Why do People Continue to Play Mobile Game Apps? A Perspective of Individual Motivation, Social Factor and Gaming Factor

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Abstract

This study attempts to identify the possible decisive factors of continuance intention and proposes a research model to predict the intention to continue playing mobile game apps based on the motivation theory and TAM framework. 377 valid respondents were collected by conducting an online survey and Partial Least Square (PLS) technique was applied to test our research model. The statistical results indicate that perceived playfulness (intrinsic motivation), perceived convenience (extrinsic motivation), social influence (social factor) and flow experience (gaming factor) are the significant determinants of continuance intention. Among these determinants, the flow experience is the most significant factor and the second one is intrinsic perceived playfulness. Perceived ease of use, does not affect continuance intention directly, but indirectly through perceived convenience and perceived playfulness.

Keywords: Mobile game apps, Continuance intention, Motivation theory, Technology acceptance model, Social and gaming factors

1 Introduction

Mobile entertainment is the fastest growing industry that may generate enormous revenue. Of these mobile entertainment services, mobile game applications (commonly referred to as "apps") is one of the most promising and profitable services [1]. Compared to traditional games, there are the following differences: (1) the ubiquity of mobile game apps that enables users to exempt from the temporal and spatial constraints [2]; (2) the update frequency of content that continuously brings novelty experiences for users; (3) the naturalness of operation that decreases the complexity of games and may induce the state of immersion of users.

In the information system (IS) and marketing domains, the eventual success of a product or service depends on continuance usage that also presents lower retention cost of customers. Mobile game apps providers must make the effort to establish long-term relationships with existing users, not only because they are less costly to be retained, but also they are more likely to play mobile game apps intensively [3]. Thus, users' continuance usage should be the primary goal for mobile game apps providers to keep their market share and increase their revenue. Since intention is the antecedent of actual behavior [4-6], it is essential to realize the motivations that influence users' continuance intention for mobile game apps.

However, most of the research have mainly focused on the mobile commerce adoption/continuance intention [7]. Limited studies have aimed to investigate the motivation effect on users' continuance intention on mobile entertainment service. For example, Chen and Kuan [8] applied unified theory of acceptance and use of technology (UTAUT) to investigate users' intention to play online games on mobile phone. Their study mainly focused on the applicability of UTAUT and ignored the mobile context virtues and game characteristics. Lee and Quan [9] examined the Chinese ubiquitous game service usage intention using an extended TAM and focused on the external variables impacts. Zhou [2] indicated that social influence and flow are important factors for mobile game adoption. The samples of these prior studies were persons who played "embedded or online game on mobile devices", not mobile game apps.

Therefore, there are some research gaps as follows. First, almost all of previous studies were not conducted for "mobile game apps". Second, previous studies were fragmented and did not have a more complete framework to understand the factors on continuance intention. This study tries to fill these gaps by reviewing the literature about mobile games, identifying the important factors that affect users' continuance intention, and finally developing a research model to predict why users continue to play mobile game apps.

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2 Literature Review

2.1 Past Studies on Mobile Games

There was many mobile related research in the past, but most of them mainly focused on the users' intention of utilitarian systems such as web portal sites [10], mobile data services [3, 7], mobile payment services [11], etc. Research on users' intention of mobile games was relatively limited. For example, Okazaki et al. [12] adopted the TAM to examine the factors influencing mobile gaming adoption and found that perceived convenience and perceived ease of use have significant impacts. Liu and Li [13] pointed out that users' adoption of online games on mobile devices is mainly affected by flow experience. Lee and Quan [9] revised TAM to examine the ubiquitous game services in China, and found perceived enjoyment is the determinant of the users' adoption. Leong et al. [14] reported that the perceived usefulness, perceived ease of use, social influence and perceived enjoyment are positively associated with users' adoption for mobile entertainment. Zhou [2] revealed that flow and social influence are important motivations for mobile game adoption. Park et al. [15] indicated perceived enjoyment and perceived usefulness are important predictors of intention to adopt mobile social games. Wei and Lu [16] pointed out that enjoyment, interaction with others and time flexibility significantly affect users' intention to play mobile social games. Liang and Yeh [17] integrated the technology acceptance model (TAM) and theory of reasoned action (TRA) to investigate users' continuance intention of embedded mobile games and indicated the significance of perceived ease of use. Chinomona [18] used the extended version of TAM including perceived enjoyment to examine the online/offline mobile gaming continuance intention with student samples and revealed the driving factors were perceived ease of use and enjoyment. The summary of mobile game related research as shown in Table 1.

Table 1. Summary of mobile game related research

Citation	Context	Key Findings
Okazaki, et al. [12]	Embedded mobile games	PEOU → PC (+) PC → AI (+)
Liu and Li [13]	Online games on mobile	PENJ → AI (n.s.) PU→ AI (n.s.) FE → AI (+)
Lee and Quan [9]	Ubiquitous games (including embedded mobile games, online/offline mobile games)	PEOU→ AI (n.s.) PENJ → AI (+)
Leong, et al. [14]	Mobile entertainment (including downloadable games, music, ring tone, instant messaging, internet browsing, etc.)	PEOU → AI (+) PENJ → AI (+) PU → AI (+) SI → AI (+)
Park, et al. [15]	Internet social network games on mobile devices	PENJ → AI (+) PU → AI (+)
Liang and Yeh [17]	Embedded mobile games	PP → CI (n.s.) PEOU → CI (+) SN → CI (n.s.)
Chinomona [18]	Online/offline games on mobile	PENJ → CI (+) PEOU → CI (+)

Note. PEOU: perceived ease of use; PC: perceived convenience; PENJ: perceived enjoyment; PU: perceived usefulness; SI: social influence; FE: flow experience; AI: adoption intention; CI: continuance intention; (+): positive relationship at $p < 0.05$; (-): negative relationship at $p < 0.05$; (n.s.): insignificant relationship;

After reviewing the above literature, we have the following concerns. First, most of studies were conducted before the appearance of apps era. Their research targets were online games, embedded games, or internet social games on mobile devices. There are many differences between mobile game apps and those previous games on mobile devices. The contents of mobile game apps would be continually and dynamically updated to give users more curiosity. The interfaces, operations, and interactions of mobile game apps are specially designed so that users might have totally different feeling and experiences when playing [19]. With mobile devices, any time of day and any location can provide gaming contexts and opportunities to play for any length of time [16]. It would deserve to investigate this new type of games. Second, most of previous studies ignored the important mobile context virtues such as agility, accessibility, and availability at anytime and anyplace.

2.2 Individual Motivation, Social Factor and Gaming Factor

Motivation is defined as "the forces either within or external to a person that arouse enthusiasm and persistence to purse a certain course of action" [20]. Deci and Ryan [21] first introduced intrinsic motivation and extrinsic motivation and revealed that human behavior is influenced by intrinsic motivation as well as extrinsic motivation. Extrinsic motivation refers to the performance of an activity because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself, such as improved job performance, pay or promotions [22]. Intrinsic motivation refers to the performance of an activity for no apparent reinforcement other than the process of performing the activity per se [22]. Davis, et al. [22] revised TAM and indicated that perceived enjoyment as an intrinsic motivation and perceived usefulness as an extrinsic motivation affect users' intention for technology usage. Later research has confirmed the assertions and demonstrated both intrinsic and extrinsic motivations as determinants for dominating human behaviors.

Some previous studies found that perceived usefulness only plays a minor role in hedonic contexts [12, 13, 23]. Thus, considering the mobile game apps as a hedonic service and the characteristics of mobile services that can be accessed at anytime and anyplace, we consider the perceived convenience rather than perceived usefulness. In addition, mobile game apps provide novelty contents and operations to interact with users to bring fun and pleasure entertainment experience. In the context of mobile game apps usage, such enjoyment and curiosity experience would be more close to the concept of perceived playfulness, which is defined as the strength of one's belief that the interaction with information technology could fulfill the intrinsic motives [5]. According to the research context, we consider perceived playfulness as an intrinsic motivation and perceived convenience as an extrinsic motivation for predicting users' continuance intention toward mobile game apps.

Social factor and gaming factor are important in driving users' playing behavior [24]. Several theories suggest that social influence is a critical social factor for shaping user behavior [23]. Mobile game apps allow users to share their achievement to their friends on social networking sites. On the other hand, it means that users can receive their friends' game status. Users may continue to play the mobile game app with their friends and gain enhanced social relationships [25]. In the hedonic context, flow experience is considered as a determinant for leading users' intention toward hedonic services [23, 26-27]. For example, players may forget to get off the train because they are concentrating on playing the mobile game app. Therefore, we consider social influence as social factor, and flow experience as gaming factor for enhancing users' continuance intention of mobile game apps.

3 Research Method

This study is interested in mobile game apps which are those paid or free games that could be downloaded from Apple Store or Google Play on any smart mobile devices such as smartphone, tablet. According to a report from Entertainment Software Association [28], the most mobile game type that people often play is casual game. There are only 4% multi-player games on the mobile device. Casual games are typically played in short bursts: during work/class breaks, while waiting in line, and on public transportation. Their rules are simple, and, unlike many traditional games, they do not require a long-term time commitment or special skills. Thus, considering current concise design nature of most mobile game apps, we do not pay attention to the motivations of achievement and collaboration interactions in games which are often mentioned in the traditional games. Thus, we propose the research model based motivation theory, revised TAM, social and gaming factors as shown in Figure 1.

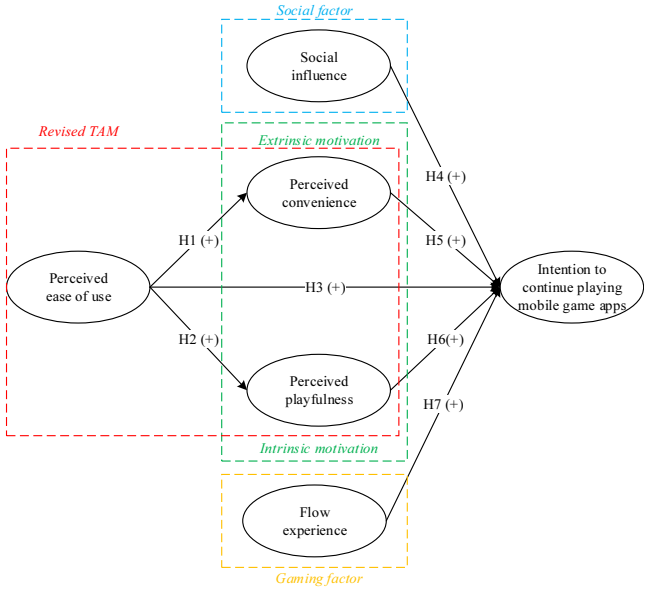

Figure 1. Research model

3.1 Hypothesis Development

Perceived convenience is defined as agility, accessibility, and availability of services, which is flexible in time and location [12]. Mobile game apps are essentially a type of ubiquitous hedonic service and enable users to be entertained at anytime and anyplace. Perceived convenience crystallizes the core ubiquitous hedonic service values of mobile game apps which are agile, accessible, and available at anytime and anyplace when users want to play. When mobile game apps are easy to use, users might perceive more convenient operation experience. For instance, mobile game apps

are easy to pause, restart and operate, which would allow users a flexible and convenient way to play game at anytime and anyplace. Yoon and Kim [29] found that perceived ease of use has a positive impact on perceived convenience in a ubiquitous computing environment. Okazaki et al. [12] studied the global youth mobile gaming in the U.S., Spain, and the Czech Republic, and demonstrated that there exists strong relationship between perceived ease of use and perceived convenience. Chang et al. [30] indicated that perceived ease of use positively affects perceived convenience in using mobile technology for English learning continuance intention. The TAM model also emphasizes the importance of perceived ease of use [4]. Thus, the following hypothesis is proposed.

H1: Perceived ease of use would enhance perceived convenience.

Perceived ease of use refers to the degree to which a person believes that using a particular system would be free of effort [4]. When mobile game apps have easy operations and intuitive interactions, users might realize the novel contents of game easily and have little efforts to learn how to play. A number of studies have investigated the effect of perceived ease of use on perceived playfulness. Tao et al. [31] revealed that perceived ease of use affects the perceived playfulness significantly in the continuance usage context of students' business simulation games. Liang and Yeh [17] indicated the strong relationship between perceived ease of use and perceived playfulness in the continuance usage of embedded mobile games. Several studies have also validated that perceived ease of use affects perceived enjoyment in the mobile game context [9, 15]. In our study, similarly to Moon and Kim [5], we define "perceived playfulness" as the perceived intrinsic enjoyment, interest, fun, or curiosity generated from engaging in absorbing interactions with games. Thus, it can be inferred that perceived ease of use would enhance perceived playfulness because an easy and smooth operation would provide enjoyable experience for users when playing mobile game apps. This leads to the following hypothesis.

H2: Perceived ease of use would enhance perceived playfulness.

Perceived ease of use refers that users only need very little efforts to use mobile game apps, which implies the improvement of operation performance and thereby may increase users' continuance intention. Kim et al. [7] hypothesized the perceived ease of use is positively related to user continuance usage intention toward mobile data services. Liang and Yeh [17] examined the relationship between perceived ease of use and continuance intention of embedded mobile games, and indicated that the more perceived ease of use is, the more users' intention to continue playing would be. Chinomona [18] found that perceived ease of use would have a direct positive effect on continuance intention to play online/offline games on mobile devices. Leong et al. [14] demonstrated that perceived ease of use is positively associated with consumer intention to use mobile entertainment. These game-related researches indicated that perceived ease of use may play a significant role on continuance intention to play. It can be conjectured that easy and intuitive operation would facilitate daily and repeated mobile game apps playing. Accordingly, this leads to the following hypothesis.

H3: Perceived ease of use would increase users' continuance intention.

Social influence, an important social factor in shaping user behavior [23], refers to the degree to which an individual user perceives the importance that others believe he/she should also use the specific product/service [32]. The mobile game apps users might think their friends expect the continuance of game playing, or they might continue play for sharing experiences or have the same discussion topics with their friends. Numerous empirical studies have found that social influence would positively affect an individual intention for specific technology. For example, Hsu and Lu [23] found the social influence is positively related to the intention to play online games. Zhou [2] showed social influence is able to predict consumer intention to adopt mobile games. Leong et al. [14] revealed that social influence is positively associated with consumer intention to use mobile entertainment. Chen et al. [24] found that social influence has positive impact on intention to play social game. Based on the findings of prior research, it can be conjectured that once if users' companions played the mobile game apps, the continuous social interactions would encourage them to continue playing. This leads to the following hypothesis.

H4: Social influence would enhance users' continuance intention.

Yoon and Kim [29] introduced perceived convenience as a new factor that reflects the characteristic of ubiquitous computing technology. Okazaki et al. [12] found that perceived convenience indirectly affects the global youth intention toward mobile gaming. Chang et al. [30] showed that perceived convenience affects college students' continuance intention to learn English via mobile technology indirectly through attitude toward using. Wei and Lu [16] found that time flexibility on the intention to play mobile social games is significant. Perceived convenience implies that users could perceive the capabilities of mobile game apps that are flexible in time and location. It would then be beneficial for users to play at anytime and anyplace [33]. Namely, due to the convenience of mobile game apps, users could play them in a more flexible way, which may fit users' easy life pace so as to motivate the continuance playing intention. Thus, this leads to the following hypothesis.

H5: Perceived convenience increases user

continuance intention.

The past research indicated perceived enjoyment as an important intrinsic motivation and has been found to be a significant predictor of various IT innovations [22, 34-35]. Chinomona [18] found that perceived enjoyment have a direct positive effect on continuance intention to play online/offline games on mobile devices with student samples. Several studies also confirmed similar results on embedded online/offline mobile games [9], mobile entertainment adoption [14], and internet social network games on mobile devices [15]. In the mobile game apps context, we consider perceived playfulness as a more suitable intrinsic motivation. The attractive screens, fantasy stories, and sustainable contents would provide more curiosity and enjoyment while playing mobile game apps. Shin and Shin [6] found that perceived playfulness has a positive effect on users' attitude for playing social network games. Thus, this leads to the following hypothesis.

H6: Perceived playfulness would increase users' continuance intention.

Flow experience is defined as the holistic sensation that people experience when they feel complete involvement in an act [36]. Experiencing flow reflects an optimal experience while playing mobile game apps. Once users could satisfy the optimal playing experience derived from mobile game apps, they might expect to obtain this experience again. Thus, continuance intention would be enhanced by flow experience. On the other hand, even if users could acquire the expected playfulness, they might give up playing mobile game apps without optimal playing experience. Flow experience has been recommended as useful in understanding users' intention to play games [37]. Lee [26] indicated flow experience is positively related to intention to play online games. Liu and Li [13] found a significant relationship between flow experience and adoption intention of online games on mobile devices. The finding of Shin and Shin [6] revealed that flow experience plays an important role to understand users' intention in social network games. Zhou [2] found flow experience as a significant motivation for mobile games adoption. It can be conjectured that once if users adopting, the flow experience would keep them playing. This leads to the following hypothesis.

H7: Flow experience would enhance users' continuance intention.

3.2 Measurement Development

To validate the research model, survey methodology was utilized. The measures in the study were adopted from the existing literature to ensure their content validity. The survey items were modified to adapt the mobile game apps context. Each item was measured on a seven-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (7). In the pretest phase, the survey measurements were reviewed by four Information System experts to identify problems in the wording, content, and to eliminate any possible ambiguities. After revising the items based on the suggestions from the pretest, the modified survey was pilot-tested on twenty mobile game apps heavy users. The reliability (Cronbach's alpha) of the questionnaire was tested. The Cronbach's alpha of each variable was above the acceptable level, that is, above 0.70. Besides, the pilot test respondents were also asked about their opinion of the survey in general. Their feedback and information from the pilot test were used to refine the final survey questionnaire.

3.3 Data Collection

Empirical data was collected by conducting an online survey for one month. Online survey has several advantages such as cheaper to conduct and elicit faster responses, as applied by many previous studies. To ensure the sample representativeness, the sampling frame was based on the membership of virtual communities devoted to mobile game apps. The online questionnaire's URL was announced on ten virtual communities related to the most popular mobile game apps (e.g., card game, baseball game, role playing game, tower defense game) in Taiwan. The online survey yielded 395 responses. Eighteen responses were deemed as invalid because they had no prior experience for playing mobile game apps. Eventually, there are 377 valid samples. The demographic information of the respondents is shown as Table 2. In order to eliminate the concern of non-response bias, we compared the subjective variables between early and late respondents (a proxy of non-respondents) which were arranged based on their submission time [38]. No significant differences were found between two groups in any variables except for continuance intention. Therefore, non-response bias should not be a major problem in this study.

3.4 Common Method Bias

In order to address on the common method variance, the Harman's single factor analysis was performed. Podsakoff and Organ [41] claimed that if all the items load on single factor or one factor explains the majority of the variance, common method variance may be a problem. The results showed that six factors explained about 73.11% variance, there is no single factor explained the majority of variance, the common method variance was not significant [42]. Moreover, by modeling all items as indicators of a single factor, the results provided a poor explanation of variance [43]. Thus, the common method variance should not be a significant problem.

Table 2. Demographic information for respondents

Profiles	Items	Frequency	Percentage
Gender	Male	262	69.50
	Female	115	30.50
Age	≦20	74	19.63
	21-30	224	59.42
	31-40	68	18.04
	Over 41	11	2.91
Education	Junior High School	14	3.70
	Senior High School	64	16.98
	College	239	63.40
	Graduate	60	15.92
Job	Government-related	17	4.51
	Service	53	14.06
	Manufacturing	47	12.47
	Information Industry	35	9.28
	No job	27	7.16
	Student	173	45.89
	Others	25	6.63
Average playing mobile game apps per day	< 1hr	78	20.69
	1hr - 2hrs	99	26.26
	2hrs - 3hrs	87	23.08
	3hrs - 4hrs	55	14.59
	4hrs - 5hrs	58	15.38

4 Results

4.1 The Measurement Model

The final items used in this research and their sources are listed in Table 3. This study first assessed the measurement model for the reliability and validity of the factors, the structural model was then analyzed to test the hypotheses. Partial Least Square (PLS) technique was used. Construct validity including convergent validity and discriminant validity should be examined [44]. As shown in Table 3, all of the item loadings (indictor reliability) were significantly larger than 0.7 and thus acceptable [45]. All of the composite reliability (CR) also fulfilled the recommended level 0.7 [44]. Table 3 confirms the all of average variance extracted (AVE) exceed the adequate value 0.5. Thus, convergent validity was assured. The correlation matrix in Table 4 indicates that the diagonal square root of AVE of each construct was higher than corresponding correlation values. Thus, the discriminant validity was assured [45]. Overall, the results assured the construct validity of the measurement model.

Table 3. Measurement items

Constructs and items	Loading	*t* value	AVE	CR	α
Perceived ease of use adapted from Davis [4]					
Learning to operate mobile game apps would be easy for me.	0.805	25.577			
My interaction with mobile game apps would be clear and understandable.	0.834	24.243			
I would find mobile game apps to be flexible to interact with.	0.819	30.247	0.717	0.927	0.902
It would be easy for me to become skillful at using mobile game apps.	0.874	36.216			
I would find mobile game apps easy to use.	0.899	65.170			
Perceived convenience adapted from Okazaki, et al. [12]					
Playing mobile game apps is an efficient way to be entertained in any time.	0.846	41.297			
Playing mobile game apps is an efficient way to be entertained in any place.	0.816	31.281			
Playing mobile game apps is convenient to be paused game anytime.	0.751	17.825	0.589	0.909	0.883
Playing mobile game apps is convenient to be paused game anyplace.	0.722	14.768			
Playing mobile game apps allows me to kill time.	0.720	17.134			
Playing mobile game apps makes my life easier.	0.727	23.189			
Playing mobile game apps fits in with the pace of my life.	0.780	33.065			

Table 3. Measurement items (continue)

Constructs and items	Loading	*t* value	AVE	CR	α
Perceived playfulness adapted from Moon and Kim [5]					
Using mobile game apps gives enjoyment to me.	0.876	67.226	0.679	0.927	0.905
Using mobile game apps gives fun to me.	0.875	68.284			
Using mobile game apps keeps me happy.	0.884	61.073			
Using mobile game apps stimulates my curiosity.	0.768	69.909			
Using mobile game apps leads to my exploration.	0.785	22.546			
Using mobile game apps arouses my imagination.	0.746	31.992			
Social influence adapted from Taylor and Todd [39]					
My peers (online friends, classmates, colleagues, or others I know) would think that I should use mobile game apps.	0.874	65.363	0.803	0.942	0.918
Generally speaking, I want to do what my peers (friends) think I should do.	0.885	52.125			
My peers would think that I should use mobile game apps.	0.918	87.934			
Generally speaking, I want to do what my colleagues (classmates) think I should do.	0.906	67.226			
Flow experience adapted from Shin and Shin [6]					
During a mobile game apps, I was intensely absorbed in the activity.	0.818	32.847	0.716	0.883	0.804
I strongly feel that I am inside a different world when playing mobile game apps.	0.877	48.541			
When playing with mobile game apps, I do not feel any control.	0.842	53.305			
Continuance intention adapted from Bhattacherjee [40]					
I would continue my use of mobile game apps.	0.853	39.978	0.766	0.908	0.848
I will strongly recommend others to continue using mobile game apps.	0.882	60.876			
It is worth to continue playing mobile game apps.	0.890	73.499			

Table 4. Correlation of constructs, AVE and mean

	Mean	PEU	PC	PP	SI	FE	CI
PEU	5.793*	**0.847**					
PC	5.639*	0.670	**0.768**				
PP	5.117*	0.508	0.558	**0.824**			
SI	4.293*	0.269	0.364	0.460	**0.896**		
FE	4.464*	0.322	0.526	0.516	0.549	**0.846**	
CI	4.691*	0.440	0.608	0.652	0.575	0.713	**0.875**

Note. PEU: perceived ease of use; PC: perceived convenience; PP: perceived playfulness; SI: social influence; FE: flow experience; CI: continuance intention; * indicates that the mean significantly larger than the middle level 4 (with scale 1-7) at $p < 0.001$, N=377.

4.2 The Structural Model

Figure 2 shows the PLS results of the structural model, including the standardized path coefficients, and variance explained (R^2). All path coefficients were significant at 0.001 except the path between perceived ease of use and continuance intention. The perceived ease of use contributes 44.9% and 25.8% of the variance in perceived convenience and perceived playfulness, respectively. The structural model explains 66.2% of the variance in continuance intention by perceived playfulness, perceived convenience, social influence, and flow experience. Overall, the hypotheses H1, H2, H4, H5, H6, and H7 were supported and significant at 0.001, and flow experience is the strongest determinant of continuance intention for playing mobile game apps.

5 Discussions

The findings revealed that perceived ease of use positively affects perceived convenience, which is also confirmed with the findings of some studies about new technology [12, 29-30]. The easier it is for playing mobile game apps, the more convenient users would perceive. The mobile game apps own several features such as easy pause and restart, mobility playing, and flexible interaction. Those features provide users an elastic way to play mobile game apps. While an incident happens suddenly, users can temporarily suspend the game at anytime and anyplace, and then restart it later as they wish. This elasticity way allows users a convenient form to play mobile games and provides a seamless experience while users switch between the game playing and daily activities.

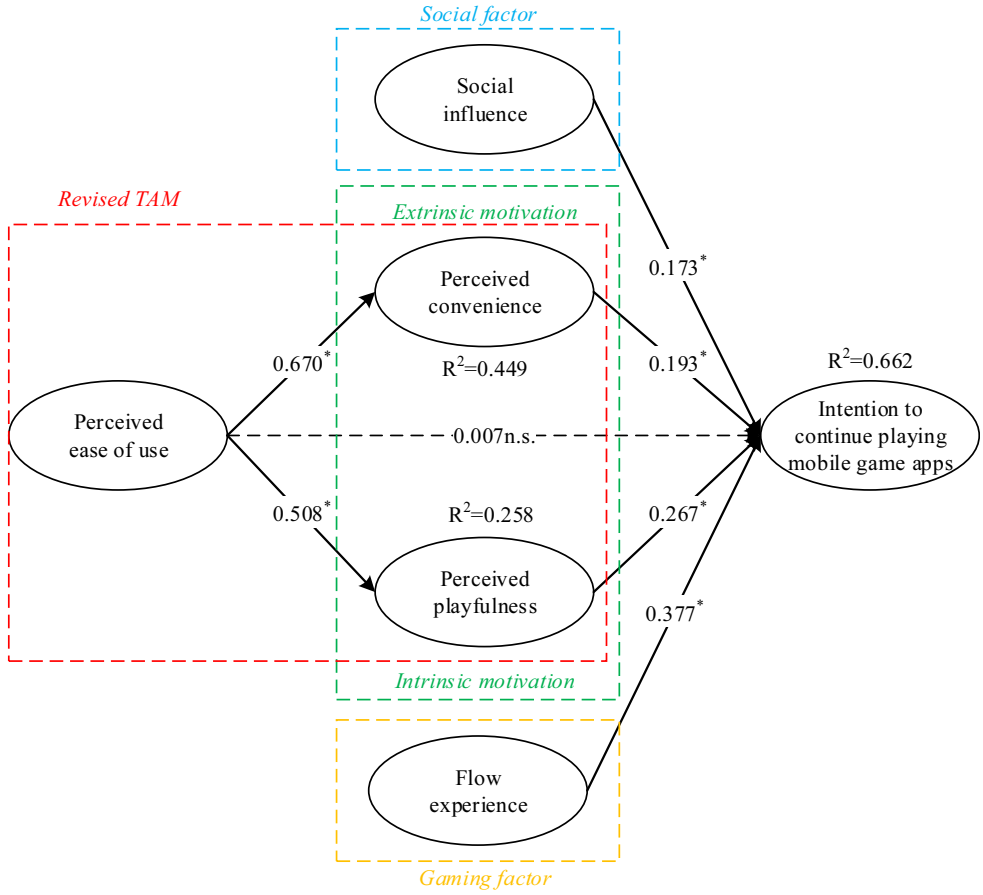

Figure 2. Result of the structural model

(* indicates $p < 0.001$; n.s. non-significant)

Consistent with prior studies [9, 15, 17, 31], our empirical results confirmed the perceived ease of use was an antecedent of perceived playfulness. It is conjectured that easy operations and intuitive interactions would cause the users' perception of playfulness and entertainment in mobile game apps. Efficient navigational mechanisms and easily-learning user interfaces are important constituents of a pleasurable playing experience. Users could experience happiness, pleasure and curiosity because easy operations and intuitive interactions imply that users only need very little efforts to understand how to operate and easy to memorize the interaction ways. The perception of ease of using the mobile game apps could help users quickly to realize the contents of mobile game apps and respond the missions from mobile game apps intuitively, thus then achieving satisfactory entertainment and fun.

Although previous studies proved that perceived ease of use has positive effect on playing intention [7, 14, 17, 18], some studies revealed a non-significant effect [7, 30, 46]. In this study, the relationship between perceived ease of use and continuance intention was clarified. The perceived ease of use had no significant direct effect on users' continuance intention toward mobile game apps. A possible conjecture is that perceived ease of use may be a necessary condition in users' first adoption intention, but not a sufficient criterion to maintain users' continuance intention. Experienced users, who were already familiar with the operation ways and interaction modes of the mobile game apps, may look for the characteristics of entertainment, fun, and curiosity. The perceived ease of use of the mobile game apps would become not sufficient, but should be accompanied with other features to attract users' senses and maintain the mobile game apps loyalty. Therefore, other mediators, such as perceived playfulness and perceived convenience, may be required for producing impact on continuance intention.

The results supported the significant effect of social influence in continuance of mobile game apps. This finding was aligned with some previous research [3, 14], but opposed to Venkatesh et al. [32] who discovered that social influence is significant only in mandatory settings or significant during early stages of experience/adoption. In our research context, the continuance intention of mobile game apps is a decision under voluntary settings and free will. This shows that users attach greater importance to the opinions of other persons, such as their friends and peers. People usually want to discuss and use the technology when the social environment encourages them to do so. It is not a mandatory force, but a

voluntary intention of users to join the same group or discuss the same topic with their friends.

To our best knowledge, there is little research exploring the relationship between perceived convenience and continuance intention. However, the trend of mobile technology has become more mobile, ubiquitous, agile, accessible, and available at any time and location. The perceived convenience should be considered as an important predictor of continuance intention in mobile hedonic services. In the existing literature about perceived convenience, the empirical results are mixed. Some studies suggested a mediator attitude effect between users' adoption intention and perceived convenience [12, 30], but others did not [29, 47]. In the current study, it was demonstrated that perceived convenience exercised significant effect on continuance intention toward mobile game apps. This confirmed our inference that the ubiquitous and flexible capabilities of mobile game apps allow users to kill time and fit with their easy life pace so as to keep the continuance playing intention. It also confirmed that perceived convenience might be a suitable surrogate for perceived usefulness in mobile hedonic contexts.

Consistent with the prior research [9, 14-15, 18, 22], the empirical result asserted that perceived playfulness could increase users' intention to continue playing mobile game apps. This finding was opposed to the study of Liang and Yeh [17] that indicated perceived playfulness has no significant effect on continuance intention in embedded mobile games. It also confirmed our concerns about the suitability of applying previous studies of "embedded mobile games" to current "mobile game apps". Mobile game apps could provide more attractive screens, fantasy stories, and sustainable contents than embedded mobile games. The attractive screens may stimulate users' curiosity, the fantasy stories may arouse users' imagination, and the sustainable contents may lead to users' exploration. These users' perceptions may derive their continuing interests in games. Thus, perceived playfulness becomes an important intrinsic motivation of continuance intention, the second significant determinant in current study.

Our research model further showed that flow experience plays the most significant role in enhancing users' continuance intention toward mobile game apps. This finding is consistent with the results of prior research [6, 13, 26] that flow experience is an important predictor for users' intention in hedonic contexts. Flow experience is an important gaming factor to describe people's feeling about an activity [36]. When playing mobile game apps, the more optimal experience of enjoyable interactions, the more possibility users would be intensely absorbed in the games. That is, carrying the mobile devices, users would experience the states characterized by a seamless sequence of responses facilitated by technology interactivity, intrinsic enjoyment, a loss of self-consciousness, and self-reinforcement.

6 Conclusions and Implications

6.1 Conclusions

The aim of this study is to identify the possible decisive factors of continuance intention toward mobile game apps. Through literature review, using TAM and motivation theory as reference framework, and considering the unique virtues of mobile game apps, this study suggested five variables include perceived ease of use, perceived convenience (extrinsic motivation), perceived playfulness (intrinsic motivation), social influence (social factor) and flow experience (gaming factor). We propose a research model to explain continuance intention of mobile game and focused on the subjects of users of true "mobile game apps" rather than "embedded/online games on mobile devices". The statistical results provide satisfactory results and explain 66.2% of the variance in continuance intention toward mobile game apps. Finally, it is confirmed that four variables directly influence users' intention to continue playing mobile game apps. The tested model can lighten our understanding for predicting the intention to continue playing mobile game apps. In the past, there was little research for investigating users' continuance intention toward mobile game apps that can be downloaded from Apple store or Google Play. Based on the motivation theory, TAM framework, social factor and gaming factor, this research would shed light on the implications for both academic and practice.

6.2 Academic Implications

There are some academic contributions as follows. First, given extrinsic and intrinsic motivation have been proven as key determinants of human behavior, there is a lack of understanding about motivation effects on continuance intention of mobile game apps. This study identified and confirmed that perceived playfulness and perceived convenience are critical extrinsic and intrinsic motivations for enhancing continuance intention of mobile game apps. Second, we revised the original TAM by replacing perceived usefulness as perceived convenience and adding social factor and gaming factor. The results confirmed that perceived convenience, social influence and flow experience have significant impacts on continuance intention. That is, continuance intention of mobile game apps is affected by individual motivation, social factor, and gaming factor simultaneously. Future research may adapt our research model for investigating specific mobile hedonic services.

6.3 Practical Implications

The findings of this study also give some important implications for mobile game app practitioners, including programmers, developers, and service providers.

First, our results revealed that perceived convenience and perceived playfulness are important extrinsic and intrinsic motivations for enhancing continuance of mobile game apps. Perceived ease of use is an antecedent of perceived convenience and perceived playfulness. It is suggested that mobile game app programmers should pay more attentions on the design of operation and user interfaces. It would be desirable to make user interaction more easy, smooth, and efficient so as to increase the users' perceptions of playfulness and convenience. For instance, it would be better to have more intuitive graphs and less pure texts for game content descriptions; have few page reload to provide smooth user experience; support considerate methods so that users can interweave virtual world gaming with real world working at anytime and anyplace; and provide a stable synchronization mechanism to allow the switch of different mobile devices and keep the consistent progress of mobile games.

Second, flow experience is the most significant gaming factor for enhancing continuance of mobile game apps. Therefore, mobile game app developers should continue adding more attractive contents, and fancy stories to increase users' flow experience. For example, developers might attempt to invite different areas of artists to co-create content as new virtual avatars, animated images and game songs. Another possible way is to write a fancy story by adapting famous mythological story, popular animation story, fashionable movie, or fairy tale, etc. Thus, the fancy story would be more familiar to users as so to invoke more interests in the games.

Finally, since this study confirmed the importance of social influence, mobile game app service providers should increase the social network size of the game by connecting with the different social platforms, such as LINE (a popular communication-oriented social platform), Facebook (a popular social networking platform), and Instagram (an attractive social platform to the younger generation). App service providers can facilitate users to share their achievements of mobile game apps in different social platforms easily, to accelerate the discussion of users about the content of mobile games, and to reinforce the social interaction of users among different social platforms. It would raise the level of social influence to enhance users' continuance of mobile game apps. For example, a famous mobile app game "Tower of Saviors" allows users to easily register game account by connecting their Facebook account. It also provides many mechanisms to assist users in communicating with each other such as sharing their card collection on Facebook, syncing friends on Facebook, and creating a Fan page on Facebook to interact with players.

6.4 Limitations and Future Research

There are some limitations of this study. First, the investigation did not separate two different types of mobile game apps: free and paid. It is more likely to have different results in free and paid mobile game apps. Second, even those free mobile game apps still have the options to allow user to pay via micro-transaction within the game. The perspective of cost was ignored in this study. Further research may consider the effect of users' cost. Finally, the mobile game apps mentioned in this study does not especially focus on the location-based mobile games such as Ingress or Pokémon GO, which allow players to interact with others and monsters at any time and place. Location-based mobile games provide a novel playing experience for players. Future investigation of location-based mobile games would be encouraged.

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