Towards the Development of a 'User-Experience' Technology Adoption Model for the Interactive Mobile Technology

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Abstract. Traditional Human-Computer Interaction (HCI) studies on interactive products are mostly instrumental in nature, focusing on usability issues when performing tasks in a work environment. This stream of research is frequently criticized for its narrow focus. More recently, the field of HCI is embracing a new concept called 'user experience' (UX) which consists of 3 facets: (1) beyond instrumental; (2) emotion and affect; and (3) the experiential to address its criticism. UX is acclaimed to be the 'thing' that can capture the full variety and the emerging aspects of technology use. In similar situation like traditional HCI studies, traditional technology adoption studies are also criticized as being overly cognitive-oriented with little consideration for affective factors and emotional experiences of the individuals. Applying the concept of UX to traditional technology adoption model, this paper synthesizes these two streams of research to propose a 'user experience'-based technology adoption model for the interactive mobile technology.

Keywords: User experience, Technology acceptance model.

1 Introduction

Since the birth of the first iPhone in 2007, we have seen a sudden explosive growth in the use of interactive mobile technology (e.g. smartphones and tablets). Most of us can agree that these interactive mobile technologies have fundamentally changed the way we work and play. Today, we spend a significant amount of time on using these interactive mobile technologies. Yet, our understanding of what draws us towards them remains unclear. Over the last decade, the research field of Human-Computer Interaction (HCI) has been attempting to use the concept of 'User-experience' (UX) to help enhance our understanding on the use of any interactive product by an individual (Park et al., 2013). One of the key drivers behind the increase in the research activities on UX is the UX researchers' belief that the success of an interactive product is largely influenced by the extent to which it could *"promote a high quality experience*" for its users (Editorial, 2010, pp. 313). Such high quality 'User-experience' will influence not just a user's intention to adopt that product (Hassenzahl and Tractinsky, 2006), but also his/her 'loyalty' towards it (Editorial, 2010). It is believed, by both practitioners

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and researchers, that the UX of an interactive mobile technology is likely going to become the main factor that differentiates one technology from another in the near future (Editorial, 2010, Nielsen, 2008). The recent launch of the iPhone 5C is one good example. Despite the widespread perceptions of the general public that it is 'poorer' in quality, compared to its competing products (e.g. Samsung S4), loyal consumers queued for hours to get their hands on them (Swift, 2013). This seems to suggest that Apple has built a high quality User-experience of the iPhone for its consumers which moves them beyond just the adoption of its technologies.

Unfortunately, despite the last decade of researches done on UX, most HCI researches are still predominately focused on the usability of a technology, such as the: (1) time to learn; (2) error rate; and (3)time to complete a task (Bulter, 1996). This approach, however, neglects other relevant UX aspects, such as the: (1) emotions; (2) aesthetics; and (3) symbolism (Hassenzahl and Tractinsky, 2006). A quote from an extant HCI research - "If it is pretty, it won't work", summarizes the prejudices in general (Hassenzahl, 2004, pp. 320) and sometimes a pretty technology is 'accused of hiding harm behind its beauty' (Russo and De Moraes, 2003, pp. 146), the HCI community sees it. In spite of the many attempts to incorporate UX into the contemporary HCI researches, Hassenzahl & Tractinsky (2006) notice that research on UX rarely enters into the relevant academic journals and they elucidate that much of this is due to the lack of empirical support to substantiate its significance in the field of HCI. This is unfortunate. As highlighted above, understanding UX is going to become increasingly essential in the design of an interactive mobile technology.

Similarly, the over-emphasis on the usability of a technology is also challenging the researchers contributing to the Technology Acceptance literature. Technology acceptance models (TAM) have been predominately based on cognitive-oriented constructs to help explain the technology adoption behavior of an individual (Bagozzi, 2007). Some past TAM researches did attempt to include 'UX-like' factors, such as 'enjoyment' (e.g. Davis et al., 1992, Thong et al., 2006, Venkatesh, 2000) and 'computer-anxiety' (Compeau et al., 1999, Hackbarth et al., 2003) into the TAM model. Nonetheless, the number of such studies is relatively small compared to those that focus primarily on cognitive-constructs. By and by, this type of research quickly becomes unfavorable among researchers who become more aware of its limitation (e.g. Bagozzi, 2007, Hirschheim, 2007). Furthermore, UX factors such as 'aesthetics' and 'symbolism', which are equally important to the adoption of an interactive mobile technology, have rarely been considered (Cyr et al., 2006) in TAM researches. This has prompted several TAM researchers to call for the incorporation of 'UX-like' factors into the TAM model (e.g. Kim et al., 2007). This paper attempts to synthesize the HCI and TAM researches to propose a 'User- experience' technology acceptance model for the interactive mobile technology. We believe that this model will fill the identified gaps in both literatures, and it will also provide a basis to help us understand better the synergy between UX factors, such as 'emotions', 'aesthetics' and 'symbolism' and the cognitive-oriented constructs in TAM, that influences an individual's intent to adopt any interactive mobile technology. Like several researchers and practitioners, we believe this proposal is timely because we are approaching a 'user-loyalty decade' when the user-experience is a key factor for the interactive mobile technology (Editorial, 2010, Nielsen, 2008). This is especially vital when we consider how the interactive mobile technologies have permeated into every aspect of our daily lives.

2 Literature Review on UX

Looking down the history of the Human-computer interaction (HCI) research on any interactive product, the focus has always been on the instrumental qualities (e.g. functionalities, usefulness and etc.) of it. Traditional research emphasizes on the instrumental quality of an interactive product by analyzing and improving the effectiveness and efficiency of the task performance in a typical work environment. This emphasis has several shortcomings when it is applied onto the area of interactive mobile technology. For instance, it is rational for an individual who is contemplating on the purchase of an interactive mobile technology to consider both the instrumental qualities (e.g. functionalities, usefulness, etc.) and the non-instrumental qualities (aesthetics, hedonic, etc.) with equal measures. While the instrumental qualities of a product are significant influences on a consumer's adoption intent, non-instrumental qualities also play important roles as deciding factors. Unfortunately, the latter qualities have been neglected by traditional HCI researches (Hassenzahl and Tractinsky, 2006). In order to create a more holistic conceptual foundation that can capture the variety and emerging aspects of technology use in today's world, researchers in Human-Computer Interaction (HCI) have relooked at an old concept called 'user-experience' (UX) (Hassenzahl and Tractinsky, 2006). In summarizing the current state of UX researches, Hassenzahl and Tractinsky (2006) identify 3 perspectives of UX and they are: (1) beyond the instrumental; (2) emotion and affect; and (3) the experiential.

Non-instrumental quality of product. The 'beyond the instrumental' perspective moves away from the concentration on solely the task and pragmatic aspects of an interactive product (i.e. its fit to behavioral goals) that used to be the pivotal focus of Human-Computer Interaction (HCI) studies. It also considers the hedonic aspects of an interactive product (Hassenzahl, 2004). In his study, Hassenzahl (2004) conducted two experiments to investigate the interplay among; (1) user-perceived usability (i.e. pragmatic attributes); (2) hedonic attributes (e.g. stimulation, identification); (3) goodness (i.e. satisfaction); (4) and beauty (i.e. aesthetics) using four different MP3-play skins. His result concluded that beauty (i.e. aesthetics) appears to be rather related to the self-oriented, hedonic attributes, more specifically identification of a product than its goal-oriented, pragmatic attributes. In similar vein, Rafaeli and Vilani-Yavetz (2004) and Crilly et al. (2004) all posit that the appreciation of the quality of a product can be divided into three conceptually distinct aspects, namely the: (1) product's pragmatic attribute; (2) asethetics attribute; and (3) hedonic attribute. This view supports our assertion that we need to take non-instrumental qualities of a product into consideration when investigating into an interactive product.

Emotion and affect. Emotion plays a critical role in the shaping of the interaction between the user and the product. It is also a factor for the evaluation and communication about the product's User-experience (Forlizzi and Battarbee, 2004). It is arguable that the emotion and experience resulted from the use of a product cannot be separated and should be investigated together when conducting a research on the effectiveness of an interactive product (McCarthy and Wright, 2004, Hassenzahl and Tractinsky, 2006).

The extant literature in HCI documented numerous researches that emphasize on the elements and relationships between usability and affect stemming from the use of a product (e.g. Cho et al., 2011, De Angeli et al., 2003, Han et al., 2000, Han et al., 2001, Hassenzahl, 2001). To better document and grasp the subjective feeling of the user of a product, Russell(1980)'s Circumplex Model of Affect has been widely used in both the literature of UX and the Technology Acceptance Model. Thuring and Mahlke (2007) have studied three carefully designed experiments to illustrate the importance of the aesthetic qualities; emotional experiences; and instrumental qualities as influential factors that affect the overall judgment of an interactive product. Outside of the Human-Computer Interaction (HCI) research, Kim et al. (2007) propose a balanced 'thinking-feeling' model of information systems continuance. They divide an experience into two distinct components: (1) thinking; and (2) feeling. Using Russell (1980)'s Circumplex Model of Affect, they classified emotions into two states: (1) pleasure; and (2) arousal. Hence, we concur with both studies on the appropriateness of the use of Russell's Circumplex Model of Affect for the measurement of the emotions and advocate it to be used as well for our proposed research model.

Experiential. On the 'experiential' perspective of 'User-experience' (UX), Hassenzahl and Tractinsky (2006) elaborate that there are two aspects of the use of technology, namely: (1) 'situatedness'; and (2) 'temporality'. A user's experience can be defined as a unique combination of various elements, such as the physical product and the internal states of the user (e.g. mood, expectation, active goal). The user's experience extends over time, with a definitive beginning and end, and these elements are interrelated and their interactions define the actual experience. The comprehensive review presented in Hassenzahl & Tractinsky (2006) not only provides us with a strong foundation defining 'User-experience' (UX), it also helps us to understand and appreciate the way it can be applied in the Human-Computer Interaction (HCI) study. Furthermore, it convinces us of the practical applicability and theoretical applicability of UX that can be incorporated into the traditional technology adoption model.

3 Literature Review on Technology Acceptance

Cognition (i.e. thinking) denotes the mental process of knowing and it includes aspects such as perception; reasoning; and judgment (Kim et al., 2007). Belief is defined as an individual's subjective probability (which involves cognitive processing) that performing the target behavior will result in a specified outcome (Fishbein and Ajzen, 1975). Under these two definitions, most traditional technology adoption models can be classified as cognitive-centric models. They illustrate that the formation of perception within an individual that eventually influences his/her attitude towards the use and/or the behavioral intent to use a new technology. For instance, the technology acceptance model (TAM) contains cognitive-centric constructs, such as: (1) 'perceived ease of use'; and (2) 'perceived usefulness', employed to predict the user behavioral intent of a new technology. Like TAM, constructs in many other popular technology adoption models are predominately cognitive-centric and this trait is summarized in Table 1.

Table 1. Models and Theories of Technology Acceptance

Models and Theories of Technology Acceptance	Cognitive Constructs
Theory of Reasoned Action (TRA) (Sheppard et al., 1988)	Attitude Toward Behavior & Subjective Norm
Technology Acceptance Model (TAM) (Venkatesh and Davis, 2000)	Perceived Usefulness, Perceived Ease of Use & Subjective Norm
Motivational Model (Vallerand, 1997)	Extrinsic Motivation & Intrinsic Motivation
Theory of Planned Behavior (TPB) (Ajzen, 1991)	Attitude Toward Behavior, Subjective Norm & Perceived Behavioral Control
Combined TAM and TPB (C-TAM-TPB) (Taylor and Todd, 1995)	Attitude Toward Behavior, Subjective Norm, Perceived Behavioral Control and Perceived Usefulness
Innovation Diffusion Theory (IDT) (Rogers, 1995)	Relative Advantage, Ease of use, Image, Compatibility, Results Demonstrability & Voluntariness of Use

Although these models and theories have received overwhelming success in helping us to understand an individual's cognitive decision making process in the context of technology adoption, other important factors that can equally influence technology adoption, such as; emotional experience; affective factors of an individual; aesthetics; and symbolism of the technology, are relatively under-explored. For instance, Kim et al. (2007) reviewed the literature of technology acceptance and continuance studies and conclude that only a limited set of affective factors are used in prior studies. Among these are: (1) 'enjoyment'; and (2) 'anxiety'. We believe it is not coincidental that 'affective factor' and 'emotional experience' are left out of the technology adoption researches. Technology was mainly intended for task improvement in work settings in the past. In this context, the definition of a task was specific and typically well-defined. Any individual was assumed to be highly motivated in task accomplishment. Hence, the focus on purely cognitive processes to analyze an individual's adoption intention of a new technology, leaving out other factors, seemed appropriate and adequate then. The inclusion of the aesthetics as a form of hedonic quality for the explanation of an individual's technology adoption intent was also rarely seen in the extant technology acceptance literature, until more recent time. Some instances quoted include a study done by Cyr et al. (2006). They combined the design aesthetics and the extended technology acceptance model (TAM), which included a hedonic component of enjoyment, and applied them in a mobile commerce context. Similarly, the study done by van der Heijden (2004) attempts to differentiate between the systems that are 'productivity-oriented' (utilitarian) and 'pleasure-oriented' (hedonic). It indicates that the latter intends to provide self-fulfilling value and prolonged use, rather than the instrumental value and the productive use. When van der Heijden (2004) was examining the determinants of hedonic systems acceptance, he added a forth construct, namely "perceived pleasure" to the TAM. His results indicate that perceived enjoyment and perceived ease of use have more influence on the intention to use hedonic systems than perceived usefulness.

As technology rapidly proliferates out of work into our lifestyles, the nature of task evolves from structured to less-structured. That increases the complexity of the scope of technology use from work-related demands to personal fulfillment of an individual. This fundamental shift in the context of technology use weakens the explanation and prediction power of the current technology adoption models. It is most apparent when they are applied to the interactive mobile technology, such as smartphones and tablets. One of the main explanations for such 'weakness' in the traditional technology adoption models is best put forth by Kim et al. (2007). They note that unlike traditional users, a user in the emerging form of information technology has to bear the cost of 'voluntary adoption and usage' and typically has to play the dual roles of both the technology user and the service consumer. When being a technology user, the instrumental (economic/cognitive view of consumption) benefit is clearly more important. But when assessing as a service consumer, the emotional (hedonic view of the situation) benefit may also become important for consideration. Kim et al. (2007) conclude that both types of benefit may affect the decision making. We share similar viewpoint as theirs. As a consequence of their observation on the dual roles of an individual, we believe that the cognition; the emotion of a user; the asethetics; and the symbolism of an interactive product are expected to be featured more frequently and prominently in the future IS adoption studies.

4 Proposed Research Model

By combining the cognitive, emotion, aesthetics and symbolism constructs from the UX and TAM literature, we have developed our proposed research model that can be applied to the investigation of the adoption of the 'interactive mobile technology'. The definitions of the constructs used within our model are outlined in Table 2. Figure 1 illustrates our proposed research model.

Russell (1980)'s Circumplex Model of Affect is particularly suitable to be applied to our research model, to model the emotion and the affect of the user of an interactive mobile technology, because it provides an overarching framework that adequately captures almost all of the existing emotional and affective factors documented in the IS adoption literature (Kim et al., 2007). For instance, the model can be broken down into two continuous, bipolar and orthogonal dimensions: (1) the pleasantness-unpleasantness dimension, representing pleasure; and (2) the arousal-quietness dimension, representing arousal. Using these two dimensions, almost all the extant constructs on emotion used in previous IS adoption literature can be mapped onto them. According to Romer (2000), the decision making process of an individual, when choosing an action to be undertaken, can follow two mechanisms: (1) thinking-based; and (2) feeling-based. In a thinking-based mechanism, a decision maker chooses an action to be undertaken by selecting the action that gives the highest value after computing the outcome function for each action using its realization probability. In contrast, he/she becomes conscious of the hedonic state generated by each action and chooses the action that offers the higher hedonic state, in a feeling-based mechanism.

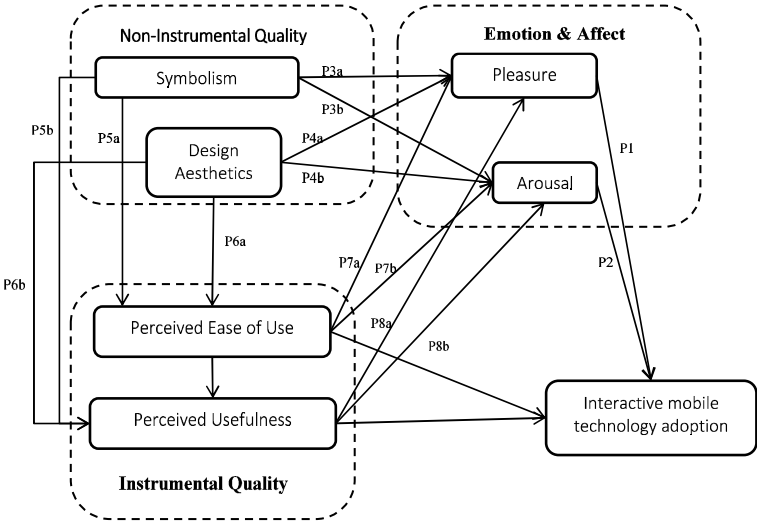

Fig. 1. Proposed Research Model

Table 2. Definitions of the constructs used in the Research Model

Construct	Definition
Pleasure (Holbrook et al., 1984, Kim et al., 2007)	The degree to which a person feels good or happy when using interactive mobile technology.
Arousal (Holbrook et al., 1984, Kim et al., 2007)	The degree to which a person feels excited, stimulated or active when using interactive mobile technology.
Perceived ease of use (Davis, 1989)	The degree to which a user believes that using interactive mobile technology would enhance his or her task performance
Perceived usefulness (Davis, 1989)	The degree to which a user believes that using interactive mobile technology would be free of effort.
Design aesthetics (Lavie and Tractinsky, 2004)	The degree to which design of interactive mobile technology looks orderly and clear.
Symbolism (Tractinsky and Zmiri, 2006, Rafaeli and Vilani-Yavetz, 2004)	The degree to which the association of using interactive mobile technology communicates favorable messages about the user and his/her personality to relevant others.

Following the same line of argument as the feeling-based mechanism, we advocate the following propositions:

Proposition 1: Pleasure generated from the use of the 'interactive mobile technology' has a *positive* influence on the behavioral intent to adopt it.

Proposition 2: Arousal generated by the use of the 'interactive mobile technology' has a *positive* influence on the behavioral intent to adopt it.

Another perspective of the User-experience model deals with the non-instrumental qualities of an interactive mobile technology. Non-instrumental qualities refer to the quality aspects of a product that go beyond tasks and goals to meet the needs of the users (Mahlke, 2007). Two distinctive categories of these non-instrumental qualities are the 'design aesthetics' and the 'symbolism' aspect of an interactive mobile

technology. They are known to influence the 'emotion' and 'affect' (Thuring and Mahlke, 2007) positively. Rafaeli and Vilani-Yavetz (2004) and Tractinsky and Zmiri (2006) also provide empirical support to demonstrate the positive effect of the 'symbolism' quality of an artifact on the emotion. Hence, we advocate that:

Proposition 3a: Symbolism of the 'interactive mobile technology' has a *positive* influence on pleasure.
Proposition 3b: Symbolism of the 'interactive mobile technology' has a *positive* influence on arousal.

In addition to the justification provided by Thuring and Mahlke (2007)'s study, the study conducted by Cyr et al. (2006) demonstrates that 'design asethetics' will also positively influence the perceived enjoyment of a web site. Since enjoyment is expressed as pleasure and arousal under Russell (1980)'s Circumplex Model of Affect, we propose that:

Proposition 4a: Design Aesthetics of the 'interactive mobile technology' has a *positive* influence on pleasure.
Proposition 4b: Design Aesthetics of the 'interactive mobile technology' has a *positive* influence on arousal.

Cyr et al. (2006)'s study also shows that the design aesthetics of a web site positively influence the technology acceptance model (TAM) variables and perceived enjoyment; and consequently they influence the user's loyalty intent for a particular mobile service. Other similar studies also confirmed similar positive effects of design aesthetics on TAM variables and perceived enjoyment (e.g. van der Heijden, 2004, Schultz, 2013, Zhang and Li, 2004). Based on all these empirical studies, we predict that the same effect of the design aesthetics of an 'interactive mobile technology' will also influence the 'perceived ease of use' and 'usefulness'. For 'symbolism', we found several studies that demonstrate empirical support for the positive effect of 'symbolism' on the overall judgment about 'goodness', which encompass 'perceived ease of use' and 'perceived usefulness' of products (Hassenzahl, 2004, Mahlke, 2007). Hence, we propose that:

Proposition 5a: Symbolism of the 'interactive mobile technology' has a *positive* influence on 'perceived ease of use'.
Proposition 5b: Symbolism of the 'interactive mobile technology' has a *positive* influence on 'perceived usefulness'.
Proposition 6a: Design Aesthetics of the 'interactive mobile technology' has a *positive* influence on 'perceived ease of use'.
Proposition 6b: Design Aesthetics of the 'interactive mobile technology' has a *positive* influence on 'perceived usefulness'.

Empirical studies on 'User-experience' (UX) in Human-Computer Interaction provide evidence for the influence of instrumental qualities of the interactive systems on the user's emotional response. The first experiment in Thuring and Mahlke (2007)'s study shows that a manipulation to the usability properties affects the user's emotional reaction. Rafaeli and Vilani-Yavetz (2004) have also conducted a qualitative study on the artifacts to explore the influence of 'instrumentality'; 'aesthetics'; and 'symbolism' on the emotional response and conclude that all three categories significantly

affect the emotion. Applying Rafaeli and Vilani-Yavetz (2004)'s idea on the interactive domain of the websites, similar results are also obtained by Tractinsky and Zmiri (2006). Thus, we posit that cognitive-centric constructs will affect a user's emotional reaction and propose that:

Proposition 7a: Perceived ease of use of the 'interactive mobile technology' has a *positive* influence on pleasure.
Proposition 7b: Perceived ease of use of the 'interactive mobile technology' has a *positive* influence on arousal.
Proposition 8a: Perceived usefulness of the 'interactive mobile technology' has a *positive* influence on pleasure.
Proposition 8b: Perceived usefulness of the 'interactive mobile technology' has a *positive* influence on arousal.

5 Contribution and Conclusion

The contribution of our research proposal is in introducing the 'beyond the instrumental' and 'emotion & affect' perspectives of the 'User-experience' (UX) from the Human-Computer Interaction (HCI) researches to the world of the technology acceptance literature. With this research proposal, we hope to help both researchers and practitioners to better understand the importance of the influence of these factors on the technology adoption intent of an individual in the context of the interactive mobile technology. As highlighted in earlier sections, the focus on these UX factors in this study is especially relevant in today's context, because: (1) technology is proliferating rapidly into every facet of our lives; (2) an individual is becoming both a technology user, as well as, a service consumer; and (3) the cost of the voluntary adoption and usage of the emerging mobile technology, such as smartphone and tablets, is being borne by the individual (Kim et al., 2007). The more inclusive the conceptual model of our proposed research model, in comparison to traditional HCI studies, the more it is current and relevant for the modeling of today's interactive mobile technology. Through our research model, we are firm in our belief that empirical evidence will be discovered to justify our position.

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