

Not So Angry Birds: Psychological Benefits of Mobile Games

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Abstract

This study explored factors that may trigger players' enjoyment of mobile games on smart devices. Gender differences and the psychological benefits of mobile gameplay were further assessed. A laboratory experiment was conducted. Results revealed that there was a significant interaction effect of game challenge and past mobile game experience on game enjoyment. A significant gender difference was found, with males performing games better, and enjoying them more than females. The indirect effect of game rewards on self-esteem through enjoyment suggested that game enjoyment may be considered an important mechanism connecting satisfying gaming performance with psychological health.

Keywords: Game Enjoyment, Flow, Self-esteem, Mobile Game, Angry Birds, Apps

Introduction

The mobile game industry continues to grow across the globe driven by the rapid increase in smart devices ownership. There is a heavy usage of accessing applications (apps) on smart devices with 89% of media time spent in apps and game apps command 32% of users' app time (Bosomworth, 2014). A report by Juniper Research reveals that, by 2017, 64.1 billion games will have been downloaded onto smart devices, over three times more than in 2012 (Rowlands, 2013). The revenue of mobile games is expected to jump from 17.5 billion in 2013 to 40.4 billion by 2017, with a 37.9% market share from the Asia-Pacific region by 2016 (GMGC, 2015).

Gamification can be defined as “taking the essence of games—fun, play, transparency, design and challenge—and applying it to real-world objectives rather than pure entertainment” (Palmer Lunceford, & Patton, 2012, p.55). It is a process of enhancing services with motivational affordances to evoke playful experiences and further behavioral outcomes (Hamari, 2013). Wu's (2011) definition further stressed the use of game attributes, such as game mechanics and dynamics, game design elements, gaming psychology, and storytelling, to drive game-like player behaviors. Here, gamification, among other factors, comprises gaming psychology that aims to introduce fun and playful elements to engage the players. Research on playfulness as individuals' interaction state has mainly based on flow theory (Moon & Kim, 2001). Flow is the “holistic sensation that people feel when they act with total involvement” (Csikszentmihalyi, 1977, p. 36). This “optimal experience” (Csikszentmihalyi, 1990) highlights enjoyment, and is a concept that has inspired research on the design of information systems (Webster, Trevino, & Ryan, 1993) as well as the human affect, behavior, and interaction toward new information technologies (Agarwal & Karahanna, 2000; Ghani & Deshpande,

1994; Hsu & Lu, 2004). For example, Webster et al. (1993) suggested that specific characteristics of the software (e.g. flexibility and modifiability) and user behaviors of the information technology (e.g. future voluntary use) contributed to the flow state. Ghani & Deshpande (1994) found that skill and challenge can directly lead to flow. Flow during gameplay refers to a pleasant and enjoyable experience, and it provides a model for understanding intrinsic motivation and reward (Privette, 1983) to examine games across various platforms, including online games (Hsu & Lu, 2004), first-person shooter PC games (Nacke, Stellmach, & Lindley, 2011), console games (Pasch et al., 2009), and massive multi-player online role-playing games (MMORPGs) (Wan & Chiou, 2006).

Mobile games for smart devices utilize the sensitivity of the interface, and the player requires a relatively brief period of experience with the software and device, thus experiencing a lesser technological and economic barrier to entry. The design of these game apps tends to match well with a play style based on snatched moments, possibly passing the boredom of commuting, all the while learning, through play, the capacities of the smart device (Wilson et al., 2011). As periods of time spent commuting or waiting are generally limited, mobile game apps usually have simple plots, allowing players to quickly develop sufficient strategy to progress during their short breaks, while past gaming experience and established skills are not a necessary prerequisite to entry. Although mobility and play have been conjoined for some time, mobile games on smart devices have introduced a casual game setting, and a pleasurable entrée into a game world that is easy to pick up and play, yet hard to master, so that players become engaged and are likely to return to the game constantly (Wilson et al., 2011). However, the enjoyment of mobile gaming, being a newer genre, has been less explored.

Further, video gameplay has traditionally been a male-dominated activity (Greenberg,

Sherry, Lachlan, Lucas, & Holmstrom, 2010). However, with more and more females playing mobile games, the gender gap is gradually diminishing (Katz & Acord, 2008). It is still inconclusive whether there is a gender difference in mobile game enjoyment or not. Further, due to the variety and complexity of gaming, past studies have shown both positive and negative effects of video games on players (Przybylski, Rigby, & Ryan, 2010). While gameplay has been shown to engender feelings of autonomy, competence, and relatedness, triggering feelings of psychological well-being in the short term (Ryan, Rigby, & Przybylski, 2006), this study assesses the role of self-esteem in relation to game enjoyment and rewards. Taken together, the current study sets out to explore factors that may contribute to the enjoyment of the games played on smart devices and attempts to understand the potential psychological benefit derived from exposure to play in the mobile game apps context.

Flow and Game Enjoyment

Flow describes a subjective state in which an individual is fully involved (Nakamura & Csikszentmihalyi, 2002). When individuals are in the flow state, they become absorbed in the activity (Csikszentmihalyi, 1990) and experience a deep sense of enjoyment, making them feel cognitively efficient, motivated, and happy (Moneta & Csikszentmihalyi, 1996). The two main characteristics of flow are total concentration in an activity, and the enjoyment that one can derive from such an activity (Ghani & Deshpande, 1994). According to Ghani and Deshpande (1994), play and intrinsic motivation is closely related to enjoyment concentration. The concept of flow has been used to study a diverse range of activities such as sports, games, religious rituals, and artistic performances. In the information system

context, flow explains individuals' perception of entertainment-centric activities such as video games and how that perception differs among individuals (Sweetser & Wyeth, 2005).

People play games to deal with challenges, make friends, and spend time, but the fundamental reason is for enjoyment (Davis, Steury, & Pagulayan, 2005). Enjoyment is an intrinsic motivation that can affect individuals' information technology use behavior (Davis, Bagozzi, & Warshaw, 1992). Researchers have found that the flow experience affects playability and the adoption of mobile games, while enjoyment is the major factor in that experience (Ha et al., 2007; Korhonen & Koivisto, 2006). Enjoyment is the crucial factor that impacts players' intentions and their continuation of play (Sweetser & Wyeth, 2005; Wu, Li, & Rao, 2008). A game flow model consisting of eight core elements—concentration, challenge, skills, control, clear goals, feedback, immersion, and social interaction—has therefore been developed, and validated, for evaluating a player's overall enjoyment of gameplay (Sweetser & Wyeth, 2005). While flow has been defined as a multi-dimensional construct, Lepper and Malone (1987) found one of the major reasons that computer games are so captivating is due to the powerful sense of control they offer to the players. That is, the challenge derives from the difficulty of the task relative to individuals' skills in using a particular information technology tool is the key determinant of the experience individuals perceive (Ghani & Deshpande, 1994). In the video gameplay context, Sherry (2004) further elucidates on the balance of challenge and skill as key components of enjoyment. Therefore, this study focuses on the enjoyable experience one is aware of while playing mobile games on smart devices, given that mobile games can be considered an entertainment-oriented media platform.

Game Challenge and Experience

Early research by Csikszentmihalyi (1988) suggested that flow is created by a balance between the degree of challenge and the player's skill. Challenge and skill are both highlighted as features of video games (Sherry, 2004), and have therefore been widely applied to gameplay studies (Jin, 2012; Pasch et al., 2009; Sweetser & Wyeth, 2005; Weber et al., 2009). It is only when the difficulty of the game matches a player's skill, and continues to be a challenge, that it produces an enjoyable gaming experience (Sherry, 2004). Games with sufficient challenge are enjoyable and fun, and the challenge lies in learning the game, in solving problems, or in the discovery of new things (Korhonen & Koivisto, 2006). However, the skills of the players and their expectations of the challenges may vary. For instance, in a 3D game setting, a simple action, like moving a camera in 3D space, may frustrate novice gamers who have never played a 3D game before, despite the rest of the game possibly being something they have enjoyed in other, 2D games (Chen, 2007). It would seem that too much challenge can lead to frustration, while too little challenge may cause boredom. When a balance between the skills of the gamer and the challenge of the game design is achieved, the challenge-based flow experience is at its most powerful (Pasch et al., 2009). A more recent study by Abuhamdeh and Csikszentmihalyi (2012) even suggests that game challenge alone can produce enjoyment.

Individuals who lack the skills to master certain types of media, due to a lack of training or experience, will not enjoy the media experience (Sherry, 2004). While resolving game tasks and mastering game challenges are closely related to game enjoyment, experienced gamers tend to have higher self-expectations and to see video games in general as a domain in which to showcase their skills and superior performance (Klimmt, Blake, Hefner,

Vorderer, & Roth, 2009). Experienced gamers tend to believe in their own capacity to master highly difficult challenges, and they expect themselves to be successful in any new game (Klimmt et al., 2009). Experienced gamers also have a better chance of mastering a new game task than novice players (Klimmt et al., 2009), and they exhibit higher levels of persistence, thereby becoming skilled at the new game faster than casual gamers (Neys, Jansz, & Tan, 2010). Experienced gamers are found to be more aware of their gaming motivation, and to adjust their gaming strategy accordingly, so that gamers with greater knowledge and skills generally achieve higher scores (Pasch et al., 2009). It is recognized that skills are accumulated through experience. It is therefore plausible to postulate that more experienced gamers have higher game skills than their counterpart novice gamers.

The addictive characteristics of MMORPG draw players to invest a significant number of hours of play in becoming skilled experts (Wolf, 2007). By further developing their game skills, players of MMORPG can make better use of in-game items, such as weapons, armor, and avatars or heroes, whether with the aid of descriptive tool tips, online help, tutorials coming with the story, or visual and auditory cues (Sweetser & Wyeth, 2005). Console games, like Nintendo Wii, Sony's PlayStation 3 and Microsoft's X-Box 360 that use motion-sensor remote controllers, can translate a wide variety of user motions into game controls, allowing a heightened sense of interactivity and presence (Tamborini et al., 2010). In console gameplay, physical presence, together with skill and challenge, can induce the flow state (Jin, 2012), whereas control schemes can affect game enjoyment (Limperos, Schmierbach, Kegerise, & Dardis, 2011). However, mobile game apps are comparatively simple, and require less time commitment. A handheld controller is not incorporated into a smart device, and the user interface of game apps and its control functions are generally very

natural and intuitive to adopt (Korhonen & Koivisto, 2006). Given that a player's level of skills can be objectively measured, and related to their subjective experience of challenge and difficulty (Engeser & Rheinberg, 2008; Keller & Bless, 2008), this study investigates players' experience of mobile games on smart devices, rather than their capacity to control the complexity of gaming software, or a user interface that measures the skills of players. More experienced mobile gamers are likely to be more familiar with the mechanisms of mobile game apps, and how the function of those games is controlled through touch-screen interfaces. They are also more likely to apply greater gaming skills across a range of different games than less experienced players.

Taken together, flow occurs and is maintained when escalating levels of challenge are matched by increasing skills (Sherry, 2004). In the media use context, a balance between skill and challenge elicits game enjoyment. Gaming skills can be accumulated through experience of playing. This study explores game experience in relation to game enjoyment, rather than directly measuring players' in-game skills. While flow is found to enhance the playability and enjoyment derived from mobile gaming (Ha et al., 2007; Korhonen & Koivisto, 2006), increased challenge, accompanied by matching game experience, may facilitate higher levels of enjoyment. Thus,

H1a: Game experience will have a positive effect on game enjoyment.

H1b: Game challenge will have a positive effect on game enjoyment.

H1c: There will be an interaction effect between game experience and game challenge such that highly experienced players will perceive higher game enjoyment when encountering high challenge games.

Game Rewards

Reward is conceptualized as a process rather than as a single state, and it has two aspects: *appetitive* and *consummatory* (Pinel, 2005). The former includes those actions involved in seeking rewards, whereas the latter describes receiving the reward of the pleasant experience of achievement (Weber et al., 2009). The experiences of pleasure and reward are mediated by a complex network of interconnected structures, rather than occurring within any single area of the human brain. Weber et al. (2009) reconceptualized flow as a cognitive network synchronization process that focuses on the enjoyment or reward of certain media experiences. Weber et al., (2009) argued that a cognitive synchronization of attentional and reward networks, under a condition of balance between challenge and skill, produces flow.

While having a clear goal in mind is normally a key ingredient of an enjoyable experience, in gaming individuals not only try to achieve their goal, but are also fully aware of how well they are doing. Immediate feedback on actions is one of the factors identified by Csikszentmihalyi (1990) that explain how individuals adjust for optimal performance, so that performance feedback will contribute to flow. Flow is thus associated with successful performance (Engeser & Rheinberg, 2008). In the video game context, however, reward mechanisms include both the intrinsically rewarding experiences, involving the fun of playing in itself, and the extrinsic rewards, involving actual rewards, such as scores, added points, collection of virtual items, treasures and artifacts, and progress reports that mark player performance (Jin, 2012; Wang & Sun, 2011). Although flow theory may seem to emphasize the intrinsic rewarding experiences, Csikszentmihalyi (1990), and Wang and Sun (2011) suggest that it is also necessary to analyze how game systems provide extrinsic rewards in order to fully understand how flow occurs. In

fact, individuals tend to respond to their own successful performance with positive emotions, like pride and joy, while self-attribution for a successful event results in the most intense positive emotions (Klimmt et al., 2009). In the video game setting, players constantly confront challenges and tasks, and being able to attribute their success in the game to their own skill is a key factor in game enjoyment (Klimmt et al., 2009). Other research has found that successful performance stimulates game enjoyment (Jin, 2012; Trepte & Reinecke, 2011; Weber et al., 2009). Game performance can therefore refer to the extrinsic rewards that the mechanism has embedded in a particular game system. For example, using a score system is a reward mechanism that helps players to set goals appropriate to their skills' level, and even if they cannot complete the game, they can still break their own records, thereby achieving a sense of accomplishment (Wang & Sun, 2011).

Game enjoyment, or the satisfaction of solving a series of challenges, requires that the challenges are at the edge of a player's ability (Koster, 2010). A successful experience of video games depends on a balance between skill and challenge (Jin, 2012). Experienced players can learn to value their good performance in objectively difficult situations (Klimmt et al., 2009). Accepting that more experienced players will have higher skills levels, and therefore will perform better than less experienced players, there is still an interaction effect between the player's experience and the game challenge that affects a player's in-game rewards. Thus,

- H2a: Game experience will have a positive effect on game rewards.
- H2b: Game challenge will have a positive effect on game rewards.
- H2c: There will be an interaction effect between game experience and game challenge such that highly experienced players will gain higher game rewards when

encountering high challenge games.

Gender and Game

Past research has suggested that more males play video games, leading to more games being developed to target the male players (Cassell & Jenkins, 2000). The content, design, character, features, and structure of the games tend to be geared towards male gamers (Greenberg et al., 2010; Hartmann & Klimmt, 2006; Ivory, 2006). More precisely, the stereotypical gender role portrayals, violent content, lack of social interaction, and the competitive structure of gaming design, all result in relative indifference among females towards video gaming (Hartmann & Klimmt, 2006).

There is also a gender difference in relation to preferences for game genre, with males tending to prefer fighter, shooter, action-adventure games, and females showing a greater preference for card, puzzle, quiz/trivia, and music games (Kafai, Heeter, Denner, & Sun, 2008; Katz & Acord, 2008; Sherry, Lucas, Greenberg, & Lachlan, 2006). Males generally devote more time to playing games (Willoughby, 2008), and they normally have more experience of video gaming than females do (Hartmann & Klimmt, 2006). Males are stereotypically viewed as the hardcore gamer while females are casual game players (Eklund, 2011). Exposure to the negative gender stereotype that females are generally poorly skilled at video games, may further decrease their experience of competence, reducing their motivation to play, and that too can affect their enjoyment of the game (Chan, 2008).

The number of females playing casual social games and mobile games has increased (Katz & Acord, 2008; Paavilainen, Hamari, Stenros, & Kinnunen, 2013; Wohn, 2011) as these games have tended to become more casual and puzzle-oriented, and less violent in comparison to traditional video games. However, market research

still shows that although females install 40% more apps than males, males use 61% more mobile game apps than females (Koetsier, 2013). The increase in female gamers does not necessarily mean that gender equality has been achieved, as the industry and culture of gaming has not really changed (Kafai et al., 2008; Salter & Blodgett, 2012). Researchers have also found that a large percent of female players were introduced to gaming by their romantic partners, and that females are more likely than males to play with their romantic partners (Yee, 2008). It is therefore plausible to assume that males may still demonstrate better performance in mobile games, and perceive more enjoyment from gaming than females do:

H3: There will be a significant gender difference in game enjoyment such that males will be more likely to perceive higher game enjoyment than females.

H4: There will be a significant gender difference in game rewards such that males will be more likely to gain higher game rewards than females.

Gameplay and Self-esteem

Self-esteem includes both the individual's positive and negative self-attitudes, as a totality (Rosenberg, Schooler, Schoenbach, & Rosenberg, 1995); it is the individual's overall evaluation of their self-worthiness (Baumeister, Campbell, Krueger, & Vohs, 2003). There has been a considerable amount of research suggesting that experiences of success and failure affect one's self-esteem (Crocker, Sommers, & Luhtanen, 2002; Neff & Vonk, 2009). This means that individuals have a vital need to achieve success and to avoid failure in order to maintain, protect, or enhance their self-esteem (Crocker, Luhtanen, Cooper, & Bouvrette, 2003; Mehdizadeh, 2010). One's judgment of oneself ultimately leads to one's emotional state, such as enjoyment,

stress or frustration (Vorderer, Hartmann, & Klimmt, 2003).

The competitive nature of video games prompts competitive actions, and gaming is therefore likely to be utilized by players to disadvantage others in order to maintain their self-esteem, and to strive for positive emotions (Vorderer et al., 2003). Satisfaction with one's performance, and with successful task resolution, is expected to increase self-esteem (Klimmt et al., 2009). In general, video gameplay can lead to improvements in a player's self-esteem (Durkin & Barber, 2002), but this is contingent upon the experience of competence and autonomy during gameplay (Ryan et al., 2006). The reward mechanism of video games that shows points or scores accumulated and levels achieved, provides immediate feedback to the players as to how well they are achieving in the game. It is therefore reasonable to assume that higher achievement will be a predictor of greater self-esteem.

Based on an understanding of flow, high challenges and good skills not only induce enjoyment, but can also stretch an individual's capacity for acquiring new skills and increasing self-esteem (Csikszentmihalyi, 1988). One's self-esteem is most positive when challenges and skills are above average, and significantly worse in situations of apathy, boredom or anxiety (Wells, 1988). In the video gameplay context, players tend to attribute their success in the game to their own skills and efforts. While games constantly provide new tasks and challenges, advance in a game does not only lift the player's self-esteem, but is a key factor in game enjoyment (Klimmt et al., 2009). That is, successful performance is considered an important antecedent to the flow state (Jin, 2012). While self-esteem is considered to be an important underlying mechanism, connecting satisfying gaming performance with enjoyment (Klimmt et al., 2009), a satisfying experience of play is also found to produce a more enjoyable perception that

can ultimately enhance a player's self-esteem (Przybylski et al., 2010). However, the interplay of game performance, game enjoyment and self-esteem is as yet unclear, and there may be a mediation effect that needs to be explored. Taking all these factors together, the following hypotheses are proposed and the research model is indicated in Figure 1.

H5: Level of game rewards will be positively related to level of self-esteem.

H6: The relationship between level of game rewards and self-esteem will be mediated by level of game enjoyment.

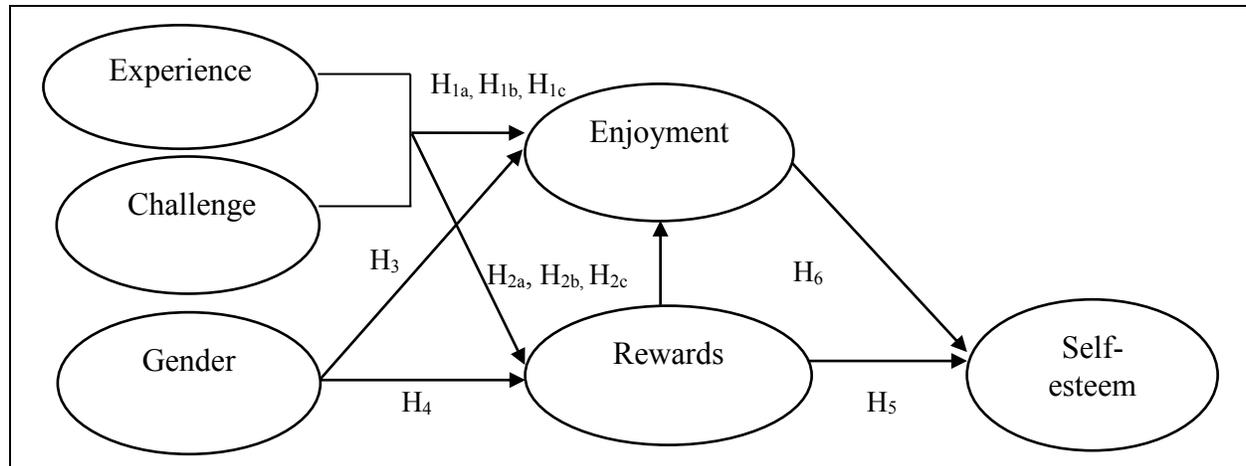


Figure 1 - Research Model

Method

Participants

A convenience sample of undergraduate and graduate students at a large public university in southern Taiwan was recruited for a gift certificate equal to about 3.5 US dollars. A call for participation was made through the campus bulletin board system (BBS) and school-wide electronic mailing lists. A total of 168 students (87 males, 81 females) participated, of whom 91 (54.2%) were undergraduates and 75 (44.6%) were graduate students, while 2 (1.2%) declined to report. Mean age for this sample was 22.82 years (SD = 2.48).

Among these participants, 147 (83.9%) owned smart devices, with 110 (69.6%) using the Android operating system. The three mobile apps most used by the group

were social networking/communication (71.4%), games (31.5%), and maps/navigation (18.5%). Among the participants who played mobile games, 58 (40.8%), 65 (45.8%), and 19 (13.4%) of them reported having had, respectively, less than one year, one to two years, and more than two years of mobile gaming experience.

Research design

A 2 (mobile game experience: high, low) \times 2 (game challenge: high, low) \times 2 (gender: male, female) factorial experiment was employed. Game challenge was manipulated and game enjoyment was the primary dependent variable. Table 1 reports the research groups and the number of the participants in each group. The mediation effect of game rewards, enjoyment, and self-esteem was further assessed.

Table 1 - Research Groups and the Participants

Group	Gender	Experience	Challenge	N
1	Male	High	High	22
2		High	Low	23
3		Low	High	22
4		Low	Low	20
5	Female	High	High	21
6		High	Low	20
7		Low	High	20
8		Low	Low	20

Stimulus material

Angry Birds Classic, a widely known mobile game app, consisting of 10 episodes, was adopted. There are about 40 to 60 levels of difficulty within each episode, starting with the easiest and progressing to the hardest. The goal of the game is to destroy pigs and their building structures. Players use a slingshot to launch birds in order to hit the targets, and move up a level after eliminating all the pigs on the playing field. The final scores, accompanied by one to three stars, are displayed on the screen. The stars are awarded according to the performance of the player, with a minimum of one for simply finishing the level, and a maximum of three, indicating that not only is the level cleared, but that the player received hard-to-obtain high scores.

In order to select two game episodes with distinct high and low challenges, a total of 20 subjects (Mean age=23.7, SD=1.66) were recruited from the graduate program of the researchers. Four of the ten episodes, namely episodes 1, 3, 6, and 8, of *Angry Birds Classic* were randomly selected by the researchers. Given that each episode starts from the easiest level, subjects were given 10 minutes to play each selected episode from level 1, followed by an evaluation of the degree of challenge on a 7-point Likert scale. The results showed that game episode 3 ($M = 4.14$, $SD = 0.69$) had the lowest level of challenge while episode 6 ($M = 5.18$, $SD = 0.43$) was the most challenging among the four selected episodes. An independent sample t-test

further suggested that there was a significant difference in game challenge between episodes 3 and 6 ($t = -2.852$, $p < .05$).

Procedure

The research announcements with a link to the informed consent, and a sign-up form were distributed electronically three weeks before the lab experiment started. Participants were asked to complete demographic information and a questionnaire measuring their self-esteem and past mobile gaming experience at the time of signing up. They were then divided into two groups (mobile game experience high vs. low) based on their past experience. Gender ratio was also controlled through the online sign-up system to ensure that the numbers of male and female participants were approximately equal.

In the laboratory setting, a tablet with the pre-downloaded *Angry Birds Classic* app, and a pair of earphones were placed on each desk. When participants arrived, they were directed by two of the research team members to take a seat. After completing the consent procedures, participants were instructed to turn on the tablet and to wear the pair of earphones. Earphones were used to prevent the players from being distracted from the game by noise. Participants could only hear the sound effects from their own game, and would not have indications of how others were progressing, by hearing sounds from their tablets.

Recall that episode 3 was rated as presenting a lower challenge than episode 6. Participants were randomly assigned to play one of these episodes for 20 minutes. A questionnaire measuring the game challenge, rewards, enjoyment, as well as the participant's self-esteem, was then administered. Participants received the research incentives and were thereafter released.

Measures

Game Challenge. To distinguish two game episodes with high and low challenges, the challenge scale of Novak & Hoffman (1997) for measuring flow experience, and the game challenge constructs of Fu, Su, & Yu (2009) were adopted and modified with wording changes to relate the play context to *Angry Birds*.

Game Experience. Past gaming experience was measured by asking items such as the frequency of mobile gameplay, the extent to which mobile games are integrated into their daily lives, and for how long they had been playing mobile games. A median was computed to place group participants into high and low experience groups.

Game Rewards. Game rewards were assessed by having participants report their scores received at each level they completed during the experiment. An average was computed, and scores were converted into a 7-point scale.

Game Enjoyment. 7-items were developed, based on Sherry's (2004) concept of media enjoyment and on Holbrook (1984) and Sweetser & Wyeth's (2005) evaluation of game enjoyment. Items were measured on a 7-point Likert-type scale.

Self-esteem. The 10-item, 7-point Likert Rosenberg Self-esteem Scale (RSE)

(Rosenberg, 1989) was used to assess participants' self-esteem.

Results

Manipulation Check

Two game episodes with distinct high and low challenges were used based on the results of the pre-test. Game challenge was again assessed in the formal experiment. A Levene's test with the value greater than .05 showed that the variability in two conditions is about the same. An independent sample t-test further revealed that there was a significant difference in game challenge between two episodes (high challenge vs. low challenge), $t(167) = 2.406, p < .05$, suggesting the manipulation was successful.

Measurement Model

A confirmatory factor analysis using the partial least squares (PLS) was conducted to assess the constructs used in this study. Game experience, game challenge, and gender have been dummified and presented as non-linear categorical variables. Game rewards (one item) were converted into a 7-point scale. Reliability and convergent validity were tested based on Cronbach's α coefficients, composite reliabilities (CRs), and average variance extracted (AVE). As shown in Table 2, the values of Cronbach's α for each construct suppressed .70 and CR values suppressed .80, indicating internal consistency of the measures (Anderson et al., 2006). In addition, factor loadings of all items were above .70 and the AVEs were close or above .70, accepting the convergent validity (Fornell & Larcker, 1981). The squared roots of the AVEs were greater than the corresponding inter-correlations, confirming discriminant validity (Fornell & Larcker, 1981).

Table 2 - Construct Reliability and Validity

	AVE	Composite reliability	R ²	Cronbach's Alpha
Rewards	1	1	0.514125	1
Enjoyment	0.784038	0.878940	0.842862	0.724795

Structural Model

The proposed hypotheses were tested with PLS and the results of the analysis are depicted in Figure 2. In the structural model, R^2 represents the amount of variance explained by the model. As shown in Figure 2, challenge and gender can explain 51.4% of the variance in rewards. All three independent variables and the interaction variable can explain 84.3% of the variance in enjoyment. The paths from experience to enjoyment and from challenge to enjoyment were both negatively correlated, rejecting H1a and H1b. It indicated that higher levels of experience and challenge yielded lower

levels of enjoyment. The interaction effect between game experience and game challenge on game enjoyment was significant as predicted in H1c. The positive effect of game challenge to game rewards was significant; however, the positive effect from game experience to game rewards was not significant. Therefore, H2b was supported and H2a was rejected. The interaction between game experience and game challenge on game rewards was not significant, rejecting H2c. The main effects of gender to game enjoyment and game rewards were significant and H3 and H4 were both supported.

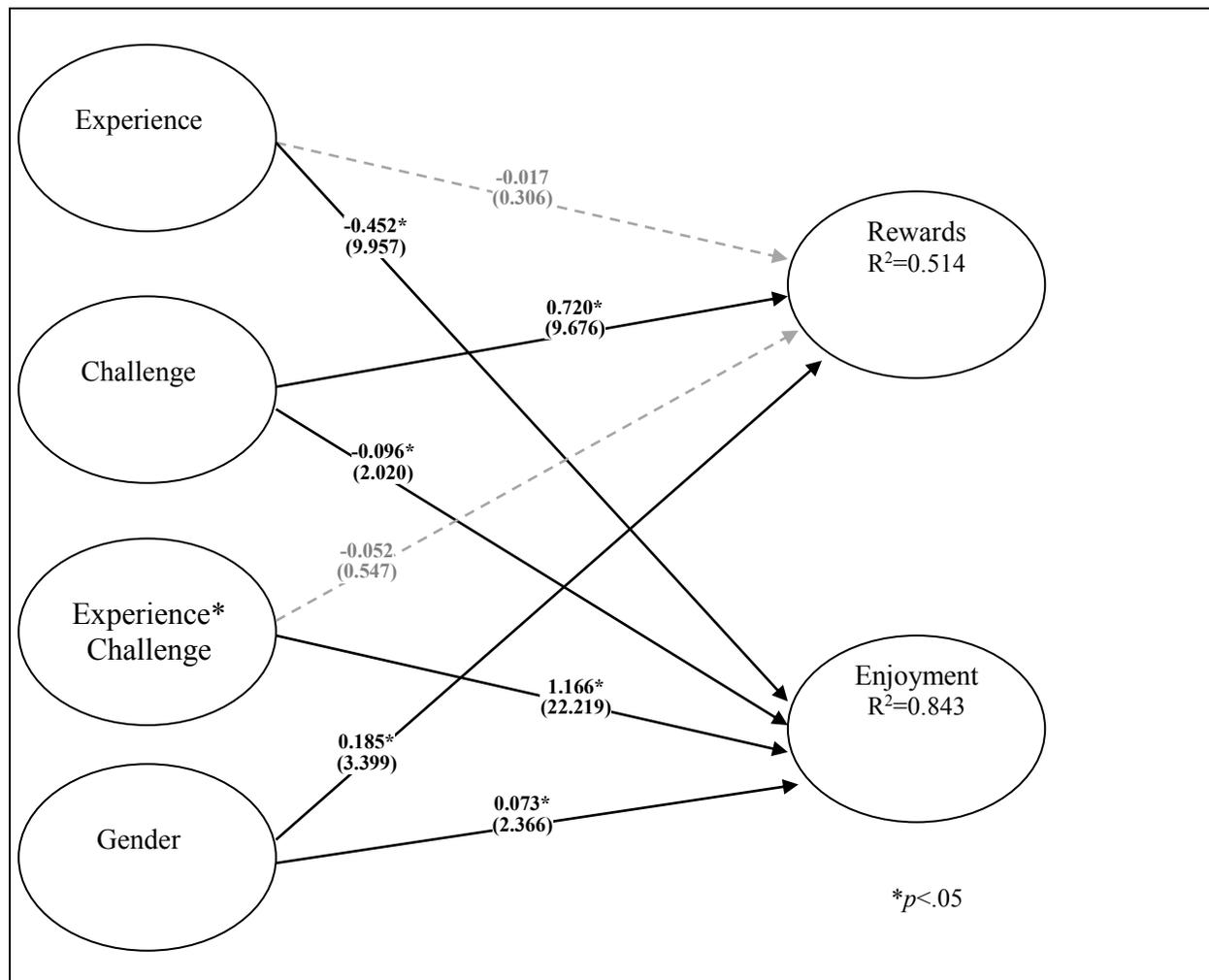


Figure 2 - Path analyses of mobile gameplay on rewards and enjoyment

Mediation Analysis

To explore the potential psychological benefits of mobile gameplay, changes in self-esteem from before to after *Angry Birds* play were first assessed. The results showed that there were no pre-play ($M=4.98$, $SD=.00$) and post-play ($M=5.02$, $SD=.87$) differences evident in participants' self-esteem ($t=.77$, $p>.05$). To test the hypothesis that the relationship between game rewards and self-esteem would be mediated by game enjoyment, a bootstrapping procedure for indirect effect was then conducted (Preacher & Hayes, 2008). Bootstrapping analysis examined the relationship between game rewards and self-esteem (the total effect; path $c = .0539$, $p = .1604 > .05$) and the relationship between game rewards and game enjoyment (path $a = 0.1135$, $p < .05$). Using game rewards and game enjoyment as predictors, the path from game enjoyment to self-esteem (path b)

was $.1943$ ($p < .05$) and the direct effect (path c') was $.0319$ ($p = .4102 > .05$) (Table 2) (Figure 3). The path from game rewards to self-esteem was not significant, rejecting H5.

This study further assessed the indirect effect as Zhao, Lynch, & Chen (2010) suggested. Based on 5000 bootstrap samples, the 95% bias-corrected confidence interval for the size of the indirect effect of game rewards on self-esteem through game enjoyment was $.0017$ to $.0551$. As zero was not in this interval, it indicated that with 95% confidence, the true indirect effect was positive. Given that path c was not significant, the indirect-only mediation was confirmed (Zhao, Lynch, & Chen, 2010). Thus, there was a complete mediation effect from game rewards to self-esteem through game enjoyment, supporting H6. Table 4 shows the hypotheses testing results.

Table 3 - Bootstrap Results for Direct and Total Effect

Effect	Coeff	SE	t	Sig.
a	.1135	.0383	2.9617	.0035
b	.1943	.0762	2.5485	.0117
c'	.0319	.0386	0.8257	.4102
c	.0539	.0383	1.4099	.1604

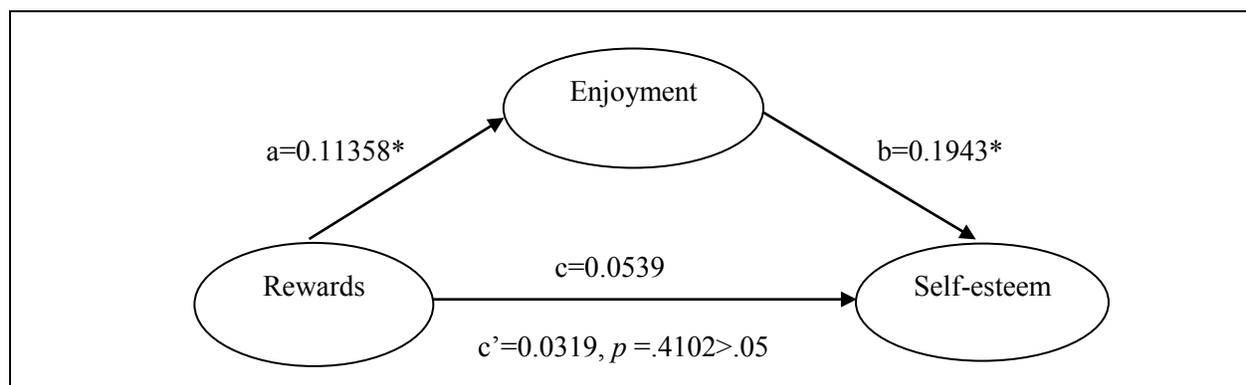


Figure 3 - Mediation analysis

Table 4 - Summary of the Hypotheses Testing Results

Hypothesis	Result
H1a: Game experience will have a positive effect on game enjoyment.	Reject
H1b: Game challenge will have a positive effect on game enjoyment.	Reject
H1c: There will be an interaction effect between game experience and game challenge such that highly experienced players will perceive higher game enjoyment when encountering high challenge games.	Support
H2a: Game experience will have a positive effect on game rewards.	Reject
H2b: Game challenge will have a positive effect on game rewards.	Support
H2c: There will be an interaction effect between game experience and game challenge such that highly experienced players will gain higher game rewards when encountering high challenge games.	Reject
H3: There will be a significant gender difference in game enjoyment such that males will be more likely to perceive higher game enjoyment than females.	Support
H4: There will be a significant gender difference in game rewards such that males will be more likely to gain higher game rewards than females.	Support
H5: Level of game rewards will be positively related to level of self-esteem.	Reject
H6: The relationship between level of game rewards and self-esteem will be mediated by level of game enjoyment.	Support

Discussion and Conclusion

The goal of this study was to empirically explore factors that may contribute to mobile game enjoyment and the psychological benefits of mobile gameplay. While previous studies have suggested that a balance between skill and challenge is a key predictor of successful performance in video games (Jin, 2012), this study did not find an interaction effect of game challenge and past gaming experience on game rewards, despite the fact that game challenge was indeed a significant predictor of game rewards. The non-significant interaction effect may be due to there being no fixed rules for gaining high scores in *Angry Birds Classic*. While a game level is cleared when a player eliminates all of the pigs in the current play field, the player can receive extra points by destroying building structures made of wood, stones or ice cubes. It may be fairly simple to complete a level, but the challenge presented is that players need to maximize the damage in order to obtain higher scores. Experienced players may complete a level faster than less experienced players, but, due to the design mechanism of the game, there is no guarantee that they will topple and knock down building structures with each shot. In

normal play, players may accumulate greater experience by replaying the same level over and over again, but during the experiment, participants were not allowed to go back to the same level once it was completed. More experienced players might have gained higher scores than less experienced players if the participants had been allowed to replay the same level several times during the experiment.

Interestingly, both game challenge and experience were found to be negatively related to enjoyment. However, the analysis also indicated a significant interaction effect of game challenge and past mobile game experience on game enjoyment, such that the combination of high challenge and high experience resulted in higher game enjoyment. It can be understood that higher levels of challenge or experience alone may not necessarily trigger higher levels of enjoyment. Findings here highlight a balance between skill and challenge is a key to produce optimal experience, as suggested by Csikszentmihalyi (1988). Further, this study measured participants' past game challenge and found a positive relationship between game challenge and game rewards. It suggests that the design of the games tend to match the challenge

with rewards to encourage the players to continue playing (King, Delfabbro, & Griffiths, 2010).

The gender differences found in this study are also consistent with past studies of video games that have constantly suggested that males perform games better and enjoy them more than females do (Greenberg et al., 2010; Hartmann & Klimmt, 2006). Although the number of female mobile gamers is increasing (Katz & Acord, 2008), females tend to prefer puzzle-oriented games (Katz & Acord, 2008; Sherry et al., 2006), and no research to date has indicated that females have better game performance or perceive greater enjoyment in the context of mobile gameplay than males. Findings suggest that males are better at games and enjoy the games more than females do, even across different gaming platforms. In addition, recent market research has found that males install more game apps and play games on smart devices more often than females do (Koetsier, 2013), suggesting that males remain heavier players than females in mobile gaming.

In terms of the psychological benefits derived from mobile gameplay, and consistent with the non-significant pre-to post game differences in self-esteem, no significant relationship was found between game rewards and self-esteem. However, the indirect effect of game rewards on self-esteem, through enjoyment, is particularly salient. Findings here provide empirical evidence to suggest that game enjoyment may not only trigger a sense of heightened self-esteem, but may also be considered an important mechanism connecting satisfying gaming performance with psychological health.

Theoretical Implications

The empirical findings of this study have a number of theoretical implications.

First, media enjoyment is considered to be the source of flow states (Nabi & Krmar, 2004; Sherry, 2004; Weber et al., 2009).

Video games, in particular, offer unique opportunities for researchers to examine the phenomenon of media enjoyment against a balance of skills and the challenge presented by the game. Unlike video games such as MMORPG, first-person shooter games, or console games, all of which offer special weapons or tools as players advance in the game, and which often require players to have advanced skills for controlling or manipulating them, the design of mobile game apps is relatively simple, skills acquired from playing video games on other platforms may not be relevant to the mobile gameplay context. Further, playing on smart devices is mostly intuitive, so that it requires a lesser time commitment to acquire the skills needed to play. Players' familiarity with the devices and game apps may be more likely to affect their intuitive interaction with mobile games. Taking into consideration the fact that the measurement of game challenge could be confounded with skill (Engeser & Rheinberg, 2008), this study investigated players' past mobile game experience rather than their skills in mastering one particular game. The main effect of game experience on enjoyment was significant, suggesting that game experience may be an alternative to measuring game enjoyment when skills cannot be objectively measured. The significant interaction effect of game challenge and experience on game enjoyment not only extends game enjoyment studies to the mobile game platform, but also provides empirical evidence to support the conclusion that only the close match between perceptions of difficulty and experience can lead to game enjoyment.

Second, while past studies have tended to focus on a balance between the skills and challenge required to stimulate the optimal experience of gaming, little research has focused on the performance of the player in relation to game enjoyment. While the optimal experience of flow emphasizes the qualities of a subjective experience that make a behavior intrinsically rewarding

(Csikszentmihalyi, 1990), researchers have also suggested the need to explore extrinsic rewards in the context of the flow experience in video gaming (Wang & Sun, 2011). In order to understand the role of extrinsic rewards in creating game enjoyment, this study objectively measured players' game performance, based on the in-game rewards they obtained. The positive relationship between game rewards and game enjoyment suggests that extrinsic reward may be an important mechanism in triggering the feelings of intrinsic reward.

Finally, past research has constantly found both positive and negative effects of video gaming on players' psychological health (Przybylski et al., 2010). Some researchers have suggested a positive relationship between game performance and self-esteem (Klimmt et al., 2009), while negative effects of video gaming on self-esteem have also been identified (Colwell & Payne, 2000; Jackson, von Eye, Fitzgerald, Zhao, & Witt, 2010). This study found no significant pre- to post game differences in self-esteem, and this may be understood by self-esteem being a trait-like construct that remains relatively stable over time (Trzesniewski, Donnellan, & Robins, 2003). A game player's mental status change may need long-term empirical support rather than short-term game exposure (Barlett, Anderson, & Swing, 2009). Despite the mixed results that have been produced in terms of the effects of gameplay on self-esteem, this study went one step further and explored the possible mediation effect of game rewards and self-esteem through game enjoyment. Although a relationship between game rewards and self-esteem was not significantly found in this study, the indirect effect, through game enjoyment, elucidates the effects of mobile gameplay on self-esteem. Findings suggest that better performance of the game may not have a direct impact on a player's self-esteem; however, game enjoyment may play a crucial role in the relationship between game performance and self-

esteem, in that only players who perform and enjoy the game well would perceive a heightened sense of self-esteem in the context of mobile gameplay.

Limitations and Future Research

The limitations of this study include the fact that flow is a complicated model that involves various elements. This study drew only on the media use perspective in exploring the enjoyment of mobile gameplay on smart devices; other possible factors, such as intense and focused concentration, a distortion of time, and a loss of self-consciousness, were not investigated. Future research may consider investigating the phenomenon across media and other disciplines. Further, an achievement motive in the activity was not considered in the research design. The intrinsic and extrinsic motivation to play the game may also have had an impact on the performance and enjoyment of the game.

Angry Birds Classic is a puzzle-style mobile game app. Although mobile game apps tend towards a puzzle-oriented design, future studies may compare different mobile game types, such as simulations, music and sports in relation to game enjoyment. In addition, due to the popularity of the *Angry Birds Classic*, most of the participants had already played the game on various platforms, such as PCs, gaming consoles, as well as on smart devices. Although this study measured the players' current experience against their past general mobile game experience, future research may explore differences between experienced and novice players of one specific game, and then compare the game performance and enjoyment of these two distinct groups.

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