UNDERSTANDING HCI ISSUES OF BROWSER GAME PLAYING IN CHINA
An Empirical Study

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Abstract: Online browser game is becoming one of the most promising and lucrative growth markets. A comprehensive understanding of online browser game adoption is the first step to understand browser game adoption. A growing body of research into the experience and effects of online games indicates that the enjoyment of playing is a complex, dynamic and multifaceted phenomenon. Based on Technology acceptance model, Flow, Theory of Planned Behavior, and social role theory, this paper proposed an integrated framework that explains player behavior toward adoption of online browser games. A survey was conducted to evaluate the research model. The results indicated that increasing consumers' perceptions of ease of use, flow experience, social norms, attitude, Perceived behavioral control, subjective norm, critical mass, descriptive norms, perceived enjoyment, and relaxation, and providing players with low access cost would improve their acceptance of online browser games.

1 INTRODUCTION

In recent years, online games have gained popularity around the world. According to the new Online Game Market Forecasts report by DFC Intelligence (DFC Intelligence, 2011), PC online game revenue alone will reach $15.7 billion in 2013 (not including video online games). Online games are computer controlled games, including both PC games and video games, played by consumers over network technology, especially through the Internet. Online games can be categorized into multiplayer and single-player games. At present, multiplayer games, especially massively multiplayer online games (MMOG) are most successful among all online games. World of Warcraft, one of the famous MMOG, surpasses 12 million monthly subscribers at the end of 2010 (Blizzard Entertain, 2011).

Browser games are a special type of MMOG that web browser is the only platform for the games. Players do not need to download or install a large amount of programs in client machine. Browser games are mainly developed using flash and web programming languages, such as PHP, while typical

MMOG or contemporary off-the-shelf games require other typical game development languages, such as C++. Similarly to MMOG, browser games allow players build large communities in the game, such as alliances. Players, therefore, can participate in mass campaigns in the games. There are four major differences between a browser game and a typical MMOG:

1) Typical MMOG require software installation while browser games only need an Internet browser to be installed in the client machine;

2) Typical MMOG require better configuration of client computers with larger computer memory, bigger hard drive, and higher performance graphic card. Browser games only require large computer memory because no software installation is needed.

3) The style of playing browser games is different. In typical MMOG, it may need hours for a playing team to complete a complicated massive task without any interruption. The activities in browser games are typically decision making tasks (e.g., allocating production resources, finalizing business campaign decisions). Players can easily leave the

game once they give the decision commands. Since the program will run by itself on the server side, the tasks will be completed on a desired time and players can return to the game later to check the completed tasks.

4) Most current MMOG require players with higher keyboard and mouse skills (e.g., remember combinations of keys to speed up the game control when fighting to enemies). The skill requirement of browser games is very low: if you know how to use mouse, you can play.

In the last two years, browser games have become extremely popular among network gamers. In China, there are over 100 million people, out of 400 million cyber users, playing browser games (CNNIC, 2011). Past studies have conducted relatively little empirical research on online browser games. There is a need to understand the factors influencing customer acceptance of browser games. The information can assist game developers and researchers in designing better games and help game vendors develop better marketing strategies to fit in customer needs for online game playing. The purpose of this study is to exam what factors affect browser game adoption and why people prefer playing browser games.

2 THEORETICAL BACKGROUND

Technology acceptance model (TAM) has received considerable attention of researchers in the human computer interface (HCI) over the last decade. TAM is defined as an individual's psychological state regarding to his/her voluntary or intended use of a particular technology (Davis, 1989). Two basic determinants, perceived ease of use and perceived usefulness, are adopted to predict and explain technology or system use in TAM. Hsu and Lu (2004) analyzed 233 online surveys and suggested that perceived ease of use and perceived usefulness are positively related to attitude toward playing an online game. However, interestingly, Lee (2009), after analyzing 672 surveys in his study, argued that both perceived usefulness and perceived ease of use do not have significant effects on playing online games and he further conclude that TAM is not suitable to explain entertainment-oriented IT.

Flow is a term first introduced by Csikszentmihalyi (1975), who defined it as the "holistic sensation that people feel when they act with total involvement" (p. 36). It denotes an optimal experience so engrossing and enjoyable that the activity becomes worth doing for its own sake without the impetus of extrinsic motivation (Csikszentmihalyi, 1999). Hsu and Lu (2004) narrowed definition of flow as an extremely enjoyable experience in online game playing and identified positive relationship between flow and intention to play an online game. Voiskounsky et al. (2004) proposed that flow is one of the sources long-time attracting online game players. Moreover, several other studies (Choi and Kim, 2004; Kim et al., 2005, Lee, 2009) identified that flow experience is significantly stronger than other factors influencing the intention to play online games.

Social Influence is the degree to which important others believed s/he should perform the behavior in question (Fishbein and Ajzen, 1975). Social influence is one of the driving forces of behavior intention to use any new technology (Tibenderana, 2010). Hsu (2004) demonstrated social norms and critical mass as two types of social influence. Social norms refer to accepted societal rules for behavior. Following these rules leads individuals to be accepted in the societal group. It was found that social norms play a significant role in the intention to use any new technology (Hsu and Lu, 2004; Lee, 2009). Hsu and Lu (2007) indicated that social norms play a very important role in online game community and are positively related to customer loyalty to the online game community.

Many studies adopted the Theory of Planned Behavior (TPB) with social influence to explain motivation in technology use (Mafe et al., 2010; Yaghoubi and Bahmani, 2010) and predict social and consumer behaviors (Ajzen, 2002; Lim and Dubinsky, 2005). TPB relies upon three factors:

1. attitude towards a behavior;

2. perceived control over performing the behavior; and

3. subjective norm regarding the behavior.

Ajzen (1991) defined attitude as an individual's overall evaluation of performing a behavior and argued that attitude affects uses' behavior intention. Several studies (Hsu and Lu, 2004; Lee, 2009) have examined the positive effects of attitude on online game playing intention. Further, Lu and Wang (2008) found that online game addiction is positively associated with game loyalty.

Perceived control refers to how easy or difficult individuals believe it would be for them to perform a behavior (Lou et al., 2000). It is determined by control beliefs, which result from the degree that individuals perceive the existence of factors that could inhibit or facilitate the occurrence of the

behavior (strength of control belief) and the power of these factors to make it easier or harder to engage in the behavior (power of control belief). Lee (2009) demonstrated that perceived control is positively related to intention to play online games. Moreover, he indicated that new players of online games are more influenced by perceived control than experts. From the perspective of online game addiction, Lu and Wang (2008) believed that perceived control is negatively associated with online game addiction. They argued that the game players are most likely to develop an addiction, if they lose control of the game.

Subjective norm refers to perceived social pressure to perform or refrain from a behavior (Ajzen, 1991). It can also be defined as what people believe important others would or would not want them to do concerning the behavior in question. Subjective norms are determined by normative beliefs (i.e., beliefs about whether specific important others think one should or should not perform the behavior) and motivations to comply (i.e., how much the person wants to comply with each normative referent). Subjective norms can partially explain why many students decide to play a certain online game while their friends are playing it. Lee (2009) pointed out that subjective norms encourage players to continually play online games.

Perceived critical mass is an individual's perception of whether a behavior has attracted a sufficient number of individuals to indicate that critical mass has been reached (Lou et al., 2000). In IT adoption, it can be defined that the perception of a technology value increases along with the number of its adopters. Lou et al. (2000) argued that communication and interaction with others may increase perceived critical mass. Hsu and Lu (2004) found that perceived critical mass significantly and directly affected attitudes and intentions and dominated online game players' behaviors.

Okun and colleagues (2002) suggested that social norms can be divided into injunctive (what people feel others think they ought to do) and descriptive (what other people actually do) norms. Lu and Wang (2008) argued that perceived critical mass was inappropriately adopted in Hsu and Lu's (2004) study because the concept of critical mass does not distinguish the relationship between the game players and the "other people". The relationship could be important or not important to the players. Hsu and Lu (2004) believed that only those important referents can significantly influence players' intentions. Therefore, they adopted descriptive norms in their research model and found

descriptive norms are positively related to online game addiction.

Social influence is subject to a lot of erroneous factors and moderations such as gender, age and experience in technology use intention and Information Systems adoption (Venkatesh and Morris, 2000). According to social role theory, behavioral gender differences are shown based on the differential social roles inhabited by women and men (Eagly et al., 2000). Williams et al. (2009) argued that social role theory offers a better understanding of online game playing regarding gender issues. According to the study based on social role theory, Williams found different characteristics associated with different gender (i.e., male are most likely to player achievement oriented and aggressive games). Stepping outside gender role theory, from data analysis perspective, researchers also found gender difference for online game playing. In his online game study, Lee (2009) found a dramatic gender difference that males have stronger influence of perceived enjoyment on the intention to play online games than females. This finding concurs with the argument of Chen and Liu (2009) that online game playing is affected by gender. Furthermore, Joe and Chiu (2009) argued that players will repeatedly intend to play similar games based on their gender characteristics.

In some game studies (Kim et al., 2002, Chou and Ting, 2003), playfulness was adopted in the research because it was demonstrated to be one of the major reasons why users intend to play the games. Playfulness refers to intrinsic interest that motivates players continually playing the games. Lu and Wang (2008) indicated that perceived playfulness is positively related to online game addiction. This finding is in line with work of Lee (2009) that perceived enjoyment has a significant influence on both attitude and intention to play online games.

Based on the results of factor analysis, Schultheiss (2008) identified four factors which motivate game players to keep playing online games:

1. thrill (playfulness);
2. challenge;
3. relaxation; and
4. playing experience.

The findings underlie the fact that game players are looking for challenges in the games to encourage them playing continually. If the game is too simple, players will lose their interest. Additionally, players are trying to relax themselves in the games and keep away from realistic working, studying, and daily issues. Playing experience is another factor

associated with game playing motivation. Players with prior game-playing experiences will understand typical game playing logics and styles and can easily start to play a similar game, which will develop a smooth beginning of game playing. Chen and Liu (2009) found that the university faculties who have prior game-playing experiences are more likely to have a positive intention to play online games. Table 1 concludes the factors related to online game playing.

3 HYPOTHESES

According to the literature review, although Lee (2009) found TAM is not suitable for online game studies, there are many acceptance studies (Lee, 2009, Koenig-Lewis, 2010, Lee et al., 2011), including the study from Hsu and Lu (2004), are howing TAM is useful to explain acceptance of new technology or services. Since no empirical study was conducted on browser games, we still proposed:

H1: Perceived ease-of-use is positively related tointention to play an online browser game.

H2: Perceived usefulness is positively related to intention to play an online browser game.

Past studies (Hsu and Lu, 2004, Voiskounsky et al., 2004, Choi and Kim, 2004, Kim et al., 2005, Lee, 2009) identified a positive relationship between flow experience and intention to play games. To evaluate the effects of flow experience on browser games, the following hypotheses were proposed:

H3: Flow experience is positively related to intention to play an online browser game.

Social influence can be defined as a real or imaginary pressure exerted by others that shapes our behavior (Kenrick, 1999). There are several factors associated to TPB and social influence that were suggested to be studied in online game playing. Therefore, we proposed:

H4: Social norms are positively related to intention to play an online browser game.

H5: Attitude is positively related to intention to play an online browser game.

H6: Perceived behavioral control is positively related to intention to play an online browser game.

H7: Subjective norm is positively related to intention to play an online browser game.

H8: Critical Mass is positively related to intention to play an online browser game.

H9: Descriptive norms are positively related to intention to play an online browser game.

Perceived enjoyment refers to the pleasure and satisfaction from performing a behavior (Deci and Ryan, 1987). To evaluate the effect on browser games, we proposed:

H10: Perceived enjoyment is positively related to intention to play an online game.

According to the study from Schultheiss (2008), we found three more factors that may impact online browser game playing.

Table 1: Factors associated to online game playing.

Authors	Extended perceived variables	Results
Hsu et al. (2004)	Perceived ease of use (PEU)	PEU → Attitude toward to play online games
Hsu et al. (2004)	Perceived usefulness (PU)	PU → Attitude toward to play online games
Hsu et al. (2004); Voiskounsky et al. (2004), Choi and Kim(2004), Kim et al. (2005), Lee (2009);	Flow experience (FL)	FL → Intention to play online games
Hsu et al. (2004); Lee (2009);	Social norms (SN)	SN → Intention to play online games
Hsu et al. (2004); Lee (2009); Lu and Wang (2008);	Attitude (A)	A → Intention to play online games A → Intention to play online games A → Online game addiction
Lee (2009); Lu and Wang (2008);;	Perceived behavioral control (PBC)	PBC → Intention to play online games PBC → Online game addiction (negatively)
Lee (2009)	Subjective Norm (SO)	SO → Intention to play online games
Hsu et al. (2004);	Critical Mass (CM)	CM → Attitude toward to play online games
Lu and Wang (2008);;	Descriptive Norms (DN)	DN → Online game addiction
Chen and Liu (2009); Willams et al. (2009)	Gender (G)	G → Attitude toward to play online games (moderator)
Schultheiss (2008); Lu and Wang (2008); Lee (2009)	Thrill Perceived Playfulness Perceived Enjoyment (PE)	PE → Motivate playing online games PE → Intention to play online games PE → Online game addiction
Schultheiss (2008);	Challenge (C)	C → Motivate playing online games
Schultheiss (2008);	Relaxation (R)	R → Motivate playing online games
Schultheiss (2008); Chen & Liu (2009)	Playing experience (PX)	PX → Motivate playing online games

Accordingly, the following hypotheses were proposed:

H11: Challenge is positively related to intention to play an online game.

H12: Relaxation is positively related to intention to play an online game.

H13: Playing experience is positively related to intention to play an online game.

4 RESEARCH METHOD

Perceptual inputs were collected using an online survey. To reach more and diverse browser game players, we cooperated with the largest Chinese online game community – 17173.com, who has over 70 million registered users and about 7 million daily online users. There is a special online browser game community on 17173.com. An online survey website was developed and the invitation messages were posted in the most heavily trafficked online browser game discussion forums on 17173.com, such as DanDanTang, which was ranked No. 1 browser game by users on 17173.com.

The survey instruments used in this study were primarily adapted from previous studies, shown as following table 2.

Table 2: Survey instruments.

Instruments	References
Perceived ease of use (PEU), Perceived usefulness (PU), Flow experience (FL), Attitude (A), Perceived behavioral control (PBC), Subjective Norm (SO), Perceived Enjoyment (PE),	Ajzen (1991); Hsu and Lu (2004); Lee (2009); Lu and Wang (2008); Lu et al. (2009)
Social norms (SN); Critical Mass (CM)	Hsu and Lu (2004); Hsu and Lu (2007); Lou et al. (2000)
Descriptive Norms (DN)	Lu and Wang (2008);
Challenge (C); Relaxation (R); Playing experience (PX)	Schultheiss (2008)
Intention	Lee (2009); Ajzen (1991); Lu and Wang (2008)

5 RESULTS AND DISCUSSION

473 responses were collected in two weeks. User name and email address were used to eliminate the duplicated responses. 392 responses were finally accepted after filtered out incomplete and invalid responses. (presented table 3).

Table 3: Demographic information.

Measure	Item	Frequency	Percentage
Gender	Male	287	0.73
	Female	105	0.27
Age (years)	<20	108	0.28
	21 –24	81	0.21
	25–30	59	0.15
	30-40	82	0.21
	>41	60	0.15
Education	>High school	47	0.12
	College	112	0.29
	Bachelor's	145	0.37
	Graduate degree	88	0.22
Experience of playing browser games(years)	<1	20	0.05
	1-2	129	0.33
	2-3	86	0.22
	>3	157	0.4

According to the analysis, the following table shows hypotheses testing results along with conclusions whether the hypothesis is supported at a<0.05. Most of the hypotheses were supported except H2, H11 and H13. All the factors except Perceived usefulness, challenge and playing experience were significantly related to intention to play online browser games.

The results of this study provide useful information about user acceptance of online browser games. The findings are in line with works of most previous studies. Perceived ease of use was found significantly related to intention. However, perceived usefulness was revealed being insignificantly related to intention. This result concurs with the argument of Lee (2009) that perceived usefulness does not have a significant effect on attitude and intention to play online games. We also found that the data does not support challenge (H11) either. Similar to the explanation of perceived usefulness, we believe that the purpose of the browser games is to entertain players by offering simple tasks rather than challenge players. In Table 3, we noticed that only 5% of the players whose experience of online browser games were less than a year. This may explain why playing experience in the last hypothesis was found insignificantly related to intention to play online browser games. It's hardly to compare when most of users have enough playing experience. In addition, gender difference was not found in the data. Browser games do not have many aggressive tasks or activities. Players, therefore, may not show up their gaming preferences in this type of the games.

Besides the hypotheses, we also found some interesting information. We found that 51% of the browser game players are over 25 years old, whereas only a small amount of people who are over 25 were playing MMOs (i.e., there is only 4% in Hsu and

Lu's (2004) study). Moreover, in the survey, we have a question as "Please tell us three reasons why you like to play online browser games". We found out several main reasons that led players choosing browser games:

1. Control of the game: 86% of the players mentioned that they like the browser games because you can play them anytime anywhere – the only thing you need is a browser;

2. Cost: 53% of the players listed free of charge as one of the top reasons why they chose browser games. Most MMOs are charging monthly fee or hourly fee for games. Therefore, the cost-effective characteristics of browser games win some of the players who do not like to pay for play;

3. Time: 37% of the players confessed that they frequently played browser games during work time. They mentioned that playing browser games does not need to concentrate your mind on the games for very long time. Mostly, they played a few minutes every two or three hours. By doing so, they were relaxed frequently through the game playing without interrupting their work.

Table 4: Hypothesis Testing Results.

Hypotheses	Independent Variables	t-value	Significance	Support
H1	Perceived ease of use (PEU)	2.550	0.007	**Yes**
H2	Perceived usefulness (PU)	1.406	0.132	**No**
H3	Flow experience (FL)	2.432	0.009	**Yes**
H4	Social norms (SN)	4.875	<0.001	**Yes**
H5	Attitude (A)	3.001	0.003	**Yes**
H6	Perceived behavioral control (PBC)	2.479	0.009	**Yes**
H7	Subjective Norm (SO)	2.275	0.022	**Yes**
H8	Critical Mass (CM)	2.941	0.005	**Yes**
H9	Descriptive Norms (DN)	5.302	<0.001	**Yes**
H10	Perceived Enjoyment (PE)	2.061	0.015	**Yes**
H11	Challenge (C)	1.612	0. 115	**No**
H12	Relaxation (R)	2.267	0.026	**Yes**
H13	Playing experience (PX)	4.983	<0.001	**No**

Understanding the factors influencing individual's adoption and usage of online browser games is crucial to both of the academic researchers and online game practitioners. This study explored how individuals play online browser games and the key factors influence its adoption. Researchers can further study the variables examined in this research and develop more suitable frameworks in online game study.

The empirical findings presented in this study also provide helpful market strategies that online game developers and vendors can use to enhance customer willingness to browser game access. This study thus suggests that there are means to improve players' acceptance of online browser games by lowing access cost, and enhancing players' perceptions of ease of use, flow experience, social norms, attitude, perceived behavioral control, subjective norm, critical mass, descriptive norms, perceived enjoyment, and relaxation.

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