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User experience, satisfaction, and continual usage intention of IT

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Abstract
The purpose of this paper is to develop and test a research model that investigates the effects of user experience with information technology (IT) on user satisfaction with and continual usage intention of the technology. The research model uses the concept of cognitive absorption (CA) to conceptualize the optimal holistic experience that users feel when using IT. A set of hypotheses are proposed regarding the direct and indirect effects of CA on user satisfaction through the perceived utilitarian and hedonic performance and expectation disconfirmation of IT. An online survey was conducted to test the model and its associated hypotheses. The results provided support for the hypothesized effects of CA and indicated its importance for the formation of post-adoption satisfaction and continuance intention with IT.
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Introduction and motivation

In recent years, there has been increased research investigating individuals' decisions to discontinue or continue usage of information technology (IT) in information systems (IS) field (Karahanna *et al.*, 1999; Bhattacherjee, 2001a, b; Kim & Steinfield, 2004; Flavian *et al.*, 2006; Thong *et al.*, 2006). This focus highlights the critical role of continuous post-adoption IT usage for the long-term viability and eventual success of IT (Karahanna *et al.*, 1999; Bhattacherjee, 2001b; Thong *et al.*, 2006). On the one hand, the benefit or value of an IT cannot be realized without continued usage of the IT; and on the other hand, for many IT companies, such as those providing Internet-based services, maintaining customers' continued usage of the technologies/services is crucial to generate constant revenues and sustain long-term profitability for the companies. This body of research has generally established user satisfaction as an important factor leading to continued usage decision and user retention for a variety of IT, such as e-commerce systems (Bhattacherjee, 2001a, b; Flavian *et al.*, 2006) and mobile Internet services (Kim & Steinfield, 2004; Thong *et al.*, 2006). Being predominantly concerned with the instrumental or utilitarian performance whereby IT is seen as providing useful functionalities, these studies have focused on the cognitive sources of satisfaction and continuance usage along the lines of expectancy confirmation and quality dimensions, such as perceived usefulness, perceived ease of use, service quality, information quality and connection quality (Karahanna *et al.*, 1999; Bhattacherjee, 2001a, b; Kim & Steinfield, 2004; Flavian *et al.*, 2006; Thong *et al.*, 2006). While these quality dimensions of IT are instrumental in fulfilling users' requirements related to task or goal achievement,

the characteristics of contemporary IT require us to go beyond the instrumental variables and pay close attention to the non-instrumental qualities (Agarwal & Karahanna, 2000), which are intrinsically pleasant and associated with the experiential aspects of IT.

Contemporary information technologies tend to create an engaging interactive experience by utilizing richer multimedia interfaces (Agarwal & Karahanna, 2000). Moreover, contemporary information technologies are becoming increasingly consumer oriented and omnipresent in our daily life as more and more technologies are designed to serve the need of general public and encompass both work-related and fun activities (Thong *et al*., 2006). IT users are not only technology users but also consumers. In consumer satisfaction literature, satisfaction is conceptualized as the 'consumer's fulfillment response' and posited to provide 'a pleasure level of consumption-related fulfillment, including levels of under- or over-fulfillment' (Oliver, 1997). While the basic quality dimensions of IT serve as preconditions to user satisfaction, they only provide a narrow view of user satisfaction by focusing on the low end of the satisfaction continuum. It is suggested that since the basic quality dimensions are what users take for granted and expect minimally from the technology (Kano *et al*., 1984; Zhang & Dran, 2001), their absence will lead to underfulfillment and dissatisfaction. However, their mere presence is not sufficient to invoke satisfaction and may go unnoticed by users (Zhang & Dran, 2001). A feeling of satisfaction requires more than just meeting users' expectations about task/goal achievement (Oliver, 1997). Over-fulfillment, termed as positive disconfirmation of expectations, leads to high levels of satisfaction (Oliver & Wayne, 1988). Adopting the view of satisfaction as pleasurable fulfillment, we believe that high levels of user satisfaction could be found in an IT that delights users by exceeding users' expectations and allowing users to experience something more than just task/goal fulfillment, for example, pleasure, enjoyment, and empowerment. In addition to task/goal achievement, IT usage in itself can be a source of pleasure and satisfaction. This requires us to focus on user experience, which emphasizes engagement, fun, and delight rather than just functionality or ease-of-use (Wright *et al*., 2001; Marcus, 2002).

The purpose of this paper is to develop and provide empirical validation for a research model of IT continuance that is applicable to contemporary IT with consumer appeal. The model specifies the relationships between cognitive absorption (CA) conceptualized as optimal IT user experience, performance evaluation of IT, user satisfaction with IT, and intention to continually use IT. For the purpose of this study, we use mobile Internet services to test our research model because they exemplify consumer-oriented contemporary IT. Mobile Internet services provide users with wireless access to various sites and services via handheld mobile devices (Chae *et al*., 2002). They can be used to support diversified needs (utilitarian and hedonic purposes) and a broad range of usage contexts (work-related and fun activities) (Van der Heijden, 2004; Lee *et al*., 2005; Van der Heijden *et al*., 2005). Examining mobile Internet services rather than a simple technology with limited functions as the target IT allows us to include the nature of technology as a boundary condition in predicting continued IT usage (Thong *et al*., 2006).

In the rest of this paper, first we will review prior relevant work in consumer behavior and IS literature, followed by a presentation of the research model of IT continuance intention. Then, we discuss the research methodology employed to test the proposed model and report the results of data analysis. Finally, we conclude with the theoretical and practical implications of this study.

Understanding user satisfaction with IT

User satisfaction

In behavioral IS research, user satisfaction construct has been a central construct of interest, employed by IS researchers and practitioners to measure user attitude about system, evaluate IS effectiveness, and predict user behavior or behavioral intention (Melone, 1990). IS research on user satisfaction suggests that user satisfaction is an important measure of IT success (Ives & Olson, 1984; Delone & McLean, 1992). User satisfaction is defined in a variety of ways in IS research, such as understanding of a system and success (Baroudi & Orlikowski, 1988) or user beliefs about the relative value of IT (Swanson, 1974). Although these definitions vary, they share the notion that user satisfaction is some form of evaluative response to IT (Melone, 1990).

Similar attitude-like constructs (e.g., consumer satisfaction) have long been an important topic of study in other fields, such as consumer research. In consumer satisfaction research, a widely accepted definition of satisfaction is formulated as follows: 'Satisfaction is the consumer's fulfillment response.' It is a judgment that a product or service 'provided a pleasurable level of consumption-related fulfillment, including levels of under- or over-fulfillment.' (Oliver, 1997, p. 13). This definition suggests that satisfaction is a pleasurable fulfillment response resulting from an evaluation with respective to how well the consumption of a product or service meets a need, desire, or goal.

Much research effort has been directed at understanding the process of product/service evaluation involved in the formation of satisfaction response. There is ample evidence that satisfaction is a function of perceived product/service performance and disconfirmation of performance expectations (Oliver & Wayne, 1988; Tse & Wilton, 1988). Perceived product/service performance is a direct result of evaluation of product/service attributes during the actual consumption experience. In general, one will be satisfied when the product/service performance is favorable and dissatisfied when the

product/service performance is unfavorable. Disconfirmation of performance expectations is an evaluation of whether the performance of product/service is better than or worse than expected. Many studies have shown that the disconfirmation of expectations is perhaps the most important determinant of satisfaction (Oliver, 1980; Spreng *et al*., 1996; Khalifa & Liu, 2003; Spreng & Page, 2003; Bhattacherjee & Premkumar, 2004).

Expectation disconfirmation theory (EDT), which is a prominent theory explaining consumers' satisfactions with products/services (Oliver, 1980; Yi, 1990; Spreng & Page, 2003), defines the disconfirmation of expectations and specifies the nature of its impact on satisfaction. The disconfirmation of expectations is described as the discrepancy or gap between prior expectations and actual performance of products/services. The disconfirmation of expectations can be positive or negative. Positive disconfirmation will result when perceived product/service performance is better than expected; and negative disconfirmation will occur if perceived product/service performance is worse than expected. According to EDT, the more positive the disconfirmation of performance expectations, the greater the satisfaction (Yi, 1990). In other words, when a product or service performs the way a consumer thought it would, he/she may not think much about it. If the product/service performance fails to meet the expectations, a negative feeling of dissatisfaction may occur. However, if the performance exceeds the consumer's expectations, he/she will be satisfied and pleased (Solomon, 1996). Consistent empirical support for EDT can be found for a variety of products and services in both marketing and IS literature (Oliver, 1980; Oliver & Wayne, 1988; Yi, 1990; Bhattacherjee & Premkumar, 2004; Hsu *et al*., 2004).

Performance evaluation

The extant research has established that consumers evaluate products/services in general along the utilitarian and hedonic dimensions (Hirschman & Holbrook, 1982; Batra & Ahtola, 1990; Mano & Oliver, 1993; Hoffman *et al*., 2003; Van der Heijden & Sorensen, 2003). These two dimensions are differentiated based on the classification of extrinsic and intrinsic motivations for product/service consumption. Extrinsically motivated consumption refers to other-oriented, utilitarian consumption that is instrumental in achieving valued outcomes or goals distinct from the consumption activity itself. Intrinsically motivated consumption is self-oriented, hedonic consumption mainly for fun and enjoyment. Traditional IT systems are mostly work or task-related, and hence are utilitarian in nature. The emerging contemporary information technologies add a hedonic aspect to the technology use experience as they are increasingly used for not only utilitarian but also hedonic purposes in all aspects of users' personal lives. For example, World Wide Web, mobile services, game-based training technology, as well as other IT products/services used in the home or leisure environment provide hedonic value to users (Van der Heijden & Sorensen, 2003; Van der Heijden, 2004).

The extrinsic versus intrinsic motivation dichotomy has also been used to explain IT acceptance and usage in IS research (Hoffman *et al*., 2003; Van der Heijden, 2004; Van der Heijden *et al*., 2005). Based on the dichotomy of intrinsic versus extrinsic motivation, Hassenzahl (2003) distinguishes between the utilitarian (extrinsic) and hedonic (intrinsic) aspects of user experience in human-computer interaction. Utilitarian experience is goal-oriented and emphasizes the functional performance of technology for goal/task-fulfillment; in contrast, hedonic experience is not motivated by just what a technology can do, but rather the experiential and emotional values the technology may bring about, such as fun, entertainment, and enjoyment (Holbrook & Hirschman, 1982; Hassenzahl, 2003). According to Hassenzahl's two-dimensional view of IT user experience (2003), we specify user-perceived utilitarian performance and hedonic performance as two primary evaluative dimensions for IT. This view is also in line with the findings of technology acceptance/adoption research. The utilitarian performance of IT includes the aspect of perceived usefulness, which is a strong predictor of technology usage intention (Davis, 1989; Van der Heijden, 2000; Venkatesh, 2000). The hedonic performance is measured using perceived enjoyment in the technology acceptance model (TAM) (Davis *et al*., 1992; Venkatesh, 2000).

CA as an optimal user experience

Consumer satisfaction research also emphasizes the importance of direct consumption experience with product/service for the evaluation of product/service performance (Oliver, 1993). Similarly, in the context of IT usage, the formation of satisfaction response requires post-adoption experience and use of IT. Users must rely on their direct experience with the technology to form perceptions of technology performance and expectancy disconfirmation. Therefore, user experience with IT serves an antecedent of satisfaction/dissatisfaction response.

As user experience is a vague term and concerns all aspects of how people use an interactive technology (Alben, 1996), there is a lack of a good definition for user experience (Forlizzi & Battarbee, 2004) in the literature. Since our focus is on the implication of a good user experience for over-fulfillment (the higher end of user satisfaction continuum), the concept of CA provides a way to conceptualize the optimal user experience with IT. Drawing on a synopsis of dimensions comprising flow experience in the context of IT usage, Agarwal & Karahanna (2000) introduced the concept of CA to describe user's holistic experience with IT. CA is a positive, highly enjoyable experience, which occurs when a user is fully immersed in the interaction with IT characterized by total attention and engagement, a sense of control, and feelings of heightened enjoyment and

curiosity, such that nothing else seems to matter and time no longer seems to pass the way it ordinarily does (Agarwal & Karahanna, 2000).

CA captures the totality of user experience with IT (Agarwal & Karahanna, 2000). It is conceptualized as a multi-dimensional construct consisting of temporal dissociation, focused immersion, heightened enjoyment, control, and curiosity (Agarwal & Karahanna, 2000) during one's interaction with IT. Temporal association refers to 'the inability to register the passage of time while engaged in interaction'; focused immersion is 'the experience of total engagement' in the interaction while ignoring other attentional demands; heightened enjoyment captures 'the pleasurable aspects of the interaction'; control represents 'user's perception of being in charge of the interaction'; and curiosity refers to 'the extent to which the experience arouses user's sensory and cognitive curiosity' (Agarwal & Karahanna, 2000).

IT users are likely to experience CA when they have clear goals, the technology is stimulating and responsive, and the task challenges and users' skills are both equally high (Csikszentmihalyi, 1997; Agarwal & Karahanna, 2000). Recently, CA has been used to extend the traditional TAM in the studies of contemporary IT adoption, such as Internet-based systems serving both utilitarian and hedonic purposes. These studies have consistently suggested the importance of CA in predicting IT beliefs and use behaviors (Agarwal & Karahanna, 2000; Hsu & Lu, 2004; Saade & Bahli, 2004; Shang *et al*., 2005; Wakefield & Whitten, 2006; Zhang *et al*., 2006).

Research model

CA is utilized to conceptualize user experience with IT. The findings of consumer satisfaction are then applied to the context of IT usage. A research model is developed to investigate how user experience influences user's satisfaction with and continual use of IT (see Figure 1). The model constructs and their relationships are illustrated in Figure 1.

Relationships derived from prior consumer satisfaction research

Since the continued usage of IT products/services is analogous to the repurchase of products/services in the consumer context, we draw on the theories and findings of consumer satisfaction literature (e.g., EDT) to explain the continued IT usage intention. Hypotheses 1–4 with regard to the relationships among perceived utilitarian performance, perceived hedonic performance, expectation disconfirmation, user satisfaction, and continuance intention are directly derived from the consumer satisfaction literature.

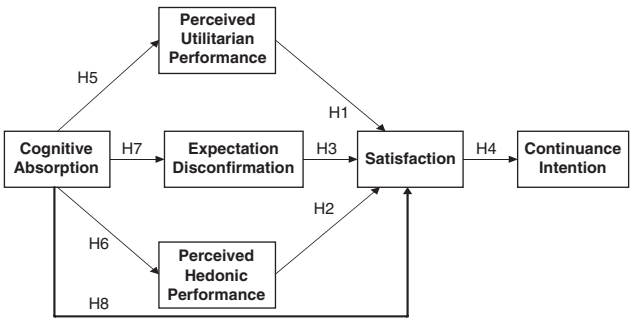

Figure 1 Research model of IT satisfaction and continual usage intention.

Adopting Oliver's definition of satisfaction (Oliver, 1997), we define satisfaction as a fulfillment response resulting from the evaluation of an IT product. Prior research suggests that perceived product/service performance is a strong predictor of consumer satisfaction (Oliver & Wayne, 1988; Tse & Wilton, 1988). It has been established that consumers evaluate products/services in general and IT products/services in specific along the utilitarian and hedonic dimensions (Batra & Ahtola, 1990; Mano & Oliver, 1993; Van der Heijden & Sorensen, 2003; Van der Heijden *et al*., 2005). Based on the view of satisfaction as an evaluative outcome, we suggest the evaluations of utilitarian and hedonic performance attributes of IT as the direct antecedents of satisfaction. Besides perceived product/service performance, satisfaction judgment is also determined by the extent to which a consumer's expectation of performance is disconfirmed (Oliver, 1980). There was significant evidence that consumers are satisfied when they experience positive disconfirmation, which occurs when perceived performance exceeds prior expectation of performance (Oliver, 1980; Mano & Oliver, 1993). According to Ajzen and Fishbein's theory (1980) of reasoned action, satisfaction indicates positive attitude, which will result in increased positive behavioral intentions or behaviors. In consumer satisfaction research, satisfied customers are found to be more likely to remain loyal to the product/service (Oliver, 1997), such as making repeat purchase of same product/service. Similarly, it is expected that satisfied IT users are more likely to continue their use of that technology (Kim & Steinfield, 2004; Thong *et al*., 2006). Therefore, we derive the following hypotheses from prior research.

H1: *The higher utilitarian performance a user perceives of an IT, the more satisfied he/she is with the IT.*

H2: *The higher hedonic performance a user perceives of an IT, the more satisfied he/she is with the IT.*

H3: *The more positive a user's expectation disconfirmation, the more satisfied he/she is with the IT.*

H4: *The more satisfied a user is with his/her use experience of an IT, the more likely he/she will continue to use the technology.*

While Hypotheses 1–4 have been examined and supported in the prior consumer satisfaction research, the current study will conduct additional empirical investigation of these hypotheses in the context of IT usage

and provide the basis for future IS satisfaction research. In addition, this study attempts to expand the original research model by incorporating CA as an antecedent in the IT continuance model. Validating the expanded IT continuance model would require an empirical testing of the complete model, which includes the original model.

Incorporating CA into the IT continuance model

The satisfaction research literature assumes the critical role of direct consumption experience in determining perceived product/service performance and expectation disconfirmation. Similarly, in the context of IT usage, user experience of IT is considered to be of paramount importance for IT success. Users draw on their direct experiences with IT to evaluate IT, form perceptions of IT, and develop future behavioral intentions with IT. However, the primary focus of extant research has been on the perceptions of IT that are subsequent to IT usage rather than user experience itself. Perceived technology performance and expectation disconfirmation are useful predictors of user satisfaction, but they do not provide much fundamental understanding of the characteristics of user experience leading to high satisfaction. While user satisfaction is posited as a function of users' perceptions of IT, it is actually determined by user experience, which the evaluations and perceptions of technology are rooted in. Merely investigating the effects of perceived technology performance and expectation disconfirmation without much regard to the nature of user experience may present a limited view of technology design practice and restrain the practical relevance of research findings. Examining the effects of user experience can provide valuable insights on why and how users form positive perceptions of technology resulting in satisfaction response and continuance behavior.

The current study uses Agarwal and Karahanna's (2000) CA to describe user's holistic experience with an IT when the user acts with total involvement. Describing an optimal user experience characterized by time distortion, total involvement, sense of control, enjoyment, and curiosity, CA combines three types of experiences: sensory, affective, and cognitive components into a complete, holistic experience for the user (Csikszentmihalyi, 2000). The sensory aspect of CA is concerned with sensory stimulation, such as the stimulation of visual and aural senses during users' interaction with an IT. The affective aspect of CA arouses the feelings of pleasure and enjoyment in users. The cognitive aspect of CA involves users' total engagement in and control over the interaction with an IT. There has been ample evidence in the literature that IT usage activity (e.g., web browsing, online gaming, computer-medicated communication) can bring users to experience CA (Trevino & Webster, 1992; Webster *et al*., 1993; Walker *et al*., 1998; Agarwal & Karahanna, 2000; Koufaris, 2002; Hoffman *et al*., 2003; Pace, 2004; Saade & Bahli, 2004; Skadberg & Kimmel, 2004; Siekpe, 2005). When using an IT, users usually have clear goals and face the challenges posed by the technology. This requires users to have adequate IT usage skills and gather necessary psychic energy to perform the activities, leading to intense concentration on the activities (Koufaris, 2002; Hoffman *et al*., 2003). As they are totally immersed in the IT usage activities, they filter out irrelevant stimuli from the environment and lose track of time (Agarwal & Karahanna, 2000; Skadberg & Kimmel, 2004). They feel in control of the interaction with IT through the immediate, appropriate feedbacks from the technology in response to their actions (Csikszentmihalyi, 1990; Agarwal & Karahanna, 2000; Pace, 2004). The technology stimulates curiosity and enjoyment by providing visually appealing interface and new options for interaction (Trevino & Webster, 1992). The experience of using IT then becomes autotelic when users are engaged in the activities for their own sake and enjoyment (Csikszentmihalyi, 1990).

CA is considered as an important explanatory variable in technology adoption and has been found to be a proximal antecedent of two dominant technology acceptance factors, perceived usefulness and perceived ease of use (Agarwal & Karahanna, 2000; Saade & Bahli, 2004; Shang *et al*., 2005). Despite the important role of CA in technology usage, few studies have investigated the implication of CA for continued IT usage. Incorporating CA in the IT continuance model allows us to trace back to the source of IT evaluation in the causal chain for satisfaction and IT continuance intention.

Given the premise of this study, CA is used as an input to user's evaluation of IT. CA is closely related to intrinsic motivation, where people are immersed in an activity for its own sake and enjoyment (Csikszentmihalyi, 1990). Therefore, CA is expected to have positive influence on perceived hedonic performance through all its five dimensions. When experiencing CA with an IT, users become so involved with the interaction with IT that they are oblivious to other stimuli, lose track of time, exercise control over the interaction, and enjoy the excitement of pleasure and curiosity. Such interaction with IT tends to go beyond being merely instrumental to be pleasurable and enjoyable as an end in itself. In IS literature, heightened enjoyment, which represents a synthesis of intrinsic interest and perceived enjoyment, is recognized as one of the five dimensions of CA (Agarwal & Karahanna, 2000; Koufaris, 2002; Siekpe, 2005; Wu & Chang, 2005). Intrinsic enjoyment of technology use exists in a concentrated state of technology involvement with a sense of control (Davis *et al*., 1992; Pace, 2004). CA involves a high level of concentration where irrelevant thoughts and perceptions are screened out, leaving no room for distractions and emotional discomfort (Csikszentmihalyi, 2000). An IT interaction activity generating the experience of CA is so enjoyable and free of discomfort that users are willing to use the technology for the pleasure it provides, with little concern for what they will get out of it (Csikszentmihalyi, 1990). Thus, in the context of IT usage, the great gratification and

pleasure derived from the experience of CA with an IT are expected to enhance users' perception of the technology's hedonic performance.

Although CA is an intrinsic motivation-related variable, it can also occur in goal-oriented (extrinsically motivated) activities and shape users' utilitarian experiences (Hoffman *et al*., 2003). For instance, CA has been consistently supported to have positive influence on perceived usefulness and perceived ease of use, which are two important beliefs about utilitarian technology use (Agarwal & Karahanna, 2000; Saade & Bahli, 2004; Shang *et al*., 2005). Agarwal and karahanna draw on the theory of self perception (Bem, 1972) and cognitive dissonance theory (Festinger, 1957) to explain the relationship between CA and perceived usefulness. The underlying logic is that individuals seek to rationalize their actions to reduce the dissonance between competing cognitions. Users feeling CA with an IT tend to block out other distractions and spend more time using the technology than originally intended. Due to the effect of cognitive dissonance, they will have a natural tendency to account for the time and effort spent on the technology by attributing instrumental/utilitarian value (Agarwal & Karahanna, 2000). They rationalize 'I am voluntarily spending a lot of time on this and enjoying it, therefore, it must be useful.' (Agarwal & Karahanna, 2000, p. 676). Hence, it makes sense to assume that individuals would appraise the utilitarian performance of an IT as being better when experiencing CA. Furthermore, the experience of CA implies peak performance (Privette, 1983). Having full attention focus on and being in charge of the interaction facilitate successful achievement of desired outcomes or goals, which in turn enhances utilitarian performance. The feeling of heightened enjoyment and curiosity can also improve task performance by encouraging exploratory and learning behaviors toward the technology. Therefore, the five dimensions of CA all contribute to the increase in perceived IT utilitarian performance. Hence, we suggest the experience of CA has a positive influence on both perceived utilitarian performance and perceived hedonic performance of IT. This leads us to propose the following hypotheses.

H5: *The more a user feels the experience of cognitive absorption with an IT, the higher utilitarian performance he/she perceives of the IT.*

H6: *The more a user feels the experience of cognitive absorption with an IT, the higher hedonic performance he/she perceives of the IT.*

While it is quite straightforward for users to form perceptions of IT performance through direct experience with IT, making comparisons between performance and expectations however demands greater levels of cognitive processing. As such, the formation of expectation disconfirmation judgment is determined by the availability of extra cognitive resources for comparing expectations with performance. The experience of CA with an IT is essentially a state of deep involvement with the technology (Agarwal & Karahanna, 2000), in which all of the user's attentional resources are focused on the interaction with technology. This in turn will provide the necessary cognitive resources for a highly elaborative process of IT evaluation. The greater the evaluative processing of IT performance, the more likely the user is to conduct expectations-performance comparisons concerning whether the technology performance is better than or worse than expected. Thus, the experience of CA can promote the formation of positive expectation disconfirmation judgment by enhancing the perception of IT performance and facilitating an in-depth cognitive process of comparing perceived performance with expectation. Moreover, CA itself can be expectation exceeding by offering a peak experience with the highest happiness and fulfillment to users (Hoffman & Novak, 1997; Walker *et al*., 1998; Pace, 2004). There, we suggest the following hypothesis.

H7: *The more a user feels the experience of cognitive absorption with an IT, the more positive is his/her expectation disconfirmation.*

CA is an optimal user experience 'so satisfying that individuals want to repeat the activity continually' (Csikszentmihalyi, 1988). The experience of CA is thus directly associated with satisfaction and loyalty behavior (Trevino & Webster, 1992; Hoffman & Novak, 1997; Koufaris, 2002; Hoffman *et al*., 2003; Skadberg & Kimmel, 2004). Hoffman and Novak found consumer returns to websites that facilitate experience of CA, which serves as 'the glue holding the consumer in the hypermedia computer mediated environment' (Hoffman & Novak, 1997). CA involves both affective and cognitive components (Webster *et al*., 1993). As manifested through its dimension of heightened enjoyment, CA is a highly pleasurable experience (Agarwal & Karahanna, 2000). To extent that satisfaction is a pleasurable outcome of IT usage, the immediate pleasure derived from CA contributes to the formation of satisfaction response. Furthermore, the experience of concentration and total attentional engagement during CA promotes users' learning about the technology (Koufaris, 2002; Skadberg & Kimmel, 2004). Individuals experiencing CA with IT are usually motivated to learn more and develop better knowledge about the technology. This is likely to result in changes in users' attitudes toward the technology (Trevino & Webster, 1992), such as satisfaction and positive attitudes (Skadberg & Kimmel, 2004).

Although there has been some debate over whether CA precedes or follows satisfaction, we believe that CA is an antecedent rather than an outcome of satisfaction. In the literature, satisfaction is conceptualized as a final state within a psychological process (Giese & Cote, 2000); that is, a summative response to the entire experience of

using IT (Oliver, 1993; Oliver, 1997). The satisfaction judgment is therefore formed as a result of technology evaluation after a direct user experience with IT (Oliver, 1997; Giese & Cote, 2000). The concept of CA is used to describe the characteristics of actual IT usage situations encountered by users. CA is directly concerned with the experiential nature of the events occurring during users' interaction with IT. Prior research has found individual traits and situational factors are likely to be the antecedents of CA, such as computer playfulness, clear goals, immediate feedbacks, and a balance between challenges and skills (Csikszentmihalyi, 1990; Webster & Martochhio, 1992; Moneta & Csikszentmihalyi, 1996). CA, in which users are carried by the flow of the activities in an automatic and spontaneous way (Rieber *et al*., 1998), can occur without any in depth evaluation of interaction with IT. CA is users' perceived experience of IT usage, whereas satisfaction is an evaluative 'fulfillment response' to the user experience. As such, the experience of CA logically precedes and provides a basis for the satisfaction response. In fact, research has shown that a lack of CA leads to absence of satisfaction. Distractions that limit users' concentration on web browsing reduce their satisfaction (Xia & Sudharshan, 2002). Therefore, we suggest CA has a direct effect on user satisfaction with an IT. Thus, the following hypothesis can be suggested.

H8: *The more a user feels the experience of cognitive absorption with an IT, the more satisfied he/she is with the IT.*

Research method

Target technology

We used mobile Internet services as the target technology to test the proposed model. Mobile Internet services are considered appropriate for this study because they exemplify consumer-oriented contemporary IT and provide both utilitarian and hedonic functions (Van der Heijden & Sorensen, 2003; Van der Heijden *et al*., 2005). Mobile Internet services have been gaining popularity in recent years (Lee *et al*., 2005). They provide users with wireless access to Internet contents and services via handheld mobile devices (Chae *et al*., 2002), such as mobile phones, portable digital assistants, and Blackberry. Examples of currently offered mobile Internet services include downloading logos/ring tones/music/graphics/video, mobile games, mobile messaging, mobile email, surfing Internet portal sites, news/weather report, stock exchange/banking/investing service, etc. These mobile Internet services are delivered over the wireless network and hence can be used independently of temporal and spatial restraints when the user is on the move. Since the usage of mobile Internet services is subscription-based, the continuous usage of mobile Internet services is critical for generating constant market revenues.

Sample and data collection

To test the proposed research model and its associated hypotheses, a web-based survey was conducted to collect data from the existing users of mobile Internet services. An email invitation was sent to over 10,000 registered undergraduate and graduate students at a southeast university in the U.S.A. Interested participants may click on the link in the email invitation to be directed to the survey website. A screening question was included at the beginning of survey to determine whether the respondent is using mobile Internet service at the time of the survey. The survey website was designed in such a way that only the existing users of mobile Internet service will be able to proceed with the survey. To encourage participation, all the participants were offered a chance to enter a lucky draw of 5 $50 Amazon.com Gift Certificates.

A total of 289 useable responses were received. There were 196 female respondents (67.82%) and 93 male respondents (32.18%). The respondents' ages ranged from 16 to 57 years, with a mean age of 25 years old. The majority of the respondents (79.58%) were between 16 and 30 years old. The respondents' periods of using mobile Internet services ranged from 0.5 to 6 years, with a mean value of 3.15 years. About 70% of the respondents (202) used mobile Internet services at least once a day.

Measures

Our survey instrument was developed by incorporating and adapting existing valid and reliable scales where appropriate (see Appendix). The measurement scale of CA construct was adopted from the original work of Agarwal and Karahanna (Agarwal & Karahanna, 2000). We adopted Van der Heijden & Sorensen (2003)'s modified version of Hedonic/Utilitarian (HED/UT) scale to measure perceived utilitarian and hedonic performance of mobile Internet service. Their scale items are derived from Batra and Ahtola's scales of hedonic and utilitarian dimensions of product evaluation (Batra & Ahtola, 1990), which are used to measure perceived hedonic and utilitarian performance of products/services in consumer research (Mano & Oliver, 1993). Van der Heijden *et al*. adapted the scales to the context of mobile services (Van der Heijden & Sorensen, 2003). Expectation disconfirmation was measured using Oliver's (1980) disconfirmation scale. We used Flavian *et al*.'s (Flavian *et al*., 2006) measurement scale of satisfaction to measure the overall satisfaction with mobile Internet service. Finally, the measure of continual use of mobile Internet service was derived from the prior work on IT continuance (Bhattacherjee & Premkumar, 2004; Thong *et al*., 2006).

Data analysis and results

We used partial least square (PLS) – a component-based Structural Equation Modeling (SEM) technique for data analysis. PLS is considered suitable for this study due to its superior prediction capability and minimal demands on sample size and residual distributions (Fornell &

Bookstein, 1982; Chin, 1998a, b). In addition, PLS allows us to test the psychometric properties of the measurement scales (the measurement model) and the relationships among the variables (the structural model) simultaneously. All the first-order constructs – the five dimensions of CA, expectation disconfirmation, perceived utilitarian performance, perceived hedonic performance, satisfaction, and continuance intention were modeled using multiple reflective indicators. CA was modeled as a reflective second-order factor with its five dimensions as first-order factors. It was estimated using the hierarchical component model by repeated use of all the indicators of the first-order factors underlying the second-order construct (Lohmoller, 1989). While some IS researchers argue that the measurement of CA is not reflective but formative, we treated the measurement of CA as reflective rather than formative for the following reasons. First, the reflective measure of CA was previously validated in a variety of IS studies (Agarwal & Karahanna, 2000; Saade & Bahli, 2004; Zhang *et al*., 2006). Until proven otherwise, we believe it is most appropriate to measure CA as a reflective second-order factor. Second, the five dimensions of CA, which serve as the indicators of CA, have been found to covary with each other (Agarwal & Karahanna, 2000; Zhang *et al*., 2006). Although the covariance between reflective indicators is expected, however, it can be a source of concern when CA is specified as formative because the estimation process of formative construct is based on multiple regression (Fornell & Bookstein, 1982). Third, CA refers to the experience of deep involvement when interacting with IT. Therefore, it is a psychological construct that shapes an individual's attitude and behavior toward the technology. It has been suggested that psychological constructs are best measured by reflective indicators because they are the underlying factors that give rise to the observed indicators (Fornell & Bookstein, 1982; Diamantopoulos & Siguaw, 2006; Hardin *et al*., 2008). Consistent with other psychological constructs, CA can be viewed as an underlying factor that exists independently of the attempts to measure it. The changes in CA will precede and be reflected by the changes in the indicators measuring it. Therefore, we believe the reflective specification of CA construct is consistent with its psychological origins.

Measurement model

The psychometric properties of the measurement scales for the first-order factors were assessed in terms of convergent validity, discriminant validity, and reliability. The measurement scales have good convergent validity if each item's loading on its corresponding construct exceeds 0.70 (Garver & Mentzer, 1999). The confirmatory factor analysis (CFA) showed that only three items – CO2, FI4, and CI4 had loadings to their corresponding factors below the recommended threshold (0.70). They were dropped from further analysis. The measurement model was then re-examined without the three dropped items. Table 1 presents the descriptive statistics of all the first-order factors (excluding the dropped items). All the factor loadings of the measurement items on their corresponding constructs exceed 0.70 (see Table 2), indicating adequate convergent validity. To establish the discriminant validity, the measurement items should load higher on their respective constructs than the remaining constructs. As shown in Table 2, all the items' loadings on their own constructs were higher than the cross-loadings on other constructs. Another criterion for evaluating discriminant validity suggests that the average variance shared between the construct and its indicators should be larger than the variance shared between the construct and other constructs (Fornell & Larcker, 1981). In other words, the square root of average variance extracted (AVE) of the constructs should exceed the inter-correlations among the constructs in the model (Fornell & Larcker, 1981; Chin, 1998b). The correlation matrix presented in Table 3 indicates that the square roots of AVE on the diagonal are greater than the corresponding off diagonal inter-construct correlations. Thus, the discriminant validity of all the first-order factors is supported.

Table 1 Descriptive statistics of first-order constructs

Construct	*Mean*	*SD*
Cognitive absorption: temporal dissociation	4.70	1.41
Cognitive absorption: focused immersion	4.30	1.26
Cognitive absorption: heightened enjoyment	5.36	1.10
Cognitive absorption: control	4.74	1.06
Cognitive absorption: curiosity	4.29	1.30
Utilitarian performance	5.40	1.13
Hedonic performance	4.97	1.16
Expectation disconfirmation	4.61	1.21
Satisfaction	5.60	1.11
Continuance intention	5.51	1.14

The reliability of the measurement items was examined using the statistics of Cronbach's alpha (Cronbach, 1971), composite reliability (Chin, 1998a), and AVE (Fornell & Larcker, 1981). It is suggested that Cronbach's alpha should exceed 0.70 (Cronbach, 1971), AVE should be 0.5 or greater (Fornell & Larcker, 1981), and composite reliability should be above 0.70 (Chin, 1998a) to indicate adequate reliability. Table 3 shows that all the values of composite reliability, AVE, and Cronbach's alpha are well above the 0.70, 0.50, and 0.70 thresholds. These results indicate high reliability of the items.

For the second-order factor of CA, the path coefficients from CA to the underlying first-order factors of time dissociation, focused immersion, heightened enjoyment, control, and curiosity (the factor loadings) are 0.81, 0.77, 0.82, 0.61, and 0.74 respectively, and all significant at the 0.0001 level. Only the path coefficient between CA and control is slightly lower than the recommended value of 0.70 (Chin, 1998a), but still greater than 0.60. The composite reliability and Cronbach's alpha of CA were 0.94 and 0.93, both above the suggested threshold

Table 2 Results of factor analysis – cross loading

	TD	*FI*	*HE*	*CO*	*CU*	*UT*	*HED*	*ED*	*SAT*	*CI*
TD1	0.81	0.42	0.45	0.28	0.33	0.30	0.22	0.18	0.26	0.27
TD2	0.89	0.52	0.48	0.25	0.37	0.27	0.31	0.26	0.21	0.20
TD3	0.87	0.54	0.55	0.30	0.45	0.32	0.33	0.28	0.29	0.26
TD4	0.85	0.51	0.39	0.22	0.31	0.23	0.23	0.17	0.10	0.20
TD5	0.85	0.53	0.40	0.27	0.37	0.26	0.25	0.18	0.15	0.23
FI1	0.42	0.83	0.40	0.35	0.40	0.17	0.21	0.20	0.20	0.25
FI2	0.59	0.90	0.43	0.33	0.41	0.23	0.27	0.24	0.22	0.27
FI3	0.56	0.90	0.42	0.32	0.41	0.19	0.26	0.21	0.18	0.23
FI5	0.39	0.72	0.33	0.32	0.31	0.13	0.15	0.18	0.13	0.15
HE1	0.51	0.48	0.90	0.51	0.50	0.37	0.41	0.40	0.39	0.41
HE2	0.53	0.49	0.92	0.48	0.53	0.42	0.47	0.42	0.41	0.40
HE3	0.48	0.38	0.92	0.43	0.47	0.45	0.48	0.43	0.45	0.42
HE4	0.33	0.24	0.74	0.28	0.34	0.37	0.37	0.33	0.38	0.37
CO1	0.25	0.35	0.48	0.89	0.45	0.30	0.31	0.38	0.31	0.25
CO3	0.30	0.34	0.40	0.87	0.36	0.23	0.22	0.26	0.28	0.25
CU1	0.38	0.47	0.50	0.49	0.93	0.26	0.40	0.39	0.40	0.33
CU2	0.39	0.44	0.51	0.40	0.95	0.27	0.39	0.32	0.32	0.31
CU3	0.43	0.35	0.48	0.41	0.91	0.26	0.34	0.31	0.30	0.29
UT1	0.32	0.19	0.45	0.24	0.21	0.77	0.52	0.42	0.53	0.52
UT2	0.26	0.19	0.41	0.27	0.25	0.81	0.58	0.39	0.46	0.43
UT3	0.29	0.22	0.31	0.13	0.24	0.72	0.55	0.35	0.35	0.40
UT4	0.22	0.17	0.39	0.25	0.21	0.84	0.58	0.45	0.52	0.40
UT5	0.26	0.17	0.44	0.26	0.27	0.87	0.62	0.44	0.52	0.43
UT6	0.32	0.21	0.43	0.35	0.28	0.88	0.64	0.50	0.56	0.44
UT7	0.27	0.20	0.37	0.30	0.25	0.90	0.67	0.47	0.49	0.44
UT8	0.21	0.13	0.29	0.19	0.19	0.81	0.61	0.42	0.39	0.37
UT9	0.24	0.12	0.29	0.18	0.20	0.80	0.58	0.48	0.44	0.43
HED1	0.28	0.23	0.40	0.29	0.34	0.68	0.84	0.39	0.37	0.29
HED2	0.25	0.25	0.43	0.31	0.38	0.69	0.88	0.43	0.38	0.28
HED3	0.24	0.22	0.41	0.28	0.36	0.61	0.88	0.44	0.33	0.31
HED4	0.28	0.28	0.43	0.18	0.31	0.47	0.75	0.34	0.25	0.21
HED5	0.27	0.27	0.42	0.22	0.35	0.56	0.87	0.47	0.36	0.34
HED6	0.29	0.21	0.45	0.28	0.32	0.70	0.89	0.44	0.42	0.36
HED7	0.31	0.22	0.46	0.25	0.40	0.61	0.88	0.37	0.31	0.29
HED8	0.25	0.19	0.42	0.26	0.32	0.62	0.88	0.42	0.36	0.33
ED1	0.25	0.24	0.47	0.35	0.35	0.48	0.42	0.88	0.59	0.52
ED2	0.20	0.21	0.34	0.30	0.32	0.41	0.41	0.91	0.56	0.44
ED3	0.20	0.21	0.40	0.32	0.33	0.49	0.43	0.90	0.59	0.48
ED4	0.26	0.22	0.44	0.35	0.31	0.52	0.47	0.91	0.66	0.48
SAT1	0.22	0.19	0.46	0.32	0.35	0.56	0.39	0.57	0.91	0.68
SAT2	0.24	0.21	0.45	0.32	0.33	0.53	0.36	0.67	0.96	0.66
SAT3	0.21	0.21	0.38	0.30	0.34	0.54	0.39	0.63	0.93	0.62
CI1	0.23	0.22	0.41	0.25	0.25	0.46	0.27	0.46	0.68	0.89
CI2	0.32	0.31	0.44	0.25	0.40	0.49	0.38	0.50	0.57	0.85
CI3	0.16	0.19	0.35	0.25	0.24	0.42	0.29	0.45	0.59	0.89

The shaded numbers are the factor loadings of the measurement items on their corresponding constructs.

of 0.70. In addition, the first-order factors showed moderately high levels of correlation with each other, ranging from 0.31 to 0.59. The positive correlations between the first-order factors were accounted for by the underlying second-order factor – CA. The correlations between the first-order factors and the high path coefficients from CA to the first-order factors implied that these first-order factors were strongly influenced by CA and thus they were reflective dimensions of CA (Fornell, 1982; Bollen & Lennox, 1991; Edwards & Bagozzi, 2000). Overall, these results provided support for the reflective measurement model of CA as a second-order factor with its five dimensions being the first-order indicators.

Structural model

The path coefficients and explained variances for the structural model are shown in Figure 2. PLS model does not generate the model fit statistics, but uses the R^2 values (explained variance) in the dependent constructs

Table 3 Inter-construct correlation, square root of AVE, composite reliability, and Cronbach's alpha of first-order factors

	Composite reliability	*Cronbach's alpha*	*CA: TD*	*CA: FI*	*CA: HE*	*CA: CO*	*CA: CU*	*UT*	*HED*	*ED*	*SAT*	*CI*
CA: TD	0.93	0.91	0.85									
CA: FI	0.91	0.86	0.59	0.84								
CA: HE	0.93	0.89	0.54	0.46	0.87							
CA: CO	0.88	0.72	0.31	0.39	0.50	0.88						
CA: CU	0.95	0.92	0.43	0.46	0.53	0.47	0.93					
UT	0.95	0.94	0.32	0.22	0.46	0.30	0.28	0.82				
HED	0.96	0.95	0.32	0.27	0.50	0.31	0.41	0.72	0.86			
ED	0.95	0.92	0.25	0.25	0.46	0.37	0.36	0.53	0.48	0.90		
SAT	0.95	0.93	0.24	0.22	0.47	0.34	0.37	0.58	0.41	0.67	0.93	
CI	0.91	0.85	0.27	0.28	0.46	0.28	0.33	0.52	0.35	0.53	0.70	0.88

CA = Cognitive absorption; TD = Time dissociation; FI = Focused immersion; HE = Heightened enjoyment; CO = Control; CU = Curiosity; UT = Utilitarian performance; HED = Hedonic performance; ED = Expectation disconfirmation; SAT = Satisfaction; CI = Continuance intention.
The shaded numbers are the square root of the variance shared between the constructs and their indicators.

to assess the explanatory power of a structural model. Figure 2 shows that the construct of CA accounted for 18.2% of the variance in perceived utilitarian performance and 22.9% of the variance in perceived hedonic performance. CA explained 19.0% of the variance in expectation disconfirmation. 53.7% of the variance in satisfaction was accounted for by CA, perceived utilitarian performance, perceived hedonic performance, and expectation disconfirmation. Finally, satisfaction explained 49.0% of the variance in continuance intention.

As indicated by the path coefficients in Figure 2, the PLS results supported all the four hypotheses pertaining to the effects of CA. As expected, CA was found to positively influence perceived utilitarian performance, perceived hedonic performance, expectation disconfirmation, and satisfaction, hence providing support for Hypotheses 5–8. The results also provided support for the hypotheses derived from prior consumer satisfaction research, except the one regarding the effect of perceived hedonic performance. The results indicated both perceived utilitarian performance (H1) and expectation disconfirmation (H3) were significant positive predictors of satisfaction. The results revealed the significant positive effect of satisfaction on continuance intention (H4).

Contrary to our expectation, perceived hedonic performance was found to have a negative effect rather than a positive effect on satisfaction (H2). The result regarding the effect of perceived hedonic performance is surprising; as perceived hedonic performance was found to be positively correlated with satisfaction (see Table 3). Table 4 presents a summary of the hypotheses testing results.

Further examination of the PLS results revealed that perceived hedonic performance might serve as a negative suppressor variable in the model. A suppressor variable is 'a variable that increases the predictive validity of another variable (or set of variables) by its inclusion in a regression equation' (Conger, 1974). Negative suppression occurs when (1) the independent variables have a positive zero-order correlation with the dependent variable; (2) the independent variables correlate positively with each other; and (3) one of the independent variables (the negative suppressor) receives a negative regression weight after inclusion in the regression equation (Conger, 1974; Maassen & Bakker, 2001). The

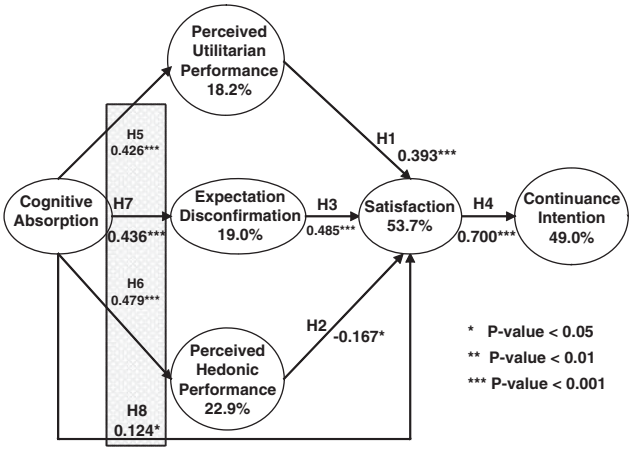

Figure 2 PLS structural model results.

Table 4 Summary of hypotheses tests

Relationships	*Support*
H1: Perceived utilitarian performance → Satisfaction	Yes
H2: Perceived hedonic performance → Satisfaction	No
H3: Expectation disconfirmation → Satisfaction	Yes
H4: Satisfaction → Continuance intention	Yes
H5: Cognitive absorption → Perceived utilitarian performance	Yes
H6: Cognitive absorption → Perceived hedonic performance	Yes
H7: Cognitive absorption → Expectation disconfirmation	Yes
H8: Cognitive absorption → Satisfaction	Yes

PLS results in Figure 2 indicate a negative path coefficient from perceived hedonic performance to satisfaction (the dependent variable). However, perceived hedonic performance had a significant positive zero-order correlation with satisfaction and was positively correlated with perceived utilitarian performance, CA, and expectation disconfirmation (other independent variables). As a follow up analysis to check for the suppressor effect, different regression models were performed with perceived hedonic performance and one or two of the other three independent variables as predictor variables. The path coefficient between perceived hedonic performance and satisfaction became negative only when perceived utilitarian performance was included in the model. In all the other alternative regression model specifications, the path coefficient for perceived hedonic performance was positive. These results indicated that perceived hedonic performance played a role of negative suppressor for perceived utilitarian performance in relation to satisfaction (Conger, 1974). Perceived hedonic performance and utilitarian performance were highly correlated with each other ($r = 0.72$). And perceived utilitarian performance was a better predictor of satisfaction than perceived hedonic performance due to its higher correlation with satisfaction. When the variance in satisfaction due to perceived utilitarian performance was accounted for, the remaining variance correlated with perceived hedonic performance revealed a negative relationship. This suggested that some respondents who reported high levels of satisfaction also reported low levels of perceived hedonic performance and high levels of perceived utilitarian performance. Further examination of the data revealed that 20 respondents (7% of the sample), who perceived relatively low hedonic performance (<4) and relatively high utilitarian performance of mobile Internet service (>4.5), reported relatively high levels of satisfaction (>4.5). After checking the demographic characteristics of these respondents (gender, age, education, etc.), we found that all of the 20 respondents were more than 30 years old. This suggests that older users (>30 years old) consider the perceived utilitarian performance of mobile Internet services a more important determinant of satisfaction than perceived hedonic performance. We deleted these 20 respondents from our sample and conducted PLS analysis again on the remaining data. The negative suppression effect of perceived hedonic performance disappeared in the resulting PLS model, which shows a positive relationship between perceived hedonic performance and satisfaction ($B = 0.143$, $P < 0.05$).

An additional supplementary analysis was conducted to determine if the effect of CA on continued IT usage intention is mediated by satisfaction. We tested the mediating effect of satisfaction in two separate models. In the first model, we tested the direct effect of CA on continuance intention without the presence of satisfaction variable. A positive relationship was found between CA and continuance intention, as indicated by the significant direct path from CA to continuance intention ($B = 0.444$, $P < 0.0001$) in the model.

In the second model, we tested the direct effects of CA and satisfaction on continuance intention. The results showed that even after the satisfaction variable was included in the model, the effect of CA on continuance intention still remained significant ($B = 0.165$, $P < 0.05$). While still significant, however, the absolute value of path coefficient from CA to continuance intention became considerably smaller than in the first model. These results led us to infer a partial rather than a full mediation effect of satisfaction between CA and continuance intention.

Discussion

This paper was motivated by an interest in understanding of factors leading to continued usage of contemporary IT. It investigated how the optimal user experience with an IT, conceptualized as the experience of CA, influences perceived utilitarian and hedonic performance, expectation disconfirmation, user satisfaction and continual use intention. The study integrated the theories and findings from prior satisfaction research (e.g., EDT) and the concept of CA on user experience of IT, and provided empirical support for incorporating CA as an antecedent in the IT continuance model.

First, the experience of CA was found to have significant positive effects on perceived utilitarian performance, perceived hedonic performance, expectation disconfirmation, and user satisfaction of mobile Internet service. The results indicate that the more the users feel the experience of CA with an IT, the more likely they will perceive high utilitarian and hedonic performance of the service, experience positive disconfirmation of expectation, be satisfied with the technology, and in turn intend to continue the technology usage. These findings point to the value of CA as an antecedent to IT satisfaction and continuance, for example, for the users of mobile Internet services.

Second, the results largely confirmed the hypotheses drawn from prior consumer satisfaction research to the continued usage of IT. Perceived utilitarian performance and expectation disconfirmation of IT were found to positively predict satisfaction with IT. The proposed effect of perceived hedonic performance on satisfaction, however, was not supported. Instead, perceived hedonic performance served as a negative suppressor of perceived utilitarian performance in relation to satisfaction.

Perceived hedonic performance had a positive zero-order correlation with satisfaction and was highly correlated with perceived utilitarian performance. While highly correlated, perceived hedonic performance and utilitarian performance are conceptually different. When both perceived hedonic performance and utilitarian performance were included as predictors of satisfaction in the regression model, perceived hedonic performance exhibited a negative relationship with satisfaction. This

negative suppressor effect of perceived hedonic performance suggests that for older people (>30 years old) the perceived utilitarian performance is more salient than perceived hedonic performance. In other words, highly perceived hedonic performance without highly perceived utilitarian performance may not be conducive to satisfaction in people more than 30 years old. Prior research on mobile service adoption shed some light on this finding. Prior research suggests that utilitarian value is probably the major driver of mobile service adoption. Consumers may not have a compelling motivation to adopt new mobile services unless those services offers new opportunities where mobility really matters and affects people's lives positively (Jarvenpaa *et al*., 2003). This suggests a situational involvement with mobile services, where the user's involvement with mobile services is evoked by a particular situation. Mallat *et al*. (2006) found that the relevance of a mobile service in a particular use situation, such as availability of other alternatives and time pressure in the service use situation, is a significant predictor of the intention to use the mobile service (Mallat *et al*., 2006). Situational involvement results in goal-oriented consumption behaviors (Hoffman & Novak, 1996), which focus on a task-completion goal associated with a specific situation. Therefore, perceived utilitarian performance of mobile Internet services might be a stronger predictor of satisfaction than perceived hedonic performance. This may be particularly true for older people (>30 years old), who may not fully appreciate the experiential features of mobile Internet services if the utilitarian features are not satisfactory.

The negative suppression effect of perceived hedonic performance concealed the real relationship between perceived hedonic performance and satisfaction. After the data causing the suppression effect were removed, the PLS analysis revealed a positive effect of perceived hedonic performance on satisfaction. Therefore, despite the negative suppression effect, we believe highly perceived hedonic performance increases rather than reduce satisfaction.

Finally, the results provided support for the validity, reliability and multidimensional nature of CA in the mobile Internet context. The CFA results suggested the adequate reliability and discriminant validity of the five dimensions of CA as distinct factors. The loadings of these dimensions on CA in the PLS model were all above 0.70 except the control dimension. Although the control dimension had a relatively low loading on CA (0.61) compared to the other four dimensions, however, it was still significant and greater than 0.60. And the composite reliability and Cronbach's alpha of CA are satisfactory, indicating CA as the second-order factor. The results therefore extend the prior research on CA by empirically validating the five theoretical dimensions of CA in the new context of mobile Internet services.

Several limitations of this study need to be noted when interpreting the results. One limitation is related to the sample for this study. Given that all the respondents are university students and the majority of them are female, the results of this study may not be applicable to other demographic groups. While university students are representative of younger users of mobile Internet services, their experience and perceptions of the technology however may be different from the non-student users who have higher income and tighter schedule. Future research is necessary to solve the generalizability issue by replicating the study to a non-student sample.

The sample also showed some bias toward female respondents, with 67.82% female and 32.18% male. It is likely that female users place more emphasis on the hedonic value and less emphasis on the utilitarian value of mobile Internet services than male respondents (Nysveen *et al*., 2005). To investigate whether gender has a moderating effect on the proposed model, we conducted PLS analysis on the female sample and male sample, respectively. The results indicate the PLS models are not different by gender. Since the model operates similarly for both female and male respondents, we believe the sample does not pose a serious threat to the validity of results of this study.

Restricting the data collection to the existing users of mobile Internet services excludes those who discontinued the usage and introduces another limitation for this study. However, since the focus of this paper is on the factors leading to continued IT usage, this limitation may not pose serious threat to the validity of our findings.

Finally, similar to what Agarwal and Karahanna (Agarwal & Karahanna, 2000) found, the loading of the control dimension on CA was somewhat lower than the 0.70 guideline. Future research is needed to further examine the psychometric properties of the CA construct, especially the control dimension.

Implications and conclusions

The contribution of the research is two folds, theoretical and practical. With regard to theoretical advancement, the major contribution of this research is to provide understanding of how IT user experience conceptualized as CA may influence user's satisfaction with and continual usage intention of IT. This research supports Agarwal and Karahanna's call for considering IT user experience in IT usage research (2000). The proposed research model expands the IT continuance model by taking a step back in the causal chain for user satisfaction and incorporating CA as an antecedent. It provides an explanation for users' evaluative responses to IT that are grounded in IT user experience. The findings of this study not only provide support for the posited effects of CA in the IT continuance model, but also suggest a direct relationship between CA and continued IT usage. These significant relationships demonstrate the value of CA in driving continued IT usage. While prior research has only focused on CA as an antecedent of initial technology adoption, this research enhances the existing technology usage literature by indicating the important role of CA for the formation of post-adoption satisfaction

and continuance intention with IT. Finally, this research suggests an alternative perspective in studying IT satisfaction and continuance usage. It highlights the changing nature of contemporary IT to be multifunctional, more engaging and consumer oriented. By applying the theories and findings from consumer behavior research, this research demonstrates the significance of consumer-oriented quality dimensions and expectation disconfirmation for explaining IT satisfaction and continuance usage.

As for practical contribution, this research will provide practitioners with insights on how to improve user satisfaction and continuance usage behavior with contemporary IT. Although this study only employed mobile Internet services as the target technology, however our research model captures the general characteristics of multifunctional contemporary IT and hence the findings of this study can enhance our understanding of the factors leading to continuance usage of contemporary IT in general, which provides both utilitarian and hedonic functions with applications in communication, information, entertainment, transaction, etc. (e.g., World Wide Web, game-based training technology, etc.). The focus on the experience of CA allows us to take a step closer to the physical design features of multifunctional contemporary IT. The results suggest the high relevance and great importance for an IT to be designed with the capability of inducing an experience of CA in users. The more users are absorbed or immersed in using the technology, the more they will perceive it to be of high utilitarian and hedonic performance and expectation exceeding, and the more they will feel satisfied with the technology and intend to continue its usage. This research also indicates that, as shown by the results regarding mobile Internet services, while users evaluate IT and form satisfaction judgment based on both its utilitarian and hedonic performance, special attention still needs to be paid to the technology's utilitarian performance (the utility in achieving a task or goal), due to its salient contribution to older users' satisfaction response and its pivotal role in determining the contribution of hedonic performance to satisfaction.

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Appendix

Measurement scales used in the survey

Cognitive absorption (the user's holistic experience with an IT when the user acts with total involvement)

Imagine that you're using the mobile Internet service. Please indicate the extent to which you disagree or agree with the following statements about your use experience with the service. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither disagree nor agree, 5 = somewhat agree, 6 = agree, 7 = strongly agree)

TD1. Time appears to go by very quickly when I am using the mobile Internet service.
TD2. Sometimes I lose track of time when I am using the mobile Internet service.
TD3. Time flies when I am using the mobile Internet service.
TD4. Most times when I get to use the mobile Internet service, I end up spending more time that I had planned.
TD5. I often spend more time using the mobile Internet service than I had intended.
FI1. While using the mobile Internet service I am able to block out most other distractions.
FI2. While using the mobile Internet service, I am absorbed in what I am doing.
FI3. While using the mobile Internet service, I am immersed in the task I am performing.
FI4. When using the mobile Internet service, I get distracted by other attentions very easily. (Reverse scale)
FI5. While using the mobile Internet service, my attention does not get diverted very easily.
HE1. I have fun interacting with the mobile Internet service.
HE2. Using the mobile Internet service provides me with a lot of enjoyment. (Reverse scale)
HE3. I enjoy using the mobile Internet service.
HE4. Using the mobile Internet service bores me. (Reverse scale)
CO1. When using the mobile Internet service I feel in control.

CO2. I feel that I have no control over my interaction with the mobile Internet service. (Reverse scale)
CO3. The mobile Internet service allows me to control my interaction with it.
CU1. Using the mobile Internet service excites my curiosity.
CU2. Interacting with the mobile Internet service makes me curious.
CU3. Using the mobile Internet service arouses my imagination.

Utilitarian performance (the performance of an IT in providing useful functionalities) and *Hedonic performance* (the performance of an IT in providing experiential and emotional values)

Please evaluate the usage of the mobile Internet service. Indicate the degree to which you evaluate the mobile service as follows. (1 = significantly, 2 = quite, 3 = slightly, 4 = neither, 5 = slightly, 6 = quite, 7 = significantly)

UT1. I evaluate the mobile Internet service as useless …… useful
UT2. I evaluate the mobile Internet service as impractical …… practical
UT3. I evaluate the mobile Internet service as unnecessary …… necessary
UT4. I evaluate the mobile Internet service as unfunctional …… functional
UT5. I evaluate the mobile Internet service as unhelpful …… helpful
UT6. I evaluate the mobile Internet service as inefficient …….. efficient
UT7. I evaluate the mobile Internet service as ineffective …… effective
UT8. I evaluate the mobile Internet service as harmful …… beneficial
UT9. I evaluate the mobile Internet service as unproductive ……. productive
HED1. I evaluate the mobile Internet service as dull ……. exciting
HED2. I evaluate the mobile Internet service as disgusting …… delightful
HED3. I evaluate the mobile Internet service as uninteresting …….. fascinating
HED4. I evaluate the mobile Internet service as serious …….. playful
HED5. I evaluate the mobile Internet service as unthrilling ……thrilling
HED6. I evaluate the mobile Internet service as unpleassant …… pleasant
HED7. I evaluate the mobile Internet service as unamusing ……..amusing
HED8. I evaluate the mobile Internet service as cheerless ……. cheerful

Expectation disconfirmation (the discrepancy or gap between prior expectations and actual performance of an IT)

Please rate how well the mobile Internet service meets your expectations along the following dimensions. (1 = much less than expected, 2 = less than expected, 3 = a little less than expected, 4 = pretty much as expected, 5 = a little greater than expected, 6 = greater than expected, 7 = much greater than expected)

ED1. I rate my experience with using the mobile Internet service as much less than expected …… much greater than expected
ED2. I rate the service level provided by the mobile Internet service as much less than expected …… much greater than expected
ED3. I rate the benefits provided by the mobile Internet service as much less than expected …… much greater than expected
ED4. I rate the overall performance provided by the mobile Internet service as much less than expected …… much greater than expected

Satisfaction (the fulfillment response resulting from the evaluation of an IT product)

Please indicate the extent to which you disagree or agree with the following statements about your satisfaction with the mobile Internet service. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither disagree nor agree, 5 = somewhat agree, 6 = agree, 7 = strongly agree)

SAT1. I think that I made the correct decision to use mobile Internet service.
SAT2. The experience that I have had with mobile Internet service has been satisfactory.
SAT3. In general, I am satisfied with mobile Internet service.

Continuance intention (the intention to continue using an IT)

Please indicate the extent to which you disagree or agree with the following statements about your intention to continue using the mobile Internet service. (1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither disagree nor agree, 5 = somewhat agree, 6 = agree, 7 = strongly agree)

CI1. I intend to continue using the mobile Internet service in the future.
CI2. I will always try to use the mobile Internet service in my daily life.
CI3. I will keep using the mobile Internet service as regularly as I do now.
CI4. If I could, I would like to discontinue my use of the mobile Internet service. (Reverse scale)