Eyeface: a new multimethod tool to evaluate the perception of conceptual user experiences

Based on the identification of a new multimethod tool necessity, a new tool called Eyeface has been created by combining two different devices: the Eye-tracking and the Facereader. This research work analyses a new multimethod tool to evaluate the user experience perception in the conceptualisation phase within the experience design process. To this end, an experiment has been carried out analysing the correlation between the Eyeface and the Positive and Negative Affect Schedule - Expanded Form (PANAS-X) evaluation tool. The result of this study showed a high similarity between each device´s results, and thus concluded that the Eyeface fits as a concept evaluation tool within the experience design process.

Keywords: Conceptual design; Experience design; Experience evaluation; User centered design

1. Introduction

For many years industrial design has been based on a problem resolution approach (Munari, 1980), but through the new paradigm a new perspective has been carried out. This new approach, instead of just focusing on operative and functional objectives, includes a new wider approach encompassing people´s emotions and feelings, and proposing specific experiences (Williams, 2006). This change in perspective is interpreted as the natural evolution of individual´s needs, and derives from the features that define the current socio-economic context. The large quantity of products flooding the market, the competition between brands and companies, and the values associated with the citizen´s consumption habits speed up this new change of scenario in which the user experience has a huge importance.

According to Roto et al. (2011) the user experience refers to an overall designation of how the user has experienced a system. Thus it is described as a highly dynamic, subjective and complex phenomenon (Law et al., 2009) and it is composed with different dimensions, such as temporal, spatial, physical and emotional (Shedroff, 2001). The temporal dimension is subdivided in different spans: Anticipated UX (before use), Momentary UX (during use), Episodic UX (after use) and Cumulative UX (over time) (Roto et al., 2011). Many of these dimensions are difficult to manage in the developing process, and that is why the implementation of new processes within a company requires an assessment or evaluation of it.

The relatively short path of experience design leads some doubts about its evaluation and the impact, both in the user and in the company. The main reason of this complex reality is that the subjective experience evaluation is based on emotional stimuli and feelings. Therefore, the evaluation of the user experience is quite important in the experience design evolution, and it could be the key in order to achieve the implementation into the business world (Väänänen-Vainio-Mattila, Roto and Hassenzahl, 2008).

It is known that the most critical phase within the whole process is the concept development phase (Duffy et al, 1993; Wodehouse and Bradley, 2003), but most of the experience evaluation tools are focused at the end of experience design process (Vermeeren et al., 2010). For this reason, this research work aims to validate a new multimethod tool, which evaluates the user experience in the conceptualisation phase within the experience design process. To achieve this a conceptual experience evaluation study was carried out with a multimethod tool called Eyeface. Users have emotional responses towards design elements in interfaces (Tzvetanova, Tang and Justice, 2009), and that is why the Eyeface is considered a suitable tool to explain

conceptual experiences.

This paper firstly provides an overview of the current situation for user experience evaluation tools and multimethod tools. It then describes the Eyeface and the study that has been carried out, comparing the results of both Eyeface and Panas-X. Lastly it analyses qualitative data from a short questionnaire to gain a better understanding of user perception and support the designer on the decision-making process.

2. Evaluation tools for user experience assessment in conceptual phase

The greatest challenge of experience design is that there is no guarantee about how the user could perceive the product or the service, because appreciation and emotional assessment is totally subjective (Hassenzahl, 2005; Pucillo and Cascini, 2013). For this reason it is necessary to ensure that the experience proposed by the designer and the experience perceived by the user are the same thing. Thus, the contribution of different evaluation tools has huge importance in order to obtain success in each experience that is proposed.

Today, more and more companies are adding experience design´s approach within the development process of their financial proposals (Pine and Gilmore, 1998). Companies are realising that the user experience is becoming more and more important and the interest of companies about user experience assessment is increasing (Roto, Ketola and Huotari, 2008). This is why it is important to keep reducing the gap between academic knowledge and companies, and in recent years many user experience evaluation methods have been created. The evidence of this fact can be found in different databases containing a collection of the many methods that have been created so far such as Engage (2006) and Humaine (2008).

2.1 Multimethod tools

Despite the wide range of user experience evaluation tools available Vermeeren et al. (2010) have shown the necessity to go further into the subject and they propose to develop new and more specific evaluation tools. They describe an opportunity in a new multimethod tool approach based on two or more different evaluation tools. This approach aims to improve the effectiveness of the user experience evaluation, and collect relevant and meaningful data (Roto, Obrist y Väänänen-Vainio-Mattila, 2009).

Following these facts, we see that there are very few multimethod tools among the user experience evaluation tools. Indeed just one multimethod tool, Emoscope, is identified (Bustillo, 2007), within the review proposed by Vermeeren et al. (2010) where 123 evaluation tools are listed.

Emoscope is a patented user evaluation tool (Ribes i Bonet et al., 2008), which evaluates the usability from a emotional perspective. The tool suggests the incorporation of a Usetherapist (UX expert). It also proposes a tool pack containing several modules including Emotron, Emotracking and Pulsetron. The Emotron, collects data related to emotions using facial expressions. The Emotracking, allows the researcher to know where the user is looking by collecting gaze tracks. Finally the Pulsetron, is a module that collects the polygraph data in order to have a better understanding of the psychological and emotional reality of user perception.

Thus, the Emoscope evaluates the user experience combining all the information that is collected with each module. The tool is currently used on functional prototypes and final products, but the features of the different tools limit the evaluation performance to web platforms, mobile apps or digital software.

On this basis, we identify a new field of application for multimethod tools linked to the product experiences. Thus, due to the importance of the first phase within the experience development and the limited use of these kinds of tools the new multimethod

tool will be focused to evaluate product experiences at this conceptual phase and anticipated UX time span.

3. Eyeface: a new multimethod tool.

The Eyeface consists of two computer workstations, each running specific tools, the Eye-tracking and the Facereader. For this research work the Facereader's webcam is installed on the top of the Eye-tracking device. Thus, two computers manage data, but the experiment is performed in front of one (Figure 1).

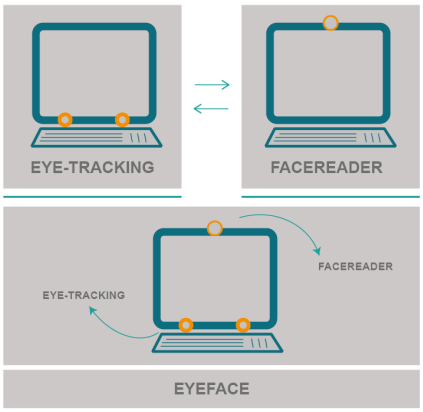

Figure 1: Eyeface description

The aim of the Eye-tracking is firstly to identify the path of the user's gaze while performing or displaying a specific element, and collect this data for analysis. The Eye-tracking that is used in this research work has two camera recorders and two software programs: Smart Eye Pro 5.5 (2009) and Gaze Tracker 8.0 (2008).

Secondly, the Facereader analyses the user emotional reactions in a delimited period of time. To do so, images of the user's face are recorded and the data is translated into human specific emotions. The device classifies the facial expressions into 7 different fields: neutral, happy, sad, angry, surprised, scared and disgusted. This tool has a webcam and software Facereader 2.0 (2008).

As the result of Eyeface analysis and combining both evaluation tools, different user-evaluation data is obtained.

4. Experience evaluation study

The aim of this first study is to validate the Eyeface as an experience evaluator in the conceptual phase. To do so, the results collected are compared with those of Panas-X.

Panas-X (Watson and Clark, 1999) consists of list of 60 words that describe different feelings and emotions. Each adjective must be filled out with numerical values ranging from 1 to 5, according to the perception of the user. This evaluation tool is usually used in experience design developments (Vaidya et al., 2002; Knobel et al., 2012; Watson et al., 2013).

4.1 Research hypothesis

The hypothesis posed in this study is the following: the data collected by the multimethod assessment tool Eyeface is valid in order to assess conceptual user experiences.

4.2 Participants

The video that is used to describe the experience shows a young couple using the proposed product. We tried to find people that could easily imagine themselves experiencing the product. So, taking into account participants' age and willingness to travel (and consequently being far away from a partner) we considered university student the most suitable participants for this experiment.

Therefore, masters degree students have participated in this study (n = 7). Being in the conceptual phase we considered that the aim must be to develop a dynamic and quick

evaluation process in order to get an overall idea and new insights for the next phases. For this reason we used 7 participants. Among the students who participated in the experiment, 4 were male and 3 female. They were between 22 and 33 years old.

4.3 Procedure

Each participant watched a video related to specific product-experience on a screen. The viewers' eyes movements were collected to use in reconstructing their thought patterns and strategies while processing the multimedia information. The Panas-X was then used to assess the experience considering that they could be the potential users. The participants filled out a sheet of 60 adjectives describing different emotions and feelings.

Lastly, the participants answered three questions in order to get a better understanding of the experience perception. These kinds of questions are very useful in the concept generation phase of the designing process, and support the designer by providing qualitative data on which the design decision-making can be based (McDonagh, Bruseberg and Haslam, 2002). The three questions used in this experiment are listed below:

- Q1: Overall rating: from 1 to 10.
- Q2: Would you buy it? : Yes - No.
- Q3: Have you met before? : Yes - No.

For each user, the experimental procedure included the following:

(1) Brief introduction and description of the experiment.

(2) Calibration of devices.

(3) Conceptual experience evaluation by the multimethod tool Eyeface.

(4) Experience evaluation by Panas-X.

(5) Answering the questionnaire.

This procedure allowed the designer to verify the accuracy of the Eyeface, and contrast the results obtained with those from Panas-X.

4.4 Showed conceptual experience

The presentation of the concepts can be done by two kinds of images: statics and dynamics (Buxton, 2010). The statics ones represent the concept with an image, sketch or painting. And the dynamic images represent the concept using a video file, describing the concept and its performance over the time.

Static images can represent the conceptual ideas of an experience in a very agile, quick and easy way. To do this, structures such as storyboards show the scenes that complete the whole experience are shown. In contrast, dynamic images can represent a more realistic and closer understanding of the user´s emotional behaviour. The dynamic approach allows the user to understand the experience that is proposed, and thus also helps to choose among different conceptual ideas.

For this first experiment, we chose the dynamic images (videos) to carry out the research, based on invisible design technique (Briggs, Olivier, y Kitson, 2009). Invisible design is a rapid prototyping method that describes the user experience without showing the detailed product, and it is commonly used in the conceptual phase. Thus, this method fits perfectly into the Anticipated UX time span, just before the first use and

when the user could imagine the experience (Roto et al., 2011).

The video shows the user experience related to a new concept called Fundawear, created by the company Durex. Fundawear is designed for those couples that want to have sexual pleasure but are physically and geographically far away. The concept is made up of two elements. Firstly, underwear with small stimulators bordering some of the most sensitive areas of the body, and secondly, a mobile application that allows to control the other person´s underwear stimulators. To promote this new concept, there is available a video on the web Youtube (Durexaustralia, 2013), which shows a couple experiencing the product.

Thus, the video shows a real couple´s video conference call. It gives an understanding of the emotions experienced by the users during the video call, and also evokes an entirely realistic scenario to be evaluated by a potential user.

4.5 Results and discussion

The information obtained from the Eyeface, Panas-X and questionnaire is shown below.

Eyeface

Firstly, the resulting video file of the Eye-tracking device allowed the designer to analyse the points that have aroused interest during the experiment (Figure 2).

Figure 2: Eye-tracking video capture

Secondly, the Facereader provided a wider range of data such as, graphs for each analysed emotion (neutral, happy, sad, angry, surprised, scared and disgusted), and numeric values that described specific graphs for these emotions. The results obtained for each user are shown in Figure 3.

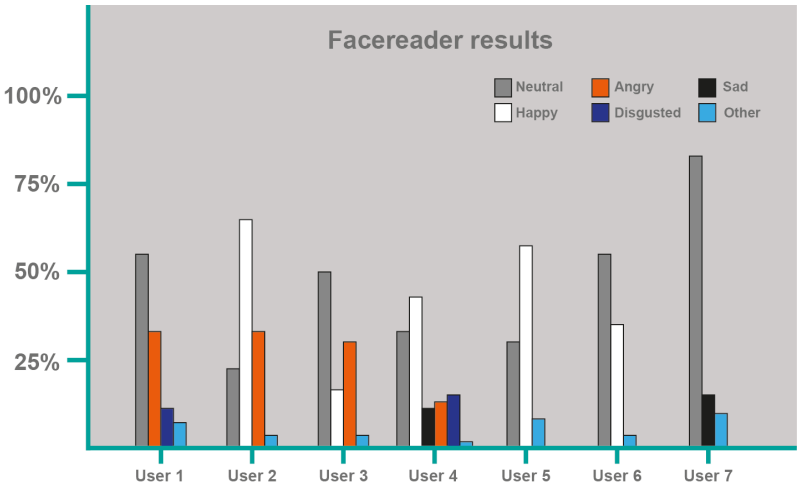

Figure 3: Facereader results

User 2, 4, 5 and 6 (four users from seven) showed traits associated with positive emotions, and conveyed positive emotions most of the time. The rest of the users (1, 3 and 7), showed more neutrality.

This difference between results was caused by the incorrect interpretation of moods and facial patterns by the Facereader software. The graph below shows the emotional balance during the evaluation for user 3 (Figure 4). This graph shows how the software interpreted negative traits on the user's face, when in fact the user observed the video with complete neutrality.

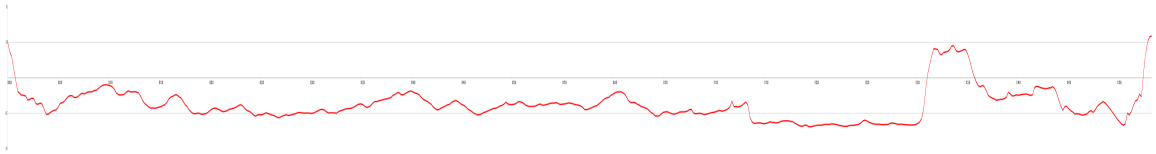

Figure 4: Emotional balance for user 3

In these cases, where the user's face is initially identified as not being neutral, the analysis should be restricted only to identify emotional jumps in the emotional balance over time. Figure 5 shows for example, one of the emotional jumps for the user 3. Emotional balance at minute 1:30 gets significantly higher values, which could be an important moment to analyse. According to this emotional jump, it is showed next to the Eye-tracking video capture.

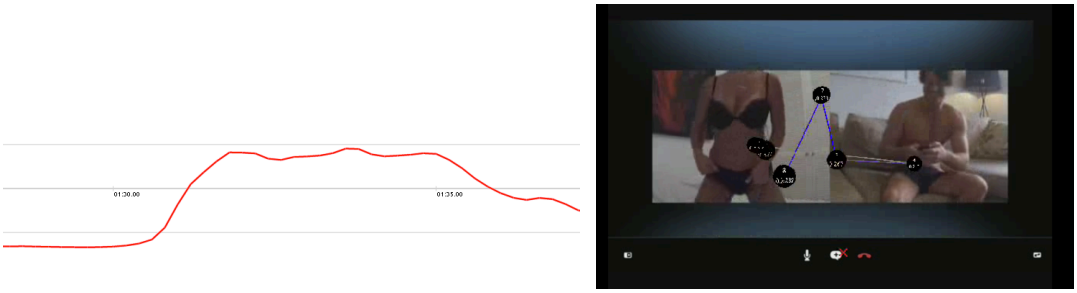

Figure 5: Emotional balance and Eye-tracking capture for user 3

In order to avoid this problem, we suggest this new approach to analyse the Eyeface's data. This new strategy allows the discovery of the moments and areas that have aroused the most interest for the user. This enables the experience designer to use the conceptual experience and the results of the evaluation to emphasize or diminish the intensity of the experience when a specific moment becomes critical.

Panas – X

In this specific experiment, the positive emotion prevailed among the user experienced emotions.

Users 1, 3, 4 and 5 rated the adjectives associated with positive emotions with higher values. One of the most critical users was the 4th, showing a small gap between the general values of positive emotions (30) and negative (28). For the rest of the users, the results were quite similar, although, user 7 and user 2 showed lower values in their

rating scores, probably caused by the difference in the degree of perception intensity that each user had when they were watching the given experience. The results data are shown in Figure 6.

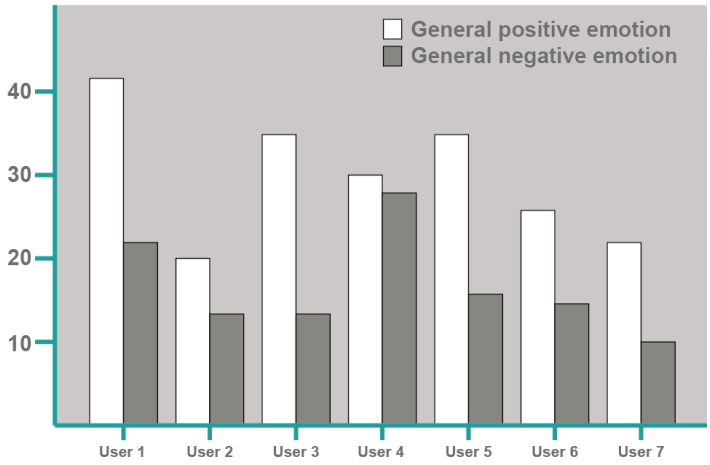

Figure 6: Panas-X results

Questionnaire

Finally, the results of the questions that have been added at the end of the evaluation were obtained. The overall score of the experience was 7.85 on average out of 10. Thus, it makes sense that the proposed experience could be linked to positive emotions or feelings.

The results also showed that five out of the seven users would purchase the product. Surprisingly, the user who gave the concept with the highest score (9 out of 10) would not buy the Fundawear. But it is interesting to analyse why user 4 would not purchase the product. Their reasoning was provoked by feelings related to shyness, as the results in Panas-X show.

Finally, the data shows that the vast majority of users were previously unaware of the concept shown. A consequence of this in association with the surprise factor (Beyer and Hotzblatt, 1997) could have enhanced the overall results and associated higher numbers

to adjectives. However, this first study does not have a representative sample in order to get meaningful conclusions. The results are shown in Figure 7.

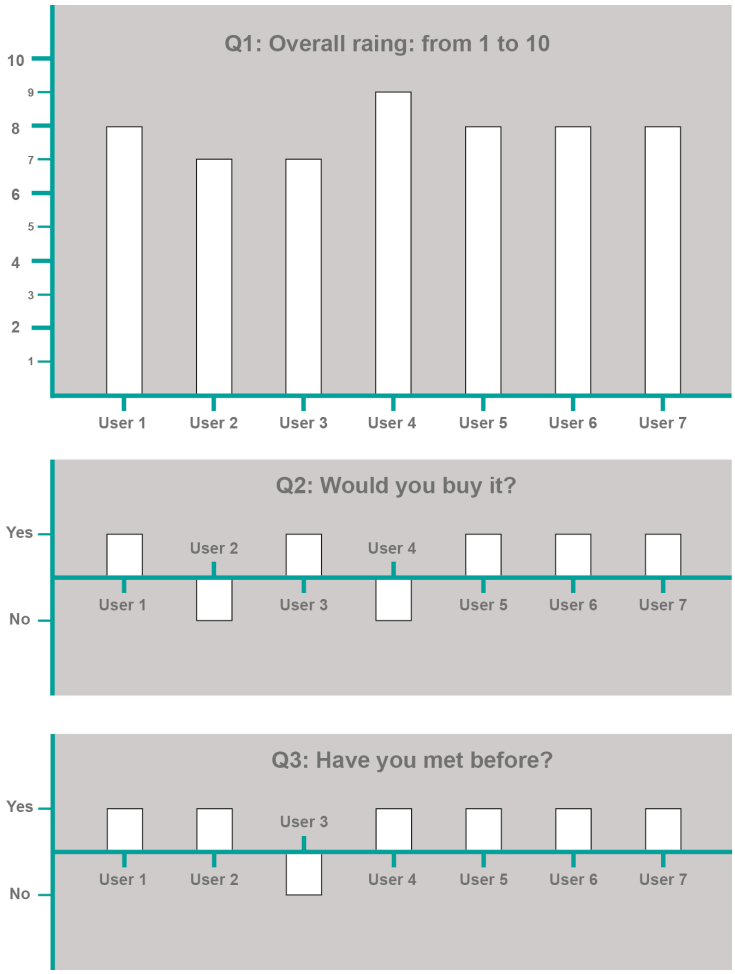

Figure 7: Questionnaire results

5. Conclusions and future work

This study with the Eyeface aimed to discover if the tool worked effectively to assess experiences at conceptual phase. At first, we saw that the Eyeface met the requirements that Väänänen-Vainio-Mattila, Roto and Hassenzahl define (2008) to be integrated into companies. But, through analysing Eyeface features and behaviour we considered that a specific method would help better integration and implementation of the tool within the development processes.

According to the results, the overall conclusion is that the Eyeface is a valid and useful tool to assess conceptual product experiences, and supports this hypothesis of this research. Therefore, it is concluded that although the Eyeface addresses the emotional and objective perception of the user experience, the Panas-X and the questionnaire help us to gain an understanding of the complex reality that defines subjective perception for each user. Thus, future work should consider to using more than just two sources of information. Furthermore, the Facereader's lack of accuracy in research results must be considered, deeply analysed and improved.

This first specific study shows how a tool such as Panas-X or the questionnaire can provide useful data and help choose the best concept within the conceptual phase. However, we think that a stronger multimethod device should be developed, based on the Eyeface. We therefore propose the integration of new and suitable assessment tools so as to understand the user experience perception in detail, such as motivations and needs (Sheldon et al., 2001).

Future work will focus on the development of new studies to analyse how the Eyeface works with a wider sample of participants, and define specific work procedures in order to help better integration of the tool within companies.

References

Beyer, H., and Holtzblatt, K. (1997). *Contextual design: defining customer-centered systems*. Morgan Kaufmann.

Briggs, P., Olivier, P., & Kitson, J. (2009). Film as invisible design: the example of the biometric daemon. In *CHI'09 Extended Abstracts on Human Factors in Computing Systems* (p. 3511-3512). ACM.

Bustillo, C. (2007) *Emoscopio: Una herramienta de Usabilidad Emocional. Formalización y aplicación en procesos de diseño centrado en el usuario (D.C.U.).* PhD thesis. University Ramon Llull.

Buxton, B. (2010). *Sketching User Experiences: Getting the Design Right and the Right Design: Getting the Design Right and the Right Design*. Morgan Kaufmann.

Duffy A.H.B, Andreasen M. M., Maccallum K. J. and Reijs L. N (1993). "Design co-ordination for concurrent engineering". Journal of Engineering Design, 4, pp251-261.

Durexaustralia (2013, April 13). Durex Fundawear -- Touch over the Internet [OFFICIAL] [Video file]. Youtube.com. Retrieved October 3, 2013 from http://www.youtube.com/watch?v=qb7DN3kpl2o

Durexexperiment (2013). The experiments [Homepage]. Retrieved July 17, 2013 from http://www.durexperiment.com

ENGAGE (2006). *Report on the evaluation of generative tools and methods for "emotional design"*. Deliverable D15.3. EU project Engage 520998.

Facereader (2.0) (2008). [Software] Noldus Information Technology.

Gaze Tracker (8.0) (2008). [Software] Eye Response Technologies.

Hassenzahl, M. (2005). The thing and I: understanding the relationship between user and product. In *Funology* (p. 31-42). Kluwer Academic Publishers.

HUMAINE (2008). Final report en WP9. Retrieved from: www.emotional-research.net seen in: Vermeeren, A., Law, E.L.-C., Roto, V., Obrist, M., Hoonhout, J. and Väänänen-Vainio-Mattila, K. (2010). User experience evaluation methods: current state and development needs. NordiCHI 2010, ACM, p. 521-530.

Knobel, M., Hassenzahl, M., Lamara, M., Sattler, T., Schumann, J., Eckoldt, K., & Butz, A. (2012, June). Clique trip: Feeling related in different cars. In

Proceedings of the Designing Interactive Systems Conference (pp. 29-37). ACM.

Law, E. L. C., Roto, V., Hassenzahl, M., Vermeeren, A. P., & Kort, J. (2009). Understanding, scoping and defining user experience: a survey approach. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 719-728). ACM.

McDonagh, D., Bruseberg, A., & Haslam, C. (2002). Visual product evaluation: Exploring users' emotional relationships with products. *Applied Ergonomics, 33*(3), 231-240.

Munari, B. (1980). Diseño y comunicación visual: contribución a una metodología didáctica. Barcelona

Pine, B. J. and Gilmore, J. H. (1998). The experience economy. Harvard Business Review. Harvard Business School. Press Boston.

Pucillo, F., and Cascini, G., (2013). A framework for user experience, needs and affordances. Design Studies. Retrieved from: http://dx.doi.org/10.1016/j.destud.2013.10.001

Ribes i Bonet, J.M., Reyes de Zuloaga, I., Calvo-Fernández Rodríguez, A., Bustillo Alonso, C., Vall-Lloresa, J.L., Pérez Rodríguez, J. (2008). Dispositivo y método para el desarrollo y modificación de dispositivos y aplicaciones interactivas. Spain, patent number 2 289 865. 11-2008, request number 200501350.

Roto, V., Ketola, P., y Huotari, S. (2008). *User Experience Evaluation in Nokia*. *Now Let's Do It in Practice: User Experience Evaluation Methods in Product Development* workshop at CHI'08, Florence, Italy.

Roto, V., Law, E., Vermeeren, A. P. O. S., & Hoonhout, J. (2011). User experience white paper. *Bringing clarity to the concept of user experience*.

Roto, V., Obrist, M., and Väänänen-Vainio-Mattila, K. (2009). User Experience Evaluation Methods in Academic and Industrial Contexts. In: Proceedings of Workshop UXEM'09, CHI'09, Boston, USA.

Roto, V., Vermeeren, A., Väänänen-Vainio-Mattila, K., and Law, E. (2011). User Experience Evaluation–Which Method to Choose?. *Human-Computer Interaction–INTERACT 2011*, 714-715.

Shedroff, N. (2001). Experience Design 1. New Riders.

Sheldon, K. M., Elliot, A. J., Kim, Y., & Kasser, T. (2001). What is satisfying about satisfying events? Testing 10 candidate psychological needs. *Journal of personality and social psychology*, *80*(2), 325.

Smart Eye Pro (v. 5.5) (2009). [Software] Smart Eye AB.

Tzvetanova, S., Tang, M. X., and Justice, L. (2009). Modelling and Evaluation of Emotional Interfaces. *Human-Computer Interaction*, 279-296.

Väänänen-Vainio-Mattila, K., Roto, V., and Hassenzahl, M. (2008). Towards practical user experience evaluation methods. *EL-C. Law, N. Bevan, G. Christou, M. Springett & M. Lárusdóttir (eds.) Meaningful Measures: Valid Useful User Experience Measurement (VUUM)*, p.19-22.

Vaidya, J. G., Gray, E. K., Haig, J., & Watson, D. (2002). On the temporal stability of personality: evidence for differential stability and the role of life experiences. *Journal of personality and social psychology*, *83*(6), 1469.

Vermeeren, A. P., Law, E. L. C., Roto, V., Obrist, M., Hoonhout, J., and Väänänen-Vainio-Mattila, K. (2010). User experience evaluation methods: current state and development needs. In *Proceedings of the 6th Nordic Conference on Human-Computer Interaction: Extending Boundaries* (pp. 521-530). ACM.

Watson, D., and Clark, L. A. (1999). The PANAS-X: Manual for the positive and negative affect schedule-expanded form.

Watson, D., Hancock, M., Mandryk, R. L., & Birk, M. (2013). Deconstructing the touch experience. In *Proceedings of the 2013 ACM international conference on Interactive tabletops and surfaces* (pp. 199-208). ACM.

Williams, J. (2006). Design for Experience: a New Rationale. Design and Technology Education, 11(2). doi:10.1016/0142-694X(93)80045-E

Wodehouse, A., and Bradley, D. (2003). Computer tools in product development. In *DS 31: Proceedings of ICED 03, the 14th International Conference on Engineering Design, Stockholm*.