# Let the contents lead the way – formulating DX from the information contents of users' mental representations

## Abstract

This paper describes a study investigating user experience (UX) evaluations from a user psychological perspective. The research specifically analyses the information contents given by end-users when qualitatively evaluating design products ranging from: 2D experience (mobile phone UI icons) and 3D experience (handheld/tangible items). The idea has been to observe the types and dimensions of mental information contents that are generated in users' mind when encountering designs. The information contents observed includes the following dimensions: cognitive, technical/practical, aesthetic and emotional. Currently, a framework of mental information contents is being developed, designed to assist designers in understanding generalized types of UXs triggered in relation to various designs and related characteristics. The goal of this framework is to provide designers with

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#### First Author

Rebekah Rousi University of Jyväskylä IT Faculty, PO Box 35 FIN-40014 University of Jyväskylä rebekah.rousi@jyu.fl

#### Second Author

Pertti Saariluoma University of Jyväskylä IT Faculty, PO Box 35 FIN-40014 University of Jyväskylä pertti.saariluoma@jyu.fi direct insight, into the minds of users, to generate Designer Experience (DX) to allow them to more adequately design for experience.

#### Keywords

User experience, mental information contents, design, framework

## ACM Classification Keywords

D.2.10. Design: methodologies and representation

## **General Terms**

Design, Human Factors, Standardization, Theory.

## Introduction

It is not rocket science to understand that in order to produce designs which are not only functional for users, but also appealing, designers need to know more about the users in terms of their wants, requirements and overall opinions of designs and design experiences. Yet, in order to create a situation in which the designer can experience the same way as the design's end-user, it is not enough just to know the user. Instead, the designer should know what the end-user *thinks*. To create a detailed designer experience (DX) based on user experience (UX), the ideal situation should be similar to that which is seen in the movie Being John Malkovich, whereby, the designer is able to step inside the head of the user to experience design from their perspective. As we know that it is virtually impossible to undo all the psychological filters that years of design training have produced, and to anticipate the many filters that a potential user may possess, the likelihood of the designer experiencing the product in the same way as another user is guite close to none.

However, this paper outlines a study which is designed to come as close to mapping the way in which an enduser thinks as is possible via communicated experiences. It analyses mental information contents through linguistic information provided during design evaluation experiments. The paper does not go into detail illustrating the participants, procedure and results of any one experiment. Instead, the main points of our investigation are illustrated in summaries of observations made from several experiments centering of the user evaluation of the following diverse products: mobile phone icons and handheld moisture meters.

The paper begins by defining what we mean by the information contents of mental representations, its role in formulating mental representations, and how this generates the lived experiences of individuals. It then moves on to discussing the outline of a framework being developed on the basis of findings extracted from the user evaluations of the above mentioned design forms. This framework of the dimensions of experience comprises the following information content types: cognitive, aesthetic, emotional, practical and technical [15]. We then go on to conclude the paper by reflecting on our position that experiences exist within mental representations, which have been formulated through the combination and interaction of mental information contents. In order to establish the possibility for the Designer to experience user experience, from the nondesigner perspective, they need to be able to view experience as an image created from the user's own mental representations of the experience.

# Information Contents of Mental Representations

As explained in the introduction, human mental representations have information contents, these contents are often referred to as mental contents [14,1,6,7,8,9]. Thus, our understanding of representations is that they are not solid, static entities existing within the minds of individuals. Rather they are fluid and constantly changing, as they are formulated and re-formulated again according to internal and external dynamics of the end-user and the design usage circumstances (i.e., context). In other words, every moment a person lives they learn something new, their circumstances change, and their thoughts are altered. Thus, they acquire new information (cognitive and emotional), which consequently changes the repertoire of contents readily available to the individual when they are in the process of experiencing, for instance an object or a phenomenon. For example, until today Billy had never seen a red Volkswagen before. However, upon his first encounter he observed one speeding through a red light. Tomorrow, when he sees another red Volkswagen, he will 'know' to be careful, because they speed and run red lights. Likewise, when faced with another technological encounter, information such as 'red', 'speed', 'notstopping', 'lights', 'Volkswagen' etc. is left in the mind, ready for re-formulation and sense-making for other, possibly unrelated experiences. Yet, alone or randomly combined, this information has no contents – it makes no sense.

It has therefore been common to interpret mental contents in semantic terms [6,5]. Yet, it is also possible to analyze mental contents as information contents [18,19]. In the latter approach, the question is no

longer about the interpretations and assignments of symbols but directly about the mental contents of thoughts. Even if we had a full description of the semantic rules for any language, we cannot explain a single thought on the basis of those rules. This is why it is essential to work directly on contents and not on how symbols are assigned or processed. Thus, studying user experience would mean explicating the conscious contents of users' mental representations and pursuing this material as explanatory grounds for users' behavior [19]. In this way, a new conceptual perspective to the mind can be opened. This would be in line with user psychology and content-based psychological investigations [18,19,20,23].

When we think carefully about the tradition of modern HCI psychology, explanations are commonly based on the limited information processing capacity of attention and working memory [2,4]. Work with mental contents is different as it relies on the information contents of mental representations and not on the number of chunks in processing systems.

Additionally, content-based psychology differs to capacity-based thinking in its explanatory grounding [18]. It takes the contents of the mental representations or mental contents under investigation and works with types of phenomena which can be explained in terms of mental contents [19]. Contentbased thinking allows us to ask new types of questions. For example, the issues of relevance and truth, in addition to correctness of content-based issues. The main problem seems to be related to the means by which the mental contents of users may be explained. The contents shift from one phase to another, they are lively and elusive in nature. A core question of our research is as follows: what would be an effective way of operationalizing conscious experience given its character as a freely floating phenomenon?

In this we continue the earlier work of Saariluoma [18,19,20,22,23], which has analyzed thought-related real life processes from a content-based point of view. It has also been applied to the analysis of human technology interaction (HTI) relating to older adults [13]. Here, in the following section, we demonstrate the development of a framework of design experience, which in the near future may be utilized by designers to gain insight into the ways in which their design-decisions influence the experience within the user.

#### Extracting the Dimensions of Experience

When considering UX from a user psychology perspective we understand that experience, occurring via mental representations, is enabled by a range of different types or categories of information contents. Here, we think of these categories as dimensions of experience. The contents brought to the fore within the mind of the user vary in nature between: cognitive, emotional, aesthetic, practical and technical.

The observations were first made in relation to a study investigating the attractiveness of mobile phone icons. Within this study a method called picture sorts technique [16,17,24] was employed to observe how end-users evaluated a set of 22 different icon displays from competing mobile phone brands and various generations (presented in the form of playing cards). To do this, participants were asked to sort the cards into three piles from least attractive to most attractive (the middle pile being indifferent). Once they had finished they were then asked to give the piles descriptive names and then explain their reasons for allocating the names that they did. Content-analysis was performed to analyze the data collected in the tradition of Personal Construct Theory (PCP) [10,16,17]. The rationale behind PCP is that when people perceive the world around them, they do so through constructs which they themselves mentally create [10]. The aim of implementing content-analysis on this type of material was to observe the types of constructs people allocate to certain designs and how these correspond with negative and positive experiences (i.e. the least attractive to most attractive piles).

The experiments were conducted in Australian and Finland, and what we found was that the contents of the qualitative data could be divided into the following themes: aesthetic appeal, clarity, icons colors layout, intuitiveness, labels and size. Then another theme that was observed in the Finnish material that was not apparent in Australian material was 'labels'. These themes in turn were divided into the dimensions mentioned above: cognitive (clarity, intuitiveness), aesthetic (aesthetic appeal, icons colors layout), practical/technical (labels, size, shape), and emotional (some of the terms used to describe the aesthetic components were sorted into emotional such as "joyful", "dreary", "dull", "invigorating".

Interestingly, what was noticed was that more emotional terms and phrases were used to describe the cards that participants had a negative response to, than were used for those they had a positive response to. Further, the cognitive dimension seemed equally as important in explaining why the cards were both negative and positive. Participants seemed to have more concrete reasoning behind why they felt certain cards were better than others, and they were able to demonstrate this by articulating their reasoning mostly through the aesthetic and practical/technical dimensions. Given the nature of mobile phone user interface (UI) icons, it is not surprising that one of the chief priorities would be to be able to understand what the icons meant (cognitive). This seemed to increase with the age of the participants (45 years old and over) who prioritized the ability to clearly see, read and understand the icons above other factors such as decorative features. What was not expected was that the icons which were experienced negatively gained more emotional responses - sometimes people distinctly knew why they did not like the designs (cognitive and practical/technical), but dislike in the aesthetics seemed more difficult to 'rationally' articulate.

Thus, above was an example of a study that focused on the aesthetic (attractive) appeal of mobile phone icons, which serve a purpose – they are the communicative link between user and function. Yet, the nature of mobile phones is both personal (personalisable) and practical. Thus, many take the initiative in buying phones or customizing them to suit our own aesthetic tastes. However, handheld moisture meters (HMMs) are specified professional tools designed to do the particular job of measuring moisture levels in building interiors and other spaces. It would be extremely rare that an individual would buy an HMM for aesthetic purposes. Yet, our task in this case study was also to examine how end-users aesthetically experienced these devices. For this experiment, the repertory grid technique (RGT) was employed – a method in which devices are sorted into random groups of three, participants are asked to pick the most outstanding of

the three (for negative or positive reasons) and then assign an adjective to describe why the device was outstanding, and then think of an adjective which means the opposite (to them). These adjectives were added to a grid and the process was repeated with 10 random groups of three. This was followed by an evaluation of each of the devices individually on a scale of 1-7 against the bi-polar adjectives.

When observing the constructs provided, similar dimensions were noticed – cognitive, aesthetic, practical/technical and emotional (yet to a lesser extent). In all of the encounters, positive and negative, the cognitive and practical/technical dimensions were important. Emotional terms were not prominent amongst the adjectives, but could be seen to overlap with aesthetic terms such as "friendly". Interestingly, the aesthetic dimension came to the fore mostly when participants were describing the designs negatively these were in the forms of "ugly", "unprofessional", "spaceship-like". The only participant to use an aesthetic term positively was an architect by trade, who described one of the designs as "beautiful" and "modern".

# **Conclusion – the beginning**

Although this paper has not thoroughly accounted for all the details of the experiments, nor has it outlined the exact results – qualitative and statistical – it was designed to give a taste of the types of findings that have been occurring in a larger research project which goes on to include designs such as glassware and elevators. Within this small sample, it can be observed that even the components of experience that are at work in the minds of the users when encountering designs are not static. It can be seen that there are several dimensions that are constantly present, and come into play when users are creating mental representations of their experiences. Yet, the amounts of, presence and dominance of the dimensions changes depending on the types of experiences the user is undergoing, and even the order of the dimensions (i.e., whether or not their presence is positive or negative) changes according to the type of design the user is encountering.

There is a large difference between mobile phone icons and handheld moisture meters, they are designs of a different nature. One is a two-dimensional communication tool for identifying functions in a digital user interface. Much discussion has taken place regarding designs particularly of this character in which hedonic characteristics, or the qualities of a design which are not purely present for functional reasons, but rather to gain some emotional response from the user (see for example 3 and 12), have been seen as an important part of the usability, or UX. Yet, icons still fill a functional purpose. But while, what occurred within the experiments was that emotions only really came into play when users were experiencing the designs negatively, emotions did not directly come to mind (or mental representations) when describing experiences with the profession tool of an HMM. Instead, aesthetic descriptions were used to describe negative experiences, but similar to the icon study, the cognitive and practical dimensions played a major role in describing positive experiences.

It is from this basis that we are beginning to paint a picture of experience from the user's psychological perspective, but with the aim of providing designers with possibilities to access the same experiences when considering their active projects. Thus, we believe that through generating a user-centered DX, the goals and intentions of both designers and users will be more adequately met.

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