Gender differences in the perception and acceptance of online games

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Abstract
With the proliferation of online games, understanding users’ intention to play online games has become a new issue for academics and practitioners. Prior studies have investigated the factors affecting behavioural intention to play online games. However, little research has been conducted to investigate the gender differences in the acceptance of online games. Thus, this study is to investigate the effects of perceived playfulness and its potential antecedents (i.e., computer self-efficacy, computer anxiety, challenge, speed and feedback) on the behavioural intention to play online games, and to examine the gender differences in the perception and acceptance of online games. Data collected from 281 respondents in Taiwan were tested against the research model using analysis of variance and structural equation modelling approaches. The theoretical and practical implications of the results were discussed.

Introduction
There has been an explosive growth of online game players over the past few years. Statistics indicate that Internet users visit game-playing sites more often and stay longer than for any other Internet sites (Draenos, 2000); thus, playing online games has become one of the most popular entertainment/learning activities on the Internet. One of the most used online games is the massive multiplayer online game (MMOG). An MMOG is a computer game that is capable of supporting hundreds or thousands of players simultaneously, and is played on the Internet (Wikipedia, 2006b). Bonk and Dennen (2005) also suggest that the massive multiplayer online game is an advanced

Online game in this study refers to massive multiplayer online game.
distributed-learning technology that can offer unique education, training and performance support opportunities. In general, players like online games because these offer the illusion of transcending space and time. Players can play any roles they like in a virtual reality scenario and interact with other players. Because online games allow players to play together without seeing or knowing each other in the context of the Internet, they may satisfy various human desires that players cannot pursue in the real world. Communicating through online games may provide people with opportunities to experience new forms of social contacts without any real social presence (King, 1996). Therefore, the online game world is regarded not only as a temporary medium for playing games but also as a social place where new sorts of human relations are formed (Baek, Song & Seo, 2004).

With the proliferation of online games, understanding hedonic systems/online game acceptance has become a hot topic in the fields of educational technology and information systems (eg, Hsu & Lu, 2004, 2007; Kiili, 2005; van der Heijden, 2003, 2004). Many researchers have suggested that perceived playfulness or perceived enjoyment has a significant influence on the behavioural intention to use hedonic systems/online games (cf. Chung & Tan, 2004; Dickinger, Arami & Meyer, 2006; Hsu & Lu, 2007; Moon & Kim, 2001; Teo, Lim & Lai, 1999; van der Heijden, 2003, 2004). For example, Moon and Kim (2001) extended and empirically validated the Technology Acceptance Model (TAM) for the context of the World Wide Web (WWW) by adding an intrinsic motivation factor, perceived playfulness, to the TAM. They found that perceived playfulness has a significant positive influence on behavioural intention to use WWW. Chung and Tan (2004) suggest that perceived playfulness (similar to perceived enjoyment) is an important determinant of user acceptance of general-information-searching websites, and that while Moon and Kim’s (2001) research found perceived playfulness as part of TAM, no attempt was made to further identify possible variables (antecedents) that influence perceived playfulness. In addition, little research has been conducted to examine the gender differences in the perception and acceptance of online games. Thus, the main purpose of this study is to empirically investigate the antecedents of perceived playfulness and to explore the gender differences in the perceptions and acceptance of online games. This empirical study will be useful to researchers in developing and testing theories relating to online game acceptance, as well as to practitioners in understanding the strategies for designing and promoting online learning games.

The rest of this paper is organised as follows. In Section 2, we establish the theoretical foundation for the research model. It is followed by the description of the survey instruments and data collection methods used in this study. Next, we present the hypotheses testing results. Finally, the theoretical and practical implications and directions for future research are discussed.

**Theoretical background**

Unlike prior studies augmenting the TAM (eg, Carter & Bélanger, 2005; Chen, Gillenson & Sherrell, 2002; Gefen, Karahanna & Straub, 2003; Luarn & Lin, 2005; Moon & Kim, 2001; Teo *et al*, 1999; Wang, 2003; Yi, Jackson, Park & Probst, 2006), the current study
is to investigate the direct and/or indirect effects of perceived playfulness and its potential antecedents on the behavioural intention to play online games, and to examine the gender differences in the perception and acceptance of online games. According to previous literature (Agarwal & Prasad, 1999; Chung & Tan, 2004; Davis, 1993; Hong, Thong, Wong & Tam, 2002; Igbaria, Gamers & Davis, 1995; Jackson, Chow & Leitch, 1997; Venkatesh, 2000), this study identifies two main categories of external antecedent variables of perceived playfulness: individual differences and system characteristics. The research model tested in this study is shown in Figure 1. The research model suggests that two individual difference variables (ie, computer self-efficacy and computer anxiety) can influence behavioural intention directly or indirectly through perceived playfulness and that three system characteristics (ie, challenge, feedback and speed) can only influence behavioural intention through the mediation of perceived playfulness. Besides, gender difference was hypothesised to affect users’ perceptions of online games and moderate the relationships between the constructs in the research model. This section elaborates on the theory base and derives the hypotheses.

**Perceived playfulness**
Intrinsic motives are believed to play an important role in computer usage. Intrinsic motivation refers to the pleasure and satisfaction from performing a behaviour (Deci & Ryan, 1987), while extrinsic motivation emphasises performing a behaviour to achieve specific goals/rewards (Vellerand, 1997). Hsu and Lu (2007) suggest that ‘the main purpose of participating in online games community is for leisure and pleasure, not to achieve specific goals nor improve performances’. Thus, they replaced TAM’s perceived usefulness with perceived enjoyment, an intrinsic motivator, to explain the continuance...
intention to use online games. Past studies have also suggested that the use of information technology is influenced by perceived enjoyment (Chin & Gopal, 1995; Davis, Bagozzi & Warshaw, 1992; Igbaria et al, 1994; van der Heijden, 2003, 2004). Based on Lieberman’s (1977) pioneering works, Barnett’s (1990, 1991) studies and Csikszentmihalyi’s (1975) flow theory, Moon and Kim (2001) define perceived playfulness as the extent to which an individual perceives that his or her attention is focused on the interaction with the information system.

Perceived playfulness can be considered to be either a state of mind (eg, Moon & Kim, 2001) or an individual trait (eg, Webster & Martocchio, 1992). A state of mind represents a short-lived affective or cognitive experience felt by the individual; a trait, however, refers to a comparatively stable characteristic of the individual, which tends to be relatively invariant to situational stimuli but also slowly changes over time (Hackbart, Grover & Yi, 2003). While the trait-based approach focuses on playfulness as the individual’s characteristic, the state-based approach emphasises playfulness as the individual’s subjective experience of human–computer interaction (Moon & Kim, 2001). The current study defines perceived playfulness as a state of mind that can change. This view is consistent with previous information technology literature (Hackbart et al, 2003; Moon & Kim, 2001; Yager, Kappelman, Maples & Prybutok, 1997; Chung & Tan, 2004).

Atkinson and Kydd (1997) claim that playfulness is significantly related to total web use, especially for entertainment purposes, such as playing online games. Hsu and Lu (2007) also provided empirical evidence supporting that perceived enjoyment, similar to perceived playfulness, is a significant determinant of online game continuance behaviour. Besides, some researchers have investigated if females and males maintain the same perception of all types of computer use (Mitra et al, 2000; Scott & Rockwell, 1997). Lockheed (1985) and Scott and Rockwell (1997) have found that males reported loving to play video games more than females. Thus, it is expected that men have higher perceived playfulness and intention to play than women. This study also suggests that the influence of perceived playfulness on behavioural intention will be moderated by gender, such that the effect will be stronger for men. Therefore, this study tested the following hypotheses:

Hypothesis 1: Men’s rating of behavioural intention to play online games is higher than women’s.
Hypothesis 2: Men’s rating of perceived playfulness of online games is higher than women’s.
Hypothesis 3: Perceived playfulness positively influences behavioural intention to play online games more strongly for men than for women.

Individual differences related to computer skills
Several important external variables that have received more and more attention in the context of technology acceptance research are individual differences (cf. Agarwal & Prasad, 1999; Hong et al, 2002; Venkatesh & Morris, 2000; Wang, 2003). Consistent with prior studies (eg, Alavi & Joachimsthaler, 1992; Harrison & Rainer, 1992), ‘indi-
Individual differences refer to user factors that include traits such as personality and demographic variables, as well as situational variables that account for differences attributable to circumstances such as experience and training (Agarwal & Prasad, 1999, p. 362). Prior studies have suggested that computer self-efficacy/computer skill is an important antecedent of playfulness-related construct (e.g., Chung & Tan, 2004; Ghani, Supnick & Rooney, 1991; Hoffman & Novak, 1996; Koufaris, 2002). Thus, this study focuses on the individual difference variables related to computer skills. Two potential antecedents of perceived playfulness concerning individual computer skills were examined in this study: computer self-efficacy and computer anxiety.

Computer self-efficacy is defined as the judgment of one’s ability to use a computer (Compeau & Higgins, 1995). Previous research on information technology (IT) acceptance has confirmed the critical role that computer self-efficacy plays in understanding individual responses to IT (Agarwal, Sambamurthy & Stair, 2000; Chau, 2001; Hong et al, 2002; Johnson & Marakas, 2000; Wang, 2003; Wang, Lin & Luarn, 2006). The proposed relationship between computer self-efficacy and perceived playfulness is based on Chung and Tan’s (2004) exploratory study. Self-efficacy was also found to have a direct influence on system usage (Compeau & Higgins, 1995; Compeau, Higgins & Huff, 1999) or usage intention (Luarn & Lin, 2005; Wang et al, 2006). Therefore, we expect that computer self-efficacy will have a positive effect on perceived playfulness and behavioural intention to play online games. This study further contends that men will have higher computer self-efficacy than women and that the influences of computer self-efficacy on perceived playfulness and behavioural intention will be moderated by gender, such that the effect will be stronger for men. Thus, the following hypotheses were tested:

Hypothesis 4: Men’s rating of computer self-efficacy is higher than women’s.
Hypothesis 5: Computer self-efficacy positively influences perceived playfulness of online games more strongly for men than for women.
Hypothesis 6: Computer self-efficacy positively influences behavioural intention to play online games more strongly for men than for women.

Computer anxiety is another individual difference variable related to computer skills and experience; it has been defined as emotional fear, apprehension and phobia felt by individuals towards interactions with computers or towards the thought of using computers (Herdman, 1983; Howard, 1986; Marcoulides, 1989). Hong et al (2002) suggest that computer anxiety is an important individual difference distinct from computer self-efficacy and needs to be investigated in future research. Previous researchers have contended that computer anxiety is a kind of ‘state anxiety’ that tends to change in specific situations (Cambre & Cook, 1985; Heinssen, Glass & Knight, 1987; Oetting, 1983; Raub, 1981). Computer anxiety is characterised as an affective response (Barbeite & Weiss, 2004) that can influence utilisation of computer-based technology and performance on tasks that implicate use of computers (e.g., Chang, 2005; Heinssen et al, 1987; Mahar, Henderson & Deane, 1997; Rosen & Weil, 1995). Computer anxiety was also evidenced to have a negative influence on
system usage (Compeau & Higgins, 1995; Compeau et al., 1999). For this reason, individuals with high degrees of computer anxiety are expected to have lower degrees of intention to use online game systems. Furthermore, Bozionelos (2001) contends that behavioural expressions of computer anxiety comprise ‘(1) avoidance of computers and the general areas where computers are located; (2) excessive caution with computers; (3) negative remarks about computers; and (4) attempts to cut short the necessary use of computers’ (p. 214). As playing online games is essentially an activity with computers, computer anxiety, arising from lack of computer skills or experience, could play an important role in influencing individuals’ reactions to online game playing. Therefore, we expect that computer anxiety will have a negative influence on perceived playfulness and behavioural intention to play online games. This study further contends that women will have higher computer anxiety than men and that the influences of computer anxiety on perceived playfulness and behavioural intention will be moderated by gender, such that the effect will be stronger for women. Thus, this study tested the following hypotheses:

Hypothesis 7: Women’s rating of computer anxiety is higher than men’s.
Hypothesis 8: Computer anxiety negatively influences perceived playfulness of online games more strongly for women than for men.
Hypothesis 9: Computer anxiety negatively influences behavioural intention to play online games more strongly for women than for men.

System characteristics
Several researchers have explored antecedents of perceived playfulness, flow and engagement, all of which represent intrinsic motivation and are considered to overlap each other (Agarwal & Karahanna, 2000; Chung & Tan, 2004). According to prior studies on these three similar constructs, this section identifies potential antecedent variables of perceived playfulness in the context of online games. Based on the experiential learning theory, flow theory and aspects of game design, Kiili (2005) proposes an experiential gaming model that stresses the importance of providing online game players with immediate feedback, clear goals and challenges that are matched to players’ skill levels in order to facilitate flow experience. Thus, based on the previous literature, we select three system characteristics as critical external antecedents of perceived playfulness in the context of online games: (1) challenge (Chen, Wigand & Nilan, 1999; Chung & Tan, 2004; Ghani & Deshpande, 1994; Ghani et al., 1991; Hoffman & Novak, 1996; Hsu, Lee & Wu, 2005; Kiili, 2005; Koufaris, 2002; Novak, Hoffman & Yung, 2000; Webster & Ho, 1997), (2) feedback/interactivity (Hoffman & Novak, 1996; Hsu et al., 2005; Webster & Ho, 1997) and (3) speed (Skadberg & Kimmel, 2004; Chung & Tan, 2004; Kiili, 2005).

According to Chung and Tan (2004) and Kiili (2005), challenge is defined as the extent to which perceived positive challenges presented by an online game are matched to perceived playing skills of the user. Namely, challenge in this study is conceptually a construct of challenge–playing skill match. It is worth noting that playing skills mean the skill level of playing a specific online game, which is conceptually different from
computer skills mentioned earlier. In fact, an online game itself is a big problem that is composed of smaller, causally linked problems. Generally, a problem can be anything that somehow restricts a player’s progress in the game world (Kiili, 2005). Rollings and Adams (2003) also suggest that gameplay is one or more causally linked series of challenges in a simulated environment. Thus, the aim of an online game is to provide players with challenges related to a specific virtual problem or task so that playful experience is possible. Based on Csikszentmihalyi’s (1975) theory of flow, an individual tends to experience challenging situation as rewarding and feel happiest when challenges and skills are matched. Thus, appropriate challenges can keep a player motivated and engaged throughout an entire game (Csikszentmihalyi, 1975; Csikszentmihalyi & LeFevre, 1989; Hoffman & Novak, 1996; Kiili, 2005; Woszczynski, Roth & Segars, 2002). If the system can offer the player such challenges that are in correspondence with his or her playing skills, the possibility of experiencing playfulness is higher (Kiili, 2005).

Feedback is defined as the extent to which an individual perceives that playing online games has interaction between game players (Chung & Tan, 2004; Hoffman & Novak, 1996; Webster & Ho, 1997), while speed is defined as the extent to which an individual perceives that playing online games has a fast system response (Chung & Tan, 2004). Kiili (2005) suggests that digital games should provide immediate feedback to the player in order to facilitate flow experience. Based on the results of an exploratory study, Chung and Tan (2004) also contend that both speed and feedback are possible antecedents of perceived playfulness in the context of general information-searching websites. In the context of online games, a player usually wants to interact with other players and receive a quick response from the online game system in order to facilitate a playful experience. Also, players usually need to cooperate with each other to overcome a causally linked series of challenges. Thus, the operation of online games must have sufficient servers and bandwidth in order to handle and verify a large number of connections and ensure quick system response and live interaction between a massive number of game players. Devoting insufficient resources to the maintenance of online games leads to lag and frustration for the players, which in turn decreases the level of playfulness experienced. In addition, most game players would like to make new friends through playing online games, making ‘fast system response’ and ‘live interactions between players’ important for promoting perceived playfulness. In summary, a slow system response and low level of interaction in the online game world decrease the likelihood of experiencing playfulness because the player has to sacrifice attention and other cognitive resources to inappropriate activity.

Applying the findings of prior studies (Chung & Tan, 2004; Hoffman & Novak, 1996; Kiili, 2005; Skadberg & Kimmel, 2004; Webster & Ho, 1997) to online games suggests that perceived playfulness will be positively influenced by the three system characteristics (ie, challenge, feedback and speed) perceived by individuals. This study further suggests that men will have higher system characteristics perceptions than women, and that the influence of systems characteristics on perceived playfulness will be moderated by gender, such that the effect will be stronger for men. Thus, we tested the following hypotheses:
Hypothesis 10: Men’s rating of challenge of online games is higher than women’s.
Hypothesis 11: Men’s rating of feedback of online games is higher than women’s.
Hypothesis 12: Men’s rating of speed of online games is higher than women’s.
Hypothesis 13: Challenge positively influences perceived playfulness of online games more strongly for men than for women.
Hypothesis 14: Feedback positively influences perceived playfulness of online games more strongly for men than for women.
Hypothesis 15: Speed positively influences perceived playfulness of online games more strongly for men than for women.

So far we have elaborated on the theory base and derived 15 separate hypotheses. In the following section, we proceed to describe the construct measures and data collection methods used in this study.

Research Methodology

Measures
To ensure the content validity of the scales, the items selected must represent the concept about which generalisations are to be made. Therefore, measuring instruments or items adapted from prior studies were used to measure computer self-efficacy, computer anxiety, speed, feedback, challenge, perceived playfulness and behavioural intention. Five items adapted from Moon and Kim (2001) were used to measure perceived playfulness. Four items for the computer self-efficacy construct were adapted from the original instrument of computer self-efficacy developed by Compeau and Higgins (1995). The items used to measure computer anxiety were adapted from Heinssen, Glass and Knight’s (1987) computer anxiety rating scale. Three items selected from Venkatesh, Morris, Davis and Davis (2003) were used to measure behavioural intention. Finally, the items for the speed, feedback and challenge constructs were developed based on Chung and Tan’s (2004) exploratory work. Pretesting of the measures was conducted by users selected from the online game field and experts in the area of information systems/educational technology research. Accordingly, the items were further adjusted to make their wording as precise as possible. Likert scales (1–7), with anchors ranging from strongly disagree to strongly agree, were used for all construct items. The questionnaire also contained demographic questions. The original items used in this study can be found in the appendix.

Subjects
Given that the system characteristics may differ for various types of online games and that most of the online game players in Taiwan play massive multiplayer online role-playing games (MMORPG), this study focuses on the context of MMORPGs. That is, the online games in the questionnaire of this study refers to MMORPGs (eg, World of Warcraft, Lineage and Maple Story). An MMORPG is an online computer role-playing game (RPG) in which a large number of players interact with one another in a virtual world. MMORPGs are distinguished from single-player or small multi-player RPGs by the game’s persistent world, usually hosted by the game’s publisher, which continues to exist and evolve while the player is away from the game (Wikipedia, 2006a).
Because of the lack of a reliable sampling frame, it is difficult to conduct a random sampling for all the MMORPG players in Taiwan. Thus, in this study we adopted a non-random sampling technique (i.e., convenience sampling) to collect the sample data. To make the results generalisable, we gathered sample data from five international or local organisations in Taiwan. Respondents were first asked whether they had ever played MMORPGs; if they replied in the affirmative, they were asked to participate in the survey. The respondents were instructed to answer the questions based on their prior experience of playing an MMORPG. This served to relate the survey respondents to a class of online games, i.e., MMORPG. For each question, respondents were asked to circle the response that best described their degree of agreement. On this basis, a convenience sampling was implemented and a sample of 281 usable responses was obtained from a variety of respondents with different computer or Internet experiences. A total of 54.8% of the respondents are male. The respondents had an average of 9.35 years of computer experience ($SD = 5.65$) and 5.63 years of Internet experience ($SD = 3.02$). Also, 35.2% of respondents had a degree at the university level or above. The characteristics of the respondents are shown in Table 1.

In this section, we have described the measures of the constructs and the sampling technique utilised in this study. Next, we proceed to explain the results of data analyses and hypotheses testing.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>127</td>
<td>45.2</td>
</tr>
<tr>
<td>Male</td>
<td>154</td>
<td>54.8</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;20</td>
<td>131</td>
<td>46.6</td>
</tr>
<tr>
<td>21–30</td>
<td>30</td>
<td>10.7</td>
</tr>
<tr>
<td>31–40</td>
<td>46</td>
<td>16.4</td>
</tr>
<tr>
<td>41–50</td>
<td>63</td>
<td>22.4</td>
</tr>
<tr>
<td>&gt;51</td>
<td>11</td>
<td>3.9</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elementary school</td>
<td>11</td>
<td>3.9</td>
</tr>
<tr>
<td>Junior high school</td>
<td>7</td>
<td>2.5</td>
</tr>
<tr>
<td>Senior high school</td>
<td>123</td>
<td>43.8</td>
</tr>
<tr>
<td>Junior college</td>
<td>41</td>
<td>14.6</td>
</tr>
<tr>
<td>University</td>
<td>69</td>
<td>24.5</td>
</tr>
<tr>
<td>Graduate (or above)</td>
<td>30</td>
<td>10.7</td>
</tr>
<tr>
<td>Industry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td>73</td>
<td>26.0</td>
</tr>
<tr>
<td>Service</td>
<td>39</td>
<td>13.9</td>
</tr>
<tr>
<td>Student</td>
<td>139</td>
<td>49.4</td>
</tr>
<tr>
<td>Government agencies</td>
<td>28</td>
<td>10.0</td>
</tr>
<tr>
<td>Others</td>
<td>2</td>
<td>0.7</td>
</tr>
</tbody>
</table>

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Data analysis and results

Assessment of measurement model

A confirmatory factor analysis using AMOS 4.0 was conducted to test the measurement model. All the model-fit indices exceeded their respective common acceptance levels suggested by previous research, thus demonstrating that the measurement model exhibited a fairly good fit with the data collected ($\chi^2/df = 1.56$, GFI = 0.91, AGFI = 0.88, NFI = 0.96, CFI = 0.99 and RMSR = 0.07). We could therefore proceed to evaluate the psychometric properties of the measurement model in terms of reliability, convergent validity and discriminant validity.

Reliability and convergent validity of the factors were estimated by composite reliability and average variance extracted (see Table 2). Composite reliability for all the factors in our measurement model was above 0.90. The average extracted variances were all above the recommended 0.50 level (Hair, Anderson, Tatham & Black, 1992), which means that more than half of the variances observed in the items were accounted for by their hypothesised factors. Convergent validity can also be evaluated by examining the factor loadings and squared multiple correlations from the confirmatory factor analysis. Based on Hair et al’s (1992) recommendation, factor loadings greater than 0.50 were considered very significant. All of the factor loadings of the items in the research model were greater than 0.70. Also, squared multiple correlations between the individual items and their a priori factors were larger than 0.50. Thus, all factors in the measurement model had adequate reliability and convergent validity.

To examine discriminant validity, this study compared the shared variance between factors with the average variance extracted of the individual factors (Fornell & Larcker, 1981). This analysis indicated that the shared variances between factors were lower than the average variance extracted of the individual factors, thus confirming discriminant validity (see Table 2). In summary, the measurement model demonstrated adequate reliability, convergent validity and discriminant validity.

Table 2: Reliability, average variance extracted and discriminant validity

<table>
<thead>
<tr>
<th>Factor</th>
<th>CR</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Computer self-efficacy</td>
<td>0.963</td>
<td>0.868</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Speed</td>
<td>0.960</td>
<td>0.256</td>
<td>0.888</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Feedback</td>
<td>0.947</td>
<td>0.129</td>
<td>0.406</td>
<td>0.856</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Challenge</td>
<td>0.929</td>
<td>0.094</td>
<td>0.277</td>
<td>0.381</td>
<td>0.814</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Perceived playfulness</td>
<td>0.933</td>
<td>0.098</td>
<td>0.102</td>
<td>0.086</td>
<td>0.190</td>
<td>0.739</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Computer anxiety</td>
<td>0.970</td>
<td>0.246</td>
<td>0.063</td>
<td>0.032</td>
<td>0.032</td>
<td>0.045</td>
<td>0.916</td>
<td></td>
</tr>
<tr>
<td>7. Behavioural intention</td>
<td>0.969</td>
<td>0.242</td>
<td>0.125</td>
<td>0.122</td>
<td>0.172</td>
<td>0.252</td>
<td>0.155</td>
<td>0.914</td>
</tr>
</tbody>
</table>

Diagonal elements are the average variance extracted. Off-diagonal elements are the shared variance.

CR, composite reliability.
Structural model estimation and hypotheses testing

A similar set of fit indices was used to examine the structural model. Comparison of all fit indices with their corresponding recommended values provided evidence of a good model fit ($\chi^2/df = 1.44$, GFI = 0.85, AGFI = 0.80, NFI = 0.93, CFI = 0.98 and RMSR = 0.10), except that the GFI value is slightly below the desired level of 0.90. For the male group, the model accounted for 32% of the variance in perceived playfulness and 42% of that in behavioural intention. As indicated in Figure 2, the paths from challenge to perceived playfulness, from perceived playfulness to behavioural intention, and from computer self-efficacy to behavioural intention were significant for the male group. On the other hand, for the female group, the model accounted for 12% of the variance in perceived playfulness and 40% of that in behavioural intention. Besides, the paths from challenge to perceived playfulness, from perceived playfulness to behavioural intention, and from computer anxiety to behavioural intention were significant for the female group (see Figure 2). The results also imply that there may be some gender differences in the perception and acceptance of online games. Thus, we proceed to examine the gender differences in perceptions of the online game acceptance drivers and in relationships among these drivers and behavioural intention.

Using analysis of variance (ANOVA), we investigated the effects of gender difference on computer self-efficacy, speed, feedback, challenge, perceived playfulness, computer anxiety and behavioural intention. The descriptive statistics and ANOVA test results are

**Figure 2: Standardised path coefficients** for the male and female users
*Coefficients for male users are in the shaded boxes. *p < 0.05; **p < 0.01
shown in Table 3. Significant gender differences were found for perceived playfulness, computer self-efficacy, computer anxiety and behavioural intention. The results show that men’s ratings of perceived playfulness, computer self-efficacy and behavioural intention were higher than women’s, and that women’s ratings of computer anxiety were higher than men’s. However, no gender differences in perceptions of system characteristics (ie, speed, feedback and challenge) of online games were found. Therefore, Hypotheses 1, 2, 4 and 7 were supported, while Hypotheses 10, 11 and 12 were not supported.

We continued to conduct a two-group test for examining the gender differences in strength of the path coefficients. In this analysis, one path coefficient was constrained to be equal across the two gender groups, and the resulting model fit was compared with a base model, in which all path coefficients were freely estimated using a $\chi^2$ difference test.

The results of the gender difference analysis are shown in Table 4. The paths from speed to perceived playfulness, from feedback to perceived playfulness, from challenge to perceived playfulness, from perceived playfulness to behavioural intention, from computer self-efficacy to perceived playfulness, and from computer anxiety to perceived playfulness did not differ between the male and female groups. Thus, Hypotheses 3, 5, 8, 13, 14 and 15 were not supported. Expectedly, computer self-efficacy was found to be a stronger predictor of behavioural intention for men than for women ($\Delta \chi^2 = 10.131, p < 0.01$), and computer anxiety negatively influenced behavioural intention more strongly for women than for men ($\Delta \chi^2 = 7.501, p < 0.01$). Thus, hypotheses Hypotheses 6 and 9 were supported.

Up to now, we have indicated the results of the research model validation. Next, we continue to discuss the theoretical and practical implications of the results.

### Table 3: Descriptive statistics and analysis of variance test results

<table>
<thead>
<tr>
<th>Construct</th>
<th>Women (n = 127)</th>
<th>Men (n = 154)</th>
<th>Significance of difference between women and men (F statistics)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Behavioural intention</td>
<td>4.58</td>
<td>1.42</td>
<td>3.62</td>
</tr>
<tr>
<td>Perceived playfulness</td>
<td>4.59</td>
<td>1.18</td>
<td>4.93</td>
</tr>
<tr>
<td>Computer self-efficacy</td>
<td>4.49</td>
<td>1.43</td>
<td>5.29</td>
</tr>
<tr>
<td>Computer anxiety</td>
<td>3.36</td>
<td>1.49</td>
<td>2.86</td>
</tr>
<tr>
<td>Speed</td>
<td>4.90</td>
<td>1.31</td>
<td>5.10</td>
</tr>
<tr>
<td>Feedback</td>
<td>5.07</td>
<td>1.16</td>
<td>5.23</td>
</tr>
<tr>
<td>Challenge</td>
<td>5.27</td>
<td>1.03</td>
<td>5.40</td>
</tr>
</tbody>
</table>

*ns = not significant.
*p < 0.05; **p < 0.01; ***p < 0.001.
Discussions

This research not only investigated the antecedents of perceived playfulness and explored how they influence behavioural intention to play online games directly and/or indirectly through the mediation of perceived playfulness, but it also examined the gender differences in perceptions of the online game acceptance drivers and in relationships among these drivers and behavioural intention. As expected, the results indicate that men’s ratings of perceptions with respect to computer self-efficacy, perceived playfulness and behavioural intention were all higher than women’s, and that women’s rating of perceptions concerning computer anxiety was higher than men’s. However, no gender difference in the perceptions of system characteristics (ie, speed, feedback and challenge) of online games was found.

Computer self-efficacy, computer anxiety, speed and feedback were unexpectedly found to have a non-significant influence on perceived playfulness for both men and women. However, we found that the effect of challenge on perceived playfulness and that of perceived playfulness on behavioural intention were significant, but both effects did not exist any gender difference. This finding supports previous research that has found a significant direct relationship between perceived playfulness and behavioural intention to use information technology (eg, Moon & Kim, 2001).

The results indicate that if the online games offer the game player such challenges that are in correspondence with his or her playing skills, the extent of experiencing playfulness is higher. This study confirms previous researchers’ argument that an individual likes to encounter challenges and experiences the greatest perceived playfulness when challenges and skills are matched (eg, Csikszentmihalyi, 1975; Kiili, 2005; Woszczynski et al, 2002). As Kiili (2005) noted, a player’s prior experiences and skills will affect how the player perceives the playfulness of an online game. If the

<table>
<thead>
<tr>
<th>Table 4: Two-group comparison of paths for male and female users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unconstrained base model&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>---------------------------------------</td>
</tr>
<tr>
<td>Speed→Perceived playfulness</td>
</tr>
<tr>
<td>Feedback→Perceived playfulness</td>
</tr>
<tr>
<td>Challenge→Perceived playfulness</td>
</tr>
<tr>
<td>Perceived playfulness→Behavioural intention</td>
</tr>
<tr>
<td>Computer self-efficacy→Perceived playfulness</td>
</tr>
<tr>
<td>Computer self-efficacy→Behavioural intention</td>
</tr>
<tr>
<td>Computer anxiety→Perceived playfulness</td>
</tr>
<tr>
<td>Computer anxiety→Behavioural intention</td>
</tr>
</tbody>
</table>

<sup>a</sup>Paths for the two groups were allowed to be freely estimated.

<sup>b</sup>The path specified was constrained to be equal across the two groups.

<sup>ss</sup>not significant.

* $p < 0.05$; ** $p < 0.01$.

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challenge is significantly lower than the player’s skill level, the player may feel bored. In contrast, if the challenge is significantly greater than the game player’s skill level, he or she may become frustrated. In order to increase perceived playfulness, an online game should provide a player with challenges that are closely matched to his or her skill level of playing. Thus, the critical task of online game design is to sustain the motivation and engagement of the player by offering appropriate challenges to him or her. The challenges rendered by an online game should be balanced so that the game’s difficulty increases incrementally and do not vary irregularly. If the challenge level decreases before the game is completed, a player may lose interest in the game. To keep a player in a playful state, game designers should ensure that when a player’s level of playing skill increases, the challenges will become more difficult. On the other hand, online game publishers can provide some guidance to the players or provide the possibility of solving problems with the help of other players (Kiili, 2005).

Interestingly, neither speed nor feedback has a significant effect on perceived playfulness. While speed may be an important system characteristic for a specific class of online games (e.g., action games), it was not a salient antecedent of perceived playfulness for MMORGS as a whole. On the other hand, feedback may be considered a required system characteristic for massive multiplayer online role-playing games, thus making it have a non-significant effect on perceived playfulness. Our findings also suggest that system characteristics may have different influences on perceived playfulness for different types of online games. Therefore, future research should individually examine the effects of specific system characteristics on perceived playfulness in various contexts of online games.

More importantly, the results suggest that there exist some significant gender differences in the effects of the computer self-efficacy and computer anxiety on behavioural intention. First, we found that gender difference moderates the effect of computer self-efficacy on behavioural intention. That is, the effect was only significant for men but non-significant for women. This means that men with high computer self-efficacy tend to have higher behavioural intentions to play online games than those with lower computer self-efficacy, but women with high computer self-efficacy do not have higher intention to play than those with lower computer self-efficacy. Second, this study has another interesting finding—that the effect of computer anxiety on behavioural intention was significant for women, but non-significant for men. This suggests that women with high computer anxiety tend to have lower behavioural intentions to play than those with lower computer anxiety, while men with high computer anxiety do not have lower intentions to play than those with lower computer anxiety. The findings also imply that women are usually anxious about the relatively advanced and complex computer technology and thus have lower intentions to play online games than men.

This study also provides several implications for the design and promotion of online learning game. As the use of online learning game is fully voluntary and the target user
group consists of a large number of people with diversified backgrounds, making an online learning game playful is crucial for attracting more users to the learning game system. To achieve this goal, online learning game practitioners should have skilful computer programmers and game story designers to develop online games with challenges that are closely matched to players’ skill levels. Furthermore, the results suggest that men with higher computer self-efficacy and women with lower computer anxiety will develop higher behavioural intentions to play online games. Thus, online learning game practitioners can increase men’s computer self-efficacy and decrease women’s computer anxiety by providing them with education and training courses in various computer technologies. For example, educators can provide free courses of online learning games for novices to increase their familiarity with the educational technology and to change their computer anxiety and computer self-efficacy. Even if these courses are not directly related to online learning games, they can still help individuals develop higher behavioural intention to enjoy and play online learning games.

In this section, we have thoroughly discussed the implications of the research findings for research and practice. In the next section, we present the conclusions and limitations of this study.

Conclusions and limitations
This study conducted an empirical investigation of the antecedents of perceived playfulness and of the gender differences in the perception and acceptance of online games. The findings of this study provide several important implications for online game research and practice. Through the antecedent variables of perceived playfulness, online game practitioners and educators can better control users’ beliefs about using online game systems and then suggest new strategies for improving their usage intention. The findings of this study also suggest that educational technology researchers should take gender difference into consideration in the development and validation of the theories of educational technology acceptance.

Even though a rigorous research procedure was used, this work has some limitations that could be addressed in future studies. First, investigating the gender difference in the acceptance of online games is a relatively new topic for educational technology researchers. The findings and their implications are obtained from just one study that examined a particular technology (ie, MMORPG) and targeted a specific user group in Taiwan. Thus, caution must be taken when generalising our findings and discussion to other educational technologies or groups. A cross-cultural validation using another large sample gathered elsewhere is required for further generalisation of our findings. Second, the sampling method has potential bias because a sample of willing respondents (ie, convenience sample) may not be generalisable. To remedy this, future research efforts could be conducted to test the proposed model using a random sampling approach. Third, the relatively low $R^2$ reported by the current research represents another limitation. Hence, there may be a need to search for additional variables that will improve our ability to explain perceived playfulness more accurately. Potential antecedents of perceived playfulness include control (Chung & Tan, 2004; Ghani &
Deshpande, 1994; Ghani et al., 1991) and telepresence (Chung & Tan, 2004; Hoffman & Novak, 1996; Novak et al., 2000). Finally, this study was conducted with a snapshot research approach, so longitudinal research efforts are needed to evaluate the validity of the proposed model and our findings. User acceptance and continuance of online games is a dynamic phenomenon. Thus, conducting a longitudinal and careful observation of online communities inside the games is a good way to enhance our understanding of causality and interrelationships between variables that are important to user acceptance and continuance of online games.

References

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**Appendix: Survey items used in the study**

**Computer self-efficacy**

CSE1 I feel confident playing an online game even if there is no one around to show me how to play it.

CSE2 I feel confident playing an online game even if I have never played it before.

CSE3 I feel confident playing an online game even if I have only the online instructions as a reference.

CSE4 I feel confident playing an online game if I see someone else playing it before I try it myself.

**Speed**

SPD1 When playing an online game, I feel it gives a fast response.

SPD2 When playing an online game, I feel it loads information rapidly.

SPD3 When playing an online game, I feel it rapidly generates the information I need.

**Feedback**

FBK1 When playing an online game, I feel it is interactive.

FBK2 When playing an online game, I am able to interact with other players.

FBK3 When playing an online game, I am able to cooperate with other players.
Challenges
CLG1 When playing an online game, I experience suitable levels of challenge.
CLG2 When playing an online game, I feel that it automatically becomes more challenging as my playing skill increases.
CLG3 When playing an online game, I feel it provides me with challenges that are closely matched to my skill level.

Computer anxiety
CA1 It scares me to think that I could cause the computer to destroy a large amount of information by hitting the wrong key.
CA2 I hesitate to use a computer for fear of making mistakes I cannot correct.
CA3 Computers are somewhat intimidating to me.

Perceived playfulness
PP1 When playing an online game, I do not realize the passing time.
PP2 When playing an online game, I will forget the work I have to do.
PP3 Playing an online game makes me happy.
PP4 Playing an online game stimulates my curiosity.
PP5 Playing an online game makes me want to explore.

Behavioural intention
BI1 I intend to play online games in the future.
BI2 I predict I will play online games in the future.
BI3 I plan to play online games in the future.