Pers Ubiquit Comput (2011) 15:187–196
DOI 10.1007/s00779-010-0300-1

ORIGINAL ARTICLE

Effect of use contexts on the continuous use of mobile services: the case of mobile games

Ting-Peng Liang · Yi-Hsuan Yeh

Received: 18 November 2009 / Accepted: 2 March 2010 / Published online: 24 April 2010

Abstract As mobile services become more popular and people can use them virtually anywhere, research on the effect of use contexts is gaining more attention. This research presents results from a study of continuous use of mobile services in different use contexts as defined by task and consumption place. Using mobile games as an example, the authors proposed a research model that augments current technology adoption theories to fit the hedonic nature of mobile games. The results from conducting an online survey indicate that contextual factors have significant moderating effect on the intention to play mobile games. The diverse lifestyles of users also have different attitudes and concerns regarding using mobile services. The findings suggest that service providers need to take into account the impact of use contexts and the needs of specific users when they design mobile services.

Keywords Mobile services · Mobile games · Use contexts · Technology acceptance model · Theory of reasoned action

1 Introduction

With the rapid growth of mobile technology, mobile services have played an important role in our daily life. Research on the use and impact of mobile services has increased substantially (e.g., [6, 14, 17, 21, 23, 28, 30, 31]). Research in mobile commerce has evolved over several stages. At the beginning, research mainly focused on the categorization, application opportunities of m-commerce [43, 49], future potential [4], and technological development [32, 34, 45]. Subsequent research was concerned with the usage of mobile service applications including organizational factors that affect the adoption [2, 12, 52], performance after adopting mobile technology in organizations [14, 23, 35, 39], user preferences [6, 19, 25, 42, 47], and user satisfaction [7]. Recent studies have focused on the effect of context awareness [20, 27, 44] and contextual factors [3, 24, 29, 30, 50] on the usage of mobile services.

In fact, research on use contexts has been around for sometime in consumer behavior research. For example, Jaeger and Rose [18] argue that consumer decisions are frequently affected by situational factors, such as features of certain occasions, time restrictions, or task characteristics. Mallat et al. [30, 31] also suggest that mobility and contextual elements play a very significant role in the adoption of mobile services. As mobile computing is intended to provide services everywhere, it is reasonable to assume that its value may change in different contexts, and so is the intention for a user to adopt mobile services. With the above rationale, this study focuses on two questions: First, what factors affect a user's decision to use mobile services; and second, do contextual effects have a moderating effect on a user's intention to continuance use of mobile services?

In this paper, we aim to investigate situational factors that may affect the use of mobile services and take mobile games as an example. In order to provide a solid theoretical basis for examining the use of mobile games, this paper proposes a research model that integrates the technology acceptance model (TAM) and theory of reasoned action

T.-P. Liang · Y.-H. Yeh (✉)
Department of Information Management,
National Sun Yat-sen University, Kaohsiung, Taiwan
e-mail: celeste.epaper@m2k.com.tw

T.-P. Liang
e-mail: tpliang@mail.nsysu.edu.tw

(TRA), which are augmented with the concepts of mobile use context (task and consumption place). TAM and TRA have been used in many studies to predict and understand user intention to adopt new information systems. Hence, they are also appropriate for analyzing the continuance intention to use mobile games. The purposes of this paper are specified as follows:

1. To investigate whether contextual factors significantly impact a user's intention to use mobile games.
2. To clarify which factors are more influential in affecting a user's intention to use mobile games?
3. To evaluate whether the augmented technology adoption model can provide a better predictive power for the intention to use mobile games.

This paper proceeds as follows. Section 2 reviews related literature. Section 3 describes our research framework that is based on an extended TAM model that is augmented with contextual factors. Section 4 outlines research method and instruments. Section 5 provides data analysis and results. Finally, Sect. 6 summarizes our findings and discusses potential implications.

2 Background and literature review

2.1 Mobile services and mobile games

The improvement of mobile devices involved a great potential for value-added services, from the basic services like voice communication and text message, to the multimedia services like MMS, and mobile network services such as mobile payment, mp3, game, video download, and mobile TV. The high market potential of mobile services has led many organizations to spend a huge amount of money on these technologies.

Applications of mobile technology in business have been widely reported in mobile commerce research. For example, Okazaki [37] conducted an empirical survey of the perceptions of multinational corporations (MNCs) operating in Europe regarding SMS-based mobile advertising adoption. The results showed that branding strategy, facilitating conditions, and security and costs are the strongest determinants. The cultural difference (Japanese, American, and European firms) in terms of users' perceptions of adopting mobile advertising is statistically significant. Wang and Liao [51] proposed an instrument for researchers to develop and test m-commerce systems, and Mallat [29] presented a qualitative study on consumer adoption of mobile payment technology. The findings suggest that the relative advantage of mobile payments is different from that specified in adoption theories. Mallat et al. [30] further investigated the adoption of mobile ticketing services in public transportation. Liang et al. [23] proposed the fit-viability model to interpret successful adoption of mobile technologies in organizations. Ngai et al. [35] argued that RFID can benefit an organization, with particular reference to the operators of a container depot.

In addition to organizational applications, a mobile service that has brought in much revenue in entertainment is mobile games. A mobile game is broadly defined as a video game played on mobile devices, including mobile phones, smart phones, PDA's, or handheld computers. These entertainment-oriented mobile applications allow people to set up and play a game on their mobile devices wherever they go. They may be embedded in mobile devices when they were purchased or downloaded by the user from service providers. They can be an electronic version of a traditional game or a new game designed specifically for mobile devices, and can be single-player or multiplayer games.

Many scholars have studied the application of mobile games. For example, Baber and Westmancott [2] considered mobile game playing from the perspective of social network analysis. The findings demonstrated that mobile gaming is not simply a matter of playing games on mobile devices, but that the essential ability to support mobility changes the nature of play and alters the social aspects of gaming. Schwabe and Göth [41] described the design of the mobile game prototype and explored the opportunities to support learning through an orientation game in a university setting. Ha et al. [15] used an extension of TAM to predict potential users' adoption of Mobile Broadband Wireless Access technology-based (MBWA) games. The results revealed that the effect of perceived enjoyment was very important but that usefulness did not influence an individual's attitude, and the age can be a key moderator of game acceptance.

Although these prior studies have revealed insights into the adoption of mobile games, none of them has investigated the effect of contextual factors (such as the consumption place) that are unique to mobile applications. In regard to the high sensitivity to time and location in mobile commerce, the context in which an application is used is a potentially important factor that is worth further investigation.

2.2 Mobile use context

The mobile use context can be simply described as "people use their mobile device in diverse environments". Researchers give mobile use context different definitions such as Barnard et al. [3] think that context is a set of conditions or user states that influence the ways in which a human interacts with a mobile computing; Dey et al. [11]

define context as any information that characterizes a situation related to the interaction between humans, applications, and the surrounding environment. Similarly, in consumer behavior research, a context (as a situation) is a point in time and space in which a particular action is taken. Situational factors can affect a consumer's decision making at a particular moment and place [38]. A clearer and more specific category of contextual factors is provided. Hansen [16] pointed out three situational characteristics in a decision-making process: consumption situation, purchase situation, and communication situation. Belk [5] also defined five situational variables in marketing: physical surroundings, social surroundings, temporal perspective, task definition, and antecedent states.

In general, context is viewed as a critical moderating factor in consumer behavior research. Previous researches provide empirical findings, for example Topi et al. [46] found that time availability does not have any effect on task performance while task complexity has a strong influence on performance at all time availability levels. Nordqvist et al. [36] explored the proposition that time pressure was negatively related to both estimated goal fulfillment and job satisfaction. Schmitt and Shultz [40] studied the influence of situational variables (such as the purchasing situation and the purchasing target) on consumer preferences toward the image product of men's fragrances.

In mobile computing research, three characteristics have been used to describe a mobile setting: spatiality, temporality, and contextuality. Contextuality is concerned with the dynamic environments in which mobile devices are used and has received special attention. Lee and Benbasat [22] suggested that the design of m-commerce customer interfaces should take into account the particular mobile setting. Mallat [29] pointed out that the adoption of mobile payments is dynamic, depending on certain situational factors such as a lack of other payment methods or urgency. Mallat et al. [30] found that mobility and contextual factors, including budget constraints, availability of other alternatives, and time pressure in the service usage situation have a strong effect on the adoption decision. In a later study by Mallat et al. [31], they found that situational factors have effect on the intention to adopt mobile ticketing. Other studies that examined the effect of contextual factors on mobile value-added services indicate that time pressure and location have a moderating effect on attitude toward mobile value-added services and the intention to use them [24].

2.3 Theory of reasoned action and technology acceptance model

A few theories have been developed to interpret the intention to adopt a technology. TRA and TAM are two popular ones. TRA which was derived from social psychology postulates that a person's intention to perform a behavior is the immediate determinant of that behavior [1, 13]. Three major constructs are behavioral intention, attitude, and subjective norm. Behavioral intention refers to a person's decision to engage or not to engage in using information systems. Attitude is defined as a person's attitude toward using information systems. Subjective norm refers to the social pressure exerted on an individual to use or not use information systems. This theory has been applied to study many information technology applications and is certainly appropriate for investigating the intention to use mobile games. However, a shortcoming of TRA is that it does not have a clearly definition of what precedents may affect attitude.

Another popular theory which was developed to predict end-user acceptance of information technologies is the technology acceptance model [9, 10]. TAM originated from TRA and has two main tenets, perceived usefulness (PU) and perceived ease of use (EOU). Perceived usefulness refers to the degree to which a person believes that using a particular system would enhance his/her job performance. Perceived EOU refers to the degree to which a person believes that using a particular system would require acceptable effort. TAM postulates that these two tenets determine the attitude toward using information systems; attitude and perceived usefulness determine the intention to use the system, and perceived EOU enhance the perceived usefulness of technology and further affect the attitude toward using the system. A body of evidences has demonstrated a good explanatory power of TAM in predicting usage of various information systems. The effect of PU on the usage intention is particularly significant in most studies. Nevertheless, TAM ignores the influences of reference groups and other contextual factors and assumes that user attitude is the sole factor that determines user intention. Therefore, it seems that the integration of these two models can provide a better predictive power.

The integration of TAM with other models has been found better in previous information systems research. For example, Lopez-Nicolas et al. [26] combined TAM and diffusion of innovations (DOI) models to explore the usage behavior of mobile services. The findings pointed to the fact that social influences and personal innovation characteristics were important factors affecting the adoption of mobile services. Mallat et al. [30] also used TAM and DOI as the theoretical basis to investigate the adoption of mobile ticketing service in public transportation. The findings suggested that contextual and mobile service-specific features are important determinants of mobile service adoption and should be integrated into the traditional adoption models. Yi et al. [53] integrated TAM,

DOI, and the theory of planned behavior (TPB), to analyze the adoption of PDAs in medical treatment. They found that perceived usefulness, subjective norm (SN), and perceived behavioral control have great influences on usage intention, but perceived EOU does not. Personal innovation characteristics also have an effect on perceived behavioral control, perceived EOU, and SN.

2.4 Perceived playfulness of games

Although the integration of TAM and TRA is reasonable, an issue emerges when it is applied to hedonic applications such as mobile games, because the perceived usefulness may not be the same as other business applications. In fact, previous studies have demonstrated that perceived usefulness is an important factor for work-related tasks and perceived playfulness (or enjoyment) is an important factor for entertainment-oriented task [33]. The hedonic nature of an information system is an essential boundary condition to the validity of TAM. Perceived enjoyment and perceived EOU are stronger determinants of intention to use than perceived usefulness [48]. Mobile games are obviously the entertainment-oriented usage of information technology. Thus, we further revise TAM to replace perceived usefulness with perceived playfulness for studying mobile games.

3 Research model and hypothesis

As described in previous section, our research model draws upon two major theories, theory of reasoned action (TRA) and technology acceptance model (TAM), and further augmented with mobile use contexts. Therefore, the research model includes six constructs: perceived ease of use, perceived playfulness, subjective norm, and attitude as independent variables; contextual factors as moderating variables, and continuance usage intention as the dependent variable. Figure 1 shows our theoretical framework. Four hypotheses are developed as will be described in the following.

3.1 Hypotheses about Integrating TRA and TAM for hedonic applications

TAM model is solely based on user's own perception of technology without having any contextual concerns. Since our research focus is the effect of contextual factors, subjective norm in the TRA model can be included as a construct associated with the social context in which a technology is used. Therefore, two hypotheses with respect to user attitude and intention can be derived:

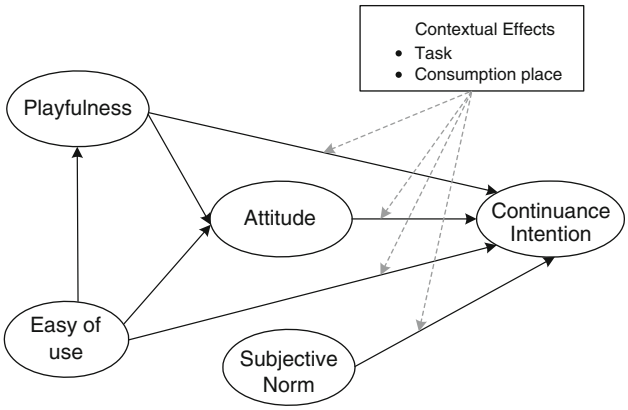

Fig. 1 The research framework

H1 Attitude toward playing mobile games is affected by the perceived playfulness and perceived ease of use of the game.

H2 Intention to continue playing mobile games is affected by perceived playfulness, perceived ease of use, the attitude toward playing the game, and the subjective norm of the user with respect to playing the game.

3.2 Hypotheses regarding contextual factors

As many contextual factors may play roles in decision making, this study focuses on two major factors that are highly related to mobile games: the physical place where a game is to play and the psychological factor of whether the user has another task on hand. When the person has another task on hand, the psychological stress may be higher to affect the intention to play a mobile game. The combination of these two factors forms four different usage situations. Hence, four hypotheses are posited as follows:

H3 The integrated TAM model is moderated by contextual factors.

H3a The relationship between perceived playfulness and intention to use a mobile game is moderated by contextual variables.

H3b The relationship between perceived ease of use and continuance intention to use a mobile game is moderated by contextual variables.

H3c The relationship between attitude toward a mobile game and continuance intention to use is moderated by contextual variables.

H4 The relationship between SN and continuance intention to use a mobile game is moderated by contextual variables.

4 Instrument development and research methodology

4.1 Instrument development

A pseudo-experimental study that used cross-sectional surveys to collect data was conducted to evaluate the proposed research model. Four hypothetical contexts were used as our experimental design factors. The four contextual settings were defined by two factors: place of consumption (at home vs. at school/in office) and other task on hand (with task vs. no task). Table 1 shows brief descriptions of the contexts. Every subject was assigned into a particular context and given a clear description of his/her scenario as the basis for answering the survey questions.

Validated items were used to measure perceived playfulness [8], perceived EOU [9], attitude [9], SN [13], and continuance intention [9]. Likert scales ranging from 1 to 5, which anchors ranging from "strongly disagree" to "strongly agree" were used for all questions. After the pretest, a few items were modified to fit the mobile game context. The final items in the questionnaire are shown in Table 2.

4.2 Measure and data collection

In order to recruit subjects, we published the online survey on a popular Web site, *Electronic Commerce Times* (http://www.ectimes.org.tw/) in Taiwan. This Web site provides a variety of information about e-commerce, m-commerce, new trends and technologies to more than 20,000 subscribers. Those who have experiences in playing mobile games were invited to participate in the online survey. Each volunteer was randomly assigned to four experimental settings and asked to answer the questionnaire based on the given scenario.

A total of 410 volunteers were recruited but 20 of them were invalid, which resulted in 390 useful observations. Each setting had 78 observations. Results from a homogeneity test show no significant difference among those groups. The profile of respondents is shown in Table 3. Their ages ranged from 20 to 30. The ratio of male to female was 53.8–46.2%, and student to non-student was 46.2–53.8%; 89.8% of the subject had at least a college degree (shown in Table 3).

5 Analysis of results

5.1 Measurement model

A confirmatory factor analysis using the partial least squares (PLS) was conducted to assess the validity and reliability of our data. Reliability and convergent validity of the factors were estimated by composite reliability and average variance extracted (AVE). The acceptable composite reliability value is suggested to be above 0.70, and the AVE value to be above 0.5. Discriminant validity verifies whether the squared correlation between a pair of latent variables is less than the AVE for each variable. As can be seen in Table 4, all constructs satisfies the criteria, thus requiring no changes to the constructs.

5.2 Structural model

Since PLS does not allow direction measurement of path models with moderators, we have to build the base model without moderators and then assess the moderating effect by comparing different models. Figure 2 presents a graphical depiction of the PLS analysis on the base model with no contextual influence. The model indicates that the perceived playfulness can explain 38.2% of the variance in attitude, and the attitude along with perceived ease of use can explain 64.8% of the variance in continuance intention. Attitude was primarily affected by the perceived playfulness, and intention to use was affected by attitude and perceived ease of use. Perceived EOU had no significant influence on users' attitude toward playing mobile games but had direct effect on the intention to play. Perceived playfulness and subjective norm had no significant effects on the continuance intention to use mobile games.

Table 1 Description of different contextual scenarios

	Home	School/office
With task	You are at home now, and you have homework assignments to be done and handed in tomorrow (for students)	You are at school now, and you have homework assignments to be done and handed in tomorrow (for students)
	You are at home now, and you have a task assigned by your boss that you have to finish by tomorrow (for workers)	You are in the office now, and you have a task assigned by your boss that you have to finish by tomorrow (for workers)
No task	You are at home now and have free time (for workers and students)	You are at school now, and you have no homework assignments by your teacher you are in the office now, and
		You have no additional task to do (for workers)

Table 2 List of items in the survey

Construct	Items	
Perceived playfulness	PP1	When playing mobile games, I do not realize the time elapsed
	PP2	When playing mobile games, I am not aware of any noise
	PP3	When playing mobile games, I often forget the work I must do
	PP4	Playing mobile games brings me enjoyment
	PP5	Playing mobile games gives fun to me
	PP6	Playing mobile games keeps me happy
	PP7	Playing mobile games stimulates my curiosity
	PP8	Playing mobile games arouses my imagination
Perceived ease of use	PEOU1	Learning to play mobile games is easy for me
	PEOU2	It will be impossible to play mobile games without the manual
	PEOU3	It takes too much time to learn to play mobile games
	PEOU4	Playing mobile games requires a lot of mental effort
Subjective norm	SN1	My partners/close friends support me to play mobile games
	SN2	Generally speaking, I care about how my partners/close friends think what I should do
	SN3	My boss/parents support me to play mobile games
	SN4	Generally speaking, I care about how my boss/my parents think I should do
	SN5	My colleagues/my classmates support me to play mobile games
	SN6	Generally speaking, I care about how my colleagues/classmates think what I should do
Attitude	ATT1	Playing mobile games is good
	ATT2	Playing mobile games is wise
	ATT3	Playing mobile games is pleasant
Continuance intention	CI1	I will regularly play mobile games in the near future
	CI2	I will frequently play mobile games in the near future
	CI3	I intend to play mobile games in the near future

Table 3 Demographic characteristics of participants

Characteristics	Item	Frequency	Percent
Gender	Female	36	46.2
	Male	42	53.8
Age	20–30 years	60	77
	31–40 years	13	16.6
	41–50 years	5	6.4
Education	High school	5	6.4
	College	32	41
	Upper college	41	52.6
Occupation	Students	36	46.2
	IT/IS industries	18	23.1
	Manufacturing industries	10	12.8
	Finance/insurance	5	6.4
	Others	9	11.5

Therefore, hypotheses 1 and 2 are partially supported. That is, the integrated model can predict 64.8% of the continuance intention to play mobile games. However, the effect of subjective norm, which is a subjective judgment of the reference group's attitude toward the use of mobile games, is not significant. In other words, subjects in our study treated playing mobile games as a personal business and would not be affected by their peers.

5.3 Effects of contextual factors

Given the base model being reasonably supported, we can further analyze the moderating effect of contextual factors by comparing the models in four different contexts. The results are shown in Table 5. Since the contextual factors include task and place, we can analyze their effects separately.

5.3.1 Effect of task

The task effect can be seen by comparing the coefficients between the no-task and with-task columns. Based on the result in Table 5, we find that there exist three kinds of moderation. First, individual factors have different effect

Table 4 Reliability, convergent validity, and discriminant validity

	AVE	Composite reliability	R^2	Cronbachs apha
Attitude	0.760517	0.904966	0.381940	0.842805
Perceived EOU	0.772038	0.910202		0.851067
Continuance intension	0.854324	0.946201	0.648250	0.914610
Perceived playfulness	0.581126	0.917012	0.142316	0.896536
Subjective norm	0.817764	0.930850		0.889096

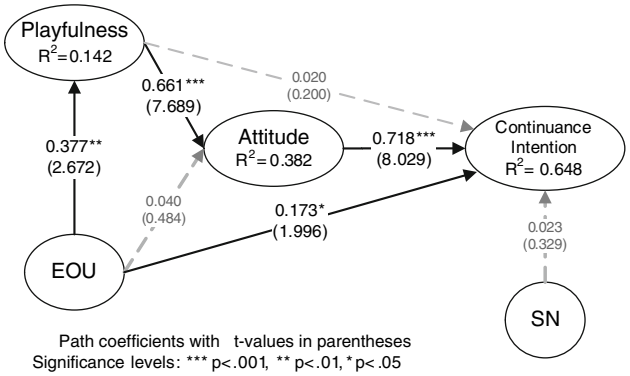

Fig. 2 Path analyses of mobile games

sizes in different settings. For example, the effect of playfulness on attitude is stronger in the no-task setting (0.786) than that in the with-task setting (0.698). This indicates that the stress of having another task in mind reduces the effect of perceived playfulness on attitude. Similarly, the effect of attitude on intention is stronger in the with-task setting (0.836) than that in the no-task setting (0.574), which indicates the existence of the moderating effect.

The second moderating effect is that certain factors that are significant in one setting may become insignificant in another. For example, the effect of playfulness on continuance intention is significant in the with-task setting (0.139), but is insignificant in the no-task setting and the effect of social norm is significant in the no-task setting (0.150), but becomes insignificant in the with-task setting. The third fact that we can observe is that the explanation power of the model is much higher in the with-task setting than that in the no-task setting (0.814 vs. 0.578). That is, the model can better explain the usage intention in a situation when the user is under work pressure.

Given the differences, we find that in the no-task setting, the subject had no other obligation at the time, and hence the continuance intention to play mobile game was determined primary by the person's attitude and the person's perception of whether the reference group agreed on playing the game (subjective norm). Since subjective norm is significant, we can conclude that the TRA model can better explain the behavior.

In the with-task setting, however, the subject had to play the game under the pressure of completing another task. Attitude toward the game became the dominating factor and the effect of social norm disappeared. That is, whether the subject would play the game was not affected by the attitude of the reference group. It is because the game which has a high playfulness would lead to more favorable attitude and higher intention to play. The TAM model can better explain the process.

5.3.2 *Effect of place*

We find that the moderating effect of place (home vs. workplace) also exists in two aspects. First, the perceived playfulness had a stronger effect on attitude when the subject was at home, when compared with that in the workplace (0.743 vs. 0.682). This result, along with the higher effect of playfulness on attitude in the no-task setting, indicates that the entertainment value of a mobile game has a stronger effect on customer attitude when the person is in a more relaxed situation. The factor of social norm is insignificant in both place settings. This implies that TAM can better explain the technology usage process

Table 5 The research model in particular contexts

	Contextual factors			
	No task	With task	At home	At school/in office
Playfulness → ATT	0.786*	0.698*	0.743*	0.682*
Playfulness → CI	0.097	0.139**	0.128	0.103
Attitude → CI	0.574*	0.836*	0.804*	0.817*
EOU → CI	0.109	−0.061	−0.090	−0.085
SN → CI	0.150**	−0.047	−0.036	0.066
R^2	0.578	0.814	0.729	0.844

* $p < 0.001$, ** $p < 0.5$

in different places. Second, the model has a higher explanation power in the workplace setting than that in the home setting. This may imply that the behavior in the workplace is more rational than that in a more relax setting at home.

Since we anticipate that students and non-students may have different attitudes and concerns regarding playing mobile games, we further divided the whole sample into two groups (student and non-student) based on their occupations to examine the difference. Reliability and validity of data are also acceptable for both groups. The resulting base models are shown in Figs. 3 and 4, respectively.

Both models have similar explanation powers, but we can see that major difference exists between these two models. The perceived ease of use (EOU) has exactly opposite effects in the student and non-student groups. That is, the perceived ease of use has a significant positive effect on perceived playfulness, but has no effect on attitude toward and continuance intention to use mobile games for students, but has no effect on perceived playfulness and has significant positive effect on the continuance intention to use mobile games for non-students.

We further analyze the moderating effects of contextual variables in these two models. Table 6 shows the results.

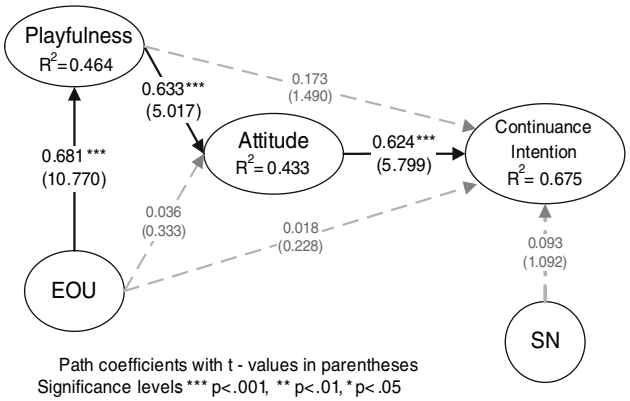

Fig. 3 Resulting model for students

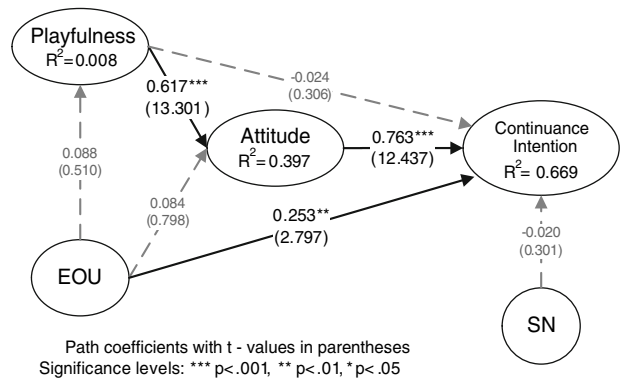

Fig. 4 Resulting model for non-students

As we can see that the model fits best for the student group making decisions under the pressure of having another task. All coefficients in the model are significant and the model has a 75.4% of explanation power. The model fits relatively poor when the context is no-task for non-students. The explanation power is 58.4%. Subjective norm has influences on the intention to play mobile games in the with-task context for students. Perceived playfulness has significant effects on the continuance intention to playing mobile games when students have homework assignment and when they are at home.

6 Discussions and conclusion

Mobile use contexts have become more and more important in mobile research. However, there are not many studies stressing on this issue. Given that mobile technology is context-sensitive, this paper aims to analyze consumer acceptance of mobile services by providing an integrated TRA and TAM model and augmented the model with contextual variables. Using mobile games as example, our specific goal is to examine to what extent our model can explain the adoption process of mobile games and whether the same behavioral process exists in different use contexts. After the empirical study and data analysis, we have obtained the following findings.

First of all, we found that user's attitude had great effects on the continuance intention to play mobile games when contextual factors were not included, just like prior literature has confirmed that attitude is a crucial factor to users' continuance intention to use. Perceived EOU had no significant influence on user's attitude toward playing mobile games, but had direct effect on the intention to play. It indicated that if a mobile game is easier to play, it will directly enhance the user's continuance intention to play the game. Perceived EOU also increases users' perceived playfulness of playing mobile games. Perceived playfulness had significant influence on users' attitude toward playing mobile games. It means when people play a mobile game and feel happy about it, their attitude toward playing will be strengthened. Subjective norm, however, had no significant effects on the continuance intention to play mobile games in such situation.

When use contexts were taken into account, we found some differences of the consequences. For example, when the users had no other obligation (no-task setting), their intention to play mobile games was determined primarily by personal attitude and personal perception of whether the reference group agreed on playing the game. On the contrary, when the users had to play the game under the pressure of completing another task (with-task setting), the effect of subjective norm did not exist, and personal

Table 6 Students vs. non-students in particular contexts

	Students				Non-students			
	Task		Consumption place		Task		Consumption place	
	Have task	No task	At home	At school	Have task	No task	At home	At work
Playfulness → ATT	0.755***	0.971***	0.644***	0.726***	0.680***	0.781***	0.845***	0.700***
Playfulness → CI	0.243**	0.270	0.207*	0.130	0.110	−0.037	0.123	0.084
ATT → CI	0.810***	0.423***	0.842***	0.798***	0.858***	0.721***	0.772***	0.821***
EOU → CI	−0.113*	0.020	−0.201	−0.119	−0.054	0.177	0.006	−0.035
SN → CI	−0.185*	0.204***	−0.031	0.039	0.026	0.101	0.059	0.080
R^2	0.754	0.633	0.752	0.819	0.881	0.584	0.734	0.852

* $p < 0.5$, ** $p < 0.01$, *** $p < 0.001$

attitude toward the game dominated the person's intention to play. If they feel enjoyable from playing the game, it will lead to more favorable attitude and higher intention to play continuously. It accounts for the nature of human emotional motive to decompress or to shift attention when encountering a pressure situation.

As to the moderating effect of place (home vs. workplace), we found that people felt happier from playing mobile games when they were at home than when they were in the workplace. That is, the entertainment value on mobile game is a crucial factor to customer attitude when a person is more relaxed. The factor of subjective norm, however, is insignificant in both settings.

As our expectations, the users with different lifestyle (student and non-student) have different attitudes and concerns regarding playing mobile games. The perceived ease of use has completely opposite effects between student and non-student groups. The perceived ease of use can enhance students' playfulness of playing mobile games, but has no effect on attitude toward and continuance intention to use mobile games. As for non-students, it can directly affect their continuance intention to play mobile games, but has no effect on perceived playfulness and attitude. According to the result of moderating analyses on contextual factors, the model fits best for students making decisions under task pressure. The model fits relatively poorly when non-students have no task on hand. Subjective norm has influences on the intention to play mobile games only in with-task situation for students. That is, students felt obligations to their parents, teachers, or reference people. Perceived playfulness had significant effects on the continuance intention to play mobile games when students had homework assignment and when they were at home.

The findings from this study have plenty of theoretical and practical contributions. First, we have modified the TAM and TRA models by adding the subjective norm from the TRA model and shown that it can successfully explain the consumer behavior of hedonic mobile services. Second, we have found that some contextual variables have significant moderating effects on the main effects previously described in TAM and TRA. In addition, we have explored the moderating effects of certain contexts on a user's continuance intention to use mobile games. This is an earlier study that considers contextual influences in the hedonic use of mobile technology. The findings provide useful insights for marketers and advertisers. Successful mobile applications must be able to provide users with tailored and timely value-added service. Thus, mobile use contexts and different lifestyle groups should be taken into consideration when new mobile services are introduced.

One potential limitation of this research surrounds the size of the sample collected. The convenient sampling used to solicit survey respondents may not be as perfect as a random sampling. The study may also be limited by the experimental design of only two contextual effects were investigated. Nonetheless, the findings have provided insights into the behavior of mobile users in different settings. Further research may consider other contextual factors that may affect users' intentions and whether culture or other demographic characteristics may affect consumer acceptance of mobile services.

References

1. Ajzen I, Fishbein M (1980) Understanding attitudes and predicting social behavior. Prentice-Hall, Englewood Cliffs
2. Baber C, Westmancott O (2004) Social networks and mobile games: the use of bluetooth for a multiplayer card game. MobileHCI2004, pp 98–107
3. Barnard L, Yi JS, Jacko JA, Sears A (2007) Capturing the effects of context on human performance in mobile computing systems. Pers Ubiquitous Comput 11:81–96
4. Barnes SJ (2002) The mobile commerce value chain: analysis and future developments. Int J Inf Manag 22:91–108
5. Belk RW (1974) An exploratory assessment of situational effects in buyer behavior. J Mark Res 11(2):156–163
6. Chen LD (2008) A model of consumer acceptance of mobile payment. Int J Mobile Commun 6(1):32–52

7. Choi J, Seol H, Lee S, Cho H, Park Y (2008) Customer satisfaction factors of mobile commerce in Korea. Internet Res 18(3):313–335
8. Csikzentmihalyi M (1990) Flow, the psychology of optimal experience. Harper & Row, New York
9. Davis FD (1989) Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Q 13(3):319–340
10. Davis FD, Bagozzi RP, Warshaw PR (1989) User acceptance of computer technology: a comparison of two theoretical models. Manag Sci 35(8):982–1003
11. Dey AK, Abowd GD, Salber D (2001) A conceptual framework and a toolkit for supporting the rapid prototyping of context-aware applications. Hum-Comput Interact 16:97–166
12. Fang X, Chan S, Brzezinski J, Xu S (2005–2006) Moderating effects of task type on wireless technology acceptance. J Manag Inf Syst 22(3):123–157
13. Fishbein M, Ajzen I (1975) Belief, attitude, intentions and behavior: an introduction to theory and research. Addison-Wesley, MA
14. Gebauer J, Shaw MJ (2004) Success factors and impacts of mobile business applications: results from a mobile e-procurement study. Int J Electron Commun 8(3):19–42
15. Ha I, Yoon YS, Choi MK (2007) Determinants of adoption of mobile games under mobile broadband wireless access environment. Inf Manag-Amst 44(3):276–286
16. Hansen F (1972) Consumer choice behavior: a cognitive theory. Free Press, New York
17. Herzberg A (2003) Payments and banking with mobile personal devices. Commun ACM 46(5):53–58
18. Jaeger SR, Rose JM (2008) Stated choice experimentation, contextual influences and food choice: a case study. Food Qual Prefer 19:539–564
19. Jung Y, Perez-Mira B, Wiley-Patton S (2009) Consumer adoption of mobile TV: examining psychological flow and media content. Comput Hum Behav 25(1):123–129
20. Kurkovsky S, Zanev V, Kurkovsky A (2005) SMMART: using context-awareness in m-commerce. MobileHCT2005, pp 383–384
21. Lee YE, Benbasat I (2003) Interface design for mobile commerce. Commun ACM 46(12):49–52
22. Lee YE, Benbasat I (2004) A framework for the study of customer interface design for mobile commerce. Int J Electron Commun 8(3):79–102
23. Liang TP, Huang ZW, Yeh YH, Lin B (2007) Adoption of mobile technology in business: a fit-viability model. Ind Manag Data Syst 107(8):1154–1169
24. Lin YL, Liang TP, Ho SC, Yeh YH (2007) The impact of situation influences on the intention to use mobile value-added services. Paper presented at the 6th workshop on e-business (WeB2007), Montreal, Quebec, 9 December 2007
25. Lin YM, Shih DH (2008) Deconstructing mobile commerce service with continuance intention. Int J Mobile Commun 6(1):67–87
26. Lopez-Nicolas C, Molina-Castillo FJ, Bouwman H (2008) An assessment of advanced mobile services acceptance: contributions from TAM and diffusion theory models. Inf Manag-Amst 45:359–364
27. Luley PM, Paletta L, Almer A (2005) Visual object detection from mobile phone imagery for context awareness. MobileHCT2005, pp 385–386
28. Maamar Z (2003) Virtual extension: commerce, e-commerce, and m-commerce: what comes next? Commun ACM 46(12):251–257
29. Mallat N (2007) Exploring consumer adoption of mobile payments—a qualitative study. J Strateg Inf Syst 16:413–432
30. Mallat N, Rossi M, Tuunainen VK, Oorni A (2008) An empirical investigation of mobile ticketing service adoption in public transportation. Pers Ubiquitous Comput 12:57–65
31. Mallat N, Rossi M, Tuunainen VK, Oorni A (2009) The impact of use context on mobile service acceptance: the case of mobile ticketing. Inf Manag 46:190–195
32. Matskin M, Tveit A (2001) Mobile commerce agents in WAP-based services. J Database Manag 12(3):27–35
33. Moon JW, Kim YG (2001) Extending the TAM for a world-wide-web context. Inf Manag-Amst 38:217–230
34. Morales-Aranda AH, Mayora-Ibarra O, Negrete-Yankelevich S (2004) M-modeler: a framework implementation for modeling m-commerce applications. Paper presented at the 6th international conference on electronic commerce, pp 596–602
35. Ngai EWT, Cheng TCE, Au S, Lai KH (2007) Mobile commerce integrated with RFID technology in a container depot. Decis Support Syst 43:62–76
36. Nordqvist S, Hovmark S, Zika-Viktorsson A (2004) Perceived time pressure and social processes in project teams. Int J Proj Manag 22:463–468
37. Okazaki S (2005) Mobile advertising adoption by multinationals senior executives' initial responses. Internet Res 15(2):160–180
38. Park CW, Iyer ES, Smith DC (1989) The effects of situational factors on in-store grocery shopping behavior: the role of store environment and time available for shopping. J Consum Res 15(4):422–433
39. Peffers K, Tuunanen T (2005) Planning for IS applications: a practical, information theoretical method and case study in mobile financial services. Inf Manag-Amst 42:483–501
40. Schmitt BH, Shultz CJ (1995) Situational effects on brand preferences for image products. Psychol Mark 12(5):433–446
41. Schwabe G, Göth C (2005) Mobile learning with a mobile game: design and motivational effects. J Comput Assist Learn 21:204–216
42. Shin DH (2009) Towards an understanding of the consumer acceptance of mobile wallet. Comput Hum Behav 25:1343–1354
43. Slack F, Rowley J (2002) Online kiosks: the alternative to mobile technologies for mobile users. Internet Res 12(3):248–257
44. Tamminen S, Oulasvirta A, Toiskallio K, Kankainen S (2004) Understanding mobile contexts. Pers Ubiquitous Comput 8:135–143
45. Tewari G, Youll J, Maes P (2002) Personalized location-based brokering using an agent-based intermediary architecture. Decis Support Syst 34:127–137
46. Topi H, Valacich JS, Hoffer JA (2005) The effects of task complexity and time availability limitations on human performance in database query tasks. Int J Hum-Comput Stud 62:349–379
47. Tsang M, Ho SH, Liang TP (2004) Consumer attitudes toward mobile advertising: an empirical study. Int J Electron Commun 8(3):65–78
48. Van der Heijden H (2004) User acceptance of hedonic information systems. MIS Q 28(4):695–704
49. Varchney U, Vetter R (2002) Mobile commerce: framework, applications and networking support. Mobile Netw Appl 7:185–198
50. Verkasalo H (2009) Contextual patterns in mobile service usage. Pers Ubiquitous Comput 13:331–342
51. Wang YS, Liao YW (2007) The conceptualization and measurement of m-commerce user satisfaction. Comput Hum Behav 23:381–398
52. Wong YK, Hsu CJ (2008) The confidence-based framework for business to consumer (B2C) mobile commerce adoption. Pers Ubiquitous Comput 12:77–84
53. Yi MY, Jackson JD, Park JS, Probst JC (2006) Understanding information technology acceptance by individual professionals-toward an integrative view. Inf Manag-Amst 43:350–363