Computers in Industry 61 (2010) 342–349

Contents lists available at ScienceDirect

Computers in Industry

journal homepage: www.elsevier.com/locate/compind

Personality and enjoyment of computer game play

Xiaowen Fang [a,*], Fan Zhao [b]

[a] School of Computing, College of Computing and Digital Media, DePaul University, United States
[b] Lutgert College of Business, Florida Gulf Coast University, United States

ARTICLE INFO

Article history:
Available online 8 January 2010

Keywords:
Sensation seeking
Self-forgetfulness
Personality
Computer game
Enjoyment

ABSTRACT

This paper introduces a research framework of game play based on a review of media enjoyment theories, personality theories, effects of computer game play, and technology acceptance model. The proposed framework suggests that an appropriate fit between characteristics of the player and gaming technology will result in greater enjoyment while social influence may moderate effects of the fit. An empirical study is carried out to investigate the relationship between enjoyment of computer game play and two personality traits (sensation seeking and self-forgetfulness). Hypotheses are proposed. A survey is conducted in two US universities. Results and implications are discussed.

1. Introduction

Computer controlled games (referred as computer games thereafter in this article) are becoming a prominent form of entertainment. This is evidenced by some interesting facts found by Entertainment Software Association [1]:

- Sixty-five percent of American households play computer or video games.
- The average game player is 35 years old and has been playing games for 13 years.
- The average age of the most frequent game purchaser is 40 years old.
- Forty percent of all game players are women.

However, the majority of prior psychological game research has focused on two specific areas of investigation: (a) the effects of excessive playing on children and adolescents and (b) whether or not playing (violent or nonviolent) video games makes children and adolescents more violent ([2,3,4]). A comprehensive framework for examining the interaction between player characteristics and game features is needed for a better understanding of the process of game play and its impacts on users.

As a first step towards building such a comprehensive framework, this research attempts to investigate the impact of two personality traits (sensation seeking and self-forgetfulness) on enjoyment of computer game play. The following sections discuss prior research on computer game enjoyment and personality, theoretical framework, method, and results.

2. Background literature

Prior research in the following allied fields was examined: video games, game player's characteristics, and personality.

2.1. Video games

Research on video game uses and gratifications has focused on the main appeal of video games. Selnow [5] published the first such study based on a survey of 244 10–24 year olds and isolates five gratification factors that attract players to arcade video game play. These factors show that a video game: (1) is preferable to human companions, (2) teaches about people, (3) provides companionship, (4) provides activity/action, and (5) provides solitude/escape. Another study of video games [6] reveals a similar set of gratifications for arcade game use: excitement, satisfaction, and tension reduction. A survey conducted by Phillips et al. [7] suggests several uses of video game play, including "to pass time," "to avoid doing other things," "to cheer oneself up," and "just for enjoyment." Furthermore, Griffith's [8,9] research on video game addiction includes additional uses and gratifications: arousal, social rewards, skill testing, displacement, and stress reduction.

In several more comprehensive studies, Sherry and his coworkers [10,11,12] have enumerated a set of video game uses and gratifications based on focus group research and surveys of over 1000 participants ranging in age from 10 to 24 years old. These factors include *competition*—to prove to other people who has the best skills and who can react or think the fastest; *challenge*—to solve the puzzles to achieve goals such as reaching the next level or

* Corresponding author.
E-mail addresses: xfang@cdm.depaul.edu (X. Fang), fzhao@fgcu.edu (F. Zhao).

0166-3615/$ – see front matter © 2009 Elsevier B.V. All rights reserved.
doi:10.1016/j.compind.2009.12.005

beating the game; *social interaction*—to use video games to interact with friends and learn about the personalities of others; *diversion*—the use of games to avoid stress or responsibilities and to fill time, relax, escape from stress, and/or because there is nothing else to do; *fantasy*—to do things they normally would not be able to do, such as driving race cars, playing professional football, or flying; and *arousal*—the stimulation of emotions resulting from fast actions and high quality graphics.

Grodal [13] explains that much of the fascination with video games can be attributed to the ability of players to control the game in terms of outcomes (i.e., deciding how the "plot" will unfold), the speed at which the game progresses, and mastery of the game or mastery over other players. Grodal further argues that video games are a tool for emotional control, whereby desired arousal levels can be maintained through playing. As such, video games are enjoyed most when the level and speed of the game match the player's optimal mental and motor capacity. Vorderer et al. [14] have provided support for the idea that game play is more enjoyable when there are a variety of ways to solve a challenge offered in a video game.

2.2. Game player characteristics

Several individual characteristics may influence enjoyment of computer game play. A literature review reveals gender, age, and personality as key characteristics.

2.2.1. Gender

One of the most consistent results in studies of video game usage is the striking difference between boys and girls in the amount of play (e.g., [7,9]). Some scholars argue that this difference may be due to access. The annual Annenberg Public Policy Center survey on family media use points out that 76% of homes with at least one boy contain video games, as compared to 58% of homes with at least one girl [15]. Others emphasize that the gender gap in game use may have less to do with access than the content of the games. For example, video games have been criticized for having either highly sexualized or weak female protagonists, which can turn away potential female players [16]. The emphasis on competition and violence may deter girls from playing ([17,18]). In a more recent study, Norris [19] conducted an online survey and found that women who played computer games perceived their online environments as less friendly but experienced less sexual harassment online. When compared to women who used the computer but did not play games, those who played computer games were more aggressive themselves, but did not differ in gender identity, degree of sex role stereotyping, or acceptance of sexual violence. This study also found that women with high masculine gender identities were more likely to use computers at work. Based on a survey of 367 16- to 18-year old students, Bonanno and Kommers [20] discover that a high percentage of females prefer puzzle, adventure, fighting, and managerial games, and males prefer first-person shooters, role playing games, sport, and strategy games. They suggest that these tendencies can be viewed as a process of accommodation to different underlying gender-related neurocognitive processes.

2.2.2. Age

An online survey conducted by Griffiths et al. [21] compares adolescent and adult online game players. Significant patterns emerge among adolescent gamers. They were more likely to be male, less likely to gender swap their characters, and more likely to sacrifice their education or work to play video games. In relation to favorite aspects of game play, significantly more adolescents than adults claimed violence as their most favorite aspect of playing. Results also show that, in general, the younger the player, the more time they spent each week playing online games.

2.2.3. Personality and computer game play

Previous research has consistently shown that exposure to violent video games is significantly linked to increases in aggressive behavior, aggressive cognition, aggressive affect, and ardiovascular arousal, and to decreases in helping behavior [2,3,4,22]. Anderson and Dill [3] also suggest that the positive relationship between violent video game play and aggressive behavior and delinquency is stronger for individuals who are characteristically aggressive and for men. Furthermore, a few other studies show that personality is linked to gaming behaviors. Fetchenhauer and Huang [23] indicate that the "justice sensitivity," a personality disposition introduced by Schmitt et al. [24], could be used to predict decisions in a number of games using theoretical paradigms (dictator games, ultimatum games, and a combination of these two games). Douse and McManus [25] suggest that players of a fantasy Play-By-Mail game were less feminine, less androgynous, and more introverted than matched controls. The fantasy game players showed lower scores on the scale of empathic concern, and were more likely to describe themselves as "scientific," and to include "playing with computers" and "reading" among their leisure interests than players in the control group. In a more recent study, Whang and Chang [26] explored the lifestyles of online game players. Based on an online survey, they classify lifestyles of game players into three groups: single-oriented players, community-oriented players, and off-real world players. Players in each group display distinct differences in their values and game activities, as well as in their anti-social behavior tendencies. This study further suggests that differences in game players' lifestyles reflect not only their personality but also their socio-economic status within the virtual world constructed through game activities.

2.3. Personality

Personality has a long history as an important topic for psychological research. Over the years, researchers have developed many personality models and inventories. The following is a summary of some widely used personality inventories.

- The California Psychological Inventory (CPI). The CPI is developed by Gough [27] as a measure of various psychological characteristics that he finds to be useful in predicting important outcome variables. The CPI is developed according to an empirical approach, and this strategy has sometimes been found to produce scales less valid than those produced by the rational strategy [28].
- The Eysenck Personality Questionnaire (EPQ) and Eysenck Personality Profiler (EPP). According to Eysenck and Eysenck [29], personality has three dimensions: psychoticism (P) as opposed to impulse control, extraversion (E) as opposed to introversion, and neuroticism (N) as opposed to stability. Psychoticism (P) consists of the following traits: aggressive, cold, antisocial, unempathic, egocentric, creative, impersonal, tough-minded, and impulsive. Traits making up extraversion (E) include sociable, lively, carefree, active, dominant, surgent, assertive, venturesome, and sensation seeking. Neuroticism contains traits: anxious, depressed, irrational, shy, guilt-feelings, moody, emotional, low self-esteem, and tense. Based on the Eysenck theory, the Eysenck Personality Questionnaire (EPQ) [30] and the revised version (EPQ-R) were developed to measure personality.
- The Myers-Briggs Type Indicator (MBTI). The MBTI [31] is loosely based on a theory of psychological "types" developed by the Swiss psychologist, Carl Jung. The MBTI is used very widely in business settings. Some studies have shown some support for the construct validity of the MBTI [28]. However, one shortcoming is

that it loses a great deal of precision by describing people in terms of only two levels of each characteristic rather than in terms of a more specific score on each characteristic [28].

- The NEO Personality Inventory-Revised (NEO-PI-R) and the NEO Five-Factor Inventory (NEO-FFI). The NEO-PI-R and the NEO-FFI are developed to measure five major dimensions of personality [32,33]: neuroticism (N), extraversion (E), openness to experience (O), agreeableness (A), and conscientiousness (C) (also known as "Big Five"). These scales have shown very good levels of reliability and validity, and have probably become the most widely used personality inventories in psychological research [28].
- The International Personality Item Pool (IPIP). The IPIP [34] is a list of personality questionnaire items that has been developed on an ongoing basis since the early 1990s. The IPIP provides lists of items to measure each of the traits assessed by most of the published inventories.

According to the current consensus among structurally oriented scientists in personality research personality can be described best through the dimensions of the Five-Factor Model of Personality, the so called Big-Five—extraversion, agreeableness, conscientiousness, neuroticism and openness [35,36].

3. Theoretical framework

The technology acceptance model (TAM) [37] has been used in technology adoption research for a decade. The TAM model suggests that perceived usefulness and perceived ease of use are the two primary factors impacting on user intention to adopt a new technology. Zigurs and Buckland [38] developed a theory of task/technology fit (TTF) in group support systems based on attributes of task complexity and their relationship to relevant dimensions of GSS technology. The TTF theory indicates that an appropriate task/technology fit should result in higher performing groups. Based on personality theories, the technology acceptance model [37] and the task/technology fit theory [38], we propose a conceptual model of computer game play as depicted in Fig. 1. This framework suggests that enjoyment derived from game play is the result of a fit between characteristics of the player and gaming technology. The better the player-technology fit, the more enjoyment. Social influence will moderate the effects of player-technology fit. Based on this framework, enjoyment and perceived ease of use are two determinants of user intention to play computer games. This framework conceptualizes the impact of player characteristics and social influence on game play enjoyment that have been observed in many earlier studies. Furthermore, the framework incorporates the gaming technology and its interactions with the player in affecting enjoyment of game play and intention to play.

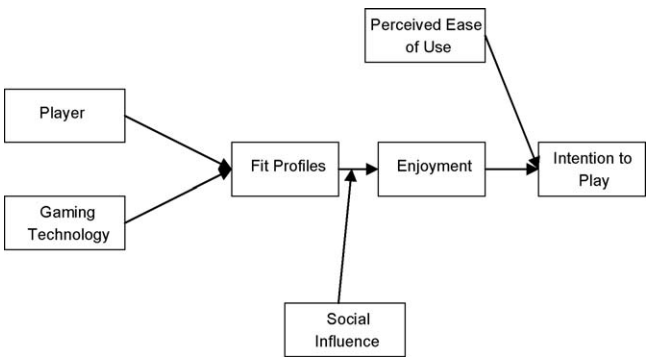

Fig. 1. A framework of computer game play.

The following Sections (3.1–3.6) discuss the main constructs of this framework.

3.1. Fit

Fit has been examined in some detail in the strategic management literature. Three definitions of fit in structural contingency theory have been identified: fit as congruence, fit as interaction, and fit as internal consistency [39]. Venkatraman [40] has extended these ideas to six unique perspectives on fit in the strategy literature: fit as moderation, as mediation, as matching, as gestalts, as profile deviation, and as covariation. The most promising perspective for player-technology fit in a gaming context is the idea of fit as an ideal profile. From this perspective, fit is viewed as feasible sets of equally effective alternative designs of games. Each design should be internally consistent and matched to a player's characteristics. This conceptualization of fit translates well into a gaming environment. The player-technology fit can be defined as ideal profiles composed of an internally consistent set of player characteristics and gaming elements that affect game play enjoyment. A higher degree of adherence to an ideal profile increases the game play enjoyment. A test of player-technology fit would require three steps: (1) identifying distinct player characteristics, (2) specifying ideal gaming technology for each set of player characteristics, and (3) testing player enjoyment resulting from player-technology alignment.

3.2. Enjoyment

Strong empirical evidence indicates that the motivational basis of human activity relies on two rather independent systems: a so-called approach system and an avoidance system [41]. Activation of the approach system results in pleasure, whereas activation of the avoidance system leads to pain [42]. Research in psychology and neuroscience most often uses the term pleasure to describe agreeable reactions to experiences in general. Most communication researchers have used the term enjoyment to describe and explain such positive reactions toward the media and its contents. Our framework uses enjoyment to describe and explain positive reactions derived from game play.

The tripartite model of media enjoyment proposed by Nabi and Krcmar [43] suggests three types of reactions to enjoyment: affective, cognitive, and behavioral reactions. Their model well conceptualizes player reactions to enjoyment discussed in other media enjoyment theories such as model of complex entertainment experience [14], transportation theory [44], disposition theory of drama [45], and flow theory [46]. These three types of reactions to enjoyment can be applied to develop an instrument to measure the degree of enjoyment derived from game play. Based on the tripartite model [43], Fang et al. [47] develop an instrument to measure enjoyment of computer game play. This instrument has 3 subscales: affect, behavior, and cognition. Affect focuses largely on empathy, the moods (positive and negative), and specific affective states (e.g., horror, sadness, and suspense). Behavior is related to selective exposure in terms of the player's viewing intent as well as behaviors during viewing, including the act of viewing itself. Cognition focuses primarily on judgments of game characters' actions, though other judgments, like general enjoyment as attitudes toward story assessments (e.g., perceived realism, story coherence, message quality) or more personal evaluations (e.g., relevance, similarity) could also be included in this category.

Hoffman and Novak [48] present a model of flow in computer-mediated environments. The flow model involves "positive affect," "exploratory behaviors," and "challenge/arousal," which could be

considered as elements of enjoyment. A stream of recent studies has used the flow model to interpret and understand user experience during game play. Flow is widely considered to have eight elements: concentration, challenge, skills, control, clear goals, feedback, immersion, and social interaction.

3.3. Gaming technology

Gaming technology certainly plays a major role in shaping the possible enjoyment derived from game play. In this paper, three dimensions of games are identified: dimensionality, the number of players, and genre. It is essential to develop taxonomy of computer games that could capture important characteristics of games in order to fine-tune the player-technology fit.

3.4. Player characteristics

Previous research has shown that game play is linked to gender (e.g., [7,9]), age [21], and personality [2,3,4,22]. Media enjoyment theories also imply close relationships between a player's personality and enjoyment [43–46]. In the proposed framework, a player can be described in terms of gender, age, and personality.

3.5. Social influence

Social factors profoundly impact user behavior. Various theories suggest that social influence is crucial in shaping user behavior. For example, in the theory of reasoned action (TRA) [49], a person's behavioral intentions are influenced by subjective norms as well as attitude. Hsu and Lu [50] indicate that social influences, including perceived critical mass and social norms, significantly and directly, but separately, affect player attitude and intention of playing online games. Choi and Kim [51] also note the importance of social interactions on continuing to play online games. Our proposed framework of game play posits that social influence impacts enjoyment as a moderator. It moderates the effects of player-technology fit.

3.6. Extending TAM to game play

The technology acceptance model (TAM) [37] is one of the most widely used models for IT adoption. According to TAM, an individual's IT adoption is influenced by perceived usefulness and perceived ease of use. Perceived usefulness (PU) is defined as the degree to which a person believes that using a particular system would enhance his or her job performance. Perceived ease of use (PEOU) refers to the degree to which a person believes that using a particular system would be free of effort.

In a gaming context, perceived usefulness is no longer applicable and therefore not an appropriate measure of extrinsic motivation [52]. Enjoyment is deemed as a more appropriate measure of extrinsic motivation to play games because enjoyment measures how the gaming technology helps achieve the task-related objective – enjoyment – and it becomes an outcome expectancy.

3.7. Sensation seeking and self-forgetfulness

The core of the framework depicted in Fig. 1 is the fit profiles between player and gaming technology. As the first step towards building such fit profiles, this paper presents a study that attempts to investigate the relationships among two personality traits (sensation seeking and self-forgetfulness), gaming technology, and enjoyment of computer game play because some researchers [53] have suggested that these two personality traits may lead to higher engagement in computer game play.

Sensation seeking is a personality trait defined by the need for varied, novel, and complex sensations and experiences and the willingness to take physical and social risks for the sake of such experience [54]. Computer games are designed to offer thrills and excitement. It is likely that highly sensation seeking players may find a computer game more entertaining. Therefore, it is hypothesized that:

H1. Sensation seeking is positively related to enjoyment of computer game play.

Self-forgetfulness has been described as the same as experienced transiently by people when they are totally absorbed, intensely concentrated, and fascinated by one thing [55]. In such one-pointed concentration people may forget where they are and lose all sense of the passage of time. Given these characteristics, highly self-forgetful individuals would be expected to experience higher presence when playing computer games and thus perceive higher level of enjoyment.

H2. Self-forgetfulness is positively related to enjoyment of computer game play.

4. Method

A survey was conducted in two U.S. universities to investigate the relationships between enjoyment of computer game play and the two personality traits: sensation seeking and self-forgetfulness. In total, 173 students responded to the survey. Table 1 shows the demographic information of the participants.

There are two sections in the questionnaire. Section 1 contains 21 items about participant's demographic information and personality traits. Responses from the first 6 items were summarized in Table 1. Sensation seeking trait was measured by 12 items (e.g., "I sometimes like to do things that are a little frightening.") taken from the sensation seeking scale introduced by [54]. Self-forgetfulness trait was measured by 3 items taken from the temperament and character inventory [55]. All questions about personality traits were rated on a 7-point scale, ranging from 1 (strongly disagree) to 7 (strongly agree).

Section 2 of the survey questionnaire contains questions about enjoyment of computer game play. Enjoyment was measured by 15 items from the computer game enjoyment scale developed by Fang et al. [47].

A printed questionnaire was handed to students in classes, in a gaming lab, and in other public places on campus. The survey was

Table 1
Demographic information of participants.

Variables		
Gender	Male (%)	59.5
	Female (%)	40.5
Age	Mean	22.9
	Std.	4.94
How long have you been playing computer/video games?	Mean (years)	12.1
	Std.	5.92
How many hours on average do you play?	Mean	2.0
	Std.	2.02
How often do you play computer/video games?	Daily (%)	20.3
	Weekly (%)	34.3
	Monthly (%)	19.2
	Seldom (%)	26.2
On average, how many hours do you play in each week?	Mean	5.8
	Std.	8.27

Table 2
Correlation matrix of action/adventure/shooting/fighting games.

		Affect	Sensation seeking	Behavior	Cognition
Affect	Pearson correlation	1	.080	.218**	.177*
	Sig. (2-tailed)		.325	.007	.028
Sensation seeking	Pearson correlation	.080	1	.256**	−.055
	Sig. (2-tailed)	.325		.001	.501
Behavior	Pearson correlation	.218**	.256**	1	−.103
	Sig. (2-tailed)	.007	.001		.205
Cognition	Pearson correlation	.177*	−.055	−.103	1
	Sig. (2-tailed)	.028	.501	.205	

* Significance of 0.05.
** Significance of 0.01.

completed on the spot or completed at the participant's leisure time and returned to the research team via campus mail. A gift certificate was provided as an incentive for participation. All the responses were kept anonymous. Participants were required to answer all the 21 questions in Section 1. In Section 2, participants were asked to rate their enjoyment of five categories of games. The five categories of computer games (action/adventure/shooting/fighting, role playing, sport games/racing, family entertainment/simulation, and strategy) were primarily derived from the classification scheme adopted by the Entertainment Software Association [1]. For each category of games, some sample games were listed. For each category, participants were instructed to choose a game they played most frequently and answer questions about their experience with it. If they had never played any game in a particular category, they might skip the entire category. They were not allowed to skip a portion of the enjoyment questions though.

5. Results

5.1. Data analysis procedure

For responses to each of the five categories of games, the following data analysis procedure was applied.

A factor analysis was conducted to establish the discriminant and construct validity. Only items highly loaded (loadings >0.5) on one of the following constructs were retained in the analysis: sensation seeking, self-forgetfulness, affect, behavior, and cognition. In some cases, a whole construct might be excluded from the analysis if none of its items converged together. Complex items loaded on multiple constructs were also excluded from the analysis.

Subsequently, reliability analysis was performed. Cronbach's Alpha values were calculated to check the internal consistency of the items. Only constructs with an Alpha value greater than 0.7 were retained and used for further analysis.

Finally, a correlation matrix was computed and linear regression was conducted to explore the relationships between enjoyment of computer game play and the two personality traits: sensation seeking and self-forgetfulness.

In the following 5 subsections, the data analysis results for each of the five categories of games will be presented and discussed in detail.

5.2. Action/adventure/shooting/fighting games

154 participants evaluated this category. Constructs affect, behavior, cognition, and sensation seeking passed both the factor and reliability analyses. Self-forgetfulness was excluded due to low reliability of the items (Cronbach's Alpha value = 0.417). Tables 2 and 3 present the correlation matrix and the regression analysis results respectively.

Both the correlation and regression analyses suggest that sensation seeking is positively related to and has a significant effect on behavior (correlation coefficient = 0.256, p-value = 0.001; r-square = 0.059, p-value = 0.001). This result implies that a higher sensation seeking personality leads to more engagement in computer game play. Because behavior is a sub-factor of enjoyment of computer game play [47], indications of higher engagement suggest higher enjoyment. Therefore, hypothesis H1 is supported for action/adventure/shooting/fighting games.

Because self-forgetfulness construct was excluded from the analysis due to low reliability, it is impossible to assess its relationship with enjoyment. In the future study, more items on this construct may improve its reliability and make it possible to examine its effect on enjoyment.

5.3. Role playing games

76 participants evaluated this category. Constructs affect, behavior, sensation seeking, and self-forgetfulness passed both the factor and reliability analyses. Cognition was excluded because its items did not converge in the factor analysis. Tables 4 and 5 present the correlation matrix and the regression analysis results respectively.

The correlation analysis suggests that behavior is significantly correlated to both sensation seeking (correlation coefficient = 0.258, p-value = 0.025) and self-forgetfulness (correlation coefficient = 0.300, p-value = 0.009). A further regression analysis (r-square = 0.077, p-value = 0.009) shows that self-forgetfulness has a bigger effect than sensation seeking. These results support both hypotheses H1 and H2. They also suggest that a higher sensation seeking personality results in higher engagement in computer game play and a higher self-forgetfulness personality also leads to higher engagement in computer game play. The higher the engagement, the higher the enjoyment [47].

5.4. Sport and racing games

125 participants evaluated this category. Constructs affect, behavior, and sensation seeking passed both the factor and reliability analyses. Both cognition and self-forgetfulness were excluded due to low reliability of the items (Cognition: Cronbach's Alpha value = 0.597; self-forgetfulness: Cronbach's Alpha value = 0.493). Tables 6 and 7 present the correlation matrix and the regression analysis results respectively.

Table 3
Regression analysis of action/adventure/shooting/fighting games.

Model	r-Square	Beta	T-value	p-Value
Behavior = Sensation seeking + errors	0.059	0.256	3.267	0.001

Table 4
Correlation matrix of role playing games.

		Affect	Behavior	Sensation seeking	Self-forgetfulness
Affect	Pearson correlation	1	−.003	−.037	−.068
	Sig. (2-tailed)		.977	.750	.562
Behavior	Pearson correlation	−.003	1	.258*	.300**
	Sig. (2-tailed)	.977		.025	.009
Sensation seeking	Pearson correlation	−.037	.258*	1	.363**
	Sig. (2-tailed)	.750	.025		.001
Self-forgetfulness	Pearson correlation	−.068	.300**	.363**	1
	Sig. (2-tailed)	.562	.009	.001	

* Significance of 0.05.
** Significance of 0.01.

Both the correlation and regression analyses show the significant relationship between sensation seeking and behavior (correlation coefficient = 0.276, p-value = 0.002; r-square = 0.076, p-value = 0.002). This result suggests that a higher sensation seeking personality is associated with higher engagement in computer game play. Higher engagement implies higher enjoyment [47]. Therefore, hypothesis H1 is supported.

Because self-forgetfulness construct was excluded from the analysis due to low reliability, it is impossible to assess its relationship with enjoyment. In the future study, more items on this construct may improve its reliability and make it possible to examine its effect on enjoyment.

Table 5
Regression analysis of role playing games.

Model	r-Square	Beta	T-value	p-Value
Behavior = Self-forgetfulness + errors	0.077	0.300	2.702	0.009

Table 6
Correlation matrix of sport and racing games.

		Affect	Sensation seeking	Behavior
Affect	Pearson correlation	1	.067	.354**
	Sig. (2-tailed)		.457	.000
Sensation seeking	Pearson correlation	.067	1	.276**
	Sig. (2-tailed)	.457		.002
Behavior	Pearson correlation	.354*	.276*	1
	Sig. (2-tailed)	.000	.002	

** Significance of 0.01.

Table 7
Regression analysis of sport and racing games.

Model	r-Square	Beta	T-value	p-Value
Behavior = Sensation seeking + errors	0.076	0.276	3.182	0.002

5.5. Family entertainment/simulation games

136 participants evaluated this category. Constructs affect, behavior, cognition, and sensation seeking passed both the factor and reliability analyses. Self-forgetfulness was excluded due to low reliability of the items (Cronbach's Alpha value = 0.426). Tables 8 and 9 present the correlation matrix and the regression analysis results respectively.

Both the correlation and regression analyses indicate that sensation seeking has a significant effect on cognition (correlation coefficient = 0.171, p-value = 0.047; r-square = 0.022, p-value = 0.047). This result suggests that a high sensation seeking personality is linked to a higher cognition value in computer game play. Because cognition is a sub-factor of enjoyment of computer game play [47], a higher cognition value implies higher enjoyment. Therefore, sensation seeking is positively related to enjoyment of computer game play and hypothesis H1 is supported.

It is interesting to observe that sensation seeking impacts on enjoyment through cognition for family entertainment/simulation games instead of through behavior like most of other games. This fact may suggest that one primary reason of enjoying this type of games is the perceived value of game characters' actions. Players may enjoy this type of games more because they feel these games are more valuable to their families or personal goals.

Because self-forgetfulness construct was excluded from the analysis due to low reliability, it is impossible to assess its relationship with enjoyment.

5.6. Strategy games

55 participants evaluated this category. Constructs affect, behavior, and sensation seeking passed both the factor and

Table 8
Correlation matrix of family entertainment and simulation games.

		Affect	Behavior	Cognition	Sensation seeking
Affect	Pearson correlation	1	.209*	.492**	.044
	Sig. (2-tailed)		.015	.000	.610
Behavior	Pearson correlation	.209*	1	.114	.150
	Sig. (2-tailed)	.015		.188	.081
Cognition	Pearson correlation	.492**	.114	1	.171*
	Sig. (2-tailed)	.000	.188		.047
Sensation seeking	Pearson correlation	.044	.150	.171*	1
	Sig. (2-tailed)	.610	.081	.047	

* Significance of 0.05.
** Significance of 0.01.

Table 9
Regression analysis of family entertainment and simulation games.

Model	*r*-Square	Beta	*T*-value	*p*-Value
Cognition = Sensation seeking + errors	0.022	0.171	2.008	0.047

Table 10
Correlation matrix of strategy games.

		Affect	Behavior	Sensation seeking
Affect	Pearson correlation	1	.263	.080
	Sig. (2-tailed)		.052	.560
Behavior	Pearson correlation	.263	1	.153
	Sig. (2-tailed)	.052		.265
Sensation seeking	Pearson correlation	.080	.153	1
	Sig. (2-tailed)	.560	.265	

reliability analyses. Cognition was excluded because its items did not converge in the factor analysis. Self-forgetfulness was excluded due to low reliability of the items (Cronbach's Alpha value = 0.389). Table 10 presents the correlation matrix.

No significant correlation was found in the analysis. Because the sample size (55) is much smaller than other types of games, it probably does not have enough statistic power to test the hypotheses. In the future study, a larger sample should help boost the power and make it possible to test the hypotheses.

6. Conclusion

This paper presents our proposed framework of game play based on genres of gaming technologies, media enjoyment theories, personality theories, and previous research in computer games. An appropriate fit between characteristics of the player and gaming technology could result in greater enjoyment while social influence may moderate the effects of player-technology fit. By extending the technology adoption model, this framework identifies enjoyment and perceived ease of use as two determinants of user intention to play computer games.

This framework suggests the existence of ideal profiles of player and gaming technology. The next step for validating this framework is to identify, operationalize, and test the ideal profiles. This requires measurements to be developed for player characteristics, dimensions of gaming technology, and enjoyment. Empirical studies should be conducted in an environment with some control of the player characteristics and gaming technology. One problem with earlier research was the lack of control because most of those studies used surveys as the primary data collection method with little control over the types of games and types of players researched. Exercising more controls in testing the proposed framework will likely lead to studies that generate more definitive findings.

As computer game technologies and applications are gaining popularity among users, our proposed framework lays a fertile ground for future research on computer games in several directions.

- The measurement of enjoyment is important as computer technology becomes increasingly
  immersive in daily life and its uses for hedonic tasks. Research on technology adoption for hedonic tasks will depend on measures of enjoyment, a strong determinant of user intention [52]. Based on media enjoyment theories, enjoyment can be measured through three types of reactions: affective, cognitive, and behavioral. A more detailed instrument is to be developed and validated.
- Many earlier studies have investigated the impact of violent games on personality. Without measuring personality prior to game play, it is difficult to conclude whether personality is the motivation to play violent games or the result of playing violent games. Our framework suggests that longitudinal studies can be used to oversee the change of personality over the course of game play. These longitudinal studies will likely germinate more definitive findings.
- Future research may focus on the development of taxonomy of computer games. Many of the earlier studies have concentrated on the negative effects of violent video games. Such a narrow scope of games does not provide much help to game development. By developing taxonomy of computer games, it is possible to identify different types of computer games that may attract different types of players. Instead of struggling with the negative impacts of violent games, better strategies may be identified for developing attractive computer games for training and educational purposes. The player-technology profiles may also be used to guide the evaluation and selection of games for such purposes.
- Future research is called upon developing ideal profiles between player characteristics and gaming technology. A good starting point is to identify what individual characteristics such as personality traits impact on enjoyment of what kind of computer games.

This paper also reports a survey that the authors conducted to investigate the impact of two personality traits (sensation seeking and self-forgetfulness) on enjoyment of computer game play. Major findings from this survey include: (1) sensation seeking has a significant and positive effect on enjoyment of computer game play through enhanced engagement during game play for action/adventure/shooting/fighting, role playing, and sport/racing games. (2) Sensation seeking has a significant and positive effect on enjoyment of computer game play through enhanced cognition values for family entertainment/simulation games. (3) Self-forgetfulness has a significant and positive effect on enjoyment of computer game play through enhanced engagement during game play for role playing games.

Future study can be improved by increasing the number of items for self-forgetfulness construct thus its reliability and construct validity. A larger sample may also help to examine the impact of sensation seeking and self-forgetfulness for strategy games.

As computer games are gaining increasing popularity, especially among younger generations of technology users, research on game play has significant implications for both IT researchers and developers. Our proposed framework contributes to both theory development and practice of game development and use.

References

[1] Entertainment Software Association, http://www.theesa.com.
[2] C.A. Anderson, B.J. Bushman, Effects of violent video games on aggressive behavior, aggressive cognition, aggressive affect, physiological arousal, and pro-social behavior: a meta-analytic review of the scientific literature, Psychological Science 12 (5) (2001) 353–359.
[3] C.A Anderson, K.E. Dill, Video games and aggressive thoughts, feelings, and behavior in the laboratory and in life, Journal of Personality and Social Psychology 78 (4) (2000) 772–790.
[4] E. Uhlmann, J. Swanson, Exposure to violent video games increases automatic aggressiveness, Journal of Adolescence 27 (2004) 41–52.
[5] G.W. Selnow, Playing videogames: the electronic friend, Journal of Communication 34 (2) (1984) 148–156.
[6] R.T. Wigand, S.E. Borstelmann, F.J. Boster, Electronic leisure: video game usage and the communication climate of video arcades, Communication Yearbook 9 (1985) 275–293.

[7] C.A. Phillips, S. Rolls, A. Rouse, M.D. Griffiths, Home video game playing in schoolchildren: a study of incidence and patterns of play, Journal of Adolescence 18 (1995) 687–691.
[8] M.D. Griffiths, The observational analysis of adolescent gambling in U.K. amusement arcades, Journal of Community and Applied Social Psychology 1 (1991) 309–320.
[9] M.D. Griffiths, Are computer games bad for children? The Psychologist: Bulletin of the British Psychological Society 6 (1991) 401–407.
[10] J.L. Sherry, R. Desouza, B. Greenberg, K. Lachlan, Relationship between developmental stages and video game uses and gratifications, game preference, and amount of time spent in play, in: Paper Presented at the International Communication Association Annual Conference, San Diego, CA, 2003.
[11] J.L. Sherry, R. Desouza, A. Holmstrom, The appeal of violent video games in children, in: Paper Presented at the Broadcast Education Association Annual Conference, Las Vegas, NV, 2003.
[12] J.L. Sherry, A. Holmstrom, R. Binns, B. Greenberg, K. Lachlan, Gender differences in video game use and preferences, in: Paper Presented at the National Communication Association Annual Conference, Miami, FL, 2003.
[13] T. Grodal, Video games and the pleasure of control, in: D. Zillmann, P. Vorderer (Eds.), Media Entertainment: The Psychology of its Appeal, Erlbaum, Mahwah, NJ, 2000, pp. 197–213.
[14] P. Vorderer, T. Hartmann, C. Klimmt, Explaining the enjoyment of playing video games: the role of competition, in: Proceedings of the Second International Conference on Entertainment Computing, Carnegie Mellon University, Pittsburgh, PA, 2003.
[15] E.H. Woodard, N. Gridina, Media in the Home 2000: The fifth Annual Survey of Parents and Children, Annenberg Public Policy Center of the University of Pennsylvania, Philadelphia, PA, 2000 (Survey Series No. 7).
[16] J. Cassell, H. Jenkins, Chess for girls? Feminism and computer games, in: J. Cassell, H. Jenkins (Eds.), From Barbie to Mortal Kombat: Gender and Computer Games, MIT Press, Cambridge, MA, 1998, pp. 2–45.
[17] C. Bruner, D. Bennett, M. Honey, Girl games and technological desire, in: J. Cassell, H. Jenkins (Eds.), From Barbie to Mortal Kombat: Gender and Computer Games, MIT Press, Cambridge, MA, 1998, pp. 72–89.
[18] J.B. Funk, D.D. Buchman, Playing violent video and computer games and adolescent self-concept, Journal of Communication 46 (2) (1996) 19–32.
[19] K.O. Norris, Gender stereotypes, aggression, and computer games: an online survey of women, Cyberpsychology & Behavior 7 (6) (2004) 714–727.
[20] P Bonanno, P.A.M. Kommers, Gender differences and styles in the use of digital games, Educational Psychology 25 (1) (2005) 13–41.
[21] M.D. Griffiths, M.N.O. Davies, D. Chappell, Online computer gaming: a comparison of adolescent and adult gamers, Journal of Adolescence 27 (1) (2004) 87–96.
[22] C.A. Anderson, An update on the effects of playing violent video games, Journal of Adolescence 27 (2004) 113–122.
[23] D. Fetchenhauer, X. Huang, Justice sensitivity and distributive decisions in experimental games, Personality and Individual Differences 36 (2004) 1015–1029.
[24] M. Schmitt, R. Neumann, L. Montada, Justice sensitivity, Social Justice Research 8 (1995) 385–407.
[25] N.A. Douse, I.C. McManus, The personality of fantasy game players, British Journal of Psychology 84 (1993) 505–509.
[26] L.S. Whang, C. Chang, Lifestyles of virtual world residents: living in the online game "lineage", Cyberpsychology & Behavior 7 (5) (2004) 592–600.
[27] H.G Gouch, California Psychological Inventory, 3rd ed., Consulting Psychologists Press, Palo Alto, CA, 1996.
[28] M.C. Ashton, Individual Differences and Personality, Academic Press, San Diego, CA, 2007.
[29] H.J. Eysenck, M.W. Eysenck, Personality and Individual Differences: a Natural Science Approach, Plenum Press, New York, NY, 1985.
[30] H.J. Eysenck, S.B.G. Eysenck, Psychoticism as a Dimension of Personality, Hodder & Stoughton, London, 1976.
[31] I.B. Myers, M.H. McCaulley, Manual: A Guide to the Development and Use of the Myers-Briggs Type Indicator, Consulting Psychologists Press, Palo Alto, CA, 1985
[32] P.T. Costa Jr., R.R. McCrae, The NEO Personality Inventory Manual, Psychological Assessment Resources, Odessa, FL, 1985.
[33] P.T. Costa Jr., R.R. McCrae, NEO Personality Inventory-Revised (NEO-PI-R) and NEO Five-Five Factor Inventory (NEO-FFI) Professional Manual, Psychological Assessment Resources, Odessa, FL, 1992.
[34] L.R. Goldberg, A broad-bandwidth, public-domain, personality inventory measuring the lower-level facets of several five-factor models, in: I. Mervielde, I. Deary, F. De Fruyt, F. Ostendorf (Eds.), Personality Psychology in Europe, vol. 7, Tilburg University Press, The Netherlands, 1999, pp. 7–28.
[35] J.M. Digman, Personality structure emergence of the Five-Factor Model, Annual Review of Psychology 41 (1990) 417–440.
[36] R.R. McCrae, O.P. John, An introduction to the Five-Factor Model and its applications, Journal of Personality 60 (1992) 175–215.
[37] F.D. Davis, Perceived usefulness, perceived ease of use, and user acceptance of information technology, MIS Quarterly 13 (3) (1989) 319–339.
[38] I Zigurs, B.K. Buckland, A theory of task/technology fit and group support systems effectiveness, MIS Quarterly 22 (3) (1998) 313–334.
[39] R. Drazin, A.H. Van de Ven, Alternative forms of fit in contingency theory, Administrative Science Quarterly 30 (4) (1985) 514–539.
[40] N. Venkatraman, The concept of fit in strategy research: toward verbal and statistical correspondence, Academy of Management Review 14 (3) (1989) 423–444.
[41] A.J. Elliot, T.M. Thrash, Approach-avoidance motivation in personality: approach and avoidance temperament and goals, Journal of Personality and Social Psychology 82 (2002) 804–818.
[42] K.C. Berridge, Pleasures of the brain, Brain & Cognition 52 (2003) 106–128.
[43] R.L. Nabi, M. Krcmar, Conceptualizing media enjoyment as attitude: implications for mass media effects research, Communication Theory 14 (4) (2004) 288–310.
[44] M.C. Green, T.C. Brock, G.F. Kaufman, Understanding media enjoyment: the role of transportation into narrative worlds, Communication Theory 14 (4) (2004) 311–327.
[45] A. Raney, Expanding disposition theory: reconsidering character liking, moral evaluations, and enjoyment, Communication Theory 14 (4) (2004) 348–369.
[46] J.L. Sherry, Flow and media enjoyment, Communication Theory 14 (4) (2004) 328–347.
[47] X. Fang, S. Chan, J. Brzezinski, C. Nair, Measuring enjoyment of computer game play, in: Proceedings of the Fourteenth Americas Conference on Information Systems (AMCIS 2008), Toronto, Canada, 2008.
[48] D. Hoffman, T. Novak, Marketing in hypermedia computer-mediated environments: conceptual foundations, Journal of Marketing 60 (3) (1996) 50–68.
[49] I. Ajzen, M. Fishbein, Understanding Attitudes and Predicting Social Behavior, Prentice-Hall, Englewood Cliffs, NJ, 1980.
[50] C.L. Hsu, H.P. Lu, Why do people play on-line games? An extended TAM with social influences and flow experience, Information & Management 41 (2004) 853–868.
[51] D. Choi, J. Kim, Why people continue to play online games: in search of critical design factors to increase customer loyalty to online contents, Cyberpsychology & Behavior 7 (1) (2004) 11–24.
[52] A.H. Van der Heijden, User acceptance of hedonic information systems, MIS Quarterly 28 (4) (2004) 695–704.
[53] N. Ravaja, M. Salminen, J. Holopainen, T. Saari, J. Laarni, A. Järvinen, Emotional response patterns and sense of presence during video games: potential criterion variables for game design, in: Proceedings of the Third Nordic Conference on Human–Computer Interaction, ACM, New York, NY, 2004, pp. 339–347.
[54] M. Zuckerman, Sensation Seeking: Beyond the Optimal Level of Arousal, Lawrence Erlbaum Associates, Inc., Hillsdale, NJ, 1979.
[55] C.R. Cloninger, T.R. Przybeck, D.M. Svrakic, A psychobiological model of temperament and character, Archives of General Psychiatry 50 (1993) 975–990.

Xiaowen Fang is an associate professor in the School of Computing, College of Computing and Digital Media, at DePaul University. He earned his PhD in Human Factors and Ergonomics from Purdue University, West Lafayette. He is the director for the Mobile Commerce Research lab. His research focuses on user-centered design of Web search tools, usability of e-business, usability of mobile commerce, enjoyment of computer game play.

Fan Zhao is an assistant professor in the Lutgert College of Business at Florida Gulf Coast University, USA. He received his PhD degree in management information systems from University of Nebraska-Lincoln, USA. His research and teaching interests are enterprise resource planning, data mining, human–computer interaction, e-commerce, and customer relationship management.