

From Usability to User Experience

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Abstract—Usability and user experience (UX) are considered as key quality determinants of any product, system or service intended for human use, which in turn can be considered as product, system or service success or failure indicators. At the same time, people regularly get confused between the two terms usability and user experience because they are strongly related to each other. In this paper, we first present a collection of usability and user experience definitions from previous studies. Then we provide a survey of different viewpoints about the interrelated relationship between them with the aim to answer the following questions: “Is User Experience part of Usability satisfaction?” or “Is Usability a part of User Experience?”

Keywords—component; (User Experience, UX, Usability, Difference, Relation)

I. INTRODUCTION

In academic and industrial research areas, the success of any product for human use depends on the user and his or her experience while interacting with the product. It does not only depend on the ability of the product to provide the user with functions that meet his needs and goals in an effective and efficient way, but on the whole experience of User-Product interaction.

User-Product interaction is a significant research area in the Human-Computer Interaction (HCI) field, which usually focuses on two important concepts: usability and user experience. Usability and User Experience are considered key quality determinants of any product, system or service intended for human use [1], which in turn can be considered as product, system or service success or failure indicators and improve user loyalty [2].

There are different viewpoints of the relationship between usability and user experience, which are often people confused. A number of research articles studied the relationship between the two terms [3], [4], [5]. However, there is no widely accepted differentiation between them.

Our aim in this paper is to survey of a number of usability and user experience studies to present different viewpoints about their relationship and answer questions related to their relationship such as “What is the relationship between Usability and User Experience?” or “Is Usability is a part of User Experience?”

In this paper, we will introduce usability and user experience definitions from previous related work then we will explain the relationship between usability and user experience.

II. USABILITY DEFINITIONS

To define the relationship between usability and user experience we first have to introduce usability and user experience definitions, and how different HCI studies see both of them. Abran et al. carried out a study to integrate available usability models in a single integrated model listed three of well-known usability standard definitions (1) IEEE Std.610.12, 1990; (2) ISO 9241-11: 1998; (3) ISO/IEC 9126-1: 2000 in which usability is defined as one of the 6 characterizing elements of software product quality “Internal and external quality model” which are: Functionalities, reliability, usability, effectiveness, maintainability, and portability [6], see Table 1.

Coursaris and Kim, proposed a usability framework for mobile applications in which the usability element ‘context of use’ consists of (user, technology, task, and environment) [7]. Coursaris and Kim’s usability framework customize ISO 9241 part 210 definition of context of use (user, product, task, and environment); however, they substituted product with technology (they justified why they used the term technology as “this term helps conceive the system that a user may interact with as a greater set of components, instead of simply the device or application itself”).

We summarize usability, its elements, and measures in Fig. 1. In which we use the term “context of use” only for the environment, which is divided into physical and social environments, which affect the user along with user characteristics.

III. USER EXPERIENCE DEFINITIONS

Hassenzahl, Law, and Hvannberg (2006) [8], stated that the term user experience (UX) term was popularized by Norman [9]. However, in HCI research field, some researchers and scholars consider UX as a vague and unclear concept [10], [11].

TABLE 1. USABILITY DEFINITIONS

| Source | Usability Definition |
|-----------------------|--|
| IEEE Std.610.12, 1990 | “The ease with which a user can learn to operate, prepare inputs for, and interpret outputs of a system or component.” |
| ISO 9241-11: 1998 | “The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.” |
| ISO/IEC 9126-1: 2000 | “The capability of the software or product to be understood, learned, used and attractive to the user, when used under specified conditions.” |

Alben defined user experience as experience which includes every detail about the interaction between users and the product from their feelings ‘while using the product’ to if they understand the way the product works and if it fulfills their goals, needs, and expectations in any context they use the product in [12].

Many definitions of UX have been introduced and we list some of them in Table 2.

IV. USER EXPERIENCE RELATED TERMS

User experience associated with wide range of terms and concepts such as instrumental qualities, non-instrumental qualities, pragmatic and hedonic qualities. Next, we will

introduce these terms to provide a better understanding of user experience meaning.

A. Instrumental qualities and non-instrumental qualities

Instrumental and non-instrumental qualities, also called Instrumental and non-instrumental aspects/or interaction. The words qualities, aspects and interaction are used interchangeably. Desmet and Hekkert used the term interaction; they defined instrumental interaction as the effect of the product on the user when he uses it to achieve his functional needs (ex. The pleasure that user feels when he finds that the product he bought is easy to use). While the effect user gets from non-functional needs called non-instrumental interaction [3].

B. Hedonic and pragmatic qualities

Hassenzahl, Platz, Burmester, and Lehner (2000) described two of software quality dimensions hedonic quality and ergonomic quality [13]; they defined ergonomic quality as task-related quality dimensions such as usability. While hedonic quality is quality dimensions such as “originality, innovativeness, beauty etc” that are not task-related. Later, Hassenzahl (2003) stated that user can perceive the product in two ways pragmatically (if the product provides the user with “effective and efficient means to manipulate the environment”) or hedonically (if the product provides the user with “stimulation, identification or provokes memories”) [14].

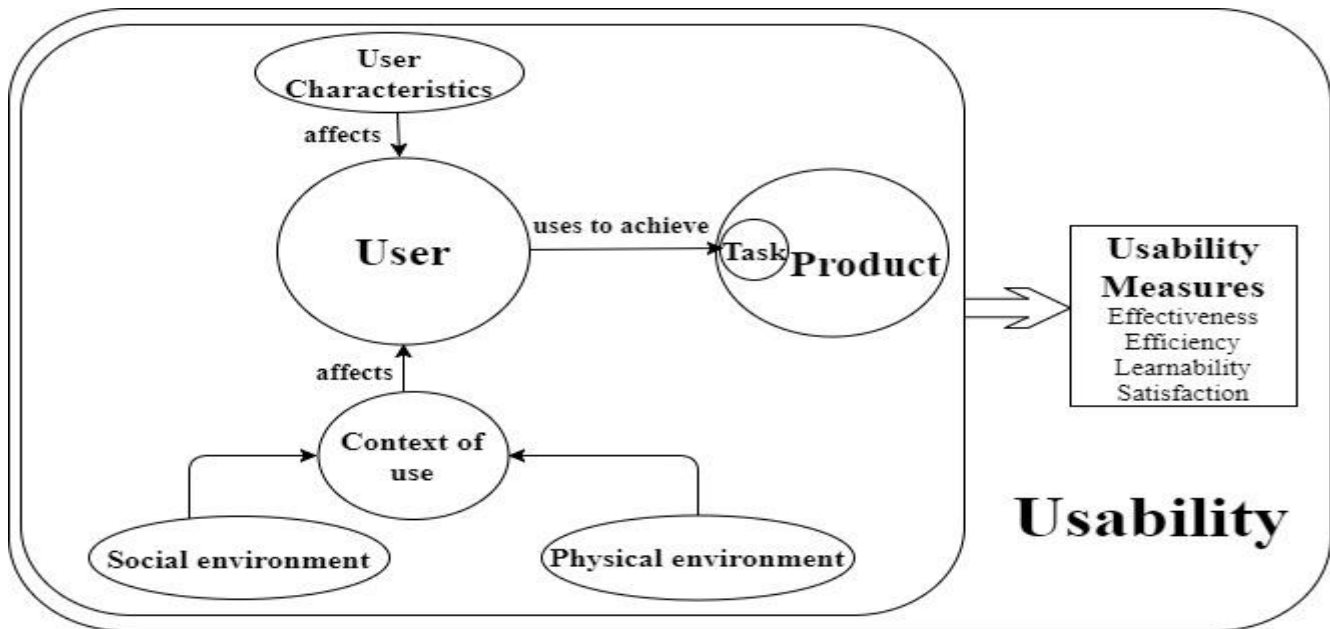


Fig. 1. Combination of Usability Definitions

TABLE 2. USER EXPERIENCE DEFINITIONS

| Source | User Experience Definition |
|-------------------|--|
| ISO 9241-11: 1998 | “Person's perceptions and responses resulting from the use and/or anticipated use of a product, system or service” |
| Marcus (2006) | “Experience covers all stakeholder touch points, such as places when (buyer, customer or investors) come into contact with product or a service or its sponsoring company or organization.” [15] |
| Law et al. (2009) | UX is something individual that emerges from interacting with a product, system, service or object [16]. |
| Kraft (2012) | that user experience is about users' unpredictable feelings when interacting with the product.[17] |

V. THE CONFLICT BETWEEN USER EXPERIENCE AND USABILITY

Følstad and Rolfsen classified relation between usability and user experience based on usability definition in ISO 9241-11, as (a) usability is user experience measure, (b) user experience is a part of usability satisfaction, and (c) user experience and usability complete each other [18].

Sharp et al., in their book “Interaction design: beyond human-computer interaction” defined interaction design as “developing an interactive product that is usable and provide joyable user experience”. The product should meet a set of usability goals and user experience goals, which need to be determined at the early phases of the product development. By usability goals, they mean designing a product that is easy to use, effective to use, efficient to use, and easy to remember. While user experience means designing a product that is satisfying, enjoyable, fun, entertaining, helpful, motivating, aesthetically pleasing, supportive of creativity, rewarding, and emotionally fulfilling [19]. They considered usability and user experience as two different concepts that have to be achieved in designing interactive products. Therefore, they view usability and user experience as complementary to each other in building an interactive product [19].

If we take a deep look again on Alben's user experience definition and the listed usability definitions we can see that usability plays an important part of user experience along with user emotions and feelings while interacting with the product. While Bevan (2009) in his study to differentiate between usability and user experience evaluation methods pointed that usability attribute ‘satisfaction’ is equivalent to ISO 9241-11 definition of user experience “A person's perceptions and responses” [20].

This conflict makes these questions arise in our minds “Is User Experience part of Usability satisfaction?” or “Is Usability a part of User Experience?”

In the next section, we will introduce different viewpoints of various user experience studies that present how researchers and scholars see the nature of user experience.

VI. USER EXPERIENCE NATURE/DIFFERENT PERSPECTIVES

Hassenzahl (2003) summarized the relation between the user and the product as a process. In which user perceives product features (the input of the process) and then he builds what is called product ‘character’. Product character is a user's description and summrization of product features in his mind. Product character has two attributes: the pragmatic and the hedonic attribute.

- Pragmatic attribute (we call it pragmatic perception) means the ability of the product to provide user with task-related needs and behavioural goals (usability) .
- Hedonic attribute (we call it hedonic perception) means the ability of the product to provide user with needs that are not task-related (identification and stimulation).

And the output of this process is the effect of the product on the user whether it is behavioural effect (ex. user decides to keep using the product), emotional effect (ex. pleasure or statisfaction), and judgemental effect of the product (overall description of the product as good or bad)[14].

Then, Hassenzahl et al. described user experience as a border notion than usability (which only focuses on pragmatic quality aspects).User experience includes pragmatic aspects, hedonic aspects along with the user emotions resulting from the interaction between the user and product [8]. Hence usability is one of the user experience components [21] or in other words, it is a part of user experience [22], which affects the overall user experience [23].

After that, Hassenzahl (2007) proposed a new user experience model which he called “hedonic/pragmatic” user experience model. Hedonics and pragmatics are the two dimensions of how the user perceives the product. He defined pragmatics as “the product's perceived ability to support the achievement of ‘do-goals’”, which is equivalent to product usability and utility. While, hedonics as “the product's perceived ability to support the achievement of ‘be-goals’”[24].

Hekkert (2006) first argued that user experience needs to be divided into three experience levels named the aesthetic, understand, and emotional level [25]. Then Desmet & Hekkert used it as a base to build a framework for product experience. In which user experience consists of three components and at

the same time they consider each component as user experience's level; these components are the aesthetic experience, the experience of meaning, and the emotional experience which refers to the emotions and feelings elicited from user interaction [3].

Mahlke explained that user experience is a combination of instrumental aspects, non-instrumental aspects, and consequent user's *feelings* and *emotions*. He concluded that non-instrumental aspects such as product aesthetics (product appeal and visual characteristics) along with instrumental aspects such as usability play an important role in user experience. By presenting a study with forty-eight participants, to show the impact of instrumental aspects and non-instrumental on the user experience. Four designs were implemented with the following features, the first with (a) high usability and high aesthetics, the second with (b) high usability and low aesthetics, the third with (c) low usability and high aesthetics, and the last design with (d) low usability and low aesthetics. The first implementation with high usability and high aesthetics had the highest rating from participants and the fourth design had the lowest rating [21].

From the different perspectives of user experience, four viewpoints of that relation between user experience and usability are produced (1) usability is a part of experience, (2) usability is a user experience measure, (3) user experience is a part of usability satisfaction, and (4) User experience and usability complete each other, see that in Table 3.

VII. THE RELATIONSHIP BETWEEN USABILITY AND USER EXPERIENCE

Designing useful product is not enough to achieve user acceptance [26], [27]. The product may be useful but boring to use or using it is not pleasurable. That is why an expansion of the usability concept is needed and the term emotional usability introduced by Logan (1994).

Logan (1994) divided the usability definition to behavioral and emotional usability. Behavioral usability is the traditional usability (effectiveness and efficiency). While emotional usability refers to "the degree to which a product is desirable or serves a need(s) beyond the traditional functional objective" [26] cited by [13].

A number of studies conducted with the aim to investigate the relation between product usability and product aesthetics [28], [29], [30], [31]. Questions to show the relation between them were discussed such as "what is beautiful is usable" [28] and "what is usable is beautiful" [29]. For example, Tractinsky, Katz, and Ikar in their study argued that product aesthetics affect perceived usability before and after the interaction between the user and product [28]. Norman (2004) showed that while a product (teapot) was not easy to use, user evaluated it by describing it as pretty and it makes him smile in the morning despite its usability problems. On the other hand, using a mobile phone with a pleasing and attractive interface cannot overcome the frustration user gets because it requires many steps to search for a friend number in the phone

list [32]. While Tuch et al. argued that aesthetics have no effect on perceived usability and the opposite is true; usability affects user perceived aesthetics after the interaction between the user and the product [29]. Some studies discussed the importance to consider the context where the usability evaluation takes place [33]. Other studies focused on the need to compare between field and laboratory usability testing [34], [33]. While some discussed the need to study usability after long-term use [28].

At the same time many studies conducted with the aim to address the influence of usability and emotions on user experience [21]-[35]. Meanwhile other studies proposed user experience models as well as user experience frameworks to determine user experience elements and influencing elements; most of these studies agreed that usability, aesthetics, context of use and emotions together form the user experience [21] [24]-[36]. Along with other influencing elements that can affect user experience such as user internal state, product characteristics [3]-[21]-[37], as well as brand experience and advertisement [16]-[38], [39], and culture differences [3].

From all these studies, we can see how user experience can be seen as the extension of usability studies. Usability can be seen as part of the user experience.

User experience is holistic [40] as user experience covers every detail about the interaction between users and the product from their feelings 'while using the product' to if they understand the way the product works and if it fulfills their goals, needs, and expectations in any context they use the product in [12]. User experience includes instrumental aspects, non-instrumental aspects, pragmatic aspects and other hedonic aspects (such as product beauty or aesthetics, challenge, stimulation, and how user get attached to the product) [40]. Use experience comprises user characteristics (such as skills, background, age, etc), internal state (user expectations, motivation, mood, etc), culture differences (language, habits, etc), product characteristics, brand image, advertisements, as well as previous experiences.

VIII. CONCLUSION

By reviewing previous usability and user experience studies, neither usability nor user experience alone can determine if the product meets user's needs and goals or can guarantee good and satisfying user experience as well as winning user's loyalty to keep using the product. We argue that these three classifications of the relation between user experience and usability (1) usability is a part of user experience, (2) usability is a user experience measure, and (3) usability and user experience complete each other, all can describe the relationship between the usability and user experience.

In summary, usability can be seen as a subset of user experience and we consider it as the heart of user experience. Usability and user experience complete each other see Table 4 and Fig.2, in which we summarize the relation between usability and user experience.

TABLE 3. SUMMARY OF THE DIFFERENT VIEWPOINTS OF THE RELATION BETWEEN USABILITY AND USER EXPERIENCE

| Usability is a part of experience | Usability is user experience measure | User experience is a part of usability satisfaction | User experience and usability complete each other |
|-----------------------------------|--------------------------------------|---|---|
| Mahlke (2006) [21] | Følstad & Rølfsen (2006) [18] | Følstad & Rølfsen (2006) [18] | Følstad & Rølfsen (2006) [18] |
| Hassenzahl (2003) [14] | ISO 9241-11: 1998 | Sharp et al (2002) [19] | |
| Hassenzahl (2007) [24] | | Bevan (2009) [20] | |
| Agarwal (2009) [22] | | | |
| Roto (2010) [11] | | | |
| Hekkert (2006) [25] | | | |
| Desmet and Hekkert (2007) [3] | | | |

IX. STRENGTHS AND LIMITATIONS

In this study, we provide a survey with widely different HCI researchers and scholar's viewpoints and perspectives of the relation between user experience and usability. We conducted our survey using articles and papers from different resources such as the Human-Computer Interaction journal, International Journal of Design, Computers in Human Behavior journal, the international conference on Human factors in computing systems - CHI 09, the international conference on engineering design, and more. However, this paper does not cover usability as a quality in the development of the application, how to measure usability and user experience as quality of use. We did not discuss the meaning of behavioral goals and tasks. This study does not go through different software quality taxonomies. We don't expect that the definitions are easy to settle, but we contribute to the debate in the hope that at some point a stable and clear demarcation of the concepts would be reached, thus making it easier to reach useful metrics for characterizing both in products intended for human use.

TABLE 4. USABILITY-USER EXPERIENCE RELATIONSHIP SUMMARY

| User Experience | | |
|------------------------|---|----------------------------|
| Usability | + | |
| Task-related | | Non- task related |
| Pragmatic Interaction | | Hedonic Interaction |
| Do-goals | | Be-goals |
| Instrumental qualities | | Non-Instrumental qualities |

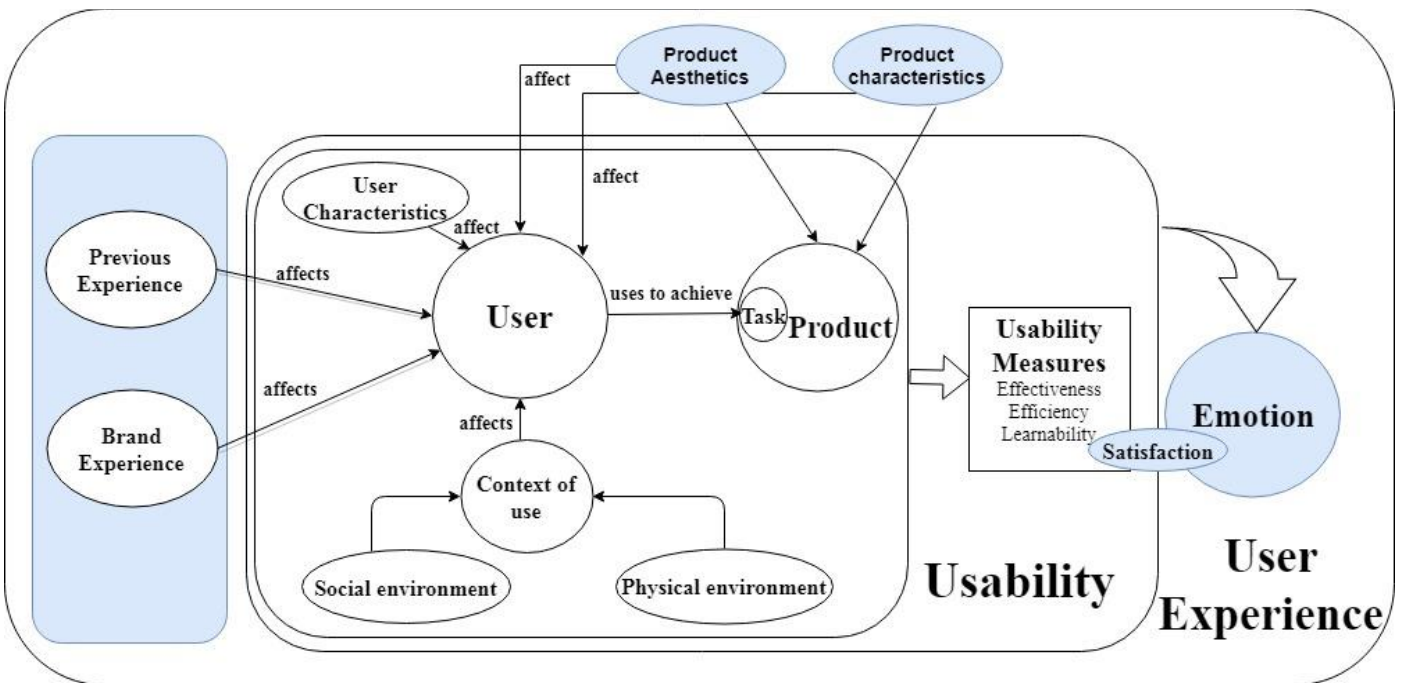


Fig. 2. Usability-User Experience Relationship Framework

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