

## Chapter 10: Conclusions

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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 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.

### **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. *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. *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.

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.





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