

A LONGITUDINAL MODEL OF POST-ADOPTION PHENOMENA AND ITS EMPIRICAL TEST IN THE CONTEXT OF SOCIAL GAMES

Research-in-Progress

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Abstract

It is widely accepted that initial adoption is critical to innovation success. A less recognized argument in the information System (IS) field is that post-adoption use of an innovation is equally important, if not more important than its initial acceptance. Drawing on the popular Unified Theory of Acceptance and Use Technology (UTAUT) model (Venkatesh et al. 2003) while adopting the Integrative Framework of Technology Use (IFTU) (Kim and Malhotra, 2005) paradigm, the present study proposes and tests a general modeling approach for one type of modern internet innovations – social games. To this end, we develop testable hypotheses which will be tested in order to support our claims. A research design based on the model is proposed, and theoretical contributions are provided.

Keywords: Social games, post-adoption, technology acceptance models

Introduction

The past decade has seen dramatic rise and fall of numerous internet innovations, such as Friendster, MySpace, Second Life, Digg, and Twitter, just to name a few. These short-lived innovations remind us that although initial adoption is an important indicator of innovation success, continued use is perhaps the key that determines the eventual victory (Bhattacharjee, 2001).

The Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al. 2003) has been widely discussed and empirically tested in the Information Systems (IS) field in recent years (Birch and Irvine 2009; Curtis et al. 2010; B. Gupta, Dasgupta, and A. Gupta 2008; Marchewka, Liu, and Kostiwa 2007). It is one of the most prominent models investigating the initial acceptance and use of a technology. Although UTAUT provides a unified lens through which our understanding of the acceptance behavior of a generic type of technology may be enhanced, it presents some difficulties in explaining and predicting the success of social games, which are gaming applications integrated in the social networking platforms (Hou, 2011). One such difficulty lies in the very fact that UTAUT views the acceptance behavior at a one-time basis—it does not explicitly address how an individual's judgment and intentions evolve over time. Another important issue is that, the scales used in UTAUT are in combination of a number of prior scales used mostly in workplaces and/or for utilitarian services. This makes UTAUT less applicable to the context of social game play, which is an individual-level activity characterized by hedonic and social motives (Hou 2011). This means that, while much effort has been made to understand the initial acceptance of a certain technology, we still have limited knowledge of the dynamics of the post-adoption behaviors, and that we have even less understanding of the repetitive use behaviors and the emotion status of individuals who use different types of modern technology innovations, such as hedonic applications (e.g. online gaming) and socially oriented services (e.g. virtual communities).

This study examines the post-adoption phenomena in the context of social games. We aim to develop a longitudinal model that extends the UTAUT paradigm (Venkatesh et al. 2003) which is used to explain the post-adoption phenomena in the context of social game play. Specifically, a two-wave panel model is proposed to examine how players adjust their evaluation and usage of social games over time. We argue that investigating individuals' post-adoption behaviors of social games will help to provide a theoretical contribution to existing theories of post-adoption behavior of communication technologies.

The following section reviews the well-established models pertaining to the acceptance and use behaviors of technologies in general and social games in particular. Next, we discuss and propose a longitudinal UTAUT model by assessing and building on prior theoretical frameworks, while also accounting for the context of digital game play. Subsequently, the key constructs are defined and their relationships are hypothesized. The research methodology is then proposed, followed by a conclusion on expected contribution for research.

Models of Technology Acceptance

A number of theoretical models have been proposed to facilitate the understanding of the factors that impact the decision to adopt and use specific technologies (Davis et al. 1989; Moore and Benbasat 1991; Venkatesh and Davis 2000). Among these theories are the Technology Acceptance Model (TAM) (F. D. Davis, R. P. Bagozzi, et al. 1989), the Theory of Reasoned Action (TRA), the Theory of Planned Behavior (TPB) (Ajzen 1991; Taylor and Todd 1995), and the Innovation Diffusion Theory (IDT) (Rogers 2003). All these conceptual models build upon a set of user internal beliefs and attitudes that influence the intention to use information and communication technologies (ICTs) and their actual usage.

Based on TAM and seven other prominent models of ICTs' acceptance, Venkatesh et al. (2003) formulate the Unified Theory of Acceptance and Use of Technology (UTAUT) and empirically test it using data from a financial services firm and an electronics retailer.¹ Their model explains about 70 percent of the variance

¹ The eight prominent models of technology acceptance are: TRA, TPB, TAM, IDT as mentioned earlier, and the decomposed theory of planned behavior (DTPB) (Taylor and Todd 1995), pertaining to the Psychology discipline,

of the usage intention, a considerable improvement compared with previous models which only explain about 40 percent. According to UTAUT, there are three direct determinants of the usage intention, namely performance expectancy (PE), effort expectancy (EE), and social influence (SI), and two direct determinants of usage behavior, namely intention and facilitating conditions (FC). Specifically, PE is defined as a prospective user's subjective probability that using a specific ICT will enhance his or her job performance. It incorporates such constructs as the perceived usefulness (from the TAM), extrinsic motivation (from MM), job-fit (from MPCU), relative advantage (from IDT), and outcome expectation (from SCT). EE is defined as the degree to which he or she expects an ICT to be free of physical or mental effort; it captures such constructs as perceived ease of use (from the TAM), complexity (from MPCU), and ease of use (from IDT). Moreover, SI is defined as his or her perception that those important others believe he or she should use an ICT; it represents such constructs as the subjective norm (from TRA, TAM, TPB, and DTPB), social factors (from MPCU), and image (from IDT). FC is defined as the extent of the belief that an organizational and technical infrastructure exists to support its use; it is used to capture such constructs as perceived behavioral control (from TPB and DTPB), facilitating conditions (from MPCU), and compatibility (from IDT). Furthermore, UTAUT includes four moderators—gender, age, experience, and voluntariness to use an ICT—to explain how differences in individuals affect technology use (for a graphic representation, see Venkatesh et al. 2003).

Since the introduction of UTAUT, many studies have found it useful in explaining ICTs' acceptance under organizational settings (Birch and Irvine 2009; Curtis et al. 2010; B. Gupta et al. 2008; Marchewka et al. 2007) as well as in the context of personal ICT use (Carlsson et al. 2006; El-Gayar and Moran 2007; Wang and Yang 2005). Although UTAUT provides great promise to enhance our understanding of technology acceptance behavior, it presents some difficulties in explaining social game play. First and foremost, since the UTAUT is an integration of eight different theoretical models, it misses the unique theoretical strengths of each of the models which are able to contribute more relevant explanations of specific ICT use and research context (Park 2010). Second, the scales used in UTAUT are in combination of a number of prior scales, and therefore, the suitability of these scales needs to be tested with great caution. As such, the core constructs in the original UTAUT model will be modified to fit the particular context of social games, as discussed later.

Post-Adoption User Behaviors

While initial adoption is undeniably a crucial step toward the innovation success, researchers have recognized that adoptions alone do not necessarily lead to sustained usage; in other words, user behaviors after the initial adoption also matter (Bhattacharjee 2001; Thompson et al. 1991). People do not perceive a piece of information in its pure form as it is presented, instead they need to process sequentially presented information, and to integrate the different pieces of information for decision making. Put another way, while a person is updating his/her beliefs or judgments toward an ICT, he or she is experiencing an “anchoring-and-adjustment” process (Tversky and Kahneman 1974). UTAUT, contradictorily, assumes that earlier evaluation of an ICT has zero impact on later evaluation. Although UTAUT, as well as other acceptance models such as TAM, TRA, and TPB, has been used as a theoretical background to explain post-adoption behaviors, there has been criticism (e.g., Limayem et al. 2003) on this approach in how well it captures the dynamics of the post-adoption behavior of technology use. There has been a growing body of research that specifically addresses such post-adoption behaviors. Scholars have attempted to improve the explanation of continued use by examining such factors as the actual usage (Parthasarathy and Bhattacharjee 1998; Speier and Venkatesh 2002), satisfaction (Bhattacharjee 2001; Limayem et al. 2003), negative emotion (Chea and Luo 2008), and habit (Gefen 2004; Limayem et al. 2003).

Although these post-adoption researches have proposed numerous mechanisms that drive such post-adoption phenomena (Bajaj and Nidumolu 1998; Bhattacharjee 2001; Venkatesh et al. 2003), few have attempted to integrate the seemingly different perspectives adopted by these mechanisms. One exception

the social cognitive theory (SCT) (Bandura 2001), the model of PC utilization (MPCU) (Thompson et al. 1991; Triandis 1977), and the motivational model (MM).

to these fragmented approaches is a longitudinal study by Kim and Malhotra (2005). Using a TAM-based two-wave panel model, Kim and Malhotra (2005) incorporate four mechanisms—reason-oriented action (i.e., the evaluation-behavior relationship), sequential updating of judgments (i.e., the evaluation-evaluation relationship), feedback (i.e., the behavior-evaluation relationship), and habit (i.e., the behavior-behavior relationship)—into an integrative framework of technology use (IFTU). In their study, the TAM, which represents the reason-oriented action framework, is complemented by the other three mechanisms to attempt a comprehensive theory of how individuals adjust their evaluations and behavior over time. Kim and Malhotra (2005) validated the IFTU using data from 189 individual users of an academic portal, and demonstrated its superiority of explanatory power over any of the partial models. As the extension of IFTU research, Kim (2006) employed a 3-wave panel model in the context of organizational software use using TPB as the theoretical backbone, suggesting that IFTU can serve as a generic and powerful model to investigate the long-term effects that the four mechanisms may have on the post-adoption behaviors. Kim (2009) further draws on the process model of memory to provide explanation of the four mechanisms underlying technology use. Thus, as an attempt to develop a comprehensive theory of how individuals adjust their evaluations and behaviors over time, Kim and his colleague demonstrate that the reason-oriented action component which represents the traditional frameworks such as TAM and UTAUT can be complemented by three other mechanisms noted earlier.

The proposed Models and Research Hypotheses

This study follows the IFTU paradigm to identify four mechanisms in regulating post-adoption phenomena: reason-oriented action, sequential updating, feedback, and habit. As discussed above, UTAUT presumes that reasoned influences impact ICT adoption through users' conscious decision-making process. The present study considers UTAUT, which represents the reason-oriented action mechanism, as theoretical backdrop or the development of a longitudinal model of continued use. In this subsection we aim to apply the theoretical framework to the focal context. Figure 1 presents the proposed research model, referred to as Longitudinal UTAUT (LUTAUT), for examining the post-adoption phenomena in the context of social game play. The following sub-subsections discuss the casual links underlying each of these mechanisms.

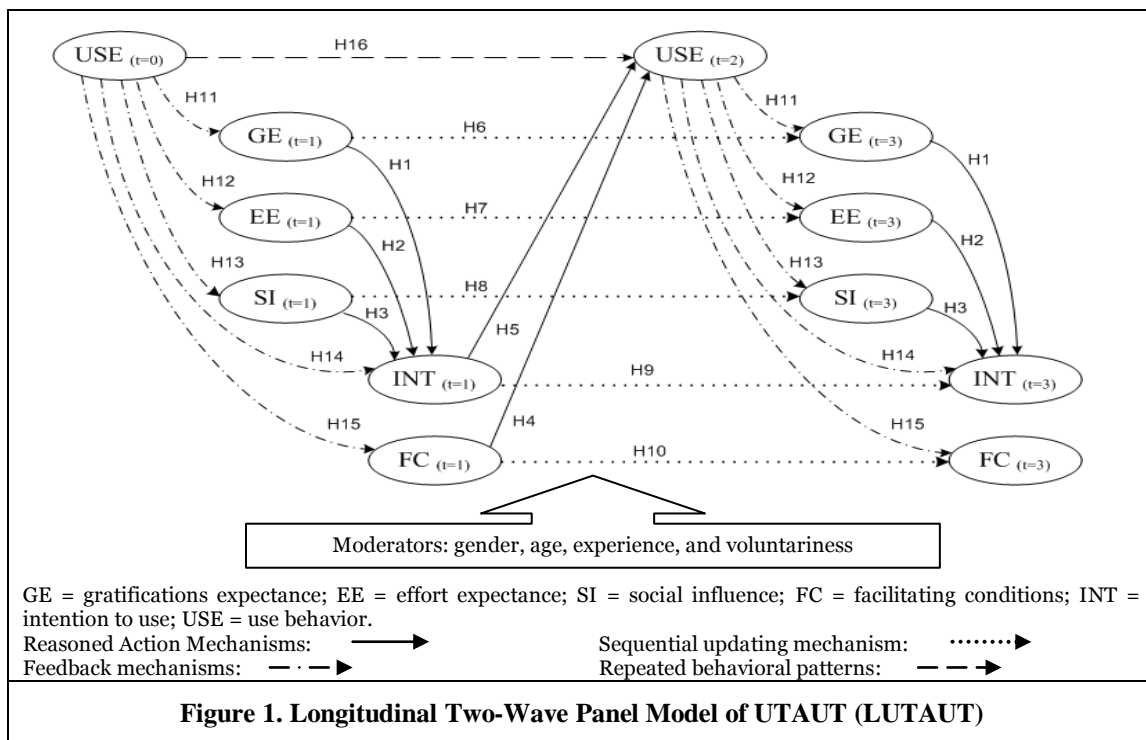


Figure 1. Longitudinal Two-Wave Panel Model of UTAUT (LUTAUT)

Component 1: Reasoned Action Mechanisms

Reasoned-action mechanisms predict that the intention to take an action usually follows careful reasoning and rationalization and takes into consideration a variety of factors. As we noted earlier, UTAUT theorizes that four constructs that significantly drive the intention or actual behavior of CITS' use are PE, EE, SI, and FC. We argue that the causal links between PE, EE, SI, FC, INT and USE generally hold in a longitudinal context. Therefore, the first model of this study equals two original UTAUT models. All the UTAUT constructs are included in this component, which is represented in Figure 1 by solid-line arrows.

H1: Gratification expectancy (GE) is associated with an influence on behavioral intention.

H2: Effort expectancy is associated with behavioral intention.

H3: Social influence is associated with behavioral intention.

H4: Facilitating conditions is associated with usage.

H5: Behavioral intention is positively associated with usage.

Note that the constructs are modified to fit the particular context of social game play. In particular, the original UTAUT constructs of *performance expectancy* (PE) is replaced by *gratification expectancy* (GE) based on Hou's (2011) study. PE was measured by the perceptions of using technology system in terms of benefits for work performance in the organizational settings. This instrument does not fit the context of social games well because social game play is an individual level activity primarily for social interaction and personal leisure purposes (Hou, 2011). For hedonic ICT adoption, perceived enjoyment/playfulness is more important than performance expectancy (Van der Heijden, 2004). Thus, our model uses GE instead of PE. GE reflects current beliefs and perceptions about the outcomes of prospective ICT use. The instrument for GE of social games includes 11 motivational determinants of end-users intentions to play adopted from Hou's (2011) study on the uses and gratifications of social games.

Table 1. Attitudinal Measurements

Constructs	Instruments
Intention to Use (INT)	3-item scale modified based on Venkatesh et al. (2003)
Gratification Expectancy (GE, modified from Performance Expectancy)	11-item scale modified based on Hou (2011)
Effort Expectancy (EE)	4-item scale modified based on Venkatesh et al. (2003)
Social Influence (SI)	8-item scale modified based on Venkatesh et al. (2003), Hou et al. (2009), and Srinivasan et al. (2002)
Facilitating Conditions (FC)	2-item scales modified based on Venkatesh et al. (2003)

Component 2: Sequential Updating Mechanisms

According to belief updating theory, people are actively engaged in the process of changing beliefs to take into account a new piece of information about the situation at present. New information adjusts previous information to form a new "anchor" of attitude (Hogarth and Einhorn 1992; Shen and Hue 2007). Belief updating has been researched extensively in psychology (Anderson 1981; Benassi 1982; Curley et al. 1988; Furnham 1986; Hogarth and Einhorn 1992) and has been applied in consumer behavior research for studying intertemporal changes in customer attitudes, satisfaction, and intention to purchase (Bolton and Drew 1991; Mittal et al. 1999). IFTU (Kim and Malhotra 2005) further suggests that user evaluations of an ICT will undergo such sequential updating mechanisms. Thus, belief updating theory underpins the sequential updating mechanisms of the post-adoption phenomena.

The sequential updating mechanism refers to the process in which prior evaluations serve as an input to the formation of subsequent evaluations. When applied into the context of continued use, the theory of belief updating suggests that current GE, EE, SI, FC, and INT will serve as anchors for future evaluations,

which will be updated with new adjustments. The LUTAUT in Figure 1 shows the sequential updating mechanisms with dotted-line arrows.

H6: Gratification expectancy at $t = 1$ has a positive effect on gratification expectancy at $t = 3$.

H7: Effort expectancy at $t = 1$ has a positive effect on effort expectancy at $t = 3$.

H8: Social influence at $t = 1$ has a positive effect on social influence at $t = 3$.

H9: Behavioral intention at $t = 1$ has a positive effect on behavior intention at $t = 3$.

H10: Facilitating conditions at $t = 1$ has a positive effect on facilitating conditions at $t = 3$.

Component 3: Feedback Mechanisms

Self-perception theory (Bem 1972) asserts that people infer their own attitudes, opinion, and other internal states by observing their behavior and the circumstances in which that behavior occurs. This is particularly true “when internal cues are weak, ambiguous, or uninterpretable” people reason their own overt behaviors rationally in the same way they attempt to explain others’ behaviors as an external observer (pp. 2). There are numerous studies conducted by psychologists that support the self-perception theory, demonstrating that attitudes and emotions do follow behaviors. In experimental studies, it is found that corresponding emotions (including liking, anger, happiness, etc) are reported following subjects’ overt behaviors, which had been manipulated by the experimenters (Strack et al. 1988). In real life situations, Brunelle (2001) find that teenagers who participated in repeated and sustained volunteering community services demonstrated that their attitudes had shifted to be more caring and considerate towards others. In the ICT area, (Bajaj and Nidumolu 1998) test the effect of past use on perceived ease of use and illustrate a positive feedback loop from past behavior to perceived ease of use.

This study incorporates the theory of self-perception into the research model to embody the feedback mechanism of post-adoption phenomena. The feedback mechanisms refer to a heuristic process, which will lead to the formation of a feedback loop that connects prior behaviors with current evaluations. When applied into the context of continued use, the theory of self-perception suggests that current USE will have a positive effect on future GE, EE, SI, FC, and INT beyond the intertemporal effects of user evaluations described in our second component. Figure 1 shows the feedback mechanisms in dotted/dashed-line arrows—that is, the path from USE to UTAUT determinants.

H11: USE at $t = 0$ has a positive effect on gratification expectancy at $t = 1$.

H12: USE at $t = 0$ has a positive effect on effort expectancy at $t = 1$.

H13: USE at $t = 0$ has a positive effect on social influence at $t = 1$.

H14: USE at $t = 0$ has a positive effect on behavior intention at $t = 1$.

H15: USE at $t = 0$ has a positive effect on facilitating conditions at $t = 1$.

Component 4: Habit Mechanisms

Human beings are often considered as creatures of habit. Many daily activities such as reading the newspaper at breakfast, checking email upon arrival at work, and faithfully tuning on TV after dinner are highly repetitive; and with time and practice they become routines that people can perform without much mental efforts. The neurological role of habit is to protect individuals from being overwhelmed when processing information about routine activities. Certain cognitive and behavioral tasks are assigned to nonconscious, automatic processes so that attention may be more efficiently allocated to other stimuli (Poldrack et al. 2005). In particular, neurologists have pointed out that the transition from goal-directed learning to habit is controlled in the medial temporal lobe and the basal ganglia, a group of nuclei in the cerebrum. When a task becomes automatic, there is decreased activation in cortical areas and brain activity shifts to regions connected to the basal ganglia. Meanwhile, the basal ganglia responsible for habit formation still have connections to cortical area so that habitual responses may be modulated by higher brain centers and thus are subject to intention and control when needed (Yin and Knowlton 2006).

The concept of habit was introduced in the early days of psychology and has evolved over the decades. In ICT use research, a number of studies have incorporated habit as a factor that impact technology adoption and post-adoption usage (Gefen 2004; Kim and Malhotra 2005; Limayem et al. 2003; Thompson et al. 1991). During the initial use of an ICT, individuals are most likely to get engaged in active cognitive processing in determining post-adoptive intention or behavior; however, with repetitive practices, reflective cognitive processing dissipates over time, leading to non-reflective, routinized behavior (Bargh 1989, 1994; Ouellette and Wood 1998). With stable context, past behavior has a direct effect on future behavior over and above the effect of intention (Ouellette and Wood 1998).

IFTU (Kim and Malhotra 2005) suggests that along with conscious intention, past use may be able to explain the variance in future use. Following this suggestion, this study incorporates the habit mechanism as a complement to reasoned influences in behavior determination to account for the impact of automatic cognitive process. The conscious (reasoned-action, sequential updating, and feedback) and automatic (habit) processes do not necessarily coexist to work on one individual simultaneously; rather they are combined to comprehend variance among different users. The following section details the proposed research model and hypotheses.

Habit mechanisms indicate that with repeated performance, a situational cue automatically activates the behavior without any conscious effort. Consistent with this view, the fourth component of our model hypothesizes that current USE will influence future USE, represented by a dashed-line arrow – that is, the path from USE at $t = i$ to USE at $t = i+1$.

H16: USE at $t = 0$ has a positive effect on USE at $t = 2$.

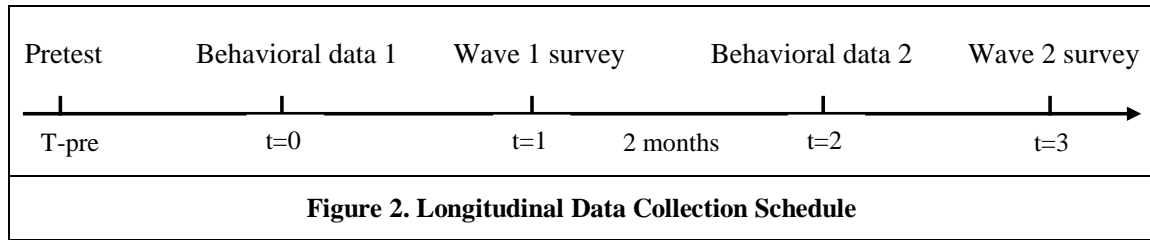
Moderators

The original moderators in the UTAUT (gender, age, experience, and voluntarism) are also included in the LUTAUT model to examine the impacts of individual differences. Kim and Malhotra (2005) imply that different types of users may adopt different post-adoption mechanisms proposed in IFTU. For example, IFTU (Kim and Malhotra 2005) predicts that whereas the sequential updating mechanisms prevail among rookie users, the feedback mechanisms are likely to occur mainly among experienced users. Therefore, the conscious (reasoned-action, sequential updating, and feedback) and automatic (habit) processes do not necessarily coexist to work on one individual simultaneously; rather they are combined to comprehend variance among different user. Furthermore, previous studies have also show gender and age differences in playing computer games (Hou 2011; Williams et al. 2008). Thus, our LUTAUT model will also examine the influences of four moderators – individual's gender, age, experience, and voluntariness – on continued ICT use.

Research Method

This study will focus on the social game *Happy Farm* because of its popularity, its representativeness of mainstream social game applications, and the likely opportunity for cooperation with its developer (hereafter, our partner) that prefers to remain anonymous. Launched in 2009, *Happy Farm* is an online virtual agriculture game running on a China-based social networking site—Kaixin001 (hereafter, Kaixin). Our partner agrees to provide access to the players' database, from which a random sample rather than a convenience sample can be generated. They will also anonymize the identification of the players, leaving us with only meaningless identifiers.

To facilitate the empirical examination of our model, we aim to combine measures of self-reported attitudes and objective game play behaviors into a novel dataset. Therefore, data for this study will be collected in several phases using different approaches. In short, a longitudinal field study will be conducted in the following steps: (1) a pretest questionnaire containing items measuring the relevant constructs administered at T-pre; (2) behavioral data collected from log information at T-0; (3) Wave 1 survey conducted at T-1; (4) two months after Wave 1 survey, behavioral data collected at T-2; and finally, (5) Wave 2 survey conducted at T3. Figure 2 presents the longitudinal data collection schedule.



On the one hand, for perceptual constructs in our model, validated measurement instruments from prior research will be used. Because of the page limit, Table 1 provides an overview of these constructs. On the other hand, the cumulatively average amount of play time per week will be used to represent the measure of social game play. The proposed model will then be estimated using path analysis implemented in LISREL. Commonly used model fit criteria will be adopted to evaluate the model.

Conclusion

To conclude, the present study aims to develop a longitudinal model that extends the UTAUT paradigm to explain post-adoption phenomena in the context of social game play. This study is expected to provide two main contributions to research. First, the UTAUT model has been primarily used to study technology adoption in formal organizations and/or for utilitarian services. We aim to extend UTAUT to the particular context of social games, which are ICT for hedonic and social purposes. Arguably, the proposed model is generally suitable for other entertainment-driven internet innovations, such as Instant Messaging systems, social networking sites, online gaming and etc. Second, this study follows the IFTU paradigm to understand how players adjust their evaluation and usage of social games over time. We believe this investigation will help provide a theoretical contribution to existing theories about user post-adoption behavior of ICTs.

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