User Experience Building Blocks

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ABSTRACT
Many books and publications have been written about user experience, but it still lacks a commonly agreed definition. The definition together with understanding of user experience building blocks would help in designing for good experiences and in evaluating user experience of a product. Based on the existing knowledge about user experience and our own empirical research, this paper proposes a set of user experience building blocks to help defining the term user experience and to facilitate method development for designing and evaluating user experiences.

Author Keywords
User experience, UX building blocks, UX definition, UX evaluation.

INTRODUCTION
The industry trend is to include the term user experience (UX) on the list of product requirements. As long as UX is vaguely defined, any single member of the product development team may define what a "superior user experience" means for a particular product. We should help the teams to verify that the product actually will create good UX, not just provide a flashy welcome animation to create a wow effect.

Most of the pragmatic UX research has addressed the process of designing for good user experiences, but few researchers have tried to come up with a formal definition for user experience. In order to design for good experiences, it would be important to state what UX stands for and how we can say whether a product provides a good user experience or not. In this paper, I will investigate the factors that affect UX. The underlying goal is to close in on a common understanding of user experience and to formulate a definition for the term user experience.

RELATED RESEARCH
There are many perspectives to user experience. Norman and Jordan list the *goals* of a successful product: to engage users on behavioral, visceral, and reflective level (Norman 2003), or to provide users functionality, usability, pleasure, and pride (Jordan 2003). Nokia follows these lines by stressing wow, flow, and show factors (Nokia 2005). All three definitions agree that in addition to behavioral level, which includes the right functionality and usability (flow), there is also visceral level (pleasure, wow) and reflective level that includes the self esteem of owning the product (pride, show). The reflective level by Norman (2003) includes also other properties such as moral and memories.

But how to design a product that fulfils the above goals? One may start visioning from clean table to create a product that fulfils the goals, but it is very unlikely that the design will avoid all pitfalls. It is easier to design if we can identify also the *building blocks* of UX. As the designs need to be evaluated with real users, we need to know the components that affect the evaluation results. The UX building blocks are even more valuable in the evaluation phase. We can provide a set of general building blocks, and each product development team may further identify the attributes specific to their product.

There are a number of researchers who have investigated UX components, although not all of them communicate having done so. There is a wide agreement that users' earlier *experiences* and *expectations* affect UX, as well as the *context of use* (Mäkelä & Fulton Suri (2001), Hiltunen et al (2002), Forlizzi & Ford (2000), Arhippainen & Tähti (2003), Hassenzahl & Tractinsky (2006)). All but Mäkelä & Fulton Suri (2001) list the *product* or *system* as one UX component.

It is hard to find the right abstraction level for the UX components and attributes. The UX definition by Usability Professionals' Association makes the abstraction level so high that it does not really help practitioners: "every aspect of the user's interaction with a product, service, or company that make up the user's perceptions of the whole" (UPA 2006). Arhippainen and Tähti (2003), in turn, list five components affecting UX (user, social factors, cultural factors, context of use, product) and a good amount of attributes for each component. They list specific attributes such as age of the user, symbols as cultural factors, or weight of a product. Listing the UX building blocks on this level requires a specific product in mind, and there's a danger that not all attributes actually affect UX. For example, age does not influence UX as such, unlike the mental and physical resources as well as the previous expectations that are somewhat related to age.

Hassenzahl & Tractinsky (2006) define UX as "a consequence of a *user's internal state* (predispositions, expectations, needs, motivation, mood, etc.), the characteristics of the designed *system* (e.g. complexity, purpose, usability, functionality, etc.) and the *context* (or the environment) within which the interaction occurs (e.g.

organizational/social setting, meaningfulness of the activity, voluntariness of use, etc.)." These three high level components are able to cover all aspects mentioned by the earlier definitions, although the lists of attributes for each component in brackets are still incomplete. I take the three components as a starting point and, with the knowledge about mobile browsing UX, identify a set of attributes that hopefully are close to the appropriate level of abstraction to be applicable for a wide range of UX cases.

EMPIRICAL RESEARCH CASE

Before tackling the UX components, I shortly explain the research in which we explored them. The research aimed to improve user experience of web browsing on mobile phones. This topic turned out to be a very fruitful case for learning about UX in general, since mobile web browsing includes many interesting aspects for UX researchers:

- Mobile browsing requires a mobile device, browser, connection, and a web site. Each of these is typically provided by a different party, and each party may aim to deliver conflicting experiences.
- Mobile context provides an interesting context of use for web browsing.
- Mobile phone is a very personal device that users have an emotional relation to.
- Mobile browsing should fulfill both utilitarian (find a specific piece of information) and hedonic (entertainment while waiting) needs.
- Mobile web browsing may have complex billing models.
- Because mobile browsing technology is immature, each component is clearly visible when evaluating UX.

Initially, we examined mobile browsing UX by investigating usability of WAP sites (Kaikkonen & Roto 2003), the goal being to improve the site user experience. We used a prototype version of a WAP 2.0 browser, and noticed that a substantial portion of the found usability problems originated from the browser, not from the sites. Also when the full Web access became a requirement for mobile phone browsers, it was the usability of the web page visualization method in the mobile browser that created the main bottleneck for a satisfying UX.

We could have developed just a visualization method that solved the usability problems of the existing methods, but luckily, we started to interview early adopters of mobile web browsers to understand their needs more thoroughly. We conducted altogether 35 interviews in Finland, United States, Japan, and the United Kingdom using Contextual Inquiry method (Beyer & Holzblatt 1998).

The interview results together with the knowledge of the underlying technologies made us realize the various attributes that affect mobile browsing UX. After identifying the current habits, delights, and problems of users, we brainstormed features to support the habits and to solve the existing problems. The development team has now a very good understanding about what matters to users, and the resulted Web Browser for S60 has received very good feedback in public.

USER EXPERIENCE AND REFERENCE PERIOD

A fundamental question in user experience definition is whether UX is a sensation, perception, emotion, mental state, or an attitude. As user experience consists of smaller experiences (Forlizzi & Battarbee 2004), the possible reference period for UX examination can vary from a single key click experience to multi-year experience of a product. A single key click experience is close to a sensation followed by perception, but the longer the reference period, the closer UX becomes to an attitude.

In our mobile browsing studies, the reference period was varying: we were interested both in the general attitude and the detailed sensations. We investigated UX of different use cases by asking the interviewee to describe and replay the previous cases of using the mobile browser. We noticed the user's mental state varied over the use case execution period: the user might have been desperate or irritated during browsing, but pleased after finding useful information. If we paid attention to the end result only, we would not have been able to improve the user experience.

The use case stories of our interviewees provided us information about the use case experience as a whole, and the replay exercise about the details and sensations. In the beginning and end of each interview, we asked questions about interviewee's general attitude towards mobile browsing. Understanding both the details and the general attitude helps us to design and improve products, so the user experience evaluation methods should pay attention to both.

The user experience building blocks are dependent on the reference period. If user experience is a sensation of pressing a key, the other system attributes do not play a (big) role. If user experience is multi-year, the details in context of use have no influence. The building blocks described in this paper are originated from investigating individual mobile browsing use cases, and there is an open question if they are applicable for shorter or longer reference periods as such.

UX COMPONENTS AND ATTRIBUTES

I follow the high level categorization by Hassenzahl and Tractinsky in identifying the UX components and specify their meaning in more detail. *System* includes all products, services, and infrastructures that are involved in the interaction when using the examined product. *Context* defines the environmental, social, and temporal factors, and (optionally) the task context for the experience. *User* component refers to the mental and physical state of the person who interacts with the system. UX is subjective: user's state affects the system perception, which in turns affects the experience and user's state (Figure 1).

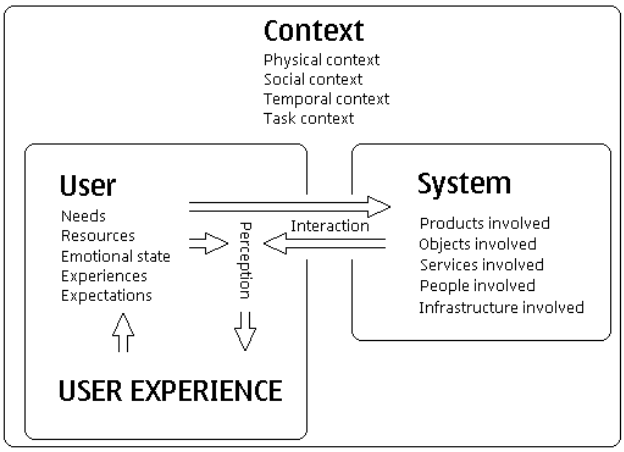

Figure 1. User experience building blocks

The list of user experience building blocks in Figure 1 mainly summarizes the existing knowledge, but its contribution lies in providing a comprehensive set of attributes for each component. Such a list is previously non-existent. Our mobile browsing research has highlighted many attributes listed here. In the following sections, the components and attributes are explained using examples from the mobile browsing studies of ours.

System

For a product designer and evaluator, the system component is the most interesting one. "System" is not a good term for systems involving simple objects or human beings, but it is the most generic one that we can invent. Also, as UX may be examined for a web site, spoon, library, car, interactive art, and many other types of systems, a shared set of attributes is hard to identify.

The key idea with the System component is to analyze not only the piece of system being investigated but the whole system that this piece is dependent of, or that is involved in the examined use case. Thinking about the different use cases and the other products, services, and infrastructure involved easily leads to innovations that improve UX. A knife that not only cuts well but is easy to keep clean and store creates better UX than one that requires hand washing and does not fit the knife storing compartment. A mobile browser that can deal with the limited memory size of the phone creates better UX than one that runs out of memory.

Systems that do not interact with the examined product are not part of System component, but they are part of the Context component. If the person cannot control or manipulate the system, but only observes or experiences it, the system is again part of the Context component. In this case, I propose not using the term user experience, but plain experience instead. A museum visit, a walk in a park, or a roller coaster ride are experiences, not user experiences.

As system attributes, we list the investigated piece of system itself plus the products, services, persons, and even the infrastructure involved in the currently examined use case or product. In mobile browsing, the system attributes include mobile device, browser, connection, gateway, and the site. In mobile browsing, the pieces of system work so closely together that the user does not even have to be aware of the different parts. Still, the UX is a combination of the device, browser, connection, and site. One part of the system often influences UX more than others, and that part might not even be the product being examined. When we were designing a browser, we understood that the browser is just a tool to deliver the experience that *site* developers want visitors to have. If the site wants to deliver a relaxing experience, the browser UI should not provide a stimulating experience e.g. with aggressive loading indicators.

In UX literature targeted for designers, the system component is often the only component discussed, and the examined product is investigated without mentioning the other parts of the system, even if they are required for using the product. For example, web site UX has been a popular topic and many UX books are almost solely targeted for web site designers. As the PC hardware, browser, and connection needed for accessing a web site work very much the same way on different PCs, these are rarely mentioned as influencers for UX. In mobile browsing case, however, the devices, browsers, and connections are varying and not optimized for web browsing, so we clearly see their influence in mobile browsing UX. If one piece of this system is changed, e.g. the mobile device, UX of a web site may be totally different.

Context

The context component includes the systems and objects that are not part of the system but that affect the UX. In the case of mobile browsing, the context is much more visible component than an office context in PC browsing (Oulasvirta et al 2005). Physical context is the most obvious one, but the context includes also social context and temporal context. When examining a specific use case, it is beneficial to examine task context as well. Let us discuss each of these contexts in more detail.

The physical context includes everything we can see or feel: the tangible physical surroundings and their movement, temperature, rain or humidity, and lighting. Also the current location and noises around are part of the physical context (Schilit 1994). Heavy crowdedness is part of the physical context, if it physically affects using the mobile browser, e.g. when avoiding to bump against other people. Otherwise, crowdedness can be considered as part of the social context, e.g. when sitting in a cafeteria.

Social context refers to the expectations and influence that other people have for the user, and/or the willingness of the user to participate in a social situation. For example, in mobile context, people may want to follow other people around and not fully concentrate in mobile browsing. On the other hand, mobile browsing provides a good excuse to shut oneself out from a social situation such as for a

husband who is waiting for his wife from a ladies' fitting room in a store.

Unlike one would think, temporal context does not refer to the current time of the day or time of the year in this case. Time alone does not directly affect UX. If it is a winter night, it is likely to affect temperature, lighting, social context, user's mental resources and needs, but not directly UX. The relevant contextual information is not in the time itself, but in the attributes the time affects. The time information may help context-aware systems to act as wanted, but plain time information does not directly affect UX.

Temporal context as a UX component refers to the time period that the user is able to dedicate for the system given the context restrictions, e.g. finding out which bus to take before missing it. In case of multitasking, the period dedicated to the system is split to many pieces, e.g. browsing while waiting for a bus, continuing the session in the bus, and later at home.

Task context refers to the role of the examined system in the higher-level goal the user has in a use case. An interaction case with the system does not often fulfill the goal alone, but it is one task along the way there. For example, one of our interviewees was driving a car when he got a call from his remote customer asking whether he could visit them the next day. He promised to check the possibilities. When he stopped at a gas station, he checked the flight options from his mobile browser and then called back the customer. The user may also have several ongoing tasks at the same time, such as the car trip in the use case above.

User

The third UX component is the user her/himself. As many researchers agree, the personal experiences and expectations of the user affect the felt experience. We found that when users try out accessing true web pages on a mobile phone for the first time, the response is typically a positive surprise. During our usability tests, it was obvious that there were many problems using the large pages on such a limited device, yet the overall UX was positive (Roto & Kaikkonen 2003). What explains this conflicting result?

First, many people have some favorite web sites that they would like to access also while being mobile, e.g. Webmail, journey planner, maps, hobby club, or chat site. The *need* for accessing these sites is at least as big as on a desktop browser, so they found the utility high. After the lab test, some of them even asked if it was possible to get the tested browser into their own mobile phone, so they were *motivated* now to take the action and start using a mobile web browser.

Second, it sounds ridiculous to view the large pages on a mobile phone, so, although we did not specifically ask them, users' *expectations* were probably low. Also the possible earlier failure experiences with WAP sites have made them expect failures with the true web as well. As they were able to accomplish something on the mobile web browser, even if with some difficulties, the overall UX was positive. This tells about the importance of internal expectations for the system as an influencer to UX.

If the user is in bad *mood*, s/he is likely to be less patient with the system, and the UX is easily poor. Sometimes the user just cannot allocate the needed *mental resources* in using the system, e.g. when taking notes during a lecture. If the system does not work smoothly, the user cannot concentrate both in listening to the lecture and writing.

Especially in mobile context, user may have limited *physical resources* available for using the system, such as only one hand for the device when the other is carrying a bag. Some users have permanently impaired physical resources, and accessibility features designed for mobile context might benefit them as well. I add physical resources onto the list of User attributes, although it is not part of "internal state" of the user (Hassenzahl & Tractinsky 2006). So, the high level UX component is now called "User" instead of "User's internal state".

CONCLUSION

Developers of various types of products are eager to provide excellent user experiences to their customers, but few know how to design excellent UX, neither how to evaluate the gained experience. Building on the work of several UX researchers, Hassenzahl and Tractinsky (2006) especially, I presented a list of attributes that affect user experience (Figure 1). The list was informed by a fruitful case of developing a web browser for mobile phones, for which we conducted 35 end user interviews in four countries plus a set of usability evaluations.

The list of UX components and attributes is only a starting point in addressing the needs of UX designers and evaluators. The methods for designing and evaluating UX are still to be developed. For design phase, the methods familiar from the HCI field seem to be applicable also for UX (Jordan 2000), but for UX evaluation, the current usability evaluation methods are not satisfactory. Usability is just one part of UX, so we need to gain a more holistic picture of user's expectations in the current context to be able to evaluate UX. Market researchers (e.g. Buttle 1996) and even medical researchers (e.g. Carr 2001) have a longer experience on evaluating the overall quality of services, products, or life, and we are in a good position to learn a lot from this existing knowledge.

We hope the found attributes for system, context, and user components help to gain a common understanding of user experience. The components hopefully serve as a starting point for practitioners in delivering excellent user experiences and for researchers in further examining the systematic approaches to design for and to evaluate user experiences.

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