s second methodological contribution is a new qualitative research methodology that comprises a combination of co-discovery, sketching, and observation methods (Section 5.1 and Section 6.1). This methodology elicits rich data from users, to identify potential contexts of user-product interactions, and to predict users’ experiences with the product being designed. It thus offers an alternative means of predicting users’ experiences without having to develop usage scenarios or having to visualise, partly design, or create low-fidelity prototypes; therefore, it complements the existing methods that employ such techniques (e.g. Buchenau and Fulton Suri, 2000; Davidoff, et al., 2007; Fulton Suri, 2003; Heikkinen, et al., 2009; Hennipman, Oppelaar, van der Veer, and Bongers, 2008).

Most importantly, the coding scheme and the research approach described above could be transferred to other studies that need to predict users’ or consumers’ potential experiences with services or non-interactive products. They could also be applicable to other domains, such as market research, as they can assist in providing information about consumers and their needs.

Another coding scheme (Table 7.2) and research methodology (Section 5.1 and Section 7.1) have also been developed as a means of exploring real user experience. The coding scheme comprises six categories (i.e. \textit{Product Quality, Experience, Emotion, Context, Familiarisation, and Expectation Disconfirmation}) and sixteen sub-categories. This scheme provides the basis for the analysis of the formation of positive and negative user experiences with interactive products.
The methods used in this study to explore real user experience are improved in several specific ways. Unlike many existing methods in similar research: (1) they do not require users to perform specific, pre-determined tasks with a product, but allow them to use it in their own ways, times, environments, and contexts; (2) they provide users with a reasonably significant usage period (three days), rather than a short interaction time in a laboratory; (3) the users’ experiences are reported in an unobtrusive way via an experience diary, where the Day Reconstruction Method (Kahneman, et al., 2004b; Karapanos, et al., 2009) is used to minimise the self-reporting bias; and (4) the co-discovery method is employed to clarify and further explore the reported experiences. All these research features allow for a more accurate and complete capture of users’ actual experiences. This methodology and the coding scheme, again, could be transferable to studies of user experience with non-interactive products or services. They could also be applicable to longitudinal user experience research.

The main theoretical contribution of this study is the new knowledge of anticipated user experience and how it differs from real user experience, as detailed in previous sections. In addition to the AUX Framework, a general framework of anticipated and real user experiences (Figure 9.2) was developed to recapitulate this new knowledge and the study results, and to make it easier for researchers and designers to navigate among the components of both types of the experiences. This framework is expected to facilitate the understanding and actions of researchers and designers with respect to design for experience in the early phases of product development.

10.3 RESEARCH LIMITATIONS

During the course of this research, several aspects that could be perceived as limitations were identified. These perceived limitations might have implications when transferring and applying the outcomes of this research.

The first perceived limitation was related to the product used in each of the experiments. While this research was directed to cover user experience with a vast range of interactive products, only one product category (i.e. digital cameras) was used to stimulate users’ anticipated experiences and to evoke their real experiences. The selected product category might not be a reflection of all types of interactive
products. For example, different product complexity (e.g. stop watches vs. computers), familiarity (e.g. televisions vs. robot assistants), and scope of use (e.g. digital thermometers vs. smartphones) might affect how users anticipate their experiences with the products, and how they actually experience them. The use of various interactive products as stimuli might also result in users’ different pragmatic and hedonic appreciations of the products’ quality. Thus, the research findings might be limited, and might not be able to be completely generalised.

However, the product used in this study was carefully considered and selected. A digital camera was deemed appropriate, as it met the criteria of being an interactive product; that is, its use comprised three key components: users, systems, and interaction. Furthermore, its reasonable level of complexity and its familiarity to a broad range of users satisfied the study requirements with respect to its experiment tasks. This study also demonstrates that the use of this product generated rich data of users’ anticipated and real experiences. In future studies, diverse types of interactive products could be included to enhance the generalisability of the findings, and to explore the influence of product variation on anticipated and real user experiences.

The second perceived limitation was the period of product use in Experiment Two. To gather real user experience data, participants were given three days to use a provided digital camera and to report their experiences. This period of use was determined by the time constraints of the research, and by the possible difficulties in obtaining participants’ commitment for a longer experiment period. While the three-day usage period is superior to a brief user-product interaction in a laboratory, the data collected might not reflect the whole experience, and might be limited in describing long-term user experiences with the product. For example, results might only delineate users’ initial experiences, which were dominated by their frustration and excitement during the product familiarisation process (cf. Karapanos, et al., 2009).

Some participants commented, however, that, over the three-day period of using the camera, they had discovered and tried nearly all of the product’s features, and started to feel less excited to use it on the last day. This indicates that a three-day usage period could be satisfactory to capture users’ experiences with a product. Moreover,
the goal of Experiment Two was to provide input for differentiating between anticipated and real user experiences; thus, the extended period of product use – as in the studies that investigated the change of user experience over time – was considered unnecessary.

10.4 FUTURE DIRECTIONS FOR THIS RESEARCH

This research has established a foundation for further studies into anticipated user experience, and created future pathways for investigating and supporting early assessment of user experience. Several future research directions are suggested.

10.4.1 Understanding the Influence of Different Interactive Products on Anticipated User Experience

One possibility for future research is to examine the influence of different categories of interactive products on users’ anticipated experiences. These products also include those that are completely new or unfamiliar to users (e.g. driverless cars, personal robot assistants). This direction is particularly relevant to current market conditions in which users are offered an extensive range of interactive products and novel technologies. Such a study could also improve the generalisability of this research’s findings or, alternatively, could provide insights into how specific types of interactive artefacts differ in eliciting users’ anticipated experiences. The latter outcome could lead to the development of a unique early assessment technique of user experience for each product category, and thus benefit the design of a broader range of products.

10.4.2 Validating the AUX Framework

Further studies could be conducted to validate the AUX Framework. These would involve testing the relationships among the factors (sub-categories) of anticipated user experience as well as the hierarchies of these relationships. The outcomes of this validation would further strengthen and justify the framework, and thus providing a better support for researchers and designers to explore anticipated user experience. Using the validated AUX Framework as a basis, a type of interactive system, rather
than a fixed schema, could also be developed in future work to better aid designers’ understanding and actions.

10.4.3 Developing Methods for Revealing Users’ Hedonic Expectations

The methodology developed in this research to investigate anticipated user experience can be modified and used specifically as a method for generating design ideas. This method can be an alternative to User-Centred Design (UCD) that starts from users’ needs, and to Experience-Centred Design that starts from defining the experience to design for. This new approach, instead, starts ideation from users’ expectations. However, the expectations that can be revealed using the current method are not always the best basis for design, because – as indicated in the outcomes of this study – the pragmatic aspects of products are emphasised over hedonic ones. Therefore, one area of future research should be aimed at developing better methods for revealing users’ hedonic expectations.

10.4.4 Developing Practical Tools for Early Assessment of User Experience

Perhaps the most important future direction for this research is to translate the findings into actionable and accessible implications. This could be done by using the research outcomes as a foundation from which to develop a tool or method for facilitating designers’ assessment of user experience in the early stages of product design. The tool or method could first take the form of a conceptual instrument. For example, it could be a table, a diagram, a set of cards, or a pictorial mind-map that assists designers to identify and explore essential factors of user experience according to their relationship hierarchy and weights. The conceptual instrument would also contain important design recommendations. It could subsequently be further developed into a working design tool or method, either as a piece of interactive software or physical device. It would also need to be tested by industry-based researchers and designers to ensure that it could be easily accessed and utilised by practising designers in their design process.
10.5 A FINAL WORD

Providing a positive user experience is the key to a product's success in the competitive market. Although difficult and challenging to achieve, it is clear that early assessment of user experience needs to be incorporated into the product development process to ensure enjoyable user experiences. However, there is limited knowledge of how to assess user experience before actual interaction with a product. In the design industry, this lack of knowledge leads to the delayed user experience assessment, which can result in unfavourable consequences.

This research has investigated anticipated user experience in addressing this knowledge gap. From the empirical work, an understanding of the characteristics of anticipated user experience was identified, and the AUX Framework – which explains the way in which users anticipate their positive experiences – was developed. The understanding of anticipated user experience and the AUX Framework were unavailable until now, and thus are a significant contribution to knowledge. The use of this understanding and this framework enables a more effective consideration and exploration of the critical factors of user experience at the early stages of the design process. This exploration can generate rich design ideas and insights into potential contexts of use and into users’ underlying needs. These outcomes, in turn, support early assessment of user experience, and can minimise costly and difficult design modifications in the late stages of product development.

The empirical exploration of real user experience also generates findings related to the differences between it and anticipated user experience. These findings provide insights into sources of positive user experiences, and into the roles that pragmatic and hedonic product qualities play in both types of the experiences. These insights, in turn, can facilitate design decisions on product attributes. For example, the design of products that contain more and improved hedonic attributes – which can enhance the fulfilment of users’ basic needs, and thus engender their positive experiences – can be promoted. In this research, the understanding of the characteristics of anticipated and real user experiences was translated into recommendations that support experience-centred design.
Chapter 10: Conclusions

This study is significant in understanding user experience before interaction, and in generating important outcomes (i.e. the AUX Framework and design recommendations) to support design for experience in the early stages of product development. It also has established a foundation for future research to develop practical and accessible methods for early assessment of user experience. By harnessing the new knowledge and outcomes resulting from this research and future related studies, product designers and product developers will be better supported to create pleasurable interactive products that engender positive user experiences.
References


References


References


References


References

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References


References


References


References

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Appendix A:
Participant Information Pack
PARTICIPANT INFORMATION for QUT RESEARCH PROJECT

Assessing User Experience in the Early Stages of Product Design and Development
(Experiment One)

Research Team Contacts

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Phone Number</th>
<th>Email Address</th>
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</thead>
<tbody>
<tr>
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<td><a href="mailto:b.kraal@qut.edu.au">b.kraal@qut.edu.au</a></td>
</tr>
</tbody>
</table>

Description

This project is being undertaken as part of a PhD research for Thedy Yogasara.

The purposes of this project are: (1) to investigate the characteristics of anticipated and real user experience in relation to user-product interaction, and (2) to identify the differences between them. In turn, the study will develop a framework and tool for assisting designers in assessing user experience in the early stages of product design and development. It is expected that the project will generate new knowledge about anticipated user experience and will assist product designers/developers in creating pleasurable and engaging products for consumers.

The research team requests your assistance because you represent a general product user, and your opinions, ideas, and experiences related to everyday products will be highly valuable for accomplishing this project.

Participation

This project contains two experiments that are related to each other, namely Experiment One and Experiment Two. However, at this stage of study, only Experiment One will be conducted. Your participation in this experiment is voluntary. If you do agree to participate, you can withdraw from participation at any time during the project without comment or penalty. It is important to highlight that your decision to participate will in no way impact upon your current or future relationship with QUT.

Experiment One will take place in the People and Systems (PAS) Laboratory, D Block - Room 408, Queensland University of Technology, Gardens Point Campus, Brisbane. In total it will require 50 - 60 minutes to complete.

Your participation will involve filling out a screening questionnaire, performing co-discovery including visual representation (sketching) tasks, and being observed during the experiment session.

The screening questionnaire will be sent by e-mail or given as a hard copy prior to the experiment. It requires about 5 minutes to fill out. This questionnaire will gather information about your demographics and background, as well as data regarding your knowledge, expertise, or experience in relation to a certain everyday product.

Your role in Experiment One:

- In the co-discovery session, you will be asked to imagine an everyday product and to anticipate using or interacting with it. You will explore, express, and discuss your views with another participant (where possible, it will be arranged that your partner is a friend or at least an acquaintance of yours).
- In the visual representation session, you will be asked to individually draw a sketch portraying your product concept and other information related to your perceived interactions or experiences with that concept. Then you will explain your drawing to your partner.
Appendices

- The observation will be conducted concurrently with the co-discovery and visual representation sessions. More detailed observation will be carried out through video recordings of the experiment to collect additional data.

The experiment will be organised that it is conducted at your convenient time.

**Expected benefits**

It is expected that this project will not directly benefit you. However, it may benefit the fields of knowledge of user-product interaction design by providing a better understanding of anticipated user experience. The design tool, as one of the perceived outcomes of this study, is also envisaged to be able to assist product designers in assessing user experience aspects of their design during the initial stages of product development. This can lead to production of more delightful and engaging products for consumers.

**Risks**

There is a minimal risk involved in your participation. The research team believes that the risk relating to your involvement in the project is limited to mild anxiety induced by the co-discovery and observation sessions.

**Confidentiality**

In this study, the names of individual persons are required in the responses. Other information such as your contact number or e-mail may also be required in order to enable the research team to re-contact you for your possible involvement in the second experiment (Experiment One and Experiment Two will not be conducted at the same time).

All comments and responses will be treated confidentially. Your anonymity and confidentiality will be safeguarded in this document and any publications through the use of codes or pseudonyms. Although you will be audio and video recorded, your details including your name will not appear on any of the data storage. All data will be stored securely in a lockable filing cabinet and password-protected computer in QUT. Only the research team will have access to the information you provide and be able to relate it to your personal data.

Participation in this project is not possible without being audio and video recorded. If you wish, you can verify the audio and video recordings including their transcriptions prior to final inclusion. Additionally, the recordings will not be used for any other purposes other than as sources of information for this research. Following the completion of this project, the recordings will be securely stored as research archives or for possible research/data re-assessment reasons.

**Consent to participate**

Should you are interested in participating in this project, we would like to ask you to sign a written consent form (enclosed) to confirm your agreement to participate.

**Questions / further information about the project**

Please contact the research team members named above to have any questions answered or if you require further information about the project.

**Concerns / complaints regarding the conduct of the project**

QUT is committed to researcher integrity and the ethical conduct of research projects. However, if you do have any concerns or complaints about the ethical conduct of the project you may contact the QUT Research Ethics Officer on +61 7 3138 5123 or ethicscontact@qut.edu.au. The Research Ethics Officer is not connected with the research project and can facilitate a resolution to your concern in an impartial manner.

*Ethics approval number: 0900001394*
PARTICIPANT INFORMATION for QUT RESEARCH PROJECT

Assessing User Experience in the Early Stages of Product Design and Development
(Experiment Two)

Research Team Contacts

<table>
<thead>
<tr>
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Description

This project is being undertaken as part of a PhD research for Thedy Yogasara. The purposes of this project are: (1) to investigate the characteristics of anticipated user experience in relation to user-product interaction, and (2) to identify the differences between anticipated and real user experiences. Based on the findings, the study will develop a framework and tool for assisting designers in assessing user experience in the early stages of product design and development. It is expected that the project will generate new knowledge about anticipated user experience and will support product designers/developers in creating pleasurable and engaging products for consumers.

The research team requests your assistance because you represent a general product user whose opinions, ideas, and experiences related to everyday products are highly valuable for accomplishing this project.

Participation

This project contains two experiments that are related to each other, namely Experiment One and Experiment Two. At current stage of the study, Experiment One has been completed and Experiment Two, focusing on real user experience, will now be conducted. Your participation in this experiment is voluntary. If you do agree to participate, you can withdraw from participation at any time during the project without comment or penalty. It is important to highlight that your decision to participate will in no way impact upon your current or future relationship with QUT.

Your role in Experiment Two involves filling out a screening questionnaire, performing tasks in experience diary and co-discovery sessions, and being observed during the co-discovery session.

- The screening questionnaire will be sent by e-mail or given as a hard copy prior to the experiment. It requires about 5 minutes to fill out. This questionnaire will gather information about your demographics and background, as well as data regarding your experience and familiarity with digital cameras. The completed questionnaires should be returned to the research team before the experiment begins.

- The experience diary session will be carried out independently without the presence of the research team. You will be provided with a new compact digital camera and an experience diary packet containing experiment instructions and forms for writing your reports. You will be asked to explore and freely use the given digital camera at any locations including your home, workplaces, recreational areas, or other daily places over a period of three days. At the end of each day, you are requested to recall and report your experiences with the camera on that day by filling out the experience diary forms.

- After completing the previous session, you will be invited to participate in the co-discovery session, in which you will discuss and share your experiences with the digital camera with another participant (where possible, it will be arranged that your partner is a friend or an acquaintance of...
yours). The co-discovery session will require about 30 minutes to complete and take place at the People and Systems (PAS) Laboratory, D Block - Room 408, Queensland University of Technology, Gardens Point Campus.

- The observation will be conducted concurrently with the co-discovery session. More detailed observation will be performed using video recordings of the experiment to collect additional data and for transcription requirement and further analysis.

The experiment will be organised that it is conducted at your convenient time.

**Expected benefits**

It is expected that this project will not directly benefit you. However, it may benefit the fields of knowledge of user experience and interaction design by providing a better understanding of anticipated user experience. The design tool, as one of the perceived outcomes of this study, is also envisaged to support product designers in assessing user experience aspects of their design during the initial stages of product development. This, in turn, can ensure high quality experiences for the users through product usage.

**Risks**

There is a minimal risk involved in your participation. The research team believes that the risk relating to your involvement in the project is limited to mild anxiety induced by the co-discovery and observation sessions.

**Confidentiality**

In this study, the names of individual persons are required in the responses. Other information such as your contact number or e-mail is also required in order to enable the research team to contact you for organising your participation, sending reminders and directions during the experience diary session, and clarifying your textual or verbal responses.

All comments and responses will be treated confidentially. Your anonymity and confidentiality will be safeguarded in thesis document and any publications through the use of codes or pseudonyms. Although you will be audio and video recorded during the co-discovery session, your details including your name will not appear on any of the data storage. All data will be stored securely in a lockable filing cabinet and password-protected computer in QUT. Only the research team will have access to the information you provide and be able to relate it to your personal data.

Participation in this project is not possible without being audio and video recorded. If you wish, you can verify the audio and video recordings including their transcriptions prior to final inclusion. Additionally, the recordings will not be used for any other purposes other than as sources of information for this research. Following the completion of this project, the recordings will be securely stored as research archives or for possible research/data re-assessment reasons.

**Consent to participate**

Should you are interested in participating in this project, we would like to ask you to sign a written consent form (enclosed) to confirm your agreement to participate.

**Questions / further information about the project**

Please contact the research team members named above to have any questions answered or if you require further information about the project.

**Concerns / complaints regarding the conduct of the project**

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Ethics approval number: 0900001394
CONSENT FORM for QUT RESEARCH PROJECT

Assessing User Experience in the Early Stages of Product Design and Development

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<td><a href="mailto:b.kraal@qut.edu.au">b.kraal@qut.edu.au</a></td>
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</table>

Statement of consent

By signing below, you are indicating that you:

- have read and understood the information document regarding this project,
- have had any questions answered to your satisfaction,
- understand that if you have any additional questions you can contact the research team,
- understand that you are free to withdraw at any time, without comment or penalty,
- understand that you can contact the Research Ethics Officer on +61 7 31385123 or ethicscontact@qut.edu.au if you have concerns about the ethical conduct of the project,
- understand that the project will partly include audio and video recording,
- understand that your de-identified photographic or video images may appear in a PhD thesis or publications related to this project,
- agree to participate in the project.

Name: 

Signature: 

Date: / /
Appendix B: Screening Questionnaire
Screening Questionnaire

Assessing User Experience in the Early Stages of Product Design and Development

Dear (participant’s name),

Thank you for your willingness to participate in my research.

As a required step in this study, I would like to gather some information from you by means of this questionnaire. This will assist me in assessing the participants’ suitability and organising the research outcomes.

The first section of the questionnaire requires your personal information that will allow me to get a good cross-section of the community as participants. The second section is intended to identify your level of experience and familiarity with digital cameras. Please note that your personal information will be safeguarded and all data will be kept anonymous in the presentation of the research outcomes or in any publications.

Please answer all requested information in this questionnaire by filling in the blanks or checking the appropriate boxes, and then return the completed questionnaire to me via e-mail at t.yogasara@qut.edu.au. If you are unsure about any question, please contact me via e-mail or call me on (07) 31389183 or 0433556475 to clarify your query.

Upon receiving the completed questionnaire, I will contact you to organise a convenient time for you to participate in the experiment.

Thank you in advance for your time.

Thedy Yogasara
Part I – Personal Information
(Please fill in the blanks and check the appropriate box)

*Please use the arrow keys on your keyboard to easily move the cursor from one blank to another.

1. Full name: ________________________________
2. Gender: ________________________________
4. Highest academic qualification: ________________________________
5. Occupation: ________________________________
6. Nationality: ________________________________
7. Telephone / Mobile phone: ________________________________
8. E-mail: ________________________________

Part II – Product Familiarity
(Please check the appropriate boxes and fill in the blanks if appropriate)

9. Do you have at least one digital camera? □ Yes □ No
   □ Yes □ Go to question 10
   □ No □ Go to question 13

10. Please specify the brand and type of your digital camera(s): ________________________________

11. How long is it since you had your first digital camera? ________________________________

12. How many digital cameras have you purchased in the last 5 years? ________________________________

13. In general, how would you rate yourself in the use of digital cameras?

Novice □ □ □ □ □ □ □ □ Expert

14. When using a digital camera, how many of the features on the product do you use?

<table>
<thead>
<tr>
<th>All of the features (I read the manual to check them)</th>
<th>As many features as I can find without the manual</th>
<th>Just enough features to get by with</th>
<th>My limited knowledge of the features limits my use of the product</th>
<th>I have never used a digital camera</th>
</tr>
</thead>
<tbody>
<tr>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

15. How often do you use a digital camera?

At least once | At least once | Once every | Only ever used | Never
Appendices

<table>
<thead>
<tr>
<th>a week</th>
<th>a month</th>
<th>few months</th>
<th>it once or twice</th>
<th>used it</th>
</tr>
</thead>
</table>

Thank You! Your participation is valuable
Appendix C:

Product Familiarity Scoring System
## Product Familiarity Scoring System

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<tr>
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<td>The product belongs to point-and-shoot / compact camera category</td>
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</tr>
<tr>
<td></td>
<td>The product belongs to more complex / professional camera category, e.g. Digital Single Lens Reflex (DSLR) type</td>
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<tr>
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<td>3 years and more but less than 5 years</td>
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<td>5 years and more</td>
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</tr>
<tr>
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<td>7</td>
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<tr>
<td>14</td>
<td>I have never used a digital camera</td>
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<tr>
<td></td>
<td>My limited knowledge of the features limits my use of the product</td>
<td>1</td>
</tr>
<tr>
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</tr>
<tr>
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<tr>
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<td>All of the features (I read the manual to check them)</td>
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<td></td>
<td>Only ever used it once or twice</td>
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<tr>
<td></td>
<td>Once every few months</td>
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<tr>
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</tr>
<tr>
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<td>At least once a week</td>
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- Minimum possible total score = 1, maximum possible total score = 30.
- The higher the score, the higher the product familiarity level.
**Example of Calculation of Product Familiarity Total Score**

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<tr>
<th>Participant</th>
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<th>Answer</th>
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<td>DW</td>
<td>9</td>
<td>Yes</td>
<td>3</td>
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<tr>
<td></td>
<td>10</td>
<td>Fujifilm S3 Pro DSLR</td>
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<tr>
<td></td>
<td>11</td>
<td>10 years</td>
<td>4</td>
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<td>13</td>
<td>6</td>
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<tr>
<td></td>
<td>14</td>
<td>All of the features (I read the manual to check them)</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>At least once a week</td>
<td>4</td>
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<tr>
<td></td>
<td><strong>Total Score</strong></td>
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<td><strong>28</strong></td>
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</table>

DW’s product familiarity total score was 28. Therefore, he fulfilled the product familiarity criteria (i.e. total score should be at least 15).
Appendix D:
Participant Data
## Experiment One: Participant Demographics

<table>
<thead>
<tr>
<th>No</th>
<th>Name Code</th>
<th>Gender</th>
<th>Age Group (years)</th>
<th>Highest Academic Qualification</th>
<th>Occupation</th>
<th>Nationality</th>
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<tbody>
<tr>
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<td>PhD Degree</td>
<td>Environmental Researcher</td>
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<tr>
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<td>Tutor</td>
<td>Chinese / Australian</td>
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<tr>
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<td>PhD Student</td>
<td>Iranian</td>
</tr>
<tr>
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<tr>
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<td>Bachelor Degree</td>
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<td>Australian</td>
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<tr>
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<td>Master Degree</td>
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## Experiment One: Participants’ Product Familiarity Information

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<td>Sony Cyber-shot DSC-S980 7 yrs 2 5 As many features as I can find without the manual</td>
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<td>HY</td>
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<td>Casio (Compact) 5 2 6 As many features as I can find without the manual</td>
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<tr>
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</table>
### Appendices

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<tr>
<th>No</th>
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<th>Score</th>
</tr>
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<tbody>
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# Experiment Two: Participant Demographics

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<th>No</th>
<th>Name Code</th>
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<th>Age Group (years)</th>
<th>Highest Academic Qualification</th>
<th>Occupation</th>
<th>Nationality</th>
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<td>Lecturer / PhD Student</td>
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<td>Bachelor Degree</td>
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# Experiment Two: Participants’ Product Familiarity Information

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Appendix E:
Task Cards
Experiment One: Task Cards

Task 1

1. Please imagine a new digital camera that you desire. Feel free to envisage the model, appearance, features, user interfaces, and other characteristics of this camera.  
   *(Allocated time: 2 minutes)*

2. Please explain and discuss with your partner the digital camera that you just imagined, including why you desire such characteristics of this camera.  
   *(Allocated time: 10 minutes)*

Task 2

1. Please imagine and pretend that you are using and interacting with this new digital camera.  
   *(Allocated time: 2 minutes)*

2. Please explore, share, and discuss with each other what you have thought for the above task.  
   *(Allocated time: 10 minutes)*
Appendices

**Task 3**

1. In this stage, please individually draw a sketch / sketches depicting the digital camera you have imagined and discussed before. Include in the drawing enough information (by using notes, diagrams, etc.) to explain the characteristics of this product. Please provide as well any other information related to its use and your perceived experiences with this product.

   *(Allocated time: 15 minutes)*

2. Having finished the drawing, please explain your sketch(es) to your partner.

   *(Allocated time: 5 minutes)*

**Task 4**

Please express to each other what your dream is with respect to the use of your digital camera concept.

*(Allocated time: 5 minutes)*

**Task 5**

Please contemplate carefully and then describe to each other what feelings and experiences you will have if you use and interact with the digital camera that you have imagined and conceptualised.

*(Allocated time: 5 minutes)*
Experiment Two: Task Cards

Task 1

Based on the three-day Experience Diary session you have just gone through, please share and discuss with each other your overall experience with the provided digital camera.

Task 2

Please explain to each other at least two of your most impactful experiences (either positive or negative) that somehow related to the digital camera we gave you.
Appendices

**Task 3**

How did you usually use and interact with the given digital camera?
What did you mostly use the product for?
Please explain these to your partner.

**Task 4**

How do you feel about this digital camera?
What are your perceptions / impressions of the product?

**Task 5**

Did your experiences with the provided digital camera meet your anticipation or expectations?
How were they compared to your anticipation or expectations?
Please discuss these with your partner.
Appendices

Appendix F:

Exemplars of Transcripts
00:03  R:  There you go, the first task. Okay, please imagine a new digital camera that you desire. Feel free to envisage the model, appearance, features, user interfaces, and other characteristics of this camera.

00:28  LT:  Well, having just looked for a digital camera, I really like the zoom feature. I really like to have a digital camera that, um, can zoom in really close to objects [gestures]. So you don’t have to really be standing right next to it to get a really good zoom. And I’d like a digital camera, um, that would also have like really easy to use features that you could like change the shutter speed really easily [gestures]. What about you?

00:45  SD:  Yeah, I agree with the zoom. I think zoom is a big thing. Um, I’ve always found that digital cameras, um, when you take photos at night or in a dark place, um, it’s not always… I know some… some really, really good camera that doesn’t get all fuzzy when you take photos at night [gestures]. But I guess that’s me understanding the features. So maybe just…

01:05  LT:  So, that would be shutter speed.

01:06  SD:  Yes, shutter speed. Okay, so it’s something easy to understand.

01:09  LT:  Yeah, something that doesn’t require leg, something that, you know, you just like look at it (unclear) pushing some buttons [gestures]. That you view, so they’ve just got a feature instead of like the flower feature, you can just go to one that’s like changing the shutter speed and just holding it [gestures].

01:21  SD:  Yeah, so maybe a camera with really, really good instructions so that they’re interesting and understandable and I can use them.

01:26  LT:  Yes. That’s good.

01:30  R:  Anything else that you really want, like some features that may not exist at the moment?

01:38  LT:  It’d be good if we could get cameras in different colours. And I know with me like size would be really important. So, having like a big chunky camera, um, you can get yourself a 35millimetre, but if you want a digital one I prefer having it really small that you could still fit into a pocket or a small bag and not have this massive camera. So all these features but really in a small camera would be good.

01:55  SD:  And with a really long lasting battery life…

01:57  LT:  Yes (laughs).

01:58  SD:  And all the space in the world [gestures] so that I just keep taking photos.

02:01  LT:  Well that would be memory card (unclear)…

02:03  SD:  That’s true. Um, and (pause) yeah. Oh, oh, and really good macro. Macro for me is really, I like taking photos [gestures] where the macro works really well. Um, so taking smaller, like taking pictures of things close up. But I guess that’s on a lens thing [gestures].

02:24  LT:  Yes. I had one camera where you could take the – it wasn’t my camera, it was someone else’s camera which I really liked. But you could take like multiple pictures and then kind of like seam together…

02:34  SD:  Yeah, like panoramic.

02:35  LT:  Yeah, exactly. So it’d be good to have like that feature where it’s really user friendly. Like you just set it to panoramic and you can take a couple of shots and it would end up seam ang it together [gestures].
Hmm, and maybe a camera that’s better at taking those shots when you put it on the table and... and you all stand and, you tap that, the timer [gestures]. More effective ways of knowing when the timer’s going to work. ‘Your photo is about to be taken’ (laughs). Speak to us...

Three, two, one (laughs).

Yes.

And is there any specific colour that you prefer, SD?

Um, of the camera casing?

Yep.

Um, well I like bright colours but for me, I don’t think the colour matters as much. Um, but I know you mentioned that you prefer having different colours.

Well I think different colours. But I prefer something bright because (speaking too quickly to decipher...) you have like black wallets, black phones, whatever. And being able to like look in your bag and it’d be like oo, because in the dark bag you’d be able to see your camera.

Glow in the dark camera.

There we go (laughs). But something bright that like when you’re reaching into a dark bag or whatever, if it’s night time and you’re trying to find it, it stands out. It’s very, very bright. It doesn’t matter what colour but as long as it’s really bright.

And perhaps having some sort of casing, um, so that if you drop it, it doesn’t... like my biggest problem is when I drop my camera it breaks. So I need some sort of like casing or like... um, you know, on iPhones they sometimes have that plastic kind of padding, protection. Um, yeah, that would be handy for me (laughs). Yeah.

Okay, anything else to add, LT?

Um... that’s all we see it.

Okay, great. Thank you for that. So you have imagined a camera that you want. Now, please imagine and pretend that you are using and interacting with this new digital camera that you’ve just discussed before.

Okay [gestures] (laughs). I’m imagining it being relatively small.

Yes.

Mm, yes. Actually I like those cameras where you can... No, don’t worry, I can’t actually remember. Okay, it’s small camera, um... okay so I’m going to take a photo of you [gestures].

Okay.

Um, so... I... oh, does it have like a shutter thing [gestures] or do we... is this automatic? Maybe automatic, I like automatic, it’s easy (laughs). Okay... click the button [gestures] that makes the zoom go really close so that I can take a picture of your left tooth (laughs).

(laughs) I hope it’s clean.

Very clean (laughs). I’ll show you the picture afterwards. Oh yes, yes, where it twists over [gestures] just like the video camera where you can see the picture that I’m taking. So that you can go oh yeah, I like it, that’s cool. Um, that way everyone can see what they look like so you don’t have to like go back and look at the photo afterwards. So twisting it over [gestures], so you like your left tooth there?

(laughs) I hope it’s clean.

Very clean (laughs). I’ll show you the picture afterwards. Oh yes, yes, where it twists over [gestures] just like the video camera where you can see the picture that I’m taking. So that you can go oh yeah, I like it, that’s cool. Um, that way everyone can see what they look like so you don’t have to like go back and look at the photo afterwards. So twisting it over [gestures], so you like your left tooth there?

Yeah, that looks good.

Perfect. Um, and it’s dark so I’m, the flash is on, but it’s not like a bright flash that your tooth’s going to like turn into this white flash mess.

Anti red eye flash, because it makes me look so badly (talking over the top).
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05:31 SD: Anti red eye, okay. That’s on [gestures]. Okay ready ch-ch [gestures]. Yay... And I don’t even have to turn the camera around because you can see the photo. Are you happy with this photo?

05:41 LT: Yeah, I love it.

05:42 SD: Awesome, okay (laughs).

05:44 R: Excellent.

05:46 SD: Do you want to have a go and we’ll see with that (laughs).

05:49 LT: I don’t think I could ever do that performance right there, you’re pretty good. See with me, because I tend to lose things I like the little thing on my keychain that I could just press it [gestures] and my camera will beep. Because I tend to put things down and forget where they are. So it’s great with a phone because you can call the phone and it rings and you find it. But a camera where like you could just like push like a little like key fob chain and it would beep and then you can find the camera. So it would be when I feel like looking for my camera [gestures]. Oh, there’s that beeping. There it is.

06:18 SD: Yeah.

06:20 R: Okay, but in terms of using and interacting with this camera…

06:25 LT: Really, I’d like it to be like really user friendly. So you go to take a picture and then not have to sit there and go through all these different settings of what I want [gestures]. I’d be like okay I want this one, just kind of push it and be like... you know, that’s just really, um, that the setting I want will be on the screen [gestures]. So it would be like yeah, I’m going to push it. But I really want like let’s say hold the shutter [gestures], because it’s really dark out and to make it easier to see so I’m going to hold it down for longer. And then, because of which, like it would just be easy if you could just ah... just ah... you know, turn a little knob [gestures] a little bit to like a certain feature and then, let’s say hold the shutter speed down. But really obvious, not something that you have to stare and read through the manual and you’re like okay, hold on a second, let me just figure out what to do. But like you could push buttons [gestures] and on the screen that has your pushing buttons, this little view finder screen will explain what is happening. So that way it says like this is the feature and this is what the feature allows you to do. And then that way it’s kind of user friendly that you’re not sort of trying to do manual and go what does that little flower picture in the corner mean? But that will actually come up on the screen and say this is what it’s saying. Like the flower means it’s like a close-up shot or it’s a running scene or whatever. That way like you can just flip to see oh yeah, this is what I want. And that way you don’t have to be like a camera genius to understand what the camera is about. You could just like flip to the scene [gestures] and you’re like oh yeah, that sounds like a good feature and then do it. Like it would say like this kind of feature’s good for this kind of situation and circumstance. Like this kind of feature is good for, if it’s an action shot and there’s lots of movement. Or good for if it’s dark or there’s backlight.

07:47 SD: And I like that because not many people actually ever do read the instructions. So it would just…

07:51 LT: Besides, it’s basic, turn it on and click [gestures].

07:53 SD: Yeah, I really like that.

07:58 R: Okay, that was excellent. Thank you. Now, drawing task. So in this stage, please individually draw a sketch or sketches depicting the digital camera you have imagined and discussed before. Include in the drawing enough information, by using notes, diagrams, etc., to explain the characteristics of this product. Please provide as well any other information related to its use and your perceived experiences with this product.

16:38 R: Alright if you are done you can start explaining to your partner.
You want to go first?

Ah yeah, so I kind of went life size. So that’s kind of, I don’t know, that seems to me um have… So this is the back. So this is the bit where you have a look. So I’ve got the display and then I had like a touch screen next to the display so that the information wasn’t like while you were trying… because often I’ll be, you know, I’ll be looking and because there’s all these words [gestures] on the picture I can’t really see what the picture is and I just get distracted. So I thought having the touch screen next to it, um, with the settings. But then also having some easy access buttons. So for me display, flash and timer are the ones that I use the most. So I had those ones, which you could probably do on the touch screen but I just thought, I think it’d be easy. Especially if someone doesn’t know what they’re doing with the camera, ah, you go okay, oh someone’s taking the photo and you say oh just press the play button, like those are the three that I miss the most. But a big button for the capture, because also again when you lend your small camera to someone to take the photo of you [gestures], they’re always like oh which button do I press. But if it’s like the only button on top then they know that that’s the one that they had to press. Um, so that was that side. And then on the front, I thought of, instead of having like… I was going to have like a flip and then turn kind of display [gestures]. But I thought there’s space enough on the camera to have the display on the front of the camera. So you don’t have to have all these extra bits on the camera. So I thought there’s the optional display, which you could turn on and off so that not everyone always sees the photo that you’re taking of them but you have the option. Um, and then the chain for holding it, because I always find it really handy because it goes everywhere. Um, I wouldn’t quite… (unclear) my camera has that on the front, so I don’t know what that was, but I’m guessing that it’s a display, a flash and a lens. And that’s basically… I thought simple, um, sort of easy. I really like the whole idea of having the info in the touch screen kind of thing. But that’s… that’s how I went. And I thought, oh and the yellow thing is, you know, that’s like the rubber protection kind of thing around it. Um, so I just used yellow to emphasise the colour of an eraser almost, but the rubber kind of thing. And I went for pink, um, but I’m guessing like you know, glow in the dark stars or something – maybe I’ll put that in – like, and that way you’ve got like it’s all, you know, glow in the dark heaven sticking out in your bag (laughs).

Alright, so my camera had the similar kind of thing. So I had the big screen. I like having a touch screen idea, but I didn’t do that. But I had, like (speaking too quickly to decipher…). I also like the grid lines where it shows you like so you can line up the camera…

Yes, I like that.

So that you can line up your photos. So I like having those up, as an option. So I did the same thing like with the play button, and the flash, and I also had a red eye because I have a lot of red eyes. So I think that’s an important thing. It’d be like anti red eye [gestures]. And then of course I have the computer hook-up button so that you can… so it’s like just an easy button where it’s like you put it into your computer and you push the button [gestures] and it will like download the photos. And then I was thinking maybe, because there’s probably (speaking too quickly to decipher…) other buttons but…

Zoom. I think it’s zoom.

Zoom is there. So I put the zoom by the button. But it could be anywhere because people now are pretty used to where the zoom goes. And then I had, just again because people are pretty used to the pin wheel tuning the features. So I just kept with the pin wheel and I just said like, you don’t, it doesn’t have any features on it but as you click [gestures] to a different feature, maybe just even for like ten seconds the explanation would flash up and then it would go… you know, how like you turn the movie (unclear) or you’ve turned the zoom and it takes a few seconds for the camera to organise itself. Well like with that one it would just flash up on the screen, like five seconds on the screen and then it would just go back to just the
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 grids. And you could always turn the grid off if you don’t like it. And I did the same thing (speaking too quickly to decipher...) there’s so much space on the front of the camera that you could do that. And then I had to add a little key fob on the side (laughs) you could push it, the camera would beep.

20:11 SD: Yes, nice.

20:13 LT: That’s it. And I made it bright orange because it had to be a bright colour.


20:19 R: Okay. That’s all? Okay that was great, thank you so much. Okay, for the next task, please express to each other what your dream is with respect to the use of your digital camera concept. So what mainly your camera will be used for.

20:45 LT: Well I guess the thing is I really love with the 35, like the features that you have in like a big camera, like a 35 millimetre. You can change the shutter speed, um, you can do all these different settings with it. But you don’t really get that in digital. But then in digital you have a nice small size and it would be so nice to have like all the kind of the awesome features of the massive camera and have it all really compacted. Like people don’t have to have this big massive camera and all this massive camera gear to really appreciate photography. And I think with a lot of the features it would just be fun to play with it and it’s really user friendly. People would be able to play more with the features, because I think right now a lot of people just, they set it to automatic and they just use it as automatic, say like it’s too complicated. But if you have like a little explanation, I think a lot of people would have a lot more fun with it, it’d be, because like see an explanation of this is the kind of situation you’d use these shots and then this is when to use it, this is how to use it. But I think a lot of people would get a lot more out of the camera. Because they could be like hold on I want to take a picture of this flower but I don’t know how best to do it. So they could, like, you know, just turn the wheel and then they wouldn’t have to have their camera book beside them. But I guess what I see from a camera like this is that people would really be able to, um, just really enjoy photography, really get a lot more out of it. Instead of just grabbing it and taking random photos, they could really have fun to play with it and play with the features. And I think it would just make photography like a lot more fun and a lot less I’ve got to take a photo because I have to. But be more like oh let’s take another cool shot.

22:06 SD: Yeah, yeah, totally, I like that. I guess, um, the concept with... the way that I made mine is, um, for it to be that sort of versatile. Like people, when I think of the way people use cameras it’s usually like in party situations or when you’re acting fun, or when you’re sort of out looking at scenery or, you know, on the beach or something like that. So something that’s easy enough that while you’re having fun you don’t have to stop and like think. Um, and I guess that comes with time and practising using it. But, um, yes, it being very user friendly. I thought the touch screen stuff, um, especially because in this age of iPhones where everyone’s used to touch screen and stuff, like their fingers are used to doing it that way. So it would, I don’t know, it would just fit in with the way that they do things.

22:46 LT: Well once you’ve learned the concept it’d be okay.

22:48 SD: Yeah. Yeah, um, (unclear) [reads the task] ...with respect to the use. Um, so yeah, I just see it as something that, you know, everyone would have one in their bag and it’s easy to spot because it’s glow in the dark and it just gets whipped out. And... and, um, people are able to use it if they just want to use it for just like taking shots of their friends. But there’s also enough depth to it that, you know, you could use it to take macro shots of flowers or a beautiful panoramic view.

23:18 LT: You wouldn’t need three different cameras. Like one for your everyday people, like I have a friend that had the 35 millimetre, like a really nice like setting camera. But she would, whenever she (unclear) she’d always carry a digital around for people that couldn’t understand this camera. That was something really user friendly that
everyone could understand. Other people that want to get more out of it, get more out of it.

23:36  SD:  Yeah, yep, I like that.

23:40  R:  Okay, anything else to add for the use of this camera?

23:44  SD:  I think this would be a very handy camera for people like me who are clumsy and then drop their camera, it just bounces... Oh it could be like bouncy ball material and it will just bounce off the floor and back into your hand (laughs). Maybe not, but it wouldn’t break (laughs). But then you’d have that like (unclear) thingy on, so that would be... would be good. Um, but yeah, and it would just be a really fun camera to have. Like and it looks really cool and everyone’s like oh, my gosh a camera glow in the dark, that’s so cool.

24:14  R:  Okay, cool. Now, task number five. Please contemplate carefully and then describe to each other what feelings and experiences will you have if you use and interact with this digital camera that you have imagined and conceptualised. So what feelings and experiences will you have?

24:41  LT:  I guess I would feel more like taking pictures is less of a chore, and more fun. Like it’d just be more fun to have features that you could just really play with it instead of just... I’m not much of a photo taker but I love seeing photos and I love seeing what people do [gestures] to make good photos. And I think to be able to do that with the camera, so to speak, it’s just like being able to play around with the photos on the camera instead of fiddling on would be really interesting. So I think, I think I’d have a lot more fun with it if it’s user friendly and if it had certain, like these kind of features. And if I had the explanation, um, of the features I would really, I think I’d like it a lot more because then I would, I would just have a lot more fun with it. I think I would use it a lot more as well if it was like... if I could, um, if it had explanation features and if it kind of show you how to use your camera beyond the point and shoot it would just be a lot more fun and I think I’d end up taking it out a lot more and just like play around with it and just taking photos and just seeing what happens with them.

25:36  SD:  Yeah. I think, yeah, it would just be a lot of fun to use and I’d feel happy giving it to other people to take photos with...

25:44  LT:  And play around with.

25:45  SD:  Yeah, to play around with. Um, can I add something? I just realised as we were talking, something that might not be a part of the section. But, um, something that would be really important is computer software in terms of viewing the photos on your laptop and, um, how to be editing and things like that. Like the cameras that I’ve had haven’t always had really good computer software to actually be dealing with the photo that you’ve taken on the computer. So something that I’d add to that then would have less frustration when it gets to plugging in the camera to my computer and knowing that it’s going to pop-up and it’s all going to be easy to do on the computer as well, not just on the camera. Because a lot of the grief is that I just don’t like downloading my photos onto my computer because it’s just frustrating trying to sort through them and all that stuff. So just adding that too. So, yes, um, but yeah, just... And I wouldn’t, I think having the like the rubber casing and it being a bit small and maybe I wouldn’t feel as stressed about dropping it. But I’d still look after it but, um, I don’t... like when little kids are playing around with it and stuff like that. Just it being a little bit less delicate, I’d feel a lot better handing it to other people to take photos. Because the more people that handle it the better photos you get, because you get a whole range of different photos and you get to be in them as well, which is cool. Yeah.

27:00  R:  Okay, then, that’s all I think.

END OF TRANSCRIPT
EXPERIMENT TWO: FULL TRANSCRIPT KB AND LO (Participant #25 and #26)

00:00  R: Right, so this is the first question. Based on the three-day experience diary session you have just gone through, please share and discuss with each other your overall experience with the camera. So what was your overall experience?

00:19  KB: Okay, do you want to?

00:20  LO: Um, well overall I, um, I had fun with it. I enjoyed playing with it. But it wasn’t, um, I wasn’t overly impressed with the results, I have to say.

00:34  KB: Okay, and you’re used to using a DSLR.

00:37  LO: DSLR. Yep.

00:38  KB: Um, and I use both. So I use a DSLR and a compact for, you know, easy things. It was my first experience with a touch-screen camera, which I found quite… neat (laughing), to play with. Um, I did like the shots that it took. I found the screen really great, it’s a nice big screen.

01:01  LO: Oh it’s huge, yeah, yep.

01:03  KB: The colour captured well, so I did like that. And I found the colour on my computer screen matched, um, fairly what I was seeing here. Ah, I was frustrated with some of the features. So I am an intuitive learner, I like to play with it and just be able to do things. And sometimes I was going well where’s, how can I do such and such. And so I would, you know, touch and try to get places but I found it difficult to find. So I did end up going to the on, ah, the… the manual, to try to find out some things. Um, which then some worked and then some I was still a bit frustrated.

01:43  LO: Yeah, well I loaded the manual first thing, while it was charging. I thought I’d better get organised, because I hadn’t really used one before. Ah, but once I started using it, it was very easy, intuitive…

01:58  LO: Yeah, so I did go to the manual twice throughout the three days, just to look at different things, but didn’t read a lot of it.

02:01  KB: Yeah, yeah.

02:09  KB: Yeah. And I, um, I skimmed the entire manual. But went and focused on a few particular areas. Um, and I would probably say if I bought, you know, if I bought the camera I would spend more time sussing out how to really use certain things. Um, because there’s… there’s so… there’s actually so many features in here that you wouldn’t necessarily, um, get a handle of. And there were still features that I didn’t get to use because I didn’t… I’d go… I went I don’t remember where it is (laughing).

02:46  LO: Well the video part was good, except for the lighting aspect. You need good lights. You need really good lights, um, because the light… in fact with a lot of the photos, apart from the outdoors ones, um, yeah, I wasn’t very impressed with the colour.

03:04  KB: Okay.

03:05  LO: Especially with this fancy little wonderful front feature. Yellow. All yellow. Did yours come out yellow?

03:12  KB: Interesting that you say that. I didn’t do a lot inside. So my, the couple that I took I still think I had, it was still daytime. So I didn’t have…
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03:23  LO:  This was daytime.

03:24  KB:  Oh, okay.

03:25  LO:  Yep, just the one where you, you know, you look at yourself and someone else. I played with that a lot.

03:29  KB:  Yeah, the self shot.

03:30  LO:  Never used that before, it’s really good.

03:33  KB:  I don’t like self shot in any compact camera. So to me this was no different. Ah, I just think they’re a... a terrible...

03:46  LO:  But having... having, like that one [pointing at video camera], having the, um, so that you could see what you’re looking like before you pressed is really good.

03:54  KB:  Agreed, totally.

03:56  LO:  And my grandson really liked that one too. So we played with that a lot.

03:59  KB:  Okay, yeah. And I would agree, my compact doesn’t have that feature, so you’re always kind of where do I put it. So that was good. But I don’t think the shots come out lovely, yeah.

04:14  R:  Alright, thank you for that. So, the next task. Please explain to each other at least two of your most impactful experiences, either positive or negative, that somehow related to the digital camera we gave you. So this is up to you how you interpret the most impactful experience. It can be the most meaningful or the most important for you. Either negative or positive.

04:38  LO:  Okay, well I’ll go first. The most impactful one was using that fancy little feature, because it was so good. That was the most impressive part of the camera for me. Um, and it, well it felt good because it was fun. It was something that you could do with other people and, um, and I used it quite a lot. I actually uploaded that... I uploaded everything to my computer. But there is one shot that I’m keeping from the whole experience and it’s one of those. I did try to get the yellow cast off with Photoshop but didn’t have such a good... but that’s okay, it’s a compact camera. Ah, and the other one, most impactful, would have been the, um, video. Yeah, I took, on Monday night I took some, some really, um... I was playing with it basically, at a barbecue. So, you know, the fire and then people and, yeah. And because I haven’t really done much with video, ah, before that was really good fun too. And I think it gives you more of a, um... yeah, it certainly gives you a different, um, type of record to a photo. And it’s kind of made me think yes, I might look into doing a video course and getting a camera. And looking further into that.

06:05  KB:  Yeah.

06:07  LO:  Mm, but not with one of those.

06:08  KB:  Okay. I have a positive and a negative. So my positive experience was the video feature as well. Because, um, same, I tend not to use that feature. I have always been a still photographer. So I gave it a go and I was impressed with... um, so I did it outside. And I followed the movements of my cats (laughing), which is not always easy. But I thought it really did capture them well, clearly, colour-wise. And even captured their sound. And when you’re standing over here and the animal’s there and meowing, barking, whatever, to actually be able to capture that sound I thought was quite impressive. So it could hear me talking to them, as well as them talking back at me. I quite like that and I have, um, recently purchased just second hand a
little, tiny video camera. Really simplistic. Um, just to give it a go because I’d never had one before, and this actually did a better job than the little…

07:14 LO: Really?

07:16 KB: You can’t even capture sound well on this little hand-held. And it’s a cheapie, nothing… but this one did a far better job. So if I was using one for video I would say this would be better. My negative experience was, um, some of the features, um, in the, ah… I’m trying to think – either down at the bottom or in scene mode, you would see a picture and click on it. But you didn’t really know what it did. So unless you read the manual and got… some of the symbols you can figure out.

07:51 LO: Yes, the symbols were difficult, yes.

07:54 KB: Some of the symbols I wasn’t sure what it meant and it didn’t really give you a description. So all of a sudden you would click and it would change the feature in the camera. But I didn’t really know what that feature did. So then I would click again and then a little tiny description would come up. So I felt it was, um, too many clicks to really find out what it is. Like to me you click, you’re on the symbol let’s say. It tells you, you know, self portrait or animal picture or fireworks or whatever. And then you know what you’re doing. As opposing to have to go back and do it again to figure out what it was. Um, and great, you know, great if you can go on the manual and remember all those things. Um, but I was saying to, ah, Thedy earlier as well that, ah, I like a manual that I can hold in my hand. So I can have it in my pocket and pull it out and go oh yeah, that’s what I want and that’s what I’ll do. Um, I didn’t always, you know, I couldn’t always be at the computer, um, to, you know, to get a chance to figure it out. So that was my negative, that I thought it could have been put together a little bit easier so that you knew what the symbols meant and what you could do with it.

09:15 R: Okay, that was great. Alright, the third one. So how did you usually use and interact with the given digital camera? What did you mostly use the product for? Please explain this to your partner.

09:32 LO: How did I usually use and interact? Well, yes, intuitively. I didn’t actually read a lot of the manual, I just fiddled with it basically, played with it. Um, and it was, um, generally in daylight, on the veranda a lot, or indoors. Um, and mostly for… Well I had my grandson a lot on the weekend, so there was a lot of photos of him. Um, and outdoors. I tried to, um, tried to do close-ups with the little close-up feature in there. But that was pretty disappointing, I have to say. You couldn’t get very close.

10:13 KB: Agreed.

10:16 LO: Yep. Um, but mostly for around the house and looking at scenery, like close, distant. Because I live on the river and you’ve got views off into the distance. So I tried that. But once again colour, not so good.

10:31 KB: Okay, interesting, yep. And it’s interesting that you say that, because I’m thinking of that too and I wonder… I thought the colour was quite good, in comparison to my other compact camera.

10:43 LO: Oh okay, yep.

10:44 KB: So, you know, if I take my DSLR aside from…

10:46 LO: I’m comparing to SLR…

10:47 KB: Of course, yeah, yeah. Whereas I’m thinking I thought the colour compared to mine was actually pretty good. Um, and I don’t have a touch-screen compact camera. So, um, but I do like the way the features operate on mine a bit better than this one. So
where did I usually use it. Um, so with mine was a lot of home kind of shots as well. So around the house, of the family, of the pets. But I did take it with me when I went out. So I actually always had it with me. So some, when I got stuck in traffic on the freeway I took a picture of that just for the sake of it. So I did try to… even use it when I normally wouldn’t just for the fun of seeing what would happen with it. Um, and I also took photos with the intention of oh this would be something good that I can then e-mail to someone. So, um, you know, because a lot of my family and friends are overseas I was thinking oh, if I take a picture of these things I can e-mail it to them and they can see what my house looks like or my painting looks like. So I did have that in mind.

11:58  LO: Because it is very easy to put those on Facebook and upload them very easily, isn’t it.

12:03  KB: Yep.

12:05  LO: Yeah, I must say I also took it out. I took some at work yesterday… And at the cinema on Saturday, I took one of some of my friend there just in the lights. So I did have it with me quite a lot. But mainly used it at home.

12:20  KB: Okay, yeah. And I did mostly outside. Just because I do like the lights, um, with just a few things inside. I would agree with your close-up comment. That I tried to do… I’ve got some pretty flowers in my garden and my mother’s garden and I tried to do that. And… you couldn’t get as close as, yeah… as you might think. It would be blurry. So I’d get a blurry shot and have to stand back. And then I could capture it nicely but just wasn’t close, close.

12:54  R: Did you, um, try the lens filter effects? No?

12:58  KB: I didn’t (laughing).

12:59  LO: Not the filters. It looked like it was filtering itself.

13:03  KB: Yeah (laughing).

13:05  R: Or maybe regarding the colour you can try like, um, vivid colour or…

13:08  LO: Oh, actually, yes I did. Yes, I did, I went into black and white. And there were also different, um, yeah, I did have a fiddle with that. But it, um, it just seemed really, like really blue tinge or really yellow tinge or really. I didn’t actually use it. I looked at it but didn’t actually go in and use much of it.

13:30  R: Right.

13:31  KB: And I did try. Like I tried smart mode, automatic mode, the program mode. I tried some different modes. And I did try using some of the different scene modes. So I went specifically to close-up and stuff.

13:46  LO: Actually I think, yeah, I had it on vivid the whole time. Rather than forest or normal. There’s three different, um, colour modes. So I set all my settings to start with, like the colour mode, the, you know, focus in the centre and all of that sort of thing. So I chose vivid to hopefully get, you know, the brightest colours.

14:07  KB: Yeah.

14:11  R: Right, that’s cool. So here is the fourth one. How do you feel about this digital camera and what are your perceptions or impressions of the product? And LO, you said before that you haven’t used a compact camera before. So how do you feel about this product?
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14:29 LO: Um, well I wouldn’t buy one. No. I’ll stick to my SLR, even though it’s, you know, big to carry around. Um, I’ve just recently taken it overseas and I was thinking oh, this is so heavy. And I also had an extra lens which I didn’t actually end up using. And I thought this would be much better. But once I’ve seen what it does, no. I like to record, you know… being a photographer, you know. Um, but I did like those other two features quite a lot, the video and the, um, little seen in front. But in general I just expect a much better quality photo in the end.

15:13 KB: Um, hmmm… yep, that’s a good question. I do like having a compact camera on hand, um, for those easy times when you go out to dinner with friends or things like that, than carrying around my big one. So would I buy this one? Hmm, probably not. Um, I do have a preferred brand that I use. So I do tend to go for that. In the same aspect I was a bit… I didn’t realise Samsung put together a fairly good digital camera. So I was more impressed than I thought I would be with this brand. I thought the touch feature was really neat. And, because I don’t even have an iPhone or anything, to me it was a whole new experience and quite neat. Ah, I did actually have some failings, though. So one night when I was trying to, you know, use this to scan through the photos it wouldn’t… it wouldn’t move over to the next. And then, you know, you’d wait a little bit and try again. And so then I thought oh, is that a problem? You know, if you have a touch-screen on a camera, you know, are those things going to happen to you often and that’s a bit frustrating than clicking a button. So those questions were going on in my mind. So I guess overall I was more impressed than I thought I’d be. I did think it did, for me compared to compacts, it did do a pretty good job. But I don’t know if I’d buy this particular one.

16:49 LO: See I have a touch phone and it actually takes better photographs than that.

16:54 KB: This one (pause), isn’t that interesting.

16:59 R: Okay (laughing). This is the second last. Um, so did your experiences with the digital camera meet your anticipation or expectation? Or how were they compared to your anticipation or expectation. So, um, yeah, did they exceed your expectation or just were under or below your expectation?

17:26 LO: Well I’m not sure that I had too many expectations. Ah, but I was anticipating learning, you know, some new technology and, um… and having fun with it, which I did. Ah it was good to use. It was, um, something that I have actually been wanting to try out for a while, um, but never have. So that aspect was really quite good. It was very useful. Um… and the experiences, I mean it was a… I wasn’t expecting huge, you know, like beautiful photographs or anything. And also I wasn’t in a position to take those sorts of photographs anyway. But, um, yeah, it was fine. Yeah, I guess it was okay.

18:15 KB: Yeah, and I think I… um, I’m a bit of a mix. So in some areas it exceeded my expectations and in some it just kind of matched. So, you know, say like the movie feature was neat. Some of the features this has, like even the fact that you can change your ISO on a digital, on a little camera, is impressive. You can’t do that with mine. So some of the features I thought wow, look what they’re throwing into a compact camera which makes it easy. So those exceeded my expectations. And I was really impressed with this back screen as well. Like, I was like oh, you can see everything. Um, where I suppose my level, um, didn’t is again some of these intuitive features. So some things I expected to be easier to find than others. Um or just have little descriptors that made it a little bit easier so that you wouldn’t have to necessarily go to the manual. So those were in some spots where I thought, mmm. And I also like to have, ah, I do like to have a hard copy full manual. So just having that little piece of paper that told you a couple of things did nothing for me (laughing).

19:27 LO: No, no, it’s quite useless.
Alright that’s great and this is the last one. So, um, do you have any other thoughts or comment at all about this experience with the camera?

(pause) Um… well, I suppose, um… yeah, I don’t know if I’d recommend it as a camera. Um, it’s… I wouldn’t mind trying some others. Some other, ah, compacts. Ah, because I know that there are some, you know, really good ones out there and I haven’t given up on them completely. Um, but I might just stick with my phone for the moment.

Yeah. Um, do I have any other thoughts, (pause). I don’t think so. I think it can, you know, I think in some ways it does compare well to what’s in the market. You know, so it’s easy to hold. It’s got a good screen. It’s got even extra features that other little cameras might have. Um, which is good. The battery actually ran out a bit faster than I expected. So I ran out, um, so I was using it Friday, Saturday. Sunday morning I ran into a glitch and luckily I was home.

Did you charge it up to start with?

It was already fully charged.

Oh, okay.

Um, so Sunday morning I was home. So that was lucky. I could plug it in before I went out and did things. So that was just a little bit of a surprise. Just, again, just in comparison to mine. Um (pause) I don’t think anything different…

Actually that, um, that shake feature. Never seen that before. I mean you get it on the… Yeah, that’s quite interesting. Don’t know how it works really.

I couldn’t get… the first time I tried...

… speeding up the shutter speed or…

Yeah, the first time I tried I didn’t get it. I had to read to kind of figure it out. So I would say, look, for a little camera it’s got a lot of features. Will everybody use them, probably not. But you do have an option there, which I think is a good thing, if you can. Um, you know, it would be interesting to know, ah, price comparisons. This one to other ones as well.

Yeah. I didn’t think to look up how much it was.

You know… and it’s a touch screen, like it’s so popular now with technology, is it the way things are going and is it the best option? So well yeah, it was definitely a surprise for me. I turned it on and I went why can’t I do anything? Then I realised. Because I didn’t read (laughing), I just went. And I thought that was kind of neat. Yes.

Alright, thank you.
Appendix G:
Exemplars of the Application of the Codes
Appendices

Experiment One: Application of the Codes

**Desired Product Characteristics (DPC), Participant #34:**
that, So I think the feature of being underwater, um, is fantastic. And then I think, so that would be involved in my perfect camera. And also with different features and functions such as, um, the button light option. The, um.

**Dislike(s) (DL), Participant #22:**
I really hate using flash. Um, onboard flash, because it makes all the pictures look like crap, basically.

**Favourable Existing Characteristics (FEC), Participant #33:**
I’m quite happy with the black. The black SLR is a classic look and for me that’s fine. It doesn’t really

**Positive Anticipated Experience (PAX), Participant #33:**
I think for me it’s just that sense of achievement, that’s a good thing. I love coming home and seeing ooh, that’s a great photo. I might have to do a little bit of editing to make it a little bit better, but I don’t have to do much to it. And go yeah, that’s a good photo.

**Negative Anticipated Experience (NAX), Participant #33:**
and you know, you can never promise that you’re not going to have a windy day and stuff like that. So even if it’s on a tripod it might still topple over. So you want some robustness there in the design. Um, for me, I’m

**Positive Prior Experience (PPX), Participant #23:**
thing to do. And, you know, I was walking a dog yesterday (clears throat), someone else’s dog and they were away and I knew they were worried about it, so I just photographed the dog and sent the picture. It was so, you know, dumb, but, you know, it was lovely for the person.

**Negative Prior Experience (NPX), Participant #29:**
would be quite useful. I used to have a case where I used to carry an additional memory card in, um, so I would be prepared. So what happened is that, um, I was in the boat and the wave actually covered the whole boat. So my camera and additional card were wet and destroyed. And I was like oh my

**Experiential Knowledge (XK), Participant #28:**
fill... Say, if I took a photo of you here now, the flash wouldn't come on because of all that light. So you need a fill-in flash otherwise you’re in shadow. So I'd have
Appendices

Positive Anticipated Emotion (PAE), Participant #35:

[gestures] that will yeah make you be more excited to use the camera. So yeah, I meant like with what we talked about I think I’d be excited anyway but if there’s extra additional technology to the camera you know you’ll feel more excited and keep you use it.

Negative Anticipated Emotion (NAE), Participant #29:

about. And that’s quite annoying. If I get a bad quality manual I get really upset, because I also have the feeling that they don’t consider me as a worthwhile consumer so they didn’t spend enough time creating the appropriate manual.

Positive Prior Emotion (PPE), Participant #29:

today I’m buying a camera so show me everything you know. in this range. And he was showing me different models and then said I might have something for you, and he pulled the pink camera. And I was like yes (laughs). Because all the other cameras were black or grey or something like that. And I said yeah that’s my

Negative Prior Emotion (NPE), Participant #21:

I tried to put that on a microscope to photograph inclusions in a gemstone, and I couldn’t get it to focus properly because something in that camera. And we had other little ones like that, that we could do it on, but we couldn’t get mine to. It must be something with its way of automatic focusing and then the microscope. I don’t know what’s happening with it, but I gave up in disgust in the end.

Intended Use (IU), Participant #24:

suppose I want to feel able to diversify what I’m doing with the camera. Like I’m not only just using it at a party when there’s lots of people around so just taking a quick shot. But I can also go outside and take an artistic photo. So I want to feel empowered I guess.

User Characteristics (UC), Participant #4:

I’m not that familiar with the lens, the aperture type, or other specifications that involve the internal part of the camera part. I’m more interested in the external part of the camera, actually.

Experiment Two: Application of the Codes
Appendices

Intended Use (IU), Participant #25:

with it. Um, and I also took photos with the intention of
dh this would be something good that I can then e-mail to
someone. So, um, you know, because a lot of my family
and friends are overseas I was thinking oh, if I take a
picture of these things I can e-mail it to them and they can
see what my house looks like or my painting looks like.

User Characteristics (UC), Participant #4:

added benefits. I had never used a touch-screen camera before
and although I'm not usually a fan of touch-screen
(computers/phones) I really liked how this camera worked. It

Positive Emotion (PE), Participant #24:

the function and then when I suddenly found this function
I was so shocked. Wow! And then I was really surprised.
And then I thought oh I got to take more photos.

Negative Emotion (NE), Participant #38:

The red eye function appeared to work; however the smile
function had me very, very frustrated and once again as I am

Positive Experience (PX), Participant #26:

the most impressive part of the camera for me. Um, and it.
well it felt good because it was fun. It was something that
you could do with other people and, um, and I used it quite
a lot. I actually uploaded that... I uploaded everything to
my computer. But there is one shot that I'm keeping from
the whole experience and it's one of those. I did try to get

Negative Experience (NX), Participant #6:

um we were at the Iranian film festival and my mum wanted
someone to take a picture of us and he kept taking pictures and my
mum kept asking him to try again, to try again and I was getting
frustrated because I'm like, "It's embarrassing mum, we can't
keep asking the guy to take pictures", but he couldn't get a picture
that focus it well either so yeah.

Experiential Knowledge (XK), Participant #28:

Yeah, I have an Olympus that I think is a lot easier to use.
And actually it has more dials with little icons on it. It's not
this nice, sleek flat screen. But by having all that right there I
think it's... easier to follow or easier to manoeuvre through.

Desired Product Characteristics (DPC), Participant #15:

overall slimmness, but I would have liked if it... if the actual
tens was better and it took a sharper picture, this would be
probably one of the better slim sort of model cameras.

Dislike(s) (DL), Participant #40:
Appendices

After using camera for the first day, I really had to turn off the ‘key sounds’ of the camera. It beeped every time you used touch-screen. It was starting to annoy those around me (and me a bit) as I was pressing a lot of buttons to find new functions.

Favourable Product Characteristics (FPC), Participant #34:

some of the good things I liked about it is I found its exposures were accurate and I found that, ah, its white balance was accurate. In other words, taking photos under like incandescent light or fluorescent light it gave a fairly accurate colour. Ah, it also had another feature I like, this is

Exploration and Learning (EL), Participant #1:

then smiling! We also tried to take photos using the timer setting. This was trial and error and it took many attempts to get it right.

Discovery (DV), Participant #1:

too dark. It was then that I realised the camera has smile recognition! That is why it randomly took photos when we didn’t press the button! This gave us a lot of fun with frowning and then

Usage and Learnability Problem (ULP), Participant #38:

I could not remember the various functions that I would have liked to use e.g. the smiley face function for children and how to deal with back lighting. I still have trouble with the touch-screen - I do not seem to have become proficient in its use at all, especially when

Positive Expectation Disconfirmation (PED), Participant #29:

expectation. But feature-wise, I would say it sort of exceeded my anticipation because, you know, I didn’t expect it to have like an LCD in front of it. Um, and I didn’t expect that I can control it using gestures. Those kinds of things make… make it, you know, exceed my expectations from those perspectives. And

Negative Expectation Disconfirmation (NED), Participant #31:

uncomplicated which I was happy about. I was quite disappointed at the quality of the pictures when they were uploaded. I had expected a lot better as I know my own older camera would have done better. They were not sharp and

Neutral Expectation Disconfirmation (NrED), Participant #34:

probably… It was probably as I expected. It’s, um, you know, I knew the, um, one of these… types of cameras. I’d hate holding it out here and I’d, um… Ah, and also I knew that the, um, it would be contrasty oh… in bright light. Um, in other words it was pretty well as I expected.
Appendix H: Co-occurrence Matrices
## Experiment One: Co-occurrence Matrix

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A sub-category co-occurs with another if it is applied to text segments that overlap with any text segments coded to the second sub-category. The number in each cell of the matrix shows the frequency of co-occurrences between two specific sub-categories. For example, there are 129 pairs of DPC-coded and IU-coded text segments that overlap; hence, DPC and IU co-occur 129 times.
### Experiment Two: Co-occurrence Matrix

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<td>8</td>
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</tr>
<tr>
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<td>8</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>28</td>
<td>65</td>
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<td>0</td>
<td>27</td>
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<td>0</td>
<td>7</td>
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<td>7</td>
<td>3</td>
<td>6</td>
<td>0</td>
<td>3</td>
<td>15</td>
<td>1</td>
<td>12</td>
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<td>3</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>UC</td>
<td>4</td>
<td>0</td>
<td>13</td>
<td>7</td>
<td>0</td>
<td>19</td>
<td>19</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>8</td>
<td>7</td>
<td>3</td>
<td>90</td>
<td></td>
</tr>
</tbody>
</table>

A sub-category co-occurs with another if it is applied to text segments that overlap with any text segments coded to the second sub-category. The number in each cell of the matrix shows the frequency of co-occurrences between two specific sub-categories. For example, there are 65 pairs of PX-coded and IU-coded text segments that overlap; hence, there are 65 co-occurrences between PX and IU.
Appendix I:

Exemplar of Experience Diaries
Introduction and Procedures

Dear (Participant’s name),

We would like to learn how you experience the use of an everyday product in a real context. In this study, we provide you with a new compact digital camera and its auxiliary products. You are requested to explore and use the product over a period of three days, during which there will be no research team observing you.

1. Firstly, please learn by using the provided user manual CD-ROM or explore by yourself, how to use the given digital camera and what features are available on this product.

2. Please use the camera to take pictures or videos of any subjects (e.g. family, landscape, flower), at any places (e.g. home, workplace, park), and at any occasions you want. If possible, always have the camera with you during your daily activities. It is best to use the camera in several different situations, locations, and times throughout the day.

   *The pictures or videos you have taken may be personal and confidential. Therefore, you do not need to submit those pictures or videos. They are yours to keep if you wish. However, you may want to turn some of them in together with the completed experience diary to help you illustrate or explain your story during the co-discovery session.*

Along with your growing familiarity with the product each day, you may want to explore it deeper and try multiple features available. For example, experimenting various scene modes, manually adjusting the light exposure and shutter speed to capture cityscapes at night, applying smart filter effects and photo styles, or taking self-pictures with the front display.

3. At the end of each day, we would like you to recall your experiences that related to the camera usage on that day and report them using the experience diary forms. Details and procedures of reporting your experiences are explained on the next page.

Researcher’s contact:
Thedy Yogasara
e-mail: t.yogasara@qut.edu.au
phone: 0433556475
Experience Diary

At the end of each day (i.e. after dinner, before going to bed, or whenever in the evening that you will not use the camera anymore on that day), we would like you to recall, reconstruct, and record your experiences with the digital camera that took place during the day.

Reconstructing your experiences

It may be hard to remember all experiences that occurred during the day. We, therefore, ask you to reconstruct what your day was like, as if you were writing in your diary. Following the steps below will help you to reconstruct your experiences.

Please fill out the Experience Episodes Tables (one for each day) by performing the following procedures:

1. First, view your day as a continuous series of episodes, containing all activities of the day. What did you do and experience? When did it happen? Where were you? (This step only needs to be done mentally; you do not need to create a written list).

2. Then, in chronological order, try to remember and list all episodes that somehow related to the provided digital camera. Please record on the table each of those episodes with a brief name (e.g. taking pictures of my children, playing with smart filter effects, transferring photos into computer).

3. Please write down when approximately each episode began and ended (e.g. 1.45 pm - 2.00 pm) and where it happened (e.g. a friend’s house). Each episode can last from minutes to hours. The end of an episode can be indicated by, for example, moving to a different location, a change in the subject being captured, using a different feature of the camera, or starting a different activity that did not relate to the camera.

4. For each episode, please try to remember in detail what your experiences with the digital camera were like, how you felt, and what your impressions about the product were. You can add a very brief note about these on the table.

The table provides spaces for listing up to ten episodes, but you may put down more or less episodes than that number. Use the breakdown of your activities that makes the most sense to you and best captures what you did and how you felt with respect to the digital camera usage.

Now, please continue to the next page for completing the first Experience Episodes Table.
Please fill out this table at the end of day 1 by reconstructing your experiences with the digital camera during the day using a procedure explained on page 2.

<table>
<thead>
<tr>
<th>No</th>
<th>Episode Name</th>
<th>Starting time</th>
<th>Ending time</th>
<th>Location</th>
<th>What happened?</th>
<th>How did you feel?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Exploring the new camera</td>
<td>05.25 pm</td>
<td>05.35 pm</td>
<td>Indooroopilly Shopping Centre</td>
<td>Getting a new camera made me excited and couldn’t wait to use it.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Starting taking pictures while having dinner with family</td>
<td>05.35 pm</td>
<td>05.45 pm</td>
<td>Indooroopilly Food Court</td>
<td>Using the common features for taking pictures. I felt a bit shocked because of the auto flash at first but it was okay after.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Taking pictures outdoor at night</td>
<td>07.10 pm</td>
<td>07.20 pm</td>
<td>Home</td>
<td>Using the auto and manual adjusting for light. Not quite used to the settings, still needed to learn more.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Taking pictures of people inside the house</td>
<td>07.45 pm</td>
<td>08.20 pm</td>
<td>Home</td>
<td>Walking proudly around the house and capturing people’s activities. Disliked the auto flash again.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Learning how to use the new camera</td>
<td>09.50 pm</td>
<td>10.05 pm</td>
<td>Home</td>
<td>I was not satisfied because I couldn’t access the CD content.</td>
<td></td>
</tr>
</tbody>
</table>

Thank you for completing this table. Please continue to the next page to write your Experience Report.
Appendices

Reporting your experiences

After you have finished reconstructing your experience episodes, we would like to learn more about them. Please consult the Experience Episodes Table you have just completed, and then select from it the three most significant (either positive or negative) experience episodes of the day.

For each of the three episodes you have chosen, please write a story that describes in detail your experience with the given digital camera. Please use the provided boxes below. On the top of each box, give the episode’s number and name according to the previous table.

Experience Report, Day 1

<table>
<thead>
<tr>
<th>Episode number</th>
<th>Episode name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Exploring the new camera</td>
</tr>
<tr>
<td>4</td>
<td>Taking pictures of people inside the house</td>
</tr>
<tr>
<td>5</td>
<td>Learning how to use the new camera</td>
</tr>
</tbody>
</table>

Getting a new camera made me excited and could not wait to use it. Started with opening the box and looked at what came with the camera. Making sure that I had all the things mentioned in the box. I was glad because they were all complete and in good condition. The camera looks elegant with black pearl colour.

There was a little red-blackish pouch for the camera to keep it safe from scratches and a hand wrist band. I wish for more convenience, the pouch and wrist band and the camera can somehow attach to one another so we do not need to hold the pouch with the other hand while taking pictures because we are afraid to lose it if we place it somewhere else (not all people can put the pouch on their pants because not all of them wear belt or big pocket shorts/trousers).

When I got home, I tried to take pictures of people inside the house. There, I was walking proudly around the house and capturing people’s activities. We were all laughing because some of them were candid pictures. Again, I had unpleasant experience with the camera because of the auto flash feature. The picture resulted in a too bright quality which is not so good to see. Although I had the same experience before, I keep on forgetting that the camera will go back to its auto flash mode after taking pictures even if we’ve already turned it off for the previous pictures.

I was not satisfied because I could not access the CD content. Somehow my computer could not read the CD, maybe because of the scratch I saw at the back of the CD (which is less likely to happen for a new camera).

Thank you for completing your Day 1 Experience Diary. Please repeat the procedure tomorrow evening after using the camera on the second day.
Experience Episodes Table
Day 2, 15 October 2011

Please fill out this table at the end of day 2 by reconstructing your experiences with the digital camera during the day using a procedure explained on page 2.

<table>
<thead>
<tr>
<th>No</th>
<th>Episode Name</th>
<th>Starting time</th>
<th>Ending time</th>
<th>Location</th>
<th>What happened?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Recording the “getting ready to go” experience on Saturday night</td>
<td>06.10 p.m</td>
<td>06.25 p.m</td>
<td>Home</td>
<td>Exciting</td>
</tr>
<tr>
<td>2</td>
<td>Taking pictures after dressed up</td>
<td>06.35 p.m</td>
<td>06.40 p.m</td>
<td>Home</td>
<td>Good. Fancied self-taking picture feature and tried different angles.</td>
</tr>
<tr>
<td>3</td>
<td>Dinner time</td>
<td>07.20 p.m</td>
<td>08.10 p.m</td>
<td>Vietnamese Restaurant, West End</td>
<td>Good. Already prepared for the auto focus mode.</td>
</tr>
<tr>
<td>4</td>
<td>Delicious desserts</td>
<td>08.25 p.m</td>
<td>09.20 p.m</td>
<td>Freestyle, West End</td>
<td>Capturing the desserts from different angles.</td>
</tr>
<tr>
<td>5</td>
<td>City view at night</td>
<td>09.30 p.m</td>
<td>10.00 p.m</td>
<td>Southbank</td>
<td>Exploring the scene and filter features.</td>
</tr>
</tbody>
</table>

Thank you for completing this table. Please continue to the next page to write your Experience Report.
Appendices

Experience Report, Day 2

Please select the three most significant (either positive or negative) experience episodes of the day from the table you have just completed. For each of the chosen episodes, please describe in detail your experience with the given digital camera (please add extra pages if you need more spaces).

Episode number: 1 Episode name: Recording the “getting ready to go” experience on Saturday night

It is fascinating to have a multi-function camera. With the recording function I can capture each moment without worrying if I might miss something important. It is a family routine to go out for dinner at Saturday evening. I and my daughter love to dress up and it’s lovely to catch every moment of the process. Moreover, since the lens angle is quite wide, I could just put the camera on one perfect spot and I didn’t need to worry about recording while I was dressing up too.

Episode number: 2 Episode name: Taking pictures after dressed up

Fancied self-taking picture feature and tried different angles. After we’re all dressed up then we could take pictures. My daughter was the one who discovered the front LCD that enabled us to take picture of ourselves without checking the LCD on the back. Very convenient… Also with the face detection and smile detection we didn’t have to bother pressing the shutter because it would take picture automatically once we’re smiling. So easy…

Episode number: 5 Episode name: City view at night

After dinner we went for citywalk, actually somewhere around Southbank Park. Now it’s the time to see the picture quality in case of low lighting. I was exploring the scene and filter features and found it worked just fine. Sometime, the pictures were a bit blurry or making a funny effect when we’re so close to the light; but the rest was okay, after all it’s just a compact camera.

Thank you for completing your Day 2 Experience Diary. Please repeat the procedure tomorrow evening after using the camera on the third day.
Please fill out this table at the end of day 3 by reconstructing your experiences with the digital camera during the day using a procedure explained on page 2.

<table>
<thead>
<tr>
<th>No</th>
<th>Episode Name</th>
<th>Starting time</th>
<th>Ending time</th>
<th>Location</th>
<th>What happened?</th>
<th>How did you feel?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Leisure time at the Park</td>
<td>11.10 a.m</td>
<td>12.30 p.m</td>
<td>Park</td>
<td>Taking pictures of birds, trees, clouds, etc.</td>
<td>Felt fantastic.</td>
</tr>
<tr>
<td>2</td>
<td>Transferring pictures into computer</td>
<td>08.30 p.m</td>
<td>08.50 p.m</td>
<td>Home</td>
<td>Transferring and sorting the pictures. Recollecting the moment and experiences.</td>
<td>Good feelings.</td>
</tr>
<tr>
<td>3</td>
<td>Safe keep the camera</td>
<td>09.00 p.m</td>
<td>09.15 p.m</td>
<td>Home</td>
<td>Cleaning it and putting it back inside the box.</td>
<td></td>
</tr>
</tbody>
</table>

Thank you for completing this table. Please continue to the next page to write your Experience Report.
Experience Report, Day 3

Please select the three most significant (either positive or negative) experience episodes of the day from the table you have just completed. For each of the chosen episodes, please describe in detail your experience with the given digital camera (please add extra pages if you need more spaces).

Episode number: 1  Episode name: Leisure time at the Park

In the morning we went to the park near our house. I was taking pictures of birds, trees, clouds, etc. With the scene feature I could manage the pictures to look better. Actually we could just use the automatic mode but it wouldn’t kill to adjust it ourselves. It felt fantastic to be able to catch some moving objects in a frame. However, it could not work anymore faster like a pro camera though. I needed to take lots and lots of pictures to actually have a good one. Well, taking picture also needs skills so I’m not really complaining… lol :D

Episode number: 2  Episode name: Transferring pictures into computer

The experience I had when I was transferring the pictures into my computer was one simple way. Just plugging in to both ends and the gadget would do the rest. Because with other cameras sometime you are just too lazy to take out the memory card, put it inside a card reader then connect the card reader to the computer. It’s good to be able to access the pictures in the camera, recollect the moment and experiences. With the touch-screen I even prefer to view in the camera rather than view them in my computer. So easy…

Episode number: 3  Episode name: Safe keep the camera

After use, it is good to safe keep the camera to make sure it will endure for longer time. Before that I cleaned the lens with the specially provided wipe. After that I put it back inside the box. I feel satisfied to know that a good gadget needs a good treatment too.

You have now completed the Experience Diary session. Thank you very much for your participation. We truly appreciate your time and effort.

Please put the completed experience diary in the provided folder and return it together with the digital camera to us before or at the time of the Co-discovery session. If you wish, we could pick them up at your place.

If you fill out the diary electronically, please send the document via e-mail to: tyogasara@qut.edu.au

Thank you and see you at the Co-discovery session!