Unpacking the Contents

A Conceptual Model for Understanding User Experience in User Psychology

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***Abstract*—Paradigm shifts can be noted to have taken place in several areas of user-technology research. The most obvious have been in terms of including users within the design process, either in terms of usability studies or user experience design. There have also been shifts towards viewing human-technology interaction as not only an optical experience, but also an embodied one. When exploring these factors it is easy to prioritize the physical over the psychological. User interactions with systems are more easily measured in terms of concrete outcomes rather than by subjective feelings and perceptions of interaction. Through the conference theme: user modeling and user focus, this study's purpose has been to uncover mental contents present during the moments of human-system interaction. The study has employed a range of design stimuli for users to encounter and evaluate, giving a holistic idea of the psychological components involved in the interactions. The article describes a conceptual model which has derived from a study of mobile phone icons in the context of their graphical user interfaces. This study shows that users draw on multiple dimensions of mental information contents when experiencing technology, these include: cognitive, practical, aesthetic and emotional. Although the dimensions somewhat overlap, shifts can be seen between the dominance of the dimensions when the experience is positive or negative.**

Keywords- user experience; mental contents; user psychology; conceptual model

I. INTRODUCTION

User interfaces (UIs) are the meeting point between technological products and users. Users, or humans, are complex organic systems in their own right. They come with varied physical, emotional and cognitive needs. Numerous factors impact the make-up of these users physically and mentally, and in order to get the connection between the user and technology 'just right', designers must consider and address these factors. As UIs become more advanced, user-centered matters are grow increasingly important. Thus, through 'user modeling and user focus', we aim to show that it is not just the physical and cognitive challenges of UI design that are important, but so too is a more encompassing view on psychological factors embedded within the user and their perception and interaction with the design.

This paper concentrates on the mental contents of user experience (UX). The term 'mental contents,' refers to information representations, which exist within an individual's mind. These representations, while constantly adapting and evolving, shape the way in which people experience phenomena [31][32][34][36]. These mental contents are shaped by a number of factors, none the least, by lived experience. Other factors include: cultural (national, gender, sexuality, religious, sub-cultural and people with disabilities), social, psychological, linguistic and geographical to name a few. The present study addresses two of these factors – national cultural and linguistic. Empirical material was collected in Australia and Finland in 2009 as a part of the Theseus [37] and ITEA2 Easy Interactions [38] projects examining the user psychology of user-system interactions.

We have been surprised to discover that astoundingly little, if anything, has really been done to understand what we consider to be the most important component of UX – mental contents. The study of mental contents is an important component of user psychology. In the next sub-section, user psychology and its application in the fields of human-technology interaction (HTI) is introduced in relation to UX. Section II details the method by explaining the picture technique and its rationale and detailing components such as the participants, measures and procedure. Section III illustrates the results and Section IV outlines a conceptual model of experiential contents. The paper is concluded in Section V, which summarizes and reflects on the findings of this study, posing further questions for future investigation.

A. *User psychology in the exploration of user experience*

In order to understand the mental processes that occur when users interact with technology, we must first

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understand the psychological pre-conditions of this interaction. This is what user psychology seeks to explain [1][2][3]. Scholars within the discipline of user psychology examine and construct psychologically justified explanatory models to influence design decisions [3]. With progress being made in the fields of UI development, it is hardly surprising that the area of UX design emerged. Emotional usability pioneer, Don Norman [4] articulates that designers and engineers know what works and users at least generally can learn how to use the products. But what lies at the heart of distinguishing two perfectly functioning products from one another, still remains somewhat of a mystery.

UX expands upon traditional usability studies, and is quite closely related to the Japanese Kansei engineering and North American emotional usability [4][5][6][7][8]. By now, the field of UX includes an abundance of conceptual models [7][9][10][11][12][13]. Inclusive in the models are dimensions such as user HTI perceptions, in addition to understandings of cultural and symbolic human-to-human interaction which impact HTI [14][15][16][17][18]. Important in the UX research paradigm is the quality improvement of HTI. Norman [4] stresses the affective and emotional aspects of interaction. Other scholars such as McCarthy and Wright [19] emphasize the role of culture as a meaning making tool in the process of UX. Battarbee [9] emphasizes the social nature of UX by demonstrating that it is not simply isolated within one individual, rather it can be and/or is a shared experience between multiple persons and communities. The major components of UX articulated by Väänänen-Vainio-Mattila et al. [20] encompass: interactional flow; pleasurable and hedonic aspects of product usage; and multisensory interaction.

The above examples represent studies undertaken in disciplines of cognitive science and task-related experimental analysis, phenomenology and qualitative analysis. They emphasize the role of feelings and emotions, perceptions and behavior in HTI [21]. Another key trait of the above mentioned models is that they broaden the perspective from human-computer-interaction (HCI), to other design products or interactive technologies. Thus, they concentrate on incorporating users' lived experience and natural interaction in the design process [19][22][23][24]. Despite this, attention is still lacking in regards to what we consider the most essential property of experience – information contents. Apart from phenomenology [25][26][27], and some aspects of cognitive models [28][29], information contents of mental representations have rarely been discussed in relation to UX [30]. Experience is the conscious part of human mental representations.

Previous work by Saariluoma [31][32][33][34][35] [36] and Leikas and Saariluoma [24] is continued in this study, whereby a content-based approach has been taken towards the investigation of life based thought-related processes. Content-based thinking enables the formulation of new questions. Problems lie within explaining the mental contents of users. Contents are in a constant state of flux from one phase to the next, leading to a core question within our investigation: Given its ever-changing nature, how is conscious experience effectively operationalized, in order to provide a detailed understanding of UX from a psychological perspective?

In light of a study into user evaluations of mobile phone icons, the key aim of this paper is to lay the foundations of a conceptual model based on categorical dimensions of mental contents. The idea is not to provide a finished map of all the dimensions and categories, but to illustrate the formational stages of the framework, starting from a skeletal version of what has been achieved though the examination of user response to graphical user interface icons. The further these studies go into other design elements, bridging newer UI designs and prototypes, the more detailed and thorough the framework becomes.

II. METHOD

For this study, the picture sorts technique [46][47][48] 49] was employed to investigate the ways in which users prioritized and constructed explanations of why specific designs were preferred over others. In addition to carrying on the tradition of investigations which explore user emotional responses to designs, the picture sort technique focuses on collecting explanatory frameworks provided by users. As mentioned above, the challenge for us has been to gain an understanding of *how* participants see and mentally construct design products using the information content available to them.

The picture sorts method, developed during the 1950s [45], is an empirical technique used to explore Personal Construct Theory (PCT). Scholars of PCT advocate that people mentally register phenomena through constructs that they themselves create by means of mental information content. This information content includes and is shaped by social, environmental, cultural and psychological factors etc. In other words, via interaction with design, environments and other people we are constantly constructing and reformulating mental images of the phenomena we encounter. In fact, our sense of reality is based on these constructs. More and more within the field of HTI, the significance of methods such as the picture sort is being recognized [46][47][48][49][50].

A. *Participants*

In total, 35 subjects participated in this study. Fourteen people participated in Australia and 21 participated in Finland. Australian participants were aged from 26 to 61: 2 were 26-29; 3 were 32-35; 3 were 40-44; 4 were 50-54; 2 were 58-61. The mean age of the participants in Australia was 44.2 years old. The gender distribution of

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the participants in Australia was 8 females and 7 males. Ages of the Finnish participants ranged from 21 to 54: 9 were 21-29; 7 were 30-38; 3 were 43-46; and 2 were 51-54. The mean age of the Finnish participants was 33.1 years old. The gender distribution of the Finnish participants was 14 females and 7 males.

B. Measures

Twenty-two screen shots of icon menus were presented on a pack of picture cards. The icon menus were chosen from competing mobile phone brands, models and generations. The idea was to have a sample representing the most commonly used brands on the Australian and Finnish markets. Once these had been selected they were then printed on 200 gsm matt card. A USB recording device was used to record the experiments.

The participants were required to sort the cards into three piles: least attractive; attractive; most attractive. This was not a time based exercise, participants could undertake the experiment at their own pace to ensure that they carefully looked at the icons. We emphasized that it was *their* personal subjective preferences that we were interested in, and that the experiment was not an examination. Once the participant had finished sorting the cards into piles, they were asked to think of descriptive titles (words or phrases) and then reasons for these titles. The titles and the reasoning were first written down on an open answer questionnaire, and then the participants were asked to verbally elicit their responses. This was in case they were more likely to favor one of the explanatory forms over the other.

C. Procedure

Before conducting the experiments, a Statement of Ethics was applied for and obtained from the University of Jyväskylä, Finland, and the Edith Cowan University, Western Australia. The experiments were conducted in quiet, controlled environments in Finland and Australia. Generally, they took place one per time, but on several occasions there were two participants at different sides of the room. The researcher's role in the experiments was to distribute and explain the experiment components and answer questions. In Finland, a native speaking Finnish research assistant was used to conduct and explain the experiments.

When entering the experiment setting, participants were given an information handout to read about the procedure. Participants were asked to sign a 'Notice of Consent' agreeing to the use of the material obtained during the experiments. Participants completed a personal details form asking: age, gender, cultural ethnicity, highest education level, profession, mobile phone user skills (expert; advanced; intermediate; beginner) and model of mobile phone. The steps of the experiment were explained to the participants. In return for participating in the experiments participants were awarded with one free movie ticket.

III. RESULTS

In an attempt to understand the relationship between particular qualities and positive and negative user experiences, the titles and explanations given by the participants were divided into categories. Through content analysis eight categories arose in the Australian data and nine from the Finnish data. The categories were: aesthetic appeal; clarity; icons, colors and layout; intuitiveness; amounts of icons on screen; understandability; labels; size; and the category of shapes emerged from the Finnish data. The positive and negative descriptions were treated separately when counting and grouping adjectives and phrases.

In the positive descriptions, clarity was the most common category (31%) used by the Australians. Intuitiveness was the next most frequent category (19%). Descriptions relating to intuitiveness included "the need to think" and "informative". Later on in the Finnish results this was mostly linked to the characteristic of familiarity. However, considering this study was supposed to focus on aesthetic attraction, it only featured in 18% of the Australian explanations. Examples of this can be seen in statements such as "good looking", "aesthetically interesting", "aesthetically appealing", "funky" etc. Comments referring directly to the icons themselves, their colors and layout, featured 11% of the time in the Australian results, which was the same as understandability (e.g., easy to understand, more understandable). On the practical side, even though the focus was on the icons, labels were mentioned in 5% of the Australians' positive comments. Interestingly, the practical dimensions (labels, size and amount-arrangement) were mentioned by participants of 50 years of age and over. Their descriptions related more to usability and physical limitations than to aesthetic appeal.

In the Finnish participants' positive evaluations, aesthetic appeal was mentioned 27% of the time. Clarity was the next most frequent category, featuring in 19% of the descriptions. The icons, their colors and layout were the next most frequently used (18%). Intuitiveness, as well as amounts of icons on screen and arrangement were both present in 10% of the comments.

There are some differences between the negative descriptions of icons, colors and layout (Australians 4% and Finns 18%) and negative descriptions regarding size (Australians 12% and Finns 3%). However, one substantial finding is connected to the way that practical usability (clarity) took preference over aesthetic appeal when Australians were positively evaluating icons. In order to see these relationships more clearly, figs. 1 and 2

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below illustrate the comparisons between the distribution of adjectives used for positive and negative descriptions, in relation to each national group. This is achieved by showing the percentage of comments (descriptions) which were allocated to each of the adjective categories.

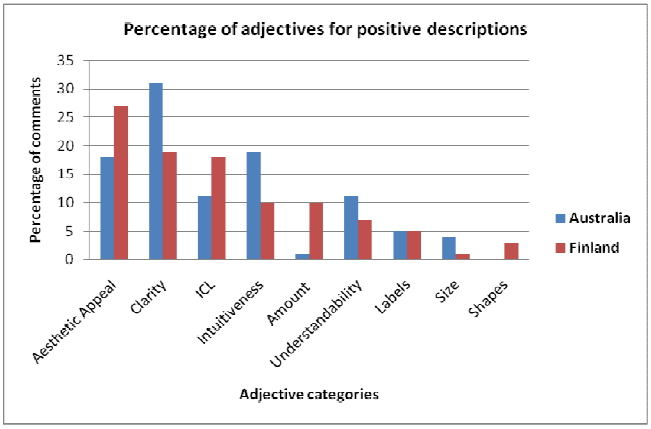

Figure 1. Percentage of adjectives for positive descriptions

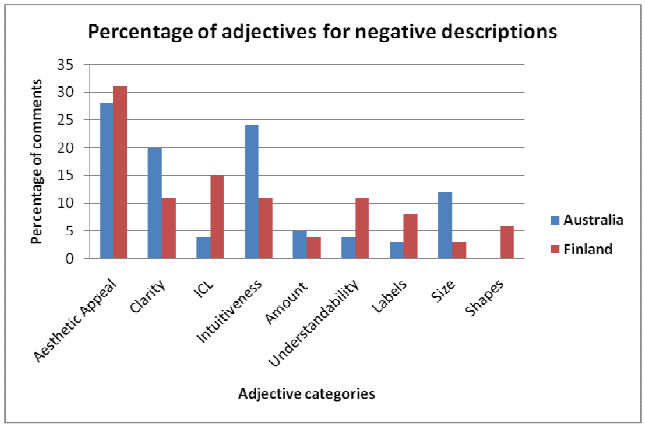

Figure 2. Percentage of adjectives for positive descriptions

The distributions show that content recognized as clarity was present particularly when Australian participants positively experienced icon designs. When negatively experiencing the icons, content associated with aesthetic appeal played an extremely active role amongst participants in both national groups. When considering the dominance of the dimension in positive descriptions, clarity (perceived simplicity and ease-of-use) is a main desired quality for positive UX, even more so than an abstract more subjective conception of aesthetic appeal. This affirms models such as TAM (technology acceptance model) [51][52][53] and their advocacy of the importance of perceived ease-of-use.

IV. CONCEPTUAL MODEL OF EXPERIENTIAL CONTENTS

A means by which we may express the mental contents involved in UX is to examine the categorical groups which people generate to justify evaluations. Individual remarks differ from one participant to the other. However, on a higher categorical level, clear dimensions of contents may be extracted from this qualitative data. The information content available enables insight into the formation and design of UX on the basis of it is described by the users themselves.

A. *A User Psychology Model of the Categorical Dimensions of UX*

In order to make sense of these results, and to create a framework by which future user psychology investigations of this nature may be guided, a model of categorical dimensions of UX has been plotted. This is not a polished product, but the basis upon which a larger framework for psychologically understanding UX may be developed.

From the results, slight tendencies may be observed within the categories which highlight the elements participants focused on during positive or negative interaction. In order to approach the results from a deeper perspective, the categories were divided into adjective dimensions which describe the products' physical attributes, and categories which describe the participants' internal/emotional attributes allocated to the icon designs. The division can be seen in the diagram below.

Fig. 3 below shows the basis of this user psychology model of the categorical dimensions of UX. It is a simplified mind map of the categories extracted from the data, and organized into 4 main dimensions: cognitive, emotional, practical, and aesthetic. Furthermore, the diagram has been divided vertically into the dimensions which can be seen from the point-of-view of the user (top) and the point-of-view of the product or design (bottom).

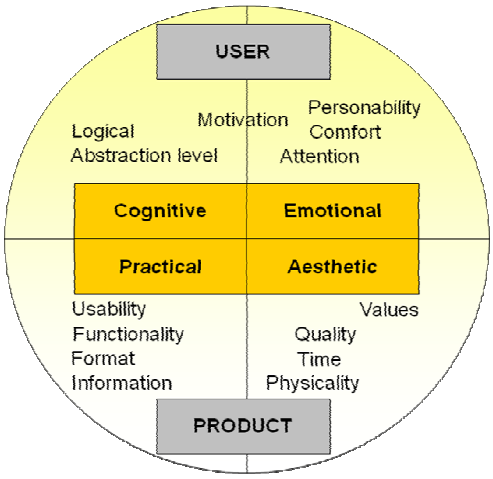

Figure 3. Categorical dimensions of UX

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The featured categories noted in the results section were used as a basis to form themes featured in the diagram above. The resulting themes informed our understanding of the categorical dimensions. These dimensions summarize the users' explanatory constructs in terms of designs' practical and aesthetic properties, and the user's cognitive and emotional properties. Theme allocation within these specific dimensions is not a straight forward task. Themes such as motivation and format-physicality, may be applied to multiple dimensions – i.e., motivation, through adjectives such as "invigorating", "stimulating" and "interesting", was allocated to the emotional dimension, but can be attributed the theme of learnability.

Through analysis of positive, semi-positive and negative comments it was observed that positive comments mostly concentrated on the technical and aesthetic dimensions. Participants focused more on how the icon designs worked within themselves, than on how they as users were emotionally affected by the designs. The positive technical comments focused on formatting – such as labels, size, amount of icons. The positive aesthetic comments focused on aesthetic values-qualities and physicality. Fig. 4 below demonstrates this relationship.

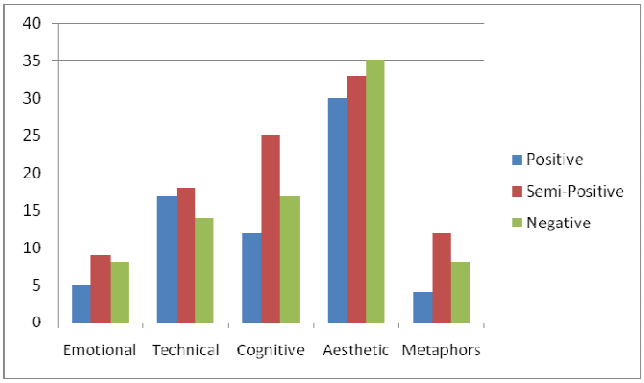

Figure 4. Adjective distribution – positive, semi-positive and negative

The semi-positive comments used to describe the attractive pile seem to emphasize the technical, cognitive and aesthetic dimensions. Thirty-three different semi-positive terms were used within the aesthetic dimension, in comparison to 30 positive and 35 negative comments. The themes emphasized in the semi-positive comments included: emotional – attention, motivation, identification and comfort; technical – usage and format; cognitive – abstraction, motivation and logic; aesthetic – values/quality, time and physicality. Notably, more metaphors were used to describe semi-positive traits than were used in the cases of positive or negative traits. These metaphors included: "basic mass" and "Linux GDM window", describing banality in the icon designs.

As with the positive comments, the negative comments concentrated on the technical dimension. Yet, the emotional dimension played a greater role in the negative (and semi-positive) comments than in the positive comments – i.e., attentional and motivational ("dull", "boring", "annoying"). Moreover, the negative comments emphasized the aesthetic dimension (values and physicality themes).

V. CONCLUSION

Based on the results of this experiment some interesting observations may be made regarding emotional usability. The findings of this experiment show that less emphasis was placed on the user's own emotional responses when positively evaluating icon designs. Emotions came to the fore when designs were experienced as negative. Interpreting design via aesthetic categories was common throughout the process of evaluation. However, the technical dimension was more important in the positive evaluations than the negative evaluations. This may be due to the fact that participants found ease in articulating technical qualities when explaining why they positively experienced certain designs.

A principal theoretical issue has been opened here. This pertains to the way that we can investigate how users encode technical devices; and how we may examine this encoding process. When allowing participants to generate reasoning behind their choices, we are able to glimpse the mental contents involved in the way they emotionally appraise products. These findings articulate: critical UX design characteristics; why they are critical; the complexity and multidimensionality of mental contents; and possibilities for benefiting from the development of design based on our knowledge of mental contents.

We believe that these empirical findings should be considered in terms of content-based psychological thinking [31][33][44]. Speech output reflects conscious experience, behind which are systems of subconscious mental contents. Thus, according to this UX means the conscious experience of encoding objects. People are guided by their mental representations. If information content is understood, then cognitive and emotional responses can be used to explain behavior. Thus, we pose that knowledge of mental contents will improve the analysis of human technology interaction.

We are no longer primarily interested in computations (as seen in Newell and Simon [28] or Fodor [41]). Instead, we investigate mental contents in the late Wittgenstein [54] sense as systems of languages, meanings and thoughts [33][55]. Percepts, concepts, beliefs, mental models, schemas and other forms of representations such as images or emotions have their contents. Therefore, theoretical and explanatory concepts are often the contents and not the format in which contents have been constructed [55][36].

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This was a small-scale study designed to develop methods and theoretical frames to measure attractiveness in terms of user psychology. However, as a result of this small sample, questions have emerged regarding the nature of emotional usability in everyday design – should more emphasis be placed on inducing positive emotions, or on reducing negative ones? We also question the relationship between thought and language in such a study, as language never precisely produces the sensations experienced by the user. The results show the complexity of conscious and verbal experience, and moreover, that four major categories give a broad idea about how people classify icons. The key purpose of the underlying conceptual model is to shed light on what people actually experience. This form of information allows for mental representations and life to be connected [23][24]. UX is not an abstract model, but rather, refers to multiple factors in the make-up of a person. This means that mental content always plays a role.

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