Positive Feedback Messages and Role of Presence during Exercise Video Game Play

Jihyun Kim[1] and C. Erik Timmerman[2]

[1]Bloomsburg University of Pennsylvania
[2]University of Wisconsin-Milwaukee
{jihyunkim218@gmail.com, eriktimm@uwm.edu}

Abstract

Although people are aware of the importance of physical exercise, many people fail to maintain a recommended level (CDC, 2008), contributing to obesity and a range of additional health concerns. This study explores how feedback messages of exercise video games (exergames) impact a user's game experience and self-efficacy. An experiment (N = 47) using a between-subjects design manipulated feedback messages: Negative vs. Positive. The investigation finds that positive feedback favorably influences a user's exergame experience (e.g., enjoyment), and social presence mediates the relationship between feedback and exergame play outcomes. The study concludes with a discussion of the primary findings and future research directions.

Keywords: **Exergame, Positive Feedback, Social Presence, Presence, Mediation**

Data collected by the US Center for Disease Control [CDC] indicate that over 20% of the U.S. population is obese (CDC, 2011). This high obesity rate results from the lack of physical activity (CDC, 2008; Medical News Today, 2004). To promote people's physical activities, a variety of health interventions and campaigns have been suggested such as Healthy People 2010, an initiative (started in January 2000) of the U.S. Department of Health and Human Services designed to guide national health promotion for all people in the U.S. However, people still maintain sedentary life styles rather than engaging in outdoor physical activities (CDC, 2008).

Extant research (e.g., Lwin & Malik, 2011; Mhurchu, et al., 2008; Song, Kim, Tenzek, & Lee, 2010; Song, Kim, Van Dyke, Schoessling, & Lee, 2011; Song, Peng, & Lee, 2011) including a meta-analysis (Peng, Lin, & Crouse, 2011) provides evidence to suggest that new media technologies, particularly exercise video games (exergames), constitute an effective method for increasing the level of physical activity. Exergames, such as Dance Revolution (DDR), EyeToy: Kinetic, Wii, and Wii Fit, require players to engage in a certain level of exercise. Given that one of the most common exercise barriers is identified as a lack of interest in exercise (Ball, Crawford, & Owen, 2000), fun factors embedded in exergames may create a sense of motivation, interest, and increase participation in the activity performed in the game, perhaps even beyond the exergame. For example, individuals participating in a tennis game via exergames may learn more about the rules of the game and, as a result, increase participation in non-virtual tennis.

Thus, by employing the exergame as a tool for promoting physical activity the current study examines strategies for facilitating favorable exergame experiences, particularly the effect of feedback upon exergame play. Further, the present study explores why and how feedback affects people's exergame experiences in virtual world. Particularly, the role of presence, *'a feeling of being there'* in a virtual world (Biocca, 1997) is being investigated.

1. Effects of Positive Feedback Messages

1.1. Positive Feedback and Exercise

The positive feedback focuses upon the recipient that her/his performance has exceeded an acceptable standard and that s/he has been making progress (Ilgen, Fisher, & Taylor, 1979; Latham & Locke, 1991). In Social Cognitive Theory (SCT), Bandura (1982, 1989, 1997) argues that people receiving encouraging messages increase effort to accomplish the task. Particularly, positive feedback (verbal persuasion) enhances people's self-efficacy, an individual's belief about being capable of performing activities and maintaining control over the motivation (Bandura, 1997).

Researchers have paid extra attention to the relationship between positive feedback and physical exercise-related outcomes. Participants receiving positive feedback during physical activities experience stronger self-efficacy and task performance (Escarti & Guzman, 1999; Fitzsimmons, Landers, Thomas, & van der Marsh, 1991), and increased competence and intrinsic motivation levels in a variety of exercise contexts (e.g., Bindarwish & Tenenbaum, 2006; Gernigon & Delloye, 2003). These findings are consistent as reported in a meta-analysis research that found beneficial effects of positive feedback upon people's experiences (Deci, Koestner, & Ryan, 1999).

1.2. Feedback Messages from Nonhumans

One of the common approaches found in the current literature is that most of the studies examine the effects of feedback delivered by human actors – actual people such as a physical trainer, teacher, and/or coach. In this regard, one of the questions raised is whether feedback from nonhumans (e.g., computers, robots, games) would generate the same outcome.

The Computers Are Social Actors (CASA) paradigm suggests that technology users apply social interaction and categorization rules to computers although they may acknowledge that it is somewhat absurd (Reeves & Nass, 1996). In other words, people's interaction with media, such as computers and television, are like interaction with humans in the natural world; media and technology are not just tools but social actors to which people apply social rules. Thus, although people are engaged in virtual experiences, they may respond to the cues from the technology as if the cues are from people (e.g., perceiving virtual objects as actual objects).

A great deal of research provides convincing support for the CASA paradigm. One experiment (Nass, Moon, & Carney, 1999) was conducted to explore whether people apply politeness rules to computers as they do to humans. Participants were asked to use a computer to learn about a topic. After computer use, half of the participants evaluated the computer's performance on the same computer used to learn; whereas another half of the participants evaluated the computer's performance on a different computer. Results indicated that participants evaluating on the same computer evaluated the computer's performance more positively than those who evaluated on a different computer -- people were more favorable and polite to the computer they used. The findings indicate that human politeness rules extend, at least to some degree, to computers.

In line with the CASA paradigm, a few studies have examined the responses of participants when they were given positive and supportive comments and feedback from nonhumans. One study (Bracken & Lombard, 2004) examined the effects of feedback from a computer among people performing tasks. The computer users receiving positive comments (e.g., "you are doing great") reported greater perceived ability, recall, and memory recognition compared to those receiving neutral comments (e.g., "Okay"). Similarly, people being flattered by a computer while performing a task on the computer (social praise) reported a higher level of attractiveness of the computer, felt better after the performance (positive mood), and expressed more favorable evaluation about the interaction with the computer than people being not flattered (Fogg & Nass, 1997).

Building on previous research and the CASA paradigm, the current study explores the effects of positive feedback from nonhumans in an exercise video game context. Although some information may be drawn from existing studies in the field of the CASA paradigm, little is known about how people would respond to feedback messages from nonhumans, particularly games, during exercise performance. Therefore, the current study examines how the valence of feedback messages (positive vs. negative) from nonhumans affects people's experiences during exercise video game play.

2. Presence

When people are engaged in virtual activities, such as video conferencing and video game play, although they are physically present in their own places, their psychological senses may be immersed in the virtual world. Simply understood, the feeling of *'being there'* in the virtual world is called presence (Biocca, 1997). Scholars have suggested a variety of ways to describe and categorize the notion of presence (e.g., Biocca, 1997; Heeter, 1992; Lee, 2004; Lombard & Ditton, 1997; Steuer, 1992), and proposed several types of presence (e.g., Biocca, 1997; Lee, 2004). Of them, social presence is the particular interest of the current study.

Social presence refers to technology users' experience that virtual social actors are perceived as actual social actors (Lee, 2004). For example, during the video game play, players may feel that the other digital game characters are perceived as actual people rather than simple, fictional portrayals of digital characters. Social presence has been measured and categorized in a variety of ways in the current literature. As an attempt to provide a more comprehensive understanding of social presence, Biocca, Harms, and Burgoon (2003) have examined and incorporated current literature and identified a set of categories of social presence, such as psychological involvement and co-presence.

Based upon Biocca et al.'s (2003) review, social presence as psychological involvement is closely related to the early research on social presence by Short et al. (1976). The focus of this category is upon individuals' subjective perceptions about media qualities that can convey enough social cues, which allow people to perceive the existence of other interaction partners as real human beings. This category is in line with the dimension of social richness in the presence literature (Lombard & Ditton, 1997).

Social presence has been also categorized as co-presence (Biocca et al., 2003). Biocca and his colleagues have identified that co-presence as 'a sense of being together' (de Greef & Ijsselsteijn, 2000) or as 'being aware of the embodied other' (Goffman, 1959). In other words, co-presence refers to the state that people feel like they are together with the partners they are virtually interacting with. This notion of co-presence is also line with of the notion of transportation --'we are together' --in the virtual world (Lombard & Ditton, 1997). Current line of research has extensively examined the notion of social presence in a variety of virtual contexts (e.g., Lee & Nass, 2004, 2005; Lee et al., 2005; Jin, 2011).

Research has indicated important roles of presence, as a mediator. The use of technology may promote the feeling of presence, which, in turn, produces outcomes -- individuals' virtual experiences. To some degree, arguments for the mediating role of presence may be understood based upon the Computers Are Social Actors (CASA) paradigm. The CASA paradigm suggests that technology users apply social interaction and categorization rules to computers although they may acknowledge that it is somewhat absurd (Reeves & Nass, 1996). While people are engaged in virtual experiences, they may respond to the cues from the technology as if the cues are from people (e.g., perceiving virtual objects as actual objects). This phenomenon, feeling like computers and technologies are not just machines, may function as a mediating mechanism that eventually leads to outcomes from the technology use. Clearly, and as current literature has documented, presence serves as a mediator between technology use and user experiences in a variety of contexts (Jin, 2009, 2011; Jin & Park, 2009; Lee & Nass, 2004; Lee et al., 2005, 2006; Song et al., 2010, 2011).

3. Outcome Variables: Self-Efficacy and Exergame Experiences

The current study is particularly interested in enhancing self-efficacy and favorable experiences during exergame play. Self-efficacy is an important factor particularly in gaming activities (Klimmt & Hartmann, 2006) because people with higher self-efficacy may invest more effort to overcome barriers and continue playing the game; whereas people with lower self-efficacy may be more reluctant to devote time and energy to playing. Thus, the current study examines self-efficacy, particularly self-efficacy for exergame play, as one of the major outcome variables.

Exergame experiences are also considered among the outcome variables in this study. Given the previous findings that playing exergames is positively related to physical activity and weight loss (e.g., Lanningham-Foster et al., 2009; Peng et al., 2011), there does appear to be a reason for encouraging people to continue playing exergames. It is commonly expected that people who have more pleasant experiences may show higher motivation to continue the activity compared to those who have less pleasant experiences. Particularly, enjoyment is understood as the sum of favorable reactions toward the activity (Ritterfeld & Weber, 2006) and is considered the core experience of game play (Vorderer, Klimmt, & Ritterfeld, 2004). Because enjoyment is closely related to intrinsic motivation (Ritterfeld & Weber, 2006), this outcome has been examined as one of the most important variables in game research. Additionally, other aspects of game experiences, such as perceived usefulness of the game and perceived skills and knowledge of the game, have been also widely examined as important variables in exergame research (e.g., Jin, 2009, 2011; Song et al., 2010, 2011).

To sum, the current study explores the effect of positive feedback messages upon exergame players' self-efficacy and game experiences. Further, the study examines the mediating role of social presence in virtual environments. Based upon the argument through theoretical and empirical evidence, the following sets of hypotheses are proposed:

> H1a-d: Individuals receiving positive feedback messages during exergame play report higher levels of (a) self-efficacy for exergame play (b) perceived usefulness of the exergame, (c) game enjoyment, and (d) perceived exergame skills than individuals receiving negative feedback messages.

> H2a-d: Presence mediates the relationship between positive feedback messages and outcomes of exergame play: (a) self-efficacy for exergame play, (b) perceived usefulness of the exergame, (c) enjoyment, and (d) perceived exergame skills.

4. Methods

The experiment included two conditions of feedback messages in a between-subjects design: Negative vs. Positive. In the negative condition, participants received discouraging and less supportive messages from the game during the play. In the positive condition, participants received encouraging and supportive feedback messages from the game.

4.1. Participants

A total of 47 undergraduate students at a large public Midwestern university in the U.S participated in the study. The average age was 21.75 years (*SD* = 3.46). Slightly more females (*n* = 25: 53.2 %) participated in the study than males (*n* = 22: 46.8%). The sample consisted of Caucasian (*n* = 30: 63.8 %), African American (*n* = 2: 4.3 %), Hispanic (*n* = 4: 8.5 %) and other ethnic groups (*n* = 11: 23.4 %). Approximately two third of the participants (*n* = 32: 68.1 %) have previously played exercise video games such as 'Wii' or 'Wii Fit'. Participants were randomly assigned into one of the two conditions: negative feedback condition (*n* = 24) or positive feedback condition (*n* = 23).

4.2. Procedure

Following typical processes for gaining approval of the university's Institutional Review Board (IRB), initial recruitment was announced via face-to-face and online (e.g., email). Individuals, who agreed to participate in the study, were contacted by researchers via email. Then, they were scheduled for an experiment.

On the experiment day each participant went through several processes. Upon arrival in the experiment lab, participants viewed pre-developed tutorial on the computer, which included information on experiment process and the game. After the tutorial session, which took approximately 3-4 minutes, participants were asked to enter the game play lab. The researcher provided each participant with individual instructions explaining how to play the game and asked them to play 70-second of practice session to ensure they are comfortable with the play. Then, the researcher informed the participants that they will be playing the game for 12 minutes and the researcher will notify after 12 minutes have elapsed. Then, the researcher left the lab, and the participants started playing the game.

When participants were finished with the game play, they were invited to a different lab where they completed a set of post-test questionnaires. Upon the completion of the post-test participants were asked to leave the lab. The researcher thanked the participants and reminded them not to discuss anything related to the experiment with anyone.

4.3. Materials and Manipulation

This study employed Nintendo *Wii Fit.* This exergame detects player's movements and translates them into the movements of an on-screen avatar, the game character that each participant is playing with. Thus, as the player is moving, the avatar is correspondingly moving to the same direction.

Of the several options (e.g., soccer, tennis) hula-hoop was employed as a specific type of exercise for this game play. This study attempted to minimize any potential effects of participants' previous experiences in the actual world upon their game experiences. For example, if an individual has played tennis before, the previous experience may affect participants' experiences with tennis play within the exergame. Considering less popularity of hula-hoop in the actual world compared to other types of sports such as tennis, golf, bowling, and running, hula-hoop was chosen as a particular type of exercise.

A set of positive and negative feedback messages were created, and participants received either positive or negative messages during the game play. Positive feedback included messages such as *"You are doing great! Keep it up"* and *"Wow! You are doing great!"* Negative feedback included messages such as *"You can do better than this"*, *"Well, I don't think you are making a very good progress."*

Feedback messages were delivered through two channels: voice and written form. Voice messages were created through an application program on Mac, which provides a fun recording function with several effects. That is, while recording voice, users can vary the voice by choosing one of the effects available. One particular female voice was chosen for this study because the voice sounds similar to the voice embedded in Wii Fit game. A researcher recorded each of the messages and saved them as an individual file. To check whether the messages sounded similar to Wii Fit voice, the researcher tested it with several people, who are blind to this study. None of them had realized any issues related to the message voice. Then, each voice message was incorporated to the corresponding written message in the Power Point slides. Wii font was used to ensure that participants perceive the messages are coming from the game. Two sets were developed: one for positive and another for negative message.

Then, additional set up was processed to incorporate messages (both written and voice) into the game, so that participants receive the message from the game during the play. A desktop computer that is equipped in the research lab was used as a main source for message delivery. First, written messages were projected on the game screen from a separate projector that was connected to the computer. This additional set up made it possible to project both the game and the written messages simultaneously on the same screen. Second, voice messages were delivered from the main speaker of the lab, which was also used to deliver the game sound. An additional connection was added to the speaker, which allowed the speaker to deliver both the game sound and voice messages simultaneously from the same speaker.

The researcher controlled message delivery during the game play in a control room that is equipped with one-side mirror. This allowed the researcher to observe the participants, but the participants cannot see the researcher. From the control room the researcher controlled the message delivery through a remote clicker that is connected to the main computer, which sends the messages. In the positive condition, positive messages were provided a) when participants were doing a good job (e.g., catching hula-hoops), b) when they were maintaining a good performance (e.g., continuing hula-hooping without dropping it), and/or c) when they were making a progress. In the negative condition, negative messages were provided a) when participants were not doing a good job (e.g., failing to catching hula-hoops), b) when they were not maintaining a good performance (e.g., dropping hula-hoop), and/or c) when they were not making a progress. Each participant received approximately 25 messages during the 12-minute of game play. Both written and voice messages were delivered simultaneously as the way it was programmed. For example, when participants hear 'You are doing great', the message appeared on the game screen.

Some research indicates that avatars influence people's virtual experiences (e.g., Fox & Bailenson, 2009). To avoid any potential issues related to the level of similarity to the avatar, all of the participants' avatars were matched with each participant's physical attributes (e.g., sex, ethnicity). For example, a Caucasian female participant played with a Caucasian female avatar.

4.4. Measures

Feedback message perception (α = .95) was measured with three items (e.g., "I received supportive messages when I was playing the game") for manipulation check. *Self-efficacy for the game play* (α = .94) refers to people's perceived ability to play exercise video games in a variety of situations. Six items, modified from Kroll et al.'s (2007), were assessed (e.g., "I am confident that I can play the exergame well even when I am tired"). *Perceived usefulness of the exergame* (α = .91) describes the degree to which participants feel that the game is useful for physical exercise purposes. Three items, modified from Davis (1989), were employed (e.g., "Using the exergame would increase the effectiveness of exercise"). *Enjoyment* (α = .92) is the sum of favorable reactions toward game play. Four items, modified from Song et al., (2010), measured enjoyment (e.g., "This game experience was fun"). *Perceived exergame skills* (α = .84) describe participants' overall assessment of their possession of knowledge and skills of the exergame use. Two items measured perceived exergame skills (e.g., "I consider myself knowledgeable about playing techniques in the Wii Fit's hula-hoop game") that were modified from Novak et al. (2000).

Regarding social presence, the aspect of psychological involvement, one of the social presence categories in Biocca et al.'s (2003) study, was particularly assessed. *Social presence focusing on psychological involvement* (α = .76) describes technology users' subjective perceptions about experiences that convey enough social cues (Lombard & Ditton, 1997; Short et al., 1976). Five items measured social presence (e.g., "The experience was sociable"). Items were adopted from previous social presence research (Lombard & Ditton, 2000; Short et al., 1976). All of the responses were reported on a 7-point Likert-type scale (1=Strongly Disagree, 7=Strongly Agree).

At the end of the questionnaires, participants' basic demographic information such as sex, age, and race were obtained. Previous exergame experience was also asked ("Have you played Wii (Wii fit) before?").

5. Results

An independent *t*-test was performed to check manipulation and examine H1a-d. As expected participants in the positive feedback condition (M = 6.23, SD = 0.64) significantly perceived feedback messages to be more positive, $t(45) = -17.70$, $p < .001$, than those in the negative feedback condition (*M* = 1.93, *SD* = 0.98). Thus, manipulation was successful.

5.1. H1a-d: The Effect of Feedback

H1a examined self-efficacy for exergame play. An independent *t*-test reported that there is no significant difference, $t(45) = 0.24$, $p > .05$, between the positive condition (*M* = 5.60, *SD* = 0.87) and negative condition (*M* = 5.67, *SD* = 1.20). Thus, H1a was not supported.

H1b explored perceived usefulness of exergame. Although not significant at $p < .05$, data indicated that participants in the positive condition (*M* = 5.83, *SD* = 1.29) reported higher usefulness of exergame than participants in the negative condition (*M* = 5.22, *SD* = 1.26) at a marginally significant level, $t(45) = - 1.64$, $p < .10$. Thus, H1b was supported at a marginally significant level.

H1c examined enjoyment. Results revealed a significant difference, $t(45) = - 2.37$, $p < .05$. Participants in the positive condition (*M* = 6.23, *SD* = 0.79) reported higher enjoyment than participants in the negative condition (*M* = 5.60, *SD* = 1.02). Thus, H1c was supported.

H1d explored perceived skills about exergame. Data reported a significant difference between the two conditions, $t(45) = - 2.27$, $p < .05$. Participants who received positive feedback (*M* = 5.43, *SD* = 1.00) reported a higher level of perceived skills than participants who received negative feedback, (*M* = 4.56, *SD* = 1.60). Thus, H1d was supported.

5.2. H2a-d: Mediating Role of Presence

A set of H2a-d was tested with a series of bootstrapping procedures for estimating indirect effects in simple mediation models (Preacher & Hayes, 2004). Bootstrapping involves the simulation of multiple interactions of sampling from the data set to estimate the indirect effect in each sample (Preacher & Hayes, 2004). To process this procedure, feedback (0 = Negative, 1 = Positive) was dummy coded. The procedure was done based upon 5,000 bootstrap samples as recommend by the current research (Preacher & Hayes, 2004). In each bootstrapping test, results were interpreted based upon 95% of Confidence Interval (CI).

The first test was performed to assess indirect effects of social presence upon self-efficacy for exergame play. The result indicated that the mean score for the indirect effect of social presence was 0.07 (*SE* = 0.29; 95% CI = [-0.63, 0.53]). The findings indicate no significant indirect effect of social presence between feedback and self-efficacy for exergame play. The data did not support H2a.

When assessing the mediation effects of social presence between feedback and perceived usefulness of the exergame, a significant effect was found. The mean score for the indirect effect of social presence was 0.94 (*SE* = 0.32; 95% CI = [0.34, 1.60]). That is, positive feedback increased feeling of social presence, which in turn enhanced perceived usefulness of the exergame. H2b was supported.

Another bootstrap test was performed on enjoyment. The mean score for the indirect effect of social presence was 0.71 (*SE* = 0.23; 95% CI = [0.29, 1.18]). These results indicate the indirect effect of social presence. This finding indicates that positive feedback messages facilitated a sense of social presence that in turn increased game enjoyment. H2c was supported.

A last bootstrap test was performed to examine perceived exergame skills. The mean score for the indirect effect of social presence was 0.67 (*SE* = 0.32; 95% CI = [0.05, 1.33]). That is, receiving positive feedback messages led to stronger social presence, which led to stronger perceived exergame skills. H2d was supported.

6. Discussion

This study examined the effect of feedback during the exergame play. Overall findings indicate that positive feedback significantly influenced participants' exergame experiences such as enjoyment and perceived skills. Furthermore, data also indicated presence mediates the relationship between feedback and exergame experiences. The remainder of the report provides explanations of primary findings, implications, and contributions of the investigation. Then, the report ends with limitations and future research directions.

6.1. Primary Findings and Implications

A first conclusion suggests that positive feedback messages have an impact upon users' exergame experiences. The present study found that when people receive positive feedback they report more favorable experiences such as enjoyment and exergame skills. Although specific variables measured are somewhat different, the effects of positive feedback upon people's experiences are consistent to previous findings in a variety of contexts (e.g., Deci, Koestner, & Ryan, 1999; Viciana & Cervello, 2007). Also, the effects of feedback from nonhumans in virtual environments are consistent with previous research that found beneficial effects of positive feedback on people's learning-related outcomes such as perceived ability and recall (Bracken & Lombard, 2004). Building on these previous studies the current investigation further reveals the beneficial effects of positive feedback from nonhuman sources.

Another highlight of this study is the mediating role of presence in virtual environments. Specifically, positive feedback messages increase a feeling of social presence, which in turn leads to more favorable exergame experiences (e.g., perceived usefulness of the exergame, enjoyment, perceived exergame skills). Empirically, these findings are consistent with the findings from a variety of virtual contexts (e.g., Jin, 2009, 2011; Jin & Park, 2009, Lee & Nass, 2004; Lee et al., 2005, 2006; Song et al., 2010; 2011). Further, existing theoretical arguments support these findings. The Computers Are Social Actors (CASA) paradigm explains that technology users apply social rules to computers as if they did to humans (Reeves & Nass, 1996). In other words, people respond to cues from technology as if the cues were from people. The CASA paradigm supports the theoretical justifications of indirect effects of presence. During the virtual experiences technology users may not notice the existence of the medium/technology, thus this experience may allow them to perceive virtual objects (e.g., space, virtual social actors, virtual self) as actual objects. Overall, these findings indicate that presence is an important notion that could facilitate effective experiences in virtual environments.

However, unlike Social Cognitive Theory's (SCT) argument that encouraging and supportive remarks increase people's self-efficacy, the current study did not find any significant changes on self-efficacy. One potential explanation may be related to the nature of the task in this exergame. Hula-hoop, the particular game employed in this study, may be one that can be mastered fairly quickly by users. Because experience of mastery is one of the strongest sources that influence self-efficacy (Bandura, 1997), just playing the exergame itself may have helped users master the skills and feel confident about their perceived ability regardless of variations presented within the game (feedback). That is, it might be possible that self-efficacy has already increased due to the experience of playing the exergame.

6.2. Contributions and Implications for Research and Practice

The current investigation reveals several contributions and implications. One of the highlights of this investigation is the theoretical contribution to presence research. Particularly, this investigation provides further support for the mediation effect of presence in virtual environments. Beyond the simple effect of presence as an independent or dependent variable, the current study shows that presence has a more advanced and complex role that mediates the relationship between an independent and dependent variable. These findings provide stronger support for the need to examine how presence is linking and connecting virtual stimuli to technology users' experiences.

This study also yields practical implications. The current study suggests that positive social feedback may provide important implications for various target audiences in a variety of contexts. First, this approach can be applied in exercise and fitness settings. Most exercise machines (e.g., treadmill) provide only factual feedback based upon a machine user's performance such as calorie consumed, number of miles, and heart rate. It may be worth considering the incorporation of positive social feedback (e.g., "you are doing great!"). The same implication can also be made to exergame designers. In addition to the game score feedback, which is a common feedback type within the game, game designers may consider incorporating positive social feedback messages to the game. As found in this current investigation, this type of messages favorably influences people's exercise experience and fitness settings and during exergame use (e.g., enjoyment), which may provide some incentive, even if machine-generated, for continuing exercise practices.

6.3. Limitations and Future Research Directions

As with any study, this investigation has limitations that should be kept in mind when interpreting the pattern of results. First, this study did not take potential individual user differences into consideration. People may respond differently to various types of feedback. For example, people with high confidence in themselves may not sensitively respond to either positive or negative messages because they have already established confidence in themselves. In other words, feedback from others may not significantly affect the way they feel about their ability or perceptions. However, people with low confidence in themselves may sensitively respond to messages from others. When they hear somewhat discouraging messages (e.g., "I don't think you are making a very good progress"), they may get easily discouraged. However, when they hear encouraging messages (e.g., "You are doing great!"), they may effectively process the messages and internalize them. This may help them increase the confidence about their perceived ability.

Second, the current investigation is limited to examining short-term, immediate responses after exergame play. To effectively address this issue, future research should explore how people's exergame experiences change over a long-period of time. In relation to that, it may be also important to assess how people's self-efficacy changes over time. Self-efficacy may develop over a long-period of time with repeated practices and experiences. If that is the case, the finding may provide an effective way for enhancing exercise self-efficacy, which is one of the key factors for exercise behavior (Anderson et al., 2006; Garcia & King, 1991; McAuley et al., 2000; McAuley 1993; Rodgers et al. 2002; Rovniak et al. 2002).

7. Conclusion

Overall, the current investigation reveals several meaningful findings in relation to presence research and exergame play experiences. The research reveals that positive feedback messages during the game play favorably influence users' exergame experiences. Further, presence mediates the relationship between feedback and exergame experiences. Based upon these findings future researchers should further expand this area of research.

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