Usability with a twist: A conceptual model for including emotions into User Interface evaluation.

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Usability is a term that has been used in user testing since the early 1980s. Starting from an over-simplistic theory to substitute the terms *user-friendliness* and *ease of use*, mainly focusing in the aspect of **comfort in product use** ((Bevan, Kiriakovsky, & Maissel, 1991); (Sarodnick & Brau, 2006)) and being promoted to a super complex and messy subject over the years, as researchers and designers tried to incorporate systematic and elaborated principles of design into it. As such, user testing was mainly focusing only on the usability of products as it was early defined. Last years, there is a vast trend in expanding usability testing taking into account the increased interest of practitioners and researchers to focus on the **subjective experience** of the users which is arising from the use of products and is related to non-instrumental aspects like **pleasure**, **fun** and **emotions** ((Jordan & Green, 2002)[1]; (Hekkert & Schifferstein, 2008)[2]). Thus, **User eXperience** (UX) is an approach in product development which is blooming in the last years and it focuses on the sensual, cognitive, physical, aesthetic and emotional experience of product use ((Forlizzi & Battarbee, 2004)[3]; (Hekkert, 2006)[4]) encompassing of course, also its usability.

While the measurement of perceived usability of applications has a long tradition in usability testing, evaluation of **affective responses** to applications has only recently gained increasing attention in product design (Marcus, 2003)[5]. By affective responses, we mean what the user feels while interacting with the product, following the idea of satisfaction coming from the usability definition, and going beyond that to include user's emotional reactions (Petriel & Bevan, 2017)[6]. User emotions may be triggered by different product characteristics like attractive and innovative functions or its aesthetic appeal. For example, research has shown that user emotions were more positively affected by the operation of an attractive product than by a less attractive one (Sauer & Sonderegger, 2009)[7].

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[1] Jordan, P., & Green, W. (2002). *Pleasure with products: beyond usability.* London: Taylor & Francis.

[2] Hekkert, P., & Schifferstein, H. (2008). Introducing produc experience. H.N.J.

[3] Forlizzi, J., & Battarbee, K. (2004). Understanding experience in interactive systems. Proceedings of the 2004 conference on Designing Interactive Systems (DIS 04): processes, practices, methods, and techniques. (p 261-268). New York: ACM.

[4] Hekkert, P. (2006). Design aesthetics: principles of pleasure in design. Psychology Science, 48(2), p 157 – 172.

[5] Marcus, A. (2003). The emotion commotion. Interactions, 10 (6), p 28–34

[6] Petriel, H., & Bevan, N. (2017). The evaluation of Accessibility, Usability and User Experience. C. Stephanidis, The Universal Access Handbook (p 21-23). CRC Press

[7] Sauer, J., & Sonderegger, A. (2009). The influence of prototype fidelity and aesthetics of design in usability tests: effects on user behaviour, subjective evaluation and emotion. Applied Ergonomics, 40 (4), p 670–677

The work currently presented provides an overview of the method of including emotional assessment and aesthetics into a usability study of a mobile routing application, since there is evidence that a positive relationship exists between product **aesthetics and its perceived usability** (Tractinsky, Katz, & Ikar, 2000)[8]. This suggests that product aesthetics and consequently its attraction, is an essential aspect of a usability test. Including emotions into a usability study can be rather tricky since assessing emotions in design requires that emotions can be adequately assessed and also be interpreted in a subjective manner. Understanding how emotions affect the human-system interaction is a critical aspect that will allow us to create pleasurable User Interfaces and designs that will elevate the overall application's usability.

Despite the difficulties of definition and measurement, the concept of UX has become very important in the field of designing products and interfaces (Hekkert & Schifferstein, 2008)[2]. It has been included in a standard of the international standardisation organization on Human Centred Design processes for interactive systems (ISO 13407) and is often considered as the main goal of product development (Earthy, Jones, & Bevan, 2001)[9]. Some authors even suggest to replace the notion of User Centred Design (UCD) with its focus on the development of usable products by the term "**Experience Centred Design**" (ECD) ((Shedroff, 2001)[10]; (McCarthy & Wright, 2004)[11]) focusing on the development of products that evoke positive user emotions. Referring to the UCD approach, this implies that user experience should be considered throughout the whole development process and that emotions and fun users experience by using a product, should be measured when a product is to be evaluated.

Mahlke and Thüring's (2007)[12] developed a model regarding Components of User Experience (CUE-Model) that consists of emotional reactions and perceptions of instrumental (i.e. ease of use) and non-instrumental (i.e. look and feel) qualities. While instrumental qualities are loosely related to the usability and usefulness of a system, non-instrumental qualities result from its appeal and attractiveness. Based on this model, we have created a variation of it that has been used during our mobile routing application trials and it is presented below.
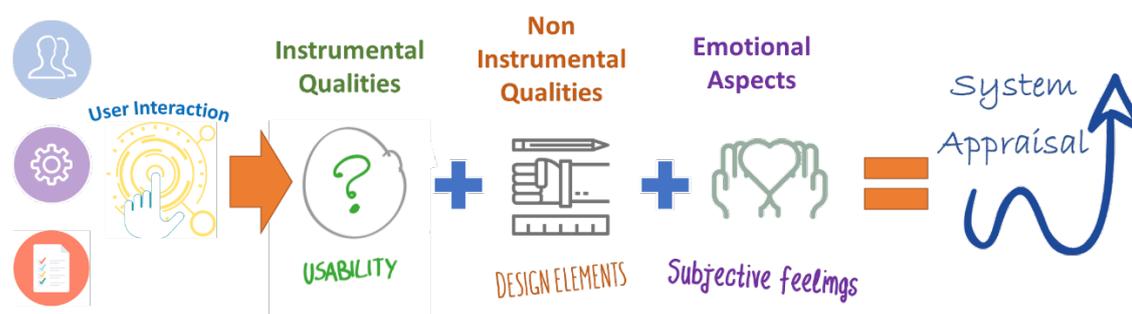

Figure 1: Conceptual model for including emotions into User Interface evaluation.

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[8] Tractinsky, N., Katz, A., & Ikar, D. (2000). What is beautiful is usable. Interacting with Computers, 13, 127–145.

[9] Earthy, J., Jones, B. S., & Bevan, N. (2001). The improvement of human-centred processes processes facing the challenge and reaping the benefit of ISO 13407. International Journal of Human Computer Studies, 553–586.

[10] Shedroff, N. (2001). *Experience design.* Indianapolis: New Riders Publishing

[11] McCarthy, J., & Wright, P. (2004). *Technology as Experience.* Cambridge: MIT Press.

[12] Mahlke, S., & Thüring, M. (2007). Studying antecedents of emotional experiences in interactive contexts. CHI (pp. 915–918). ACM Press.

UX is a very subjective concept, so by definition it is difficult to measure. However, given its importance, it is highly recommended to measure it accurately. Based the conceptual model presented above there are numerous measurement methods, ranging from mood boards to sophisticated questionnaires, from interviews to physiological measurements that try to capture the UX of a product. In our research we used a blend of Usability standardized and benchmarked questionnaires with standardized and benchmarked User Experience Questionnaires (Schrepp, Hinderks, & Thomaschewski, 2017)[13]. The results of these **questionnaires** (subjective data) will be enriched, coupled and compared with objective data retrieved from the **observations** kept by the pilot facilitators during the lab tests.

Regarding the instrumental qualities, usability is a key aspect and to measure it we followed Sauro's and Kindlund's (2005) attempt to create a single usability metric and to fully represent the entire construct of usability with a high-level model including the ISO/ANSI dimensions (effectiveness, efficiency & satisfaction). These metrics -task completion, error counts, task times and satisfaction scores- were used to represent all the dimensions of Usability as presented in the following Figure.
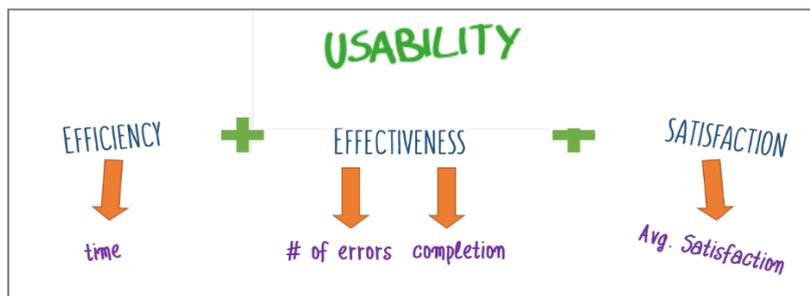

Figure 2: Usability metrics for User Interface evaluation.

These are the metrics that will be captured from our usability study, together with the **emotional, UX** and **attractiveness** assessment. These will be measured with a set of tools and using subjective and objective metrics which are summarized at the following table and will be described in detail in future papers.

Table 1: Tools and metrics to measure UX.

Usability attribute	Metric	Tool
Satisfaction	Task level satisfaction	Single Ease Question (SEQ)
	Loyalty	Net Promoter Score (NPS)
	Attractiveness	AttrakDiff 2 Lite
	Affect	Self-Assessment Manikin (SAM)
	Test level Satisfaction	System Usability Scale (SUS)
Effectiveness	Task completion	Yes/ No
	Task errors	Description of each error per task
Efficiency	Task time	Minutes

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[13] Schrepp, M., Hinderks, A., & Thomaschewski, J. (2017). *Construction of a Benchmark for the User Experience Questionnaire (UEQ).* International Journal of Interactive Multimedia and Artificial Intelligence, Vol. 4, Nº.