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## Contextual factors and continuance intention of mobile services

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### Ting-Peng Liang

Department of Information Management,  
National Chengchi University,  
Taipei, Taiwan  
E-mail: tp.liang@nccu.edu.tw

### Yu-Ling Ling

Inotera Memories, Inc.,  
667, Fu Hsing 3rd Rd.,  
Kueishan, Taoyuan, Taiwan  
E-mail: eline0210@yahoo.com.tw

### Yi-Hsuan Yeh

Institute for Information Industry,  
Hsin Yi Road, Section 3,  
No. 41, 5F-1, Taipei, Taiwan  
E-mail: celeste@mail2000.com.tw

### Binshan Lin\*

Business School,  
Louisiana State University in Shreveport,  
Shreveport, LA 71115, USA  
E-mail: Binshan.Lin@lsus.edu  
\*Corresponding author

**Abstract:** Mobile applications that allow users to perform activities on their mobile devices have attracted a substantial amount of attention in mobile commerce. The use of these application services (called *mobile services*) may be affected by contextual factors. In this paper, we investigate how contextual factors such as time pressure, location and other concurrent task may affect the intention to use a mobile service. A theoretical framework that combines Theory of Planned Behaviour (TPB) and Task-Technology Fit (TTF) and an empirical study was conducted. The results show that: 1) a higher degree of TTF resulted in a more positive attitude towards using a mobile service; 2) perceived behavioural control had a positive effect on user's intention to use communication, entertainment and data application services; 3) social norms affected the intention to use only in transaction-related applications; 4) contextual factors had moderating effects on the intention to use.

**Keywords:** mobile service; use context; TTF; task-technology fit; TPB; theory of planned behaviour; mobile commerce.

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**Biographical notes:** Ting-Peng Liang is a National Chair Professor at National Chengchi University (on leave from National Sun Yat-Sen University) in Taiwan. He received his PhD from the Wharton School of the University of Pennsylvania. He is an AIS fellow and has published extensively in electronic commerce, knowledge management, decision-support systems and other related topics. His papers have appeared in *MIS Quarterly*, *Management Science*, *Journal of MIS*, and many other high-quality journals.

Yu-Ling Ling is a Quality Engineer at Inotera Memories, Inc. She received her MS in Information Systems from National Sun Yat-Sen University in Kaohsiung, Taiwan.

Yi-Hsuan Yeh is a Senior Researcher at the Institute for Information Industry. She received her PhD from the National Sun Yat-Sen University in Kaohsiung, Taiwan. Her primary research interests include mobile commerce and organisational adoption of information technologies.

Binshan Lin is the BellSouth Corporation Professor at Louisiana State University in Shreveport. He received his PhD from the Louisiana State University. He is a nine-time recipient of the Outstanding Faculty Award at LSU. He has published over 260 papers in refereed journals.

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## 1 Introduction

Mobile commerce that allows users to conduct commercial activities over their mobile devices has enjoyed a significant growth in the past decade. An increasing amount of applications have been developed and research on the use of these applications is increasing dramatically. Although many prior studies have examined factors that may affect the intention to use mobile applications (e.g., Wang and Cheung, 2004; Ojiako, 2012; Mallat et al., 2008; Liu et al., 2011; Hsu et al., 2011), the contextual factor that has been found to be influential in mobile usage is under-investigated (e.g., Liang and Yeh, 2011).

Consumer decisions are frequently affected by contextual factors, such as time pressure, task characteristics and particular occasions (Jaeger and Rose, 2008). Consumers encountering some situations usually change their habits to buy/do other things. Researchers have already demonstrated the impact of contexts. For example, time pressure was negatively related to both estimated goal fulfilment and job satisfaction (Nordqvist et al., 2004). Task complexity was found to be the main determinant of user confidence (Topi et al., 2005). Store environment and time pressure have great influence on the consumers' shopping behaviour in the retail stores (Park et al., 1989). It is reasonable to assume that the value of mobile application services may change in different situations and hence a consumer's intention to adopt mobile services is affected

by contextual factors. With the above-mentioned rationale, this paper targets at two research questions:

- What factors affect a user's intention to continue using mobile application services?
- Do contextual influences affect the relationship between attitude and intention to use mobile application services?

In this study, mobile application services (called *mobile services* in short) are value-added mobile applications (such as games and payment), instead of mobile platform services that provide basic mobile connection and integration of data, voice and multi-media. Therefore, the focus is the application software designed for supporting certain tasks (e.g., game or payment) on mobile devices. To provide a solid theoretical basis for examining the adoption of mobile services, this paper proposes an integrated model – TTF and TPB to examine the adoption of mobile services and reports results from an empirical study.

The remainder of the paper is organised into six sections. The next section reviews literature in mobile commerce and mobile services. Section 3 presents the development of our theoretical framework and hypotheses. Section 4 describes our instrument development and research methodology. Section 5 presents data analysis and major results. Section 6 concludes the paper by highlighting the contributions, limitations and potential future research.

## 2 Mobile commerce and mobile services

Mobile commerce refers to the enabling transactions through mobile telecommunication network (Mueller-Veese, 1999). Skiba et al. (2000) expanded this definition to 'the use of mobile hand-held devices to communicate, inform, transact, and using text and data via connection to public or private networks'. From a broader perspective, m-commerce is defined as utilising mobile hand-held devices and through wireless communication networks to conduct a commercial transaction and its related interactive business processes that occur before and after actual sales transactions (Tarasewich et al., 2002).

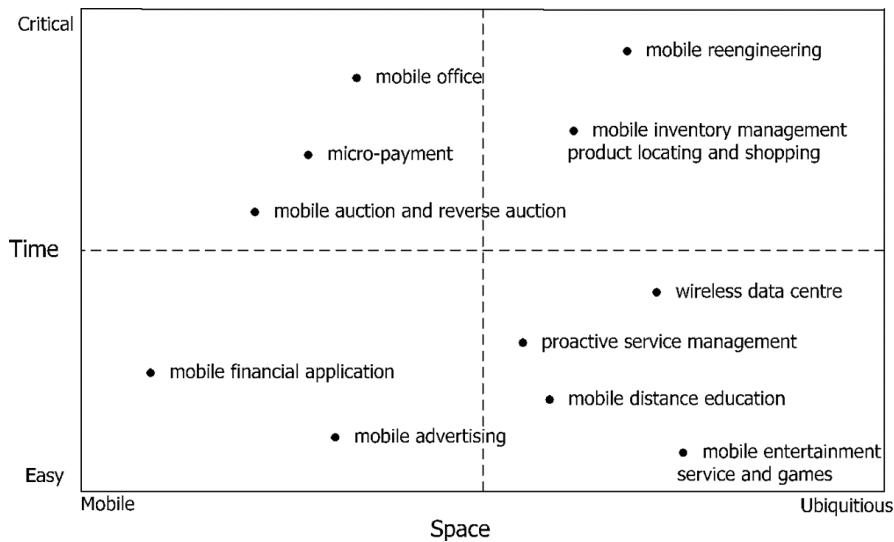
M-commerce has some characteristics to make it distinct, which include portability, reachability, accessibility, localisation and identification (Durlacher, 2000; Turban et al., 2010). Because of these characteristics, numerous mobile application services have been proposed. For instance, Varshney and Vetter (2002) had summarised and classified mobile applications into 10 categories, including mobile financial applications, mobile advertising, mobile inventory management/product locating and shopping, proactive service management, wireless re-engineering, mobile auction or reverse auction, mobile entertainment services and games, mobile office, mobile distance education and wireless data centre.

Mobile commerce has generated substantial excitement among both practitioners and academics. In the past decade, a large body of literature in m-commerce has been reported. For instance, Tsang et al. (2004) studied the effect of mobile advertisement. Jiang and Deng (2011) investigated the factors influencing the adoption of instant messaging services in China. Leong et al. (2011) examined the adoption of mobile entertainment. An excellent review on mobile commerce research in consumer behaviour

can be found in Wu et al. (2010). They divide mobile commerce research published in 2000–2009 into three groups: consumer acceptance, loyalty and continuance.

The core characteristics of mobile commerce that differentiate it from other e-commerce activities are time and space transformation. This is extremely valuable because both of them are scarce resources often in short supply. Built on the spatial and temporal attributes, we can put mobile applications services on a time–space matrix, as shown in Figure 1. This matrix helps us to capture the unique feature of an individual mobile service.

**Figure 1** Space-time matrix: mobile commerce applications



### 3 Research model and hypothesis

As the purpose of the study was to investigate how contextual factors affect the intention to use mobile services, we chose the TPB to be our major theory and extended it with the TTF model. The major reason for the extension is an underlying assumption that the attitude towards a mobile service is affected by whether the service can help the task to be tackled. For instance, a mobile payment service would be useful if the user has a need to pay under time or space constraint. The TTF would be high in this situation. Development of the research model is elaborated here.

#### 3.1 Task and Technology Fit (TTF)

The adoption and use of information technology has been a critical issue facing IS executives and researchers. A large body of research has indicated that a successful technology adoption depends as much on the nature of individuals as on the technology itself (Nelson, 1990). TTF is a model drawn from a user evaluation to measure individual performance by assessing utilisation and fit of task and technology (Goodhue, 1995, 1998; Goodhue and Thompson, 1995). TTF examines individual's performance under the circumstance that technology provides functions that match the need for completing a

task. If the technology is appropriate for a certain task, the individual would have positive performance.

Theories in technology adoption include two major research paradigms: utilisation and fit. Most of the utilisation-focused research is based on theories of attitudes and behaviour (Bagozzi, 1982; Fishbein and Ajzen, 1975). This paradigm predicts IT utilisation from user's attitudes and beliefs. A typical example is the popular Technology Acceptance Model (TAM, e.g., Davis, 1989). On the other hand, the fit paradigm argues that user attitude and intention are not the only factors that determine their behaviour in technology use. Instead, the fit between technology and the task needs plays a major role (Jarvenpaa, 1989). In other words, IT has a positive impact on performance only when there is correspondence between its functionality and the task requirements of users. Hence, we can reasonably assume that a high-level fit will lead to stronger intention for a user to adopt the technology, because the user can foresee a better performance from the fit.

TTF is in the fit paradigm and has been used widely in m-commerce research. Task is the application for the mobile application software to support. It is found that when the task has features that match the characteristics of mobile technology, using mobile services can enhance performance. For example, Lee et al. (2007) proposed a modified TTF model to study the factors affecting the adoption of mobile commerce in the insurance industry. The findings indicated that the PDA-based mobile commerce system is indeed suitable for the insurance industry. They found that position experience, cognitive style and computer self-efficacy were major factors that resulted in individual differences. Junglas et al. (2008) applied TTF to analyse mobile locatable information systems. They investigated how differing fit levels impact individual performance across various tasks performed with locatable technology. Shih (2011) adopted TTF to study to explore the factors affecting Mobile Entertainment Services use.

Although TTF is a popular theory for exploring technology adoption and performance, a weakness is its neglect of user's attitudes and intention. In addition, its assessment of the fit between task and technology is subjective. Therefore, when TTF is applied to assess user adoption, it is more powerful if we incorporate concepts in the attitude paradigm. Since TTF states that a better fit can lead to better performance, the linkage between fit and performance is through the user's attitude. Therefore, when we apply the concept to mobile services, we hypothesise that the fit between a mobile service and the task for which the mobile service is designed will affect user's attitude towards using the mobile service, as shown here:

*Hypothesis 1: The degree of fit between mobile services and the tasks the service is designed for will have a positive effect on a user's attitude towards using the mobile service.*

### 3.2 Theory of Planned Behaviour (TPB)

To fully understand the intention to use a mobile service, we need a theory to link the attitude and the intention. In this study, we adopt the TPB. TPB was proposed by Ajzen in 1985, which asserts that a user's intention is affected by his or her attitude, subjective norms and perceived behavioural control (Ajzen, 1991). Attitude is defined as a person's positive or negative feeling. Attitude can be used to predict a person's intention. In addition, subjective norm means the social pressure facing a person when he or she

decides whether to take a certain action. Subjective norms come from the person's reference group.

Perceived behaviour control is the third factor that is determined by personal experience or the expected obstacles. If someone perceives he or she has the ability, resources, or opportunities to perform the task, he or she will have a high level of perceived behavioural control. Therefore, the following three TPB-related hypotheses are posited:

*Hypothesis 2: The perceived behavioural control over a mobile service will have a positive effect on a user's intention to use the mobile service.*

*Hypothesis 3: The attitude towards a mobile service will have a positive effect on a user's intention to use the mobile service.*

*Hypothesis 4: The subjective norm of a mobile service will have a positive effect on a user's intention to use the mobile service.*

Because our major purpose of the research is to examine the contextual effects, the above-mentioned three hypotheses serve as a control check for the existence of the main effect. They serve as the base for testing the moderating effect described in the following section.

### 3.3 *Use contexts*

In mobile commerce, a major feature is its ubiquity. In other words, the user can play a mobile game in the classroom or trade stocks in his or her office. These behaviours, however, are deemed inappropriate. Hence, it is reasonable to assume that the intention of using mobile services is affected by the surrounding context and the use context (i.e., the environmental situation in which a service is used) is a key factor that we should take into consideration when we analyse mobile service adoption.

The use context of mobile services means that people use their mobile services in a certain environment. In early literature, Hansen (1972) proposed three situational characteristics in decision-making: consumption situation, purchase situation and communication situation. Belk (1974, 1975) identified five situational characteristics in a context in marketing: physical surrounding, social surroundings, temporal perspective, task definition and antecedent states.

In fact, a large amount of marketing research has investigated contextual influences in consumer's decision-making process and shopping behaviour (e.g., Machleit and Eroglu, 2000). A variety of contextual factors have been identified in the previous research. For example, Park et al. (1989) explored the influence of time pressure and store environment to the consumers' shopping behaviour in the retail stores. Machleit and Eroglu (2000) investigated the effects of store atmosphere and consumption situation (include time pressure and task characteristics) to consumers' shopping behaviour. Kleijnen et al. (2005) found that not only image congruence had a significant impact on consumer attitudes and the adoption decision, but there was also an interaction between image congruence and the consumption situation (private vs. public, and friends vs. colleagues). Topi et al. (2005) studied the effects of task complexity and time availability limitations on human performance in database query tasks. Mallat et al. (2008) found that mobility and contextual factors, including budget constraints, availability of other alternatives and time pressure in the service use situation had a strong effect on adoption

decision. Liang and Yeh (2011) examined the effects of situational factors (task and location) on users' intention to continue playing mobile games.

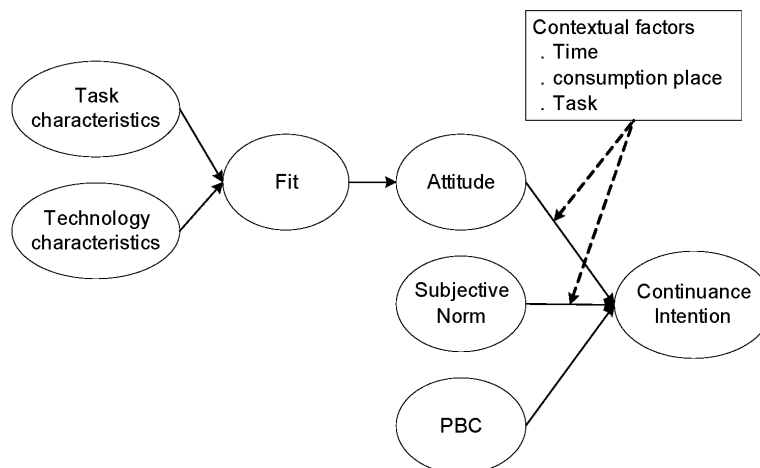
Among the factors studied in the previous literature, three factors are common: environment (at home, working or outside), time (time pressure vs. spare time) and other concurrent task (single task vs. multi-tasks). To fit in the mobile services context, therefore, we categorise the context into three types: time (having time pressure or no time pressure), busyness (with concurrent task or no), and consumption place (at home or at school/in office). We argue that these contextual factors will have moderating effects on using mobile services.

*Hypothesis 5: Different contextual factors will moderate the relationship between attitude towards mobile services and intention to use them.*

*Hypothesis 6: Different contextual factors will moderate the relationship between subjective norm and the intention to use mobile services.*

To summarise, we propose a theoretical model that examines direct effects of TTF and TPB and the moderating effects of contextual factors of time, busyness and place. Figure 2 shows our theoretical framework.

**Figure 2** Theoretical framework



#### 4 Research methodology and instrument development

An empirical survey was conducted to evaluate the proposed research model. In this section, we shall describe the service types, context design, instrument development and data collection.

##### 4.1 Task type and context design

Different types of tasks for mobile services may have different sensitivity to the contextual factors. Here, task type and service type are the same thing, as task is the target application and service is the software application for performing the task.

To examine the effect of different use contexts, four task types and six context scenarios were chosen for the study. They were mobile communication, mobile entertainment, mobile transactions and mobile data. In each type, we further chose 3 or 4 applications. A total of 14 different applications were included in the study. They were

- *communication*: short message, e-mail, multimedia message
- *entertainment*: game, music/ringtone, graphics and picture, video
- *transaction*: purchase, stock trading, banking, payment
- *data services*: map, advertising and search.

Three contextual factors were considered in designing contextual scenarios: place of consumption, existence of concurrent tasks and time pressure. Here, busyness and time pressure were treated as two distinct concepts, as having concurrent obligation does not mean the obligation needs to be done in a hurry. The following is the description of the 'school/busyness/time pressure' scenario:

"It's 10am and you are in school. You have to submit a homework assignment before 5pm today but you have not completed and will need another 7 or 8 hours to complete. Please answer the following questions about whether you will use xx mobile service."

The six contextual scenarios include

- home, busyness, time pressure
- home, busyness, no time pressure
- office/classroom, busyness, time pressure
- office/classroom, busyness, no time pressure
- home, no busyness, no time pressure
- office/classroom, no busyness, no time pressure.

Here, office and classroom are pointers to a working context in which students and office workers would fit in. If the subject was a student, he or she would be told in the classroom. If the subject was an office worker, he or she would be given a scenario in office. A pre-test indicated that the subject could clearly identify the existence of different scenarios.

#### 4.2 *Instrument development*

A survey instrument was developed based on TTF and TPB for the study. We reviewed relevant literature to define each construct and put together an initial version of the questionnaire. After a pre-test, a few items were modified to fit the mobile service context. The items in the questionnaire were measured on the 1–5 Likert scale, anchoring 'strongly disagree' to 'strongly agree'. Table 1 shows the constructs, operational definitions of the constructs, associated reference and instrument items. The 'X' in the questionnaire items is the application services (e.g., short message, payment, etc.).



**Table 1** Constructs, definition, and sources

<i>Construct</i>	<i>Operational definition</i>	<i>Questionnaire items</i>	<i>Sources</i>
Fit	The degree to which the capabilities of mobile devices meet the needs of the application	Fit is measured by the match between convenience and ubiquity	Goodhue and Thompson (1995)
Convenience	Using mobile services via a mobile device is more efficient	1 Mobile device reduces effort in X service 2 Mobile device saves my time in X service 3 Mobile device makes it easy to do X 4 Mobile device is efficient in doing X	Ankar and D'Incau (2002)
Ubiquity	Mobile devices provide services with minimum time and location constraints	1 Mobile device helps me do X in urgency 2 Mobile device is important for timely X 3 Mobile device helps me do X timely 4 Mobile device allows me do X in difference places 5 Mobile device allows me do X in the move	Clarke (2001)
Attitude	The general feeling toward a mobile service	1 I feel using mobile device to do X is good 2 I feel using mobile device to do X is smart 3 I feel using mobile device to do X is pleasant	Ajzen (1985)
Subjective norm	The user's perception about how key persons in his reference group view his use of mobile service	1 I think my friends support my use of mobile device to do X 2 I care about whether my friends support my using mobile device to do X 3 I think my supervisor/parent support my use of mobile device to do X 4 I care about whether my supervisor/parent support my using mobile device to do X 5 I think my colleague/classmate support my use of mobile device to do X 6 I care about whether my colleague/classmate support my using mobile device to do X	Ajzen (1985)

**Table 1** Constructs, definition, and sources (continued)

<i>Construct</i>	<i>Operational definition</i>	<i>Questionnaire items</i>	<i>Sources</i>	
Perceived behavioural control	Individual's belief on the person's ability to use mobile services	1	I am in full control of using mobile device to do X	Ajzen (1985)
		2	I can use mobile device to do X freely	
		3	I have enough knowledge to use mobile device to do X	
		4	I can decide whether to use mobile device to do X	
		5	I think it's easy for me to learn how to use mobile device to do X	
		6	I feel that, without operational manual, I will not be able to learn how to use mobile device to do X (reverse)	
		7	I feel that it takes me too much time to learn how to use mobile device to do X (reverse)	
		8	I feel that it will take a lot of effort to learn how to use mobile device to do X (reverse)	
Continuance intention	The intention of an individual to keep using a mobile service	1	I will use mobile device to do X in the near future	Ajzen (1985)
		2	I will use mobile device to do X regularly in the near future	
		3	I will use mobile device to do X continuously in the near future	

X in the questionnaire items is the mobile application (e.g., game or payment).

### 4.3 Data collection

The survey was conducted online to solicit mobile users as our subjects. The following procedures were followed:

- Each subject was asked to tell which of the 14 mobile application services in the study he or she had used.
- A questionnaire corresponding to a service that he or she had used was presented online for the subject to answer. A contextual scenario was randomly assigned to the subject.
- The subject filled out questions about their background.

A total of 865 responses were collected and 242 of them were removed owing to incomplete answers or answers from non-mobile users. This results in a usable sample of 623 usable responses, including 174 using communication services, 170 using entertainment services, 82 using transactional services and 197 using data services.

The respondents included 378 males and 245 females. Ninety percent of the respondents had at least college degrees.

## 5 Analysis of results

### 5.1 Measurement model

A Chi-square test was used to test data homogeneity before further analysis. The results show that no data heterogeneity owing to gender or education was found. Then, three types of validity were examined: content validity, convergent validity and discriminant validity. First, content validity is to ensure consistency between the measurement items and the literature. We invited two experienced researchers in electronic commerce to review the questionnaire and conducted a pilot test before it was finalised. This ensures a proper content validity. Second, a confirmatory factor analysis using the Partial Least Squares (PLS) was conducted to assess the validity and reliability of the multiple-item scales. 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 our composite reliability values range from 0.877 to 0.902. The AVE value is suggested to be above 0.5, and our AVE values range from 0.505 to 0.731. Third, discriminant validity verifies whether the squared correlation between a pair of latent variables is less than the AVE for each variable. All constructs satisfy the criteria, as can be seen in Table 2.

**Table 2** Reliability, convergent validity, and discriminant validity

<i>Variable</i>	<i>AVE</i>	<i>Composite reliability</i>	<i>Cronbach's alpha</i>
Convenience	0.723	0.902	0.855
Ubiquity	0.639	0.898	0.858
Fit	0.505	0.901	0.876
Attitude	0.723	0.887	0.809
Perceived behavioural control	0.631	0.895	0.854
Subjective norm	0.547	0.877	0.852
Continuance intention	0.731	0.890	0.812

### 5.2 Structural model

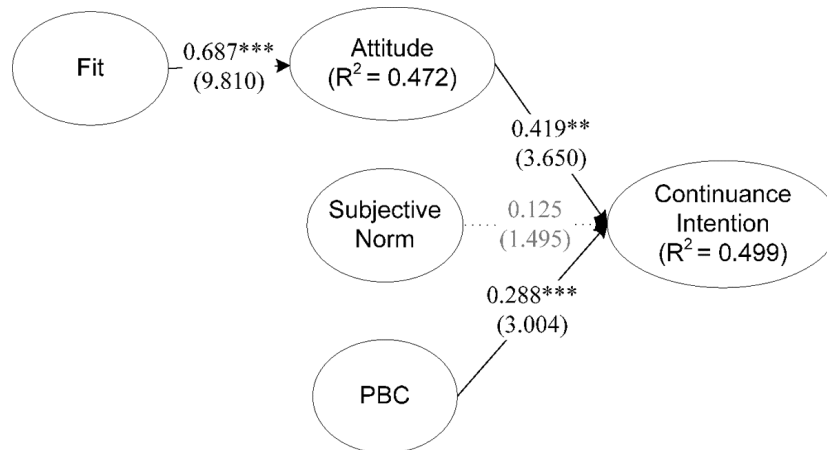
#### 5.2.1 The main effects

The hypothesis testing includes two stages. First, we would like to know the overall explanation power of our model before examining the moderating effect. Then, models in different situations are tested to identify the contextual effect. The resulting model without considering the moderating effect of contexts is shown in Figure 3.

The results provided partially support for all of the four hypotheses. The fit between task (i.e., the target application) and mobile technology can explain 47.2% of the variance in attitude and the attitude along with perceived behavioural control can explain 49.9% of the variance in continuance intention. That is, task and technology fit had a highly

significant influence on users' attitude towards using mobile services. Continuance intention was affected by attitude and perceived behavioural control but not affected by subjective norm. This is consistent with TPB, except that the effect of subjective norm is insignificant. This finding provides a benchmark for further analysis of the moderating effect.

**Figure 3** Path analyses of mobile services



Path coefficients with t-values in parentheses.  
Significance levels: \*\*\*p < .001, \*\*p < .01, \*p < .05

### 5.2.2 Moderating effects of contextual factors

Since the contextual factors include busyness, place and time pressure, we further analysed their moderating effect by comparing the models of six contextual scenarios. The results are shown in Table 3. The main differences between the base model in Figure 3 and the models under the influence of contextual variables are the following:

- the subjective norm that is insignificant in the base model becomes significant in the contextual models (SN → CI in Table 3)
- the perceived behavioural control that is significant in the base model becomes insignificant in the contextual models (PBC → CI in Table 3)
- the explanatory power of fit on attitude reduces significantly when the contextual variables are included, but the explanatory power of continuance intention increases significantly when the contextual variables are included.

Hence, these evidences support the hypotheses that use contexts moderate users' intention attitude and continuance intention to use mobile services.

Another interesting finding is that the effect sizes (i.e., path coefficients) in different contextual models do not differ significantly. The only difference that has significant difference is between the model under time pressure and the one without time pressure. The effect sizes of Fit → Attitude are 0.263 and 0.350, respectively, while the effect sizes of SN → CI are 0.356 and 0.264, respectively, between time pressure and no time pressure. This implies that when a user is under time pressure to use a mobile service, subjective norm becomes more influential than the fit between mobile technology and the

need of the task. In other words, when the user is under time pressure, the person may choose services that are not considered highly suitable for the application.

**Table 3** Models in different contexts

	<i>Contextual factors</i>					
	<i>Task</i>		<i>Location</i>		<i>Time pressure</i>	
	<i>No task</i>	<i>With task</i>	<i>At home</i>	<i>At school/ in office</i>	<i>Time pressure</i>	<i>No time pressure</i>
Fit → ATT	0.331***	0.327**	0.381***	0.325***	0.263**	0.350***
ATT → CI	0.636***	0.656***	0.656***	0.658***	0.588***	0.672***
SN → CI	0.282***	0.287***	0.267**	0.274**	0.356***	0.264**
PBC → CI	0.047	0.027	0.044	0.023	0.037	0.032
R <sup>2</sup> (Att)	0.110	0.107	0.145	0.106	0.069	0.122
R <sup>2</sup> (CI)	0.795	0.835	0.806	0.815	0.821	0.826

\* indicates  $p < 0.05$ , \*\* indicates  $p < 0.01$ , \*\*\* indicates  $p < 0.001$ .

### 5.2.3 Effect of application type

Another issue that we would like to examine is whether different application types may have different concerns in continuance use. We further built separate models for the four application types. The result is shown in Table 4.

**Table 4** Model of four types of mobile services

	<i>Mobile services</i>			
	<i>Communication</i>	<i>Entertainment</i>	<i>Data</i>	<i>Transaction</i>
Fit → ATT	0.683***	0.642***	0.682***	0.783***
ATT → CI	0.418***	0.439***	0.441***	0.333*
SN → CI	0.075	0.117	0.133	0.308**
PBC → CI	0.402***	0.266**	0.239*	0.191
R <sup>2</sup> (Att)	0.467	0.412	0.465	0.613
R <sup>2</sup> (CI)	0.627	0.464	0.477	0.502

\* indicates  $p < 0.05$ , \*\* indicates  $p < 0.01$ , \*\*\* indicates  $p < 0.001$ .

A major difference that we can see is that the model has different explanation power in four application types. The highest R-square of continuance intention is the communication model (0.627), whereas the highest R-square of attitude is the transaction model (0.613). Subjective norm has no significant effect in the communication, entertainment and data models, whereas perceived behaviour control has no significant effect in the transaction model. In other words, most subjects showed that they care about whether they could do it but did not care how other people think, when they use mobile devices for communication (e.g., short message), entertainment (e.g., music download) and data services (e.g., map). This is changed when they perform mobile transactions (e.g., mobile banking), however. Their ability was no longer a problem but how other people view the behaviour became a significant concern.

We further analyse the moderating effects of contextual factors in four types of mobile services. The one that shows significant effects is the entertainment model. The other four do not have significant moderating effects. Table 5 shows different effect sizes of different contextual models for communication services. The following differences are found meaningful:

- The effect of fit on attitude is significant in the no busyness setting, but not so in the busyness setting.
- The effect of fit on attitude is significant when the user is at home, but insignificant at school/office.
- The effect of perceived behavioural control on continuance intention is also significant when the user is at home, but insignificant at school/office.
- The effect of fit on attitude is significant when no time pressure exists, but insignificant under time pressure.
- The effect of perceived behavioural control on continuance intention is significant when the user has no time pressure, but insignificant under time pressure. The explanatory powers of attitude are very low in four of the six models in Table 5, except the no busyness and no time pressure. This indicates that fit alone is not a highly powerful predictor of the subject's attitude towards entertainment services. This may be due to the unique nature of entertainment.

**Table 5** Entertainment service models in different contexts

	<i>Contextual factors</i>					
	<i>Task</i>		<i>Location</i>		<i>Time pressure</i>	
	<i>No task</i>	<i>With task</i>	<i>At home</i>	<i>At school/ in office</i>	<i>Time pressure</i>	<i>No time pressure</i>
Fit → ATT	0.377***	0.102	0.296**	0.133	0.011	0.333***
ATT → CI	0.593***	0.586***	0.516***	0.601***	0.597***	0.528***
SN → CI	0.319***	0.369***	0.360***	0.349***	0.368***	0.379***
PBC → CI	0.093	0.071	0.130*	0.066	0.039	0.129*
R <sup>2</sup> (Att)	0.142	0.010	0.087	0.018	0.000	0.111
R <sup>2</sup> (Att)	0.756	0.860	0.753	0.847	0.852	0.787

\* indicates  $p < 0.05$ , \*\* indicates  $p < 0.01$ , \*\*\* indicates  $p < 0.001$ .

## 6 Discussions and conclusion

In this study, we have proposed a research model that integrates TTF and TPB to serve as a theoretical lens for analysing user's continuance intention to use mobile services. In particular, we focus on the moderating effects of contextual factors in mobile services. An extensive online survey was conducted and the following major findings were obtained.

First, we found that the higher degree of fit between mobile devices and target applications led to more positive attitude to use mobile services when contextual factors

were not considered. The subjective norm only affected a user's intention to continue using transaction services. Perceived behavioural control had significant influence on the continuance intention to use mobile communication, entertainment and data services but not transaction services.

Second, we found that the effect of fit on attitude was stronger when the user had no concurrent task on hand than that when there was other concurrent task to make him/her busy. The effect of subjective norm on continuance intention was stronger when the user was under time pressure than when he or she had no time pressure. The effect of fit on attitude was stronger when the user had no time pressure than that when he or she was under time pressure. It indicates that when the user has no time pressure, attitude towards using mobile services tends to be more positive when the fit is high.

Third, moderating effects of contextual factors also exist in different application types. This is true in the entertainment applications, in particular. The effect of perceived behaviour control on continuance intention exists only when the entertainment was to be used at home or under no time pressure. In other contexts, the effect becomes insignificant. The effect of fit on attitude is also significant only when the use scenario is at home, no busyness, or no time pressure. This is consistent with our general understanding that entertainment is useful only when people need to relax.

The contributions of this study are two folds. First, the proposed theoretical framework that combines TRA and TTF is proven to be useful in interpreting the continuance use of mobile services. In particular, our research findings shed much light on the moderating effects of contextual factors. We all know that mobile applications are highly context-sensitive, but not much research in mobile commerce has investigated the contextual factors. In our study, we have identified three major contextual factors: time pressure, place and busyness. They are useful for future researchers who are interested in continuing this line of work.

The second major contribution is that our findings can provide valuable information to mobile service providers when they develop their mobile marketing and advertising strategies. Through a proper integration of contextual factors, their marketing campaigns can be more effective.

Although we have tried our best to make this research rigorous, it is not without limitations. First, owing to time and budget constraints, we only chose four different types of mobile applications. We will need to be careful when the findings are extended to other types of applications. Second, online convenient sampling was used to solicit survey participants. It is well known that online convenient sampling may not be a precise representation of the actual population of mobile users. Nonetheless, our findings provide valuable exploratory evidence of how contextual factors may affect the behaviour of a mobile user. Future researchers can stand on top of our current findings to examine other potential factors in other contextual scenarios.

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