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Understanding the behavioural intention to play online games

An extension of the theory of planned behaviour

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Abstract

Purpose – The purpose of this paper is to investigate whether flow experience, perceived enjoyment, and interaction affect people's behavioural intention to play online games and whether gender, age and prior experience have moderating effects on online game acceptance.

Design/methodology/approach – This study extends the theory of planned behaviour (TPB) with flow experience, perceived enjoyment, and interaction to propose a theoretical model to explain and predict people's behavioural intention to play online games. This model is examined through an empirical study involving 458 participants using structural equation modelling techniques. In addition, a competing model based on the technology acceptance model (TAM) is proposed to evaluate whether TPB is more suitable than TAM to explain the use of online games. The two action-theoretical models are compared in terms of their predictive power and their practical utility.

Findings – Although both models explain the players' intention to play online games very well, the extended TPB model provides a better fit and explanatory power. Notably, this study finds that flow experience is a more important factor than perceived enjoyment in influencing customer acceptance of online games. Further analysis reveals that gender is a key moderator of online game acceptance.

Practical implications – Online game developers need to search for flow experience building strategies that might assist in engaging players. This study suggests that game developers should consider focusing more on establishing the interactions between players (social interaction) and online games (human-computer interaction) in their marketing strategies.

Originality/value – This study is significant for two reasons. First, it synthesises the theory of planned behaviour with psychological and interaction factors and, second, it presents a blueprint for an entertainment-oriented technology acceptance model.

Keywords Video games, Behaviour, Social interaction

Paper type Research paper

Introduction

As the internet has become widespread, it has been used to trade various kinds of content (Grover and Teng, 2001). One of the most popular online activities is games in which a person can play not only with the computer but also with other people connected via the internet (Gorriz and Medina, 2000). The rapid growth of the internet has made the game industry a highly profitable e-commerce application in recent years (Ha *et al.*, 2007). The value of the global online game market has rapidly expanded from US$3 billion in 2002 to US$9 billion in 2007 (Datamonitor, 2007). There is a need, therefore, to understand what factors affect players' acceptance of online games. This

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information can assist game developers in designing popular games or help vendors make adjustments to their marketing strategies.

Enjoyment is the single most important goal for online game players (Sweetser and Wyeth, 2005). If players do not enjoy the game, they will not play it. Ha *et al.* (2007) suggested that games are intended to provide entertainment, enjoyment and relaxation. Previous research has focused narrowly on perceived enjoyment to explain why people play online games (Hsu and Lu, 2004; Song and Lee, 2007; Sweetser and Wyeth, 2005). However, perceived enjoyment of games may not be enough to motivate customers to continue to play games, since the enjoyment of most games is temporary (Song and Lee, 2007). Sweetser reveals that players often try new online games even though they enjoy games already being played (Sweetser and Wyeth, 2005).

Recently, the concept of flow experience has been introduced to explain the adoption of information technologies such as e-learning, online shopping and games (Pilke, 2004). Flow experience refers to optimal and very pleasing activities experienced by individuals with full involvement, concentration and a sense of time distortion. When in the flow state, people become absorbed in their activity, lose their self-consciousness and are unable to recognise changes in their surroundings. Therefore, this study adopts the flow experience as a predictor of online game adoption. In addition online games are typically multiplayer games that enable users to fantasise and be entertained. Interaction is an important feature of multiplayer games, which allows thousands to play simultaneously. This feature may also play an important role in the attraction of players to games.

Although the above three factors might have varying influences on player acceptance of online games, little is known about the relationships among these factors and how they influence the players' behavioural intention to play online games. Hence, there is a need to synthesise and integrate them into a new theoretical model to examine their relationships and evaluate to what extent these concepts affect players' behavioural intention to play online games.

In order to provide a solid theoretical basis for examining players' behavioural intention, this paper draws on two schools of thought regarding the nomological structure of the theory of reasoned action (TRA):

(1) the technology acceptance model (TAM) (Davis *et al.*, 1989); and

(2) the theory of planned behaviour (TPB) (Ajzen, 1991).

Although online games are considered a type of information technology (IT) (Ha *et al.*, 2007; Hsu and Lu, 2004, 2005), their entertainment orientation distinguishes them from traditional task-oriented IT (Choi and Kim, 2004; Hsu and Lu, 2004). People play online games for pleasure as well as entertainment, not to achieve specific goals or improve job performance (Sweetser and Wyeth, 2005). While it has been widely applied to task-based IT acceptance, TAM would not be suitable to explain players' intentions regarding online games. This is because perceived usefulness (PU) and perceived ease of use (PEOU) in TAM cannot reflect feelings of favourableness or unfavourableness toward playing online games. Moreover, TAM does not include the influence of social and control factors on behaviour, and such factors have been found to significantly influence online usage behaviour (Bosnjak *et al.*, 2006; Chen *et al.*, 2007; Hsu and Chiu, 2004; Hung and Chang, 2005; Lam and Hsu, 2006; Liao *et al.*, 2007; Lin, 2007).

These variables are also determinants of behaviour in the theory of planned behaviour (Ajzen, 1985), where social influences (subjective norms) are modelled as determinants of behavioural intention and perceived behavioural control is modelled as a determinant of both intention and behaviour. Because of its predictive utility in online usage research and its widespread application in social psychology, TPB would be a more comprehensive model to understand the behavioural intention to play online games. To assess whether TPB is more suitable than TAM to explain entertainment-oriented information technology in the context of online games, a competing model based on an extension of TAM is proposed. The two models are compared in terms of their predictive power and their practical utility.

In addition gender, age and prior experience are considered as moderator variables to examine the moderating effects on the extended TPB research model. This study applies structure equation modelling (SEM) techniques to assess the empirical strength of the relationship in the proposed model. This research may give online game practitioners an increased understanding of players' psychological and technical perceptions which can be used to devise marketing strategies to attract customers' behavioural intention toward online games. Overall the purpose of this study is as follows:

- to investigate whether flow experience, perceived enjoyment, and interaction significantly affect customers' behavioural intention to play online games;
- to clarify which factors are more influential in making customers want to play online games;
- to evaluate whether TPB provide a solid theoretical basis for examining online games; and
- to check whether gender, age and prior experience as moderator variables have moderating effects on our research model.

Predictors and research hypotheses

Flow experience

Flow is defined as "the holistic sensation that people feel when they act with total involvement" (Csikszentmihalyi, 1977, p. 39). When people are in the flow state, they become absorbed in their activity and unable to recognise changes in their surroundings (Csikszentmihalyi, 1989). Thus flow theory, developed in psychology, has been used to address optimal user experiences with personal computers (Finneran and Zhang, 2005). Such a concept has been extensively applied in studies of a broad range of contexts, such as sports, shopping, rock climbing, dancing, gaming and others (Lu *et al.*, 2009). Accordingly, this study examines the influence of flow experience on the intention to play online games.

Flow is a complex concept, and researchers often measure it through multiple dimensions. Huang (2003) suggested four constructs to address flow: perceived control, attention focus, curiosity, intrinsic interest. Li and Browne (2006) suggested that flow experience comprises three dimensions: focused attention, control and curiosity. From these proposed dimensions of flow, we find that the measurement of flow includes concentration, perceived control and curiosity. In this paper two dimensions are used: concentration and curiosity. Perceived control in this model is similar to the perceived behavioural control in the TPB, so it is not examined separately.

Recently, flow experience has been recommended as useful in understanding online consumer behavioural intentions. For instance Lu *et al.* (2009) indicated that the flow experience has a significant influence on the adoption of online instant messaging (IM). Pilke (2004) also suggested that flow experience is a key determinant of online information technology usage. Therefore, it is hypothesised that:

H1. Flow experience is positively related to attitude toward playing online games.

H2. Flow experience is positively related to the intention to play online games.

Perceived enjoyment

From a motivation perspective people make an effort to use information technology for both intrinsic and extrinsic reasons (Davis *et al.*, 1992). Intrinsic motivation refers to the enjoyment and satisfaction gained from doing something (Deci and Ryan, 1987), while extrinsic motivation emphasises the achievement of specific goals/rewards (Vellerand, 1997). Perceived enjoyment is defined as "the extent to which the activity of using a specific system is perceived to be enjoyable in its own right, apart from any performance consequences resulting from system use" (Davis *et al.*, 1992, p. 1113). Perceived enjoyment as an intrinsic motivation has been found to have a significant impact on a user's technology acceptance, especially for hedonic systems (Davis *et al.*, 1992; Van der Heijden, 2003). When using a technology is fun and pleasurable, users will be intrinsically motivated to adopt it. Therefore, this study adopts perceived enjoyment as an intrinsic motivation to improve understanding of players' intentions with regard to online games.

As noted above, online games often have rich entertainment functions, and users can obtain great enjoyment when playing them. Thus it is expected that perceived enjoyment will improve the users' affective attitude toward online games and promote their acceptance intention of online games.

H3. Perceived enjoyment is positively related to attitude to playing online games.

H4. Perceived enjoyment is positively related to the intention to play online games.

Interaction

Interaction is considered one of the most important aspects related to optimal experience with computer games (Lewinski, 2000). Interaction is defined as the behaviour of communicating with two or more objects and affecting each other (Laurel, 1993). For instance a player may interact with opponents, monsters or other players by talking, trading, attacking or defending them. Such interactions have been found to have substantial impact on the popularity of games because a set of several sequences of interaction is a narrative or storytelling used to construct a play experience (Choi and Kim, 2004). In this research interactions while playing online games can be classified into two types: the first is the interaction that exists between the user and the system, while the second is the user-to-user interaction. In this paper the interaction between the user and system is referred to as human-computer interaction, and the term social interaction refers to the interaction between two or more users. The human-computer interface, defined as the point of contact between the application and the end user, is that which enables the user and the computer to communicate with

each other (Sheppard and Rouff, 1994). The interactive communication between users and online games (web-based software on the internet) takes place via computer hardware and software interfaces. A good HCI could influence whether players accept or continue to play online games. Voiskounsky *et al.* (2004) indicated that many players enjoy online games because they enhance social contacts and give access to computer-mediated patterns of interactions with close or distant players. Sweetser and Wyeth (2005) suggested that social interaction can cause immersion in games. Lazzaro (2004) also indicated that players' enjoyment came from interaction with other people. Pilke (2004) indicated that flow experience can happen in interaction with information technology. Kim *et al.* (2005) revealed that social interaction and human-computer interaction have been found to influence the antecedents of the flow experience. In addition, Choi and Kim (2004) proposed that people will feel flow, the optimal experience, if they can interact with the game system or with other people effectively. Thus it is reasonable to expect that human-computer interaction and social interaction will help players enter a flow state and promote their intention to accept online games. Accordingly, the following hypotheses are proposed:

H5. Human-computer interaction is positively related to the flow experience of online game players.

H6. Social interaction is positively related to the flow experience of online game players.

Research model and competing model

In this study, TAM and TPB are compared in terms of the extent to which each can be used to understand the intention to play online games. The two models are compared based on their respective explanatory power and the significance of paths.

Research model – an extension of the TPB model

TPB was chosen as the guiding framework for developing the research model as illustrated in Figure 1. In this research model TPB was integrated with flow experience, perceived enjoyment, and interaction as described above. TPB asserts that the intention to play online games is a function of flow experience, perceived enjoyment, attitude, subjective norms and perceived behavioural control. Furthermore flow experience mediates the impact of interaction on intention, and attitude mediates the impact of flow experience on intention. TPB was developed based on the theory of reasoned action, which argues that both behavioural attitude and subjective norms affect behavioural intention. TPB adds to TRA a third factor – perceived behavioural control – that affects behavioural intention.

Attitude is defined as an individual's overall evaluation of performing a behaviour and affects users' behavioural intention (Ajzen, 1991). When individuals form positive attitudes toward online games, they will intend to play online games. Thus, it is posited that:

H7. Attitude is positively related to the intention to play online games.

Subjective norm is defined as "the perceived social pressure to perform or not to perform the behaviour" (Ajzen, 1991, p. 188). In other words, subjective norm is related to normative beliefs about expectations from other people. According to Hsu and

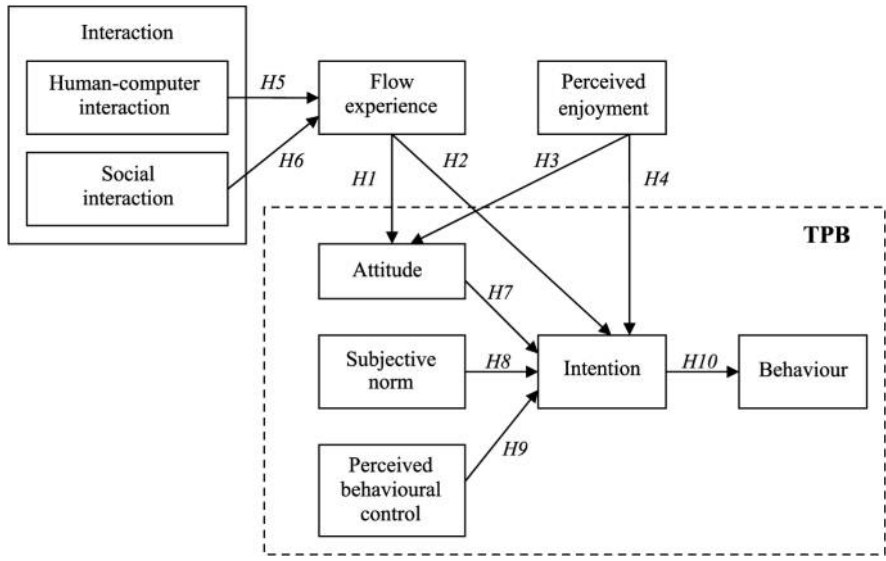


Figure 1.
The research model

Lu's (2005), research subjective norm plays an important role in online communities, encouraging people to change their attitudes, values, or behaviour in order to conform to the same community. Many internet users play online games only because their friends are online game players and recommend that they play. Thus, it is hypothesised that:

H8. Subjective norm is positively related to the intention to play online games.

Perceived behavioural control refers to "people's perception of ease or difficulty in performing the behaviour of interest" (Ajzen, 1991, p. 183). Although online games are an easy technology to use on the internet, users still need to have the basic internet interface skills such as being familiar with browsers, search engines and Windows-based operating systems. In addition compared with conventional offline computer games, online game players mainly play on game websites, which often require players to register and pay. This may arouse their anxiety about control and negatively influence their behavioural intention. Thus, it is posited that:

H9. Perceived behavioural control is positively related to the behavioural intention to play online games.

H10. The behavioural intention to play online games is positively related to actual behaviour.

The competing model – an extension of the TAM model

In this competing model, TAM was integrated with flow experience, perceived enjoyment, and interaction as described above. TAM was proposed by Davis *et al.* (1989) to explain IT users' intentions and behaviour regarding IT usage. They identified two salient beliefs – perceived usefulness and ease of use – as the primary predictors of a user's attitude or overall affect toward IT usage. PU is the extent to

which a person believes that using a system will enhance their performance, and perceived ease of use is the extent to which a person believes that using the system will be relatively free of effort. In the context of online games TAM suggests that a player's perception of the degree to which an online game is easy to play affects both perception of usefulness and their attitude toward playing the game. Attitude is also influenced by usefulness, as perceived by a player. Ultimately, the player's intention to play online games can be explained or predicted by their attitude toward playing online games and their perceived usefulness. Accordingly, it is proposed that:

H7a. PU is positively related to players' attitudes toward playing online games.

H8a. PU is positively related to players' intentions toward playing online games.

H9a. PEOU positively affects players' attitudes to playing online games.

H10a. PEOU positively affects the perceived usefulness of online games.

H11a. Attitude is positively related to the intention to play online games.

H12a. The behavioural intention to play online games is positively related to actual behaviour (see Figure 2).

Moderators of gender, age and prior experience

Many researchers have been interested in the moderating effect of experience, gender, and age on the relationship between independent and dependent variables. For instance, Ha *et al.* (2007) indicated that gender and age have significant moderating effects on the relationship between perceived ease of use and perceived enjoyment in mobile broadband wireless access based games. Yu *et al.* (2005) compared the factors influencing television-commerce for experienced and inexperienced users and showed that perceived enjoyment had the greatest impact on attitude of experienced users, and that attitude had the greatest influence on their intentions. For inexperienced users

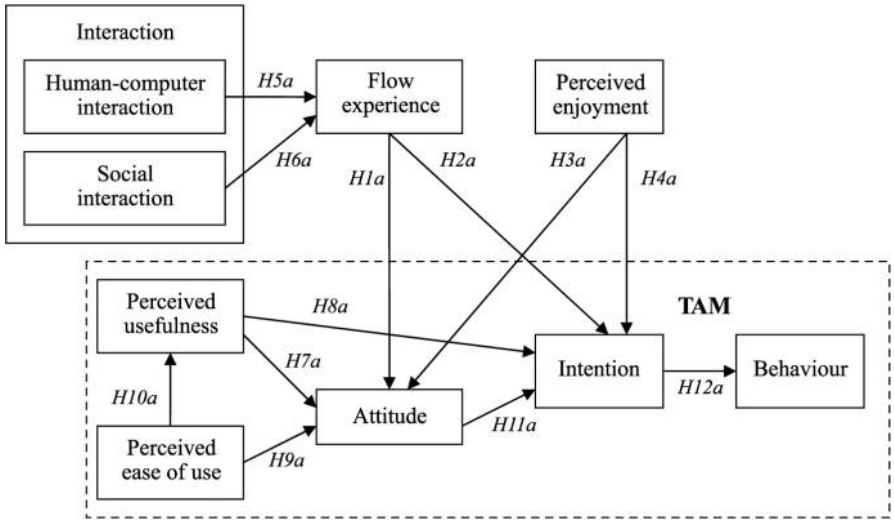


Figure 2.
Competing model

perceived enjoyment and perceived usefulness positively affected their attitude, and attitude and subjective norm had an impact on intention. Furthermore Lam and Hsu (2006) also indicated that past behaviour should be considered as a moderator that interacts with other variables in predicting behavioural intention. Based on these precedents, the current study concentrates on three moderators: gender, age, and prior experience. This study provided two subgroups for each moderator:

- male or female;
- younger or older; and
- expert or novice.

Because the research model and comparative model are very similar the moderating effect is only discussed in terms of the research model rather than both models. In sum, it is hypothesised that:

H13. All relationships among variables in the research model are moderated by gender, age, and experience.

Research method

This section discusses the research method. First the questionnaire development is outlined. Then the research subjects and data collection method are described.

Questionnaire development

The questionnaire was developed from the literature, and the list of items is given in the Appendix. In recent years many studies have developed and validated instruments for measuring TPB constructs such as attitude, subjective norm, perceived behavioural control, and behavioural intention (Liao *et al.*, 2007; Lin, 2007; Taylor and Todd, 1994). Therefore, the items in the instrument were derived from the existing literature and slightly modified to suit the context of online games. Items for measuring human-computer interaction and social interaction were adapted from Choi and Kim (2004) and Kim *et al.* (2005) with modifications to suit online games. Items for measuring flow experience were developed and tested by Hsu and Lu (2004) and Kim *et al.* (2005) while perceived enjoyment was measured using items adapted from Van der Heijden (2003), Hsu and Lu (2005) and Lee *et al.* (2005). Each item was measured on a seven-point Likert scale, ranging from "disagree strongly" (1) to "agree strongly" (7). Before conducting the main survey, both a pre-test and a pilot test were performed to validate the instrument. The pre-test involved ten respondents who had more than ten years' experience in playing online games. Respondents were asked to comment on list items, such as the length, questionnaire format, and wording of scales. Finally, in order to ensure the reliability and validity of the questionnaire, a pilot test that involved 60 respondents from Gamebase, a popular game-related website (www.gamer.com.tw), was performed.

Pilot test

The preliminary instrument was pilot tested with a convenient sample. There were 156 responses of which 122 were complete, giving a response rate of 78 percent. The results of the pilot test were evaluated using Cronbach's reliability and factor analysis. Cronbach's alpha indicator was used to assess the initial reliability of the scales. The

standard lower bound for Cronbach's alpha is 0.70 (Hair *et al.*, 1998). The item-to-total correlation was used to improve the level of Cronbach's alpha, considering a minimum value 0.5 (Churchill, 1995). Items that did not significantly contribute to the reliability were eliminated. A factor analysis was then performed to examine whether the items produced the expected number of factors and whether the individual items were loaded on their appropriate factor as expected. Hair *et al.* (1998) consider a measure to be significant if its factor loading is greater than 0.5 when the sample size is 120. This criterion was adopted to examine the item loadings of all measures. The measurement was then refined by removing items that did not load significantly onto the underlying constructs. In addition modifications to refine the instrument were made based on suggestions by respondents. The final measures obtained from the pilot test were used as indicator variables for the main study. The final version of the questionnaire items is presented in the Appendix.

Sampling plan and data collection

This study conducted a web-based survey to maintain respondents' anonymity and overcome time and place constraints, thus helping our study to reach respondents more easily than other survey methods such as interviews (in person and via telephone) and other self-administered survey techniques (Wang and Emurian, 2005; Wilde *et al.*, 2004). The internet questionnaire was hosted by Chungwa Telecom Co. Ltd. The questionnaire collection ran continuously for the six-week duration of the survey period. To solicit a pool of respondents who would be as close to the general population of internet users as possible, the link to the survey was distributed through university listservs, online discussion boards and popular game-related websites, including Bahamut (www.gamer.com.tw), Gamebase (www.gamebase.com.tw), Gamemad (www.gamemad.com) and campus BBS (bbs.ptt.cc) in Taiwan.

The main survey had 672 responses. There were 44 respondents who were obviously not thinking about their answers (i.e. giving the same rating for all items) so they were eliminated, with 628 questionnaires retained for analysis. Males comprised 59 percent of the respondents while 41 percent were female. The majority of respondents (77.5 percent) were under 25 years old. Almost a third (31.2 percent) of the respondents had one to three years' experience of playing online games, and 68.78 percent had been playing for over three years. Just over a third (36 percent) played online games for one to three hours each time, 38 percent for three to five hours, and 10.94 percent for more than six hours. To investigate the moderating effect of user heterogeneity, we conducted sample segmentation based on the moderators of age, gender, and prior experience. The measurement question for prior experience was "how long have you previously played this type of game?" to determine the subjects' familiarity with online games. An "expert" was defined as a player with over three years' experience of playing online games. The sample was divided into two groups for each moderator.

Data analysis and results

In analysing the collected data this study followed the two-step procedure suggested by Anderson and Gerbing (1988). This study first developed the measurement model by conducting confirmatory factor analysis (CFA) to measure convergent and discriminant validity. Then the structural equation model was estimated for

hypothesis testing. Both the measurement model and the structural model were assessed by the maximum likelihood method using AMOS 5.0. To evaluate the fit of models, chi-square with degrees of freedom, the comparative fit index (CFI), the goodness of fit index (GFI), the adjusted goodness of fit index (AGFI), the normed fit index (NFI), and the root mean square error of approximation (RMSEA) were assessed in addition to the chi-square test. In general model fit is considered to be adequate if GFI, NFI and CFI are larger than 0.9, AGFI is larger than 0.8, and RMSEA is smaller than 0.08. A ratio of chi-square to degrees-of-freedom falling within the suggested value of 5 or lower is acceptable (Hair *et al.*, 1998).

Analysis of the measurement model

The measurement model yielded a chi-square value of 752.74 with 278 degrees of freedom ($p = 0.000$), indicating a general lack of fit. However, although the chi-square test is a generally accepted statistical measure for SEM analysis, it is sensitive to sample sizes exceeding 200 (Chong *et al.*, 2001). As sample size increases, this measure has a greater tendency to indicate significant differences for equivalent models. As an alternative, the ratio of χ^2 to degrees-of-freedom was used. This approach obtained a value of 2.702, which falls within the suggested value of 5 or below, and the other indices provided evidence of good model fit (GFI = 0.931, AGFI = 0.845, CFI = 0.903, RMSEA = 0.072). All loadings of the measured variables on the latent variables were statistically significant (see Table I). Therefore, all of the latent variables appear to have been adequately measured by their respective indicators.

The Cronbach's alpha scores shown in Table I indicate that each construct exhibited strong internal reliability. Convergent validity was assessed based on the criteria that the indicator's estimated coefficient was significant on its posited underlying construct factor. The measurement scales were evaluated using the three criteria suggested by Fornell and Larcker (1981):

(1) All indicator factor loadings (λ) should be significant and exceed 0.5.

(2) Construct reliabilities should exceed 0.7.

(3) Average variance extracted (AVE) by each construct should exceed the variance due to the measurement error for that construct (e.g., AVE should exceed 0.5).

All λ values in the CFA model exceeded 0.5 and were significant at $p = 0.001$. Composite reliabilities of constructs ranged from 0.7098 to 0.9031 (see Table I). AVE, ranging from 0.505 to 0.7570, was greater than the variance due to measurement error. Therefore, all three conditions for convergent validity were met.

Discriminant validity was evaluated using the criteria recommended by Fornell and Larcker (1981): the square root of the AVE should exceed the correlation shared between the construct and other constructs in the model. Discriminant validity was also met. Table II lists the correlations among constructs, with the square root of the AVE on the diagonal. All diagonal values exceed the inter-construct correlations. Overall, the results suggested an adequate discriminant validity of the measurements.

Construct	Item	Factor loading	Composite reliability (CR)	CR	Average variance extracted (AVE)	Cronbach's alpha
Attitude	attitude1	0.623	13.720	0.7621	0.5172	0.8379
	attitude2	0.772	18.110			
	attitude3	0.756	17.619			
Subjective norm	subject1	0.766	17.628	0.8195	0.6032	0.8430
	subject2	0.841	19.796			
	subject3	0.718	16.282			
Perceived usefulness	pu1	0.625	13.811	0.7722	0.6011	0.8232
	pu2	0.774	18.322			
	pu3	0.757	17.639			
Perceived ease of use	peou1	0.711	12.783	0.7822	0.6001	0.8402
	peou1	0.683	15.613			
	peou1	0.809	19.719			
Perceived behavioural control	pbc1	0.566	12.016	0.7725	0.5732	0.8226
	pbc2	0.762	17.049			
	pbc3	0.843	19.191			
Intention	intention1	0.814	19.893	0.8319	0.6230	0.9053
	intention2	0.809	19.719			
	intention3	0.743	17.508			
Behaviour	behaviour1	0.711	12.783	0.7098	0.5013	0.8330
	behaviour2	0.705	11.751			
Flow experience	flow1	0.683	15.613	0.8291	0.6200	0.8502
	flow2	0.854	21.045			
	flow3	0.815	19.748			
Social interaction	social1	0.792	19.449	0.8530	0.5990	0.8455
	social2	0.897	23.317			
	social3	0.816	20.278			
	social4	0.546	12.026			
Human-computer interaction	personal1	0.814	20.556	0.9031	0.7570	0.8578
	personal2	0.920	24.714			
	personal3	0.873	22.779			
Perceived enjoyment	enjoyment1	0.902	24.309	0.8935	0.7385	0.8212
	enojyment2	0.925	25.352			
	enojyment3	0.739	18.034			

Table I.
Construct reliabilities

Analysis of the structural model

The research model and competing model were tested using the structural equation modelling approach. Overall, the goodness of fit of the two models were comparable to that of the previous model and provided evidence of adequate fit. The next step in the data analysis was to test and compare the research model (extended TPB) and competing model (extended TAM) described earlier in terms of the significance and effect size for each hypothesised path and variance explained (R^2 value) for each dependent variable. First both models tested the hypotheses without considering the

Table II.
Discriminant validity

	Construct	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1.	Perceived enjoyment	*0.895*										
2.	Human-computer interaction	0.281	*0.870*									
3.	Social interaction	0.388	0.307	*0.772*								
4.	Subjective norm	0.314	0.268	0.317	*0.776*							
5.	Perceived behavioural control	0.462	0.237	0.347	0.434	*0.757*						
6.	Flow experience	0.661	0.349	0.300	0.191	0.302	*0.787*					
7.	Perceived usefulness	0.345	0.234	0.321	0.212	0.234	0.432	*0.754*				
8.	Perceived ease of use	0.432	0.321	0.234	0.312	0.314	0.443	0.412	*0.734*			
9.	Attitude	0.565	0.362	0.443	0.447	0.538	0.505	0.334	0.412	*0.719*		
10.	Intention	0.681	0.377	0.348	0.317	0.531	0.502	0.478	0.321	0.501	*0.789*	
11.	Behaviour	0.416	0.016	0.252	0.054	0.335	0.473	0.432	0.345	0.476	0.532	*0.708*

Note: Figures in italics are square roots of average variance extracted

moderating effects on the proposed hypotheses. Second the moderating effects of gender, age, and prior experience on the research model were assessed by multi-group causal analysis (Jöreskog and Sörbom, 1993).

The research model. The hypothesised model was tested for examining the hypothesised relationships in this study. The proposed model produced a non-significant chi-square and adequate goodness of fit indices. Comparison of all fit indices, with their corresponding recommended values, indicated a good model fit ($\chi^2/df = 2.652$, GFI = 0.92, AGFI = 0.901, CFI = 0.904, RMSEA = 0.067).

As shown in Figure 3 the hypothesised paths from attitude ($\beta = 0.39$, $p < 0.001$), subjective norm ($\beta = 0.39$, $p < 0.001$), and perceived behavioural control ($\beta = 0.21$, $p < 0.001$) were significant in the prediction of online game intentions. Moreover, intention ($\beta = 0.55$, $p < 0.001$) had significant influence on actual behaviour in playing online games. Therefore *H7*, *H8*, *H9* and *H10* were supported.

The effect of perceived enjoyment on attitude was quite strong as shown by the path coefficient of 0.75 ($p < 0.001$). The path coefficient ($\beta = 0.2$, $p < 0.001$) from flow experience had significant influence on attitude. As shown in Figure 3, perceived enjoyment ($\beta = 0.26$, $p = 0.002$) had direct and indirect effects on the intention to play online games. Furthermore, flow experience significantly affected attitude ($\beta = 0.2$, $p < 0.001$) and intention ($\beta = 0.12$, $p = 0.005$). Therefore *H1*, *H2*, *H3*, and *H4* were supported. In addition, social interaction ($\beta = 0.24$, $p < 0.001$) and human-computer interaction ($\beta = 0.29$, $p < 0.001$) were found to influence the flow experience. Therefore, *H5* and *H6* were supported. The results of the hypothesis tests are shown in Table III.

The competing model. In this extended TAM model, SEM revealed that the TAM-based model fits the data reasonably well ($\chi^2/df = 2.694$), GFI = 0.93, AGFI = 0.911, CFI = 0.914, RMSEA = 0.069). Figure 4 shows that all hypothesised paths were positively significant, except the PU on attitude and intention (*H7a* and *H8a*) and PEOU on usefulness (*H10a*). Contrary to expectations perceived usefulness had no direct influence on attitude and intention ($\beta = 0.03$, $p = 0.479$ and $\beta = 0.08$,

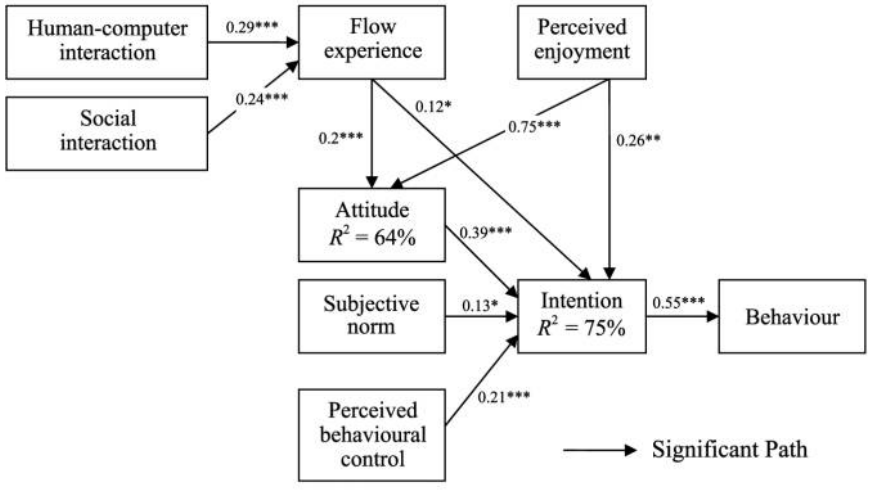


Figure 3.
Analysis of the research model

Hypotheses		β	t-value	p-value	Support
H1	Flow experience → attitude	0.2	4.585	***	Yes
H2	Flow experience → intention	0.12	1.981	0.04*	Yes
H3	Perceived enjoyment → attitude	0.75	3.737	***	Yes
H4	Perceived enjoyment → intention	0.26	3.119	0.002**	Yes
H5	Human-computer interaction → flow	0.29	4.094	***	Yes
H6	Social interaction → flow experience	0.24	4.414	***	Yes
H7	Attitude → intention	0.39	12.397	***	Yes
H8	Subjective norm → intention	0.11	3.119	0.002**	Yes
H9	Perceived behavioural control → intention experience	0.21	3.737	***	Yes
H10	Intention → behaviour	0.55	7.614	***	Yes

Table III.
Summary of hypothesis tests of model 1

Notes: Standardised estimates are shown; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; the t-value is significant at $p < 0.05$ while critical ratio values exceed 1.96

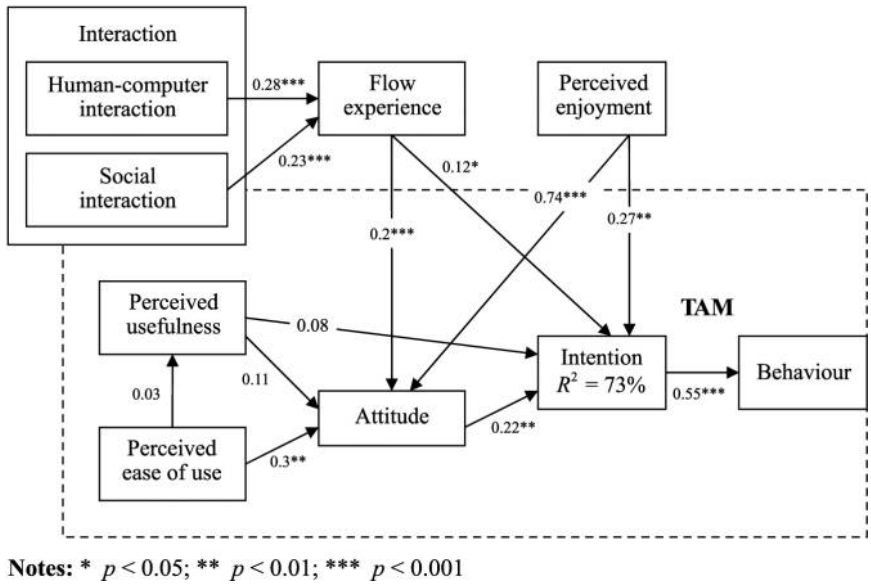


Figure 4.
Analysis of the competing model

$p = 0.275$) thus *H7a* and *H8a* were not supported. In terms of predictive power four predictor variables jointly explained 73 percent of the variance in players' intention to play online games in the TAM. The results of the hypothesis tests are shown in Table IV.

Testing for moderator effects on the research model. To test the hypotheses regarding the moderating effects of gender, age, and prior experience this study used multi-group causal analysis, as suggested by Jöreskog and Sörbom (1993). This technique comprises four steps.

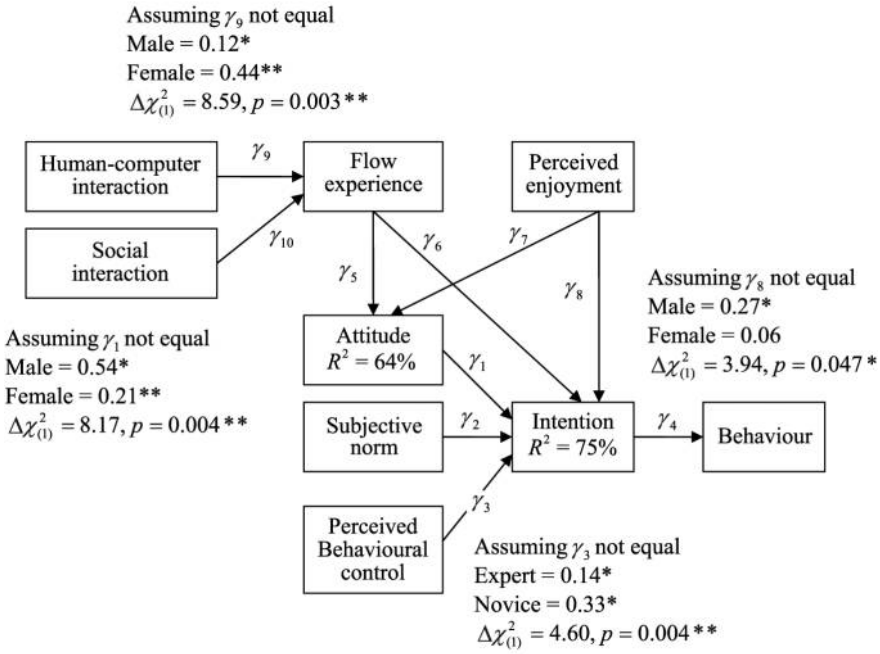
First the data was divided into two groups based on the moderators of age, gender, and prior experience. Second a path model was estimated for the sub-samples, in which all paths in the model were restricted in order to be equal between the two groups. Third the

Hypotheses		β	t-value	p-value	Supported
H1a	Flow experience → attitude	0.2	4.585	***	Yes
H2a	Flow experience → intention	0.12	1.981	0.04*	Yes
H3a	Perceived enjoyment → attitude	0.75	3.737	***	Yes
H4a	Perceived enjoyment → intention	0.26	3.119	0.002**	Yes
H5a	Human-computer interaction → flow	0.29	4.094	***	Yes
H6a	Social interaction → flow experience	0.24	4.414	***	Yes
H7a	Perceived enjoyment → attitude	0.11	0.679	0.497	No
H8a	Perceived enjoyment → intention	0.08	0.544	0.677	No
H9a	Human-computer interaction → flow experience	0.29	5.364	***	Yes
H10a	Ease of use → usefulness	0.03	0.701	0.466	No
H11a	Attitude → intention	0.22	3.119	0.002**	Yes
H12a	Intention → behaviour	0.24	4.414	***	Yes

Notes: Standardised estimates are shown; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; the t-value is significant at $p < 0.05$ while critical ratio values exceed 1.96

Table IV.
Summary of hypothesis tests of model 2

sample path model was estimated in which all paths from γ_1 to γ_{10} in Figure 5 were allowed to vary between the groups respectively. Finally to determine a moderating influence the chi-square difference test was conducted between the groups to identify whether the paths for the group were significantly different. A positive moderating



Notes: Expert: represents groups with more than three years' experience of online games; Novice: represents groups with less than three years' experience of online games; * $p < 0.05$; ** $p < 0.01$

Figure 5.
Analysis of moderating effects

influence of a moderator was confirmed if the path was higher for the group which scored higher in some moderator and a drop in chi-square between the restricted and unrestricted model with one fewer degree of freedom was statistically significant. Figure 5 shows the unstandardised estimates and results of the test regarding the moderating effects of gender, age, and prior experience. Table V shows the estimated path coefficients. For the moderating effects of gender the chi-square difference was 8.17 ($p = 0.004$) for the path γ_1 (attitude → intention), 3.94 ($p = 0.047$) for the path γ_8 (perceived enjoyment → intention), and 8.59 ($p = 0.003$) for the path γ_9 (human-computer interaction → flow experience). The chi-square differences for the three paths exceeded the critical value, which was 3.84 for one degree of freedom. The analytical results thus demonstrated that the path coefficients of γ_1, γ_8 and γ_9 were significantly different between the groups. That is, gender moderated the effects of attitude on intention (γ_1), perceived enjoyment on intention (γ_8), and human-computer interaction on flow experience (γ_9). No paths were significantly affected by age. Lastly for the moderating effect of experience the chi-square difference was 4.60 ($p = 0.032$) for path γ_3 (perceived behavioural control → intention). Thus the coefficient of path γ_3 (perceived behavioural control → intention) for novices was significantly stronger than that for experts.

Discussion

The results of this study provide support for the research framework presented in Figure 1 for the hypotheses regarding the directional linkages among the model variables. The overall explanatory power of the research framework has an *R*-square of 75 percent with regard to the intention to play online games, indicating that the predictors in this research model are capable of explaining a relatively high proportion of variation in the intention to play online games. *R*-square, a descriptive measure between 0 and 1, is the relative predictive power of a model. The closer it is to 1, the better the research model is. These relationships among the research constructs are discussed below.

Above all, this study shows that the effect of flow experience is significantly stronger than the other factors in both models; it also shows that the flow experience appears to be the most important element tested in influencing the intention to play online games. This implies that psychological rather than technical factors are more important for players with regard to their intention. Online game designers should thus put more emphasis on inducing the flow experience. Moreover human-computer interaction and social interaction should be considered important prerequisites of flow experience. This is in accord with the findings of Choi and Kim (2004) and Kim *et al.* (2005) that such experiences can be attained if the player has effective human-computer interaction or social interaction.

Perceived enjoyment has a significant influence on both attitude and intention. This finding concurs with the argument of Hsu and Lu (2005) that perceived enjoyment has a significant effect on attitude and continued intention to participate in an online community. This result underlies the fact that if the players do not enjoy an online game, they are unlikely to play it.

Notably in both models the players' attitudes strongly determine their intention to play online games. Therefore players with a more favourable attitude toward playing such games are more likely to accept and participate in them. Previous researchers have suggested that the inclusion of attitude is not meaningful (Van der Heijden, 2003), but

Table V.
The results of moderating effects

Path[a]			Gender Coefficient[b] Male	Female	$\Delta\chi^2_{(1)}$	*p*-value	Age Coefficient Young	Old	$\Delta\chi^2_{(1)}$	*p*-value	Prior experience Coefficient Expert	Novice	$\Delta\chi^2_{(1)}$	*p*-value
H1	ATT	→ INT	0.54**	0.21**	8.17	*0.004***	0.36**	0.60**	3.17	0.075	0.37**	0.43**	0.28	0.594
H2	SN	→ INT	0.09	0.001	1.07	0.30	0.03	0.06	0.06	0.804	0.01	0.14	2.53	0.112
H3	PBC	→ INT	0.23**	0.10	3.20	0.07	0.14*	0.31**	3.29	0.069	0.14*	0.33**	4.60	*0.032**
H4	INT	→ BEH	0.63**	0.82**	1.14	0.28	0.66**	0.86**	0.92	0.337	0.61**	0.98**	3.59	0.058
H5	FE	→ ATT	0.001	0.159*	2.86	0.09	0.087	0.08	3.00	0.083	0.05	0.01	0.54	0.459
H6	FE	→ INT	0.12*	0.03*	0.86	0.35	0.08	0.16**	0.86	0.352	0.10*	0.08	0.04	0.840
H7	PE	→ ATT	0.70**	0.82**	0.96	0.32	0.88**	0.80**	1.91	0.166	0.83	0.67**	1.49	0.222
H8	PE	→ INT	0.27*	0.06	3.94	*0.047**	0.22*	0.39**	0.91	0.340	0.24	0.28	0.13	0.714
H9	HI	→ FE	0.44**	0.12*	8.59	*0.003***	0.32**	0.22**	0.52	0.471	0.28**	0.32**	0.09	0.756
H10	SI	→ FE	0.31**	0.23**	0.49	0.48	0.28**	0.27**	0.03	0.958	0.22**	0.46**	3.74	0.052

Notes: [a] ATT = attitude; SN = subject norm; PBC = perceived behavioural control; INT = intention; FE = flow experience; PE = perceived enjoyment; HI = human-computer interaction; SI = social interaction; BEH = behaviour; [a] * denotes significance at $\Delta\chi^2_{(1)} > 3.84$; * $p < 0.05$, ** $p < 0.01$; italicized figures denote the significance of path coefficient comparisons between gender (males and females), age (young and old), and prior experience (experts and novices)

our research suggests otherwise. We therefore argue that attitude should continue to be used in subsequent research.

Subjective norm has a significant influence on players' continued intention to play. This suggests that a person's behaviour is affected by the desire to act like others act or think one should act, and this result is in line with work of Hsu and Lu (2004, 2005). Consequently players who observe or hear about others who are important to them playing online games with positive results are encouraged to participate in the games themselves. Therefore positive word-of-mouth is important in promoting any online game, and practitioners should use online communities to attract more players (Hsu and Lu, 2005). Table IV summarises the breakdown of the effects of the predictors on intention to play online games.

In the competing model perceived usefulness does not have a significant effect on attitude and intention to play online games (*H7a* and *H8a*). Also perceived ease of use does not have a significant effect on perceived usefulness (*H10a*). Although perceived usefulness and perceived ease of use are the key factors of TAM, the results showed that they do not reflect users' feelings of favourableness or unfavourableness toward playing online games. Thus TAM is not suitable for explaining entertainment-oriented IT.

Considering the moderating effects in the research model, the path coefficient from perceived enjoyment to the intention to play online games for males was significantly larger than that for females (γ_8: male $= 0.27 >$ female $= 0.06$). This finding indicated that the influence of perceived enjoyment on the intention to play online games is stronger for males than females. Moreover the path coefficient from human-computer interaction to flow experience for males was significantly larger than that for females (male $= 0.44 >$ female $= 0.12$). This result suggests that the effect of human-computer interaction on flow experience for males is stronger than females. These results may partially explain why most online game players are male (Charlton and Danforth, 2007). This study also provides preliminary evidence suggesting that novices in online games are more influenced by perceived behavioural control than experts (γ_3: novice $= 0.33 >$ expert $= 0.14$). According to Taylor and Todd's (1995) research perceived behavioural control reflects a person's perception of the ease or difficulty of implementing the behaviour of interest (Ajzen, 1985). Therefore the test result indicated that novices may perceive more difficulties in playing online games than experts. Creating user-friendly games is vital to increase enjoyment for the novices.

Implications

Implications for practitioners

The results of this study shed light on some important issues related to critical determinants of users' intentions to play online games which have not been addressed by previous research. First although research on online games has focused narrowly on perceived enjoyment, this study finds that flow experience is a critical factor that affects players' intentions. This implies that psychological rather than technical factors are more important in the game industry. Developing content with creative and solid storylines should be pursued to provide more fun.

Second this study suggests that developers should consider focusing more on establishing interactions between players (social interaction) and online games (human-computer interaction), which are two antecedents of flow experience. For

example games with high levels of interaction such as multiplayer games allow thousands of players to play simultaneously. The more users in an online game, the more user-generated experience it is likely to create and thus the more users it will attract. This idea, called dynamic loop, was found by Armstrong and Hagel (1996) to yield increasing returns in a virtual community.

Third male players are more easily influenced by perceived enjoyment and flow experience than female players. Therefore providers need to develop flow experience building strategies that might assist in engaging more female players and improve perceived enjoyment by analysing which sounds, graphic elements, animation and themes female players prefer.

Implications for researchers

For academic researchers the results showed that the usefulness construct does not have a significant effect on attitude and intention (hypotheses 7 and 8) and the ease of use construct does not have a significant effect on usefulness (hypothesis 10). These results imply that TAM is not a useful model for online games, which are a subset of entertainment technology. While TAM has been widely used in studying task applications, it appears that TAM does not apply to entertainment applications in the same way.

This study contributes to a theoretical understanding of whether TPB is suitable for explaining and predicting entertainment-oriented IT usage such as online games. This study demonstrates relatively satisfactory results with the extended TPB model, which supports all the proposed hypotheses and explains a relatively high proportion of variation in the intention to play online games. This result implies that the extended TPB provides a solid theoretical basis to understand the adoption of online games and may be suitable to apply to other online content fields such as e-learning. The extended TPB model is the superior model based on its suitability for prescriptive recommendations.

Conclusions and limitations

The objective of this paper was to develop an extended TPB model to predict and explain a person's behavioural intention to play online games. In conclusion the research provides insight into three findings:

(1) While most previous studies found PU an important predictor in the TAM model, it was not in this case. Online games are an entertainment technology, and therefore different from task-oriented technologies. The result shows that TPB is more suited than TAM to explaining online games.

(2) Flow experience plays a more important role in driving people to play online games and exerts more influence than perceived enjoyment on players' intention to play online games. Moreover human-computer interaction and social interaction are two important antecedents of flow experience.

(3) Group differences were examined in terms of adjustment variables (such as gender, age, and prior experience) to consider the moderating effects on the research model. The result reveals that gender is a key moderator of online game acceptance.

This study is subject to a number of limitations. First 65 percent of the respondents were students, which may reduce generalisability. Future research should determine the extent to which the findings presented in this paper apply to other people, contexts and times. Second the conclusions drawn from our study are based on cross-sectional data. As suggested by Ajzen (1991) the relative importance of attitude, subjective norm, and perceived behavioural control in predicting behavioural intention may vary according to the specific behaviour and situation. The cross-sectional data in this study comprised only a snapshot of this model. A stricter test of the argument however would be to use a longitudinal study to evaluate this aspect. By conducting a longitudinal study, the research model could be investigated in different time periods to make comparisons, thus providing more insights into the adoption of online games and more contributions from TPB perspectives.

Finally, this study suggests that future research should investigate the difference between the extended TPB behavioural model and the integration model of TAM with TPB for online games, and explore whether the integration of TAM and TPB is appropriate for explaining entertainment technology, especially online games.

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Appendix. Questionnaire items

Constructs

Social interaction (adapted from Choi and Kim, 2004)

- Playing online games enables me to make friends.
- I enjoy meeting the friends I made while playing online games.

- Communicating with others is useful for playing online games.
- Cooperating with others makes online games more enjoyable.

Human-computer interaction (adapted from ISO 14915, and 9241).

- I feel that online games provide good multimedia user interfaces, such as audio, graphics and animation.
- I feel that online games provide good navigation structures and aids, such media controls, basic controls, media selection and online help.
- I feel that online games provide ease-to-control input device interfaces, such as mouse and keyboard.
- I feel that online games offer good visual display that can be read comfortably.

Attitude (adapted from Ajzen, 1991)

- I feel good about playing an online games.
- I like playing an online games.
- I think that playing an online game is a good leisure activities.

Subjective norm (adapted from Ajzen, 1991)

- People who influence my behaviour would think that I should play online games.
- People who are important to me would think I should play online games.
- My family who are important to me would think that playing online games is a good idea.

Perceived behavioural control (adapted from Ajzen, 1991)

- Playing online games was entirely within my control.
- I have the resources, knowledge, and ability to play online games.
- Whether or not I play online games is not up to me. (Reverse coded).

Flow experience (adapted from Lu *et al.*, 2009 and Huang, 2003)

- When playing online games, I do not realise the time elapsed.
- When playing online games, I am not aware of things happening around me.
- When playing online games, I often forget the work I must do.
- Playing online games excited my curiosity.
- Playing online games aroused my imagination.

Perceived enjoyment

- The process of participating in online games is enjoyable.
- While participating in online games, I experience pleasure.
- I believe that online game are enjoyable.

Perceived ease of use

- It is easy for me to become skilful at playing online games.
- Learning to play online games is easy for me.
- It is easy to play online games.

Perceived usefulness

- I think that it is useful for me to play online games.
- I think that playing online games would enable me to accomplish my tasks more quickly.
- I think that playing online games would make it easier for me to carry out my tasks.

Intention

- It's worth playing online games.
- I will frequently play online games.
- I would be willing to recommend other people to play online game.

Behaviour

- How long do you spend playing online games?
- How many times do you play online games within a week?

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