



Full Length Article

Virtual vs. real body in exergames: Reducing social physique anxiety in exercise experiences

Hayeon Song^a, Jihyun Kim^b, Kwan Min Lee^{c,*}^a Department of Communication, University of Wisconsin-Milwaukee, P.O. Box 413, Milwaukee, WI 53201, USA^b Department of Communication Studies, Bloomsburg University of Pennsylvania, 1102 McCormick Center, 400 E. Second Street, Bloomsburg, PA 17815, USA^c Department of Interaction Science, Sungkyunkwan University, Seoul, South Korea

ARTICLE INFO

Article history:

Keywords:

Exercise
Game
Avatar
Body image
Presence

ABSTRACT

Research indicates that people with body image dissatisfaction (BID) are not benefited from exercising in group contexts. The current study tested whether exercise video games (exergames) can provide unique opportunities for exercise interventions through the use of avatars. An experiment was conducted using a 2 (BID: High vs. Low) × 2 (Exercise context: Solitary vs. Group) between-subjects design. Results demonstrated that individuals with high BID reported similar or more favorable exergame experiences compared to individuals with low BID. Further, individuals' social physique anxiety was significantly reduced during exergame play. Self-presence mediated the relationship between exercise context and exergame experiences.

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1. Introduction

Kinetic, and Wii Fit, require players' active movements through physical activities such as dancing, aerobics, or kick-boxing in game contexts. Exergames have been reported to enhance effective exercise outcomes. For example, exergames help players burn calories (Hancock, 2008) as well as increase overall physical activity levels (Yang, Vasil, & Graham, 2005), aerobic exercise effects, and cardio-physiological benefits (Unnithan, Houser, & Fernhall, 2005).

One of the attractive features of current exergames is that players can create their own game characters, known as *avatars*. Avatars influence players' virtual experiences in many ways. For example, use of avatars increases enjoyment during the virtual experience and affect the way people behave in virtual environments (Fox & Bailenson, 2009; Yee & Bailenson, 2007). However, the current literature has paid less attention to how the use of a virtual body affects players' exergame experiences, especially among those with body image concerns.

Moreover, although abundant studies have tested the effects of exercise context (e.g., Solitary vs. Group) on exercise experiences in medical and sports psychology domains, little is known in the exergame context. Individuals with body image concerns may

not enjoy exercising in traditional public exercise environments (e.g., fitness centers, local gyms). However, in the exergame context, body image concerned-individuals may enjoy exercise experiences as they can use a virtual body through an avatar that does not reflect their real body image. Thus, the present study tests whether use of avatar in the exergame contest can be an effective way to promote exercise.

2. Theoretical framework

2.1. Effects of exercise context and body image dissatisfaction

Exercise context is an important predictor of exercise experience (Hausenblas, Brewer, & Van Raalte, 2002; Rejeski, 1994). For example, McAuley, Blissmer, Katula, and Duncan (2000) found that individuals engaged in group exercise reported more positive well-being and less psychological distress compared to individuals who exercised in a solitary context, regardless of exercise intensity and duration. The positive effect of a group setting, however, depends on individual differences such as one's level of body image dissatisfaction (BID). BID serves as an exercise barrier (Ball, Crawford, & Owen, 2008; Kruger, Lee, Ainsworth, & Macera, 2008) by decreasing exercise motivation especially in settings where body image may be more salient, such as workout groups or mirrored environments (Ginis, Jung, & Gauvin, 2003; Hausenblas et al., 2002; James, 2000; Katula & McAuley, 2001; Spink, 1992).

* Corresponding author. Address: Department of Interaction Science, Sungkyunkwan University, Seoul, South Korea. Tel.: +82 2 740 1863; fax: +82 2 740 1856.

E-mail addresses: hayeon.song@gmail.com (H. Song), jihyunkim218@gmail.com (J. Kim), kwanminlee@gmail.com (K.M. Lee).

One of the reasons that people with low BID report unfavorable exercise experiences in group settings may be related to social physique anxiety. Social physique anxiety refers to a feeling that one's body is being evaluated by others and has been identified as a major hurdle for exercise practice in group settings or within the presence of others (Belling, 1992; Ginis et al., 2003; Hausenblas et al., 2002; James, 2000; Spink, 1992). Studies report that people with social physique anxiety tend to experience embarrassment in a group setting, which results in loss of exercise motivation (Belling, 1992; Spink, 1992).

2.2. Virtual body and presence in virtual environments

According to the Proteus Effect, a theoretical perspective explaining the impact of avatars on technology users, people in virtual environments make inferences about their expected dispositions from their avatars' appearance and conform to the expected attitudes and behaviors of the avatars (Yee & Bailenson, 2007; Yee, Bailenson, & Ducheneaut, 2009). A great deal of empirical studies have confirmed the Proteus Effect in a variety of contexts (e.g., Bailenson, Yiengar, Yee, & Collins, 2008; Ersner-Hershfield, Bailenson, & Carstensen, 2008; Fox & Bailenson, 2009; Fox, Bailenson, & Binney, 2009; Groom, Bailenson, & Nass, 2009; Messinger et al., 2008; Yee & Bailenson, 2007; Yee et al., 2009). For example, a study found that individuals using attractive and tall avatars were less interpersonally distant to other avatars, exhibited higher self-disclosure, and showed more confidence than those using less-attractive, shorter avatars in virtual environments (Yee & Bailenson, 2007). Similarly, individuals using more attractive avatars demonstrated more outgoing and extroverted behaviors in virtual environments (Messinger et al., 2008).

Similarly, recent research examined whether the reflection of physical attributes of an ideal self, compared to an actual self, had any influence on individuals' technology experiences. Results found that people who used an ideal version of self—a self they hope to be—reported stronger perceived interactivity during video game play compared to people who used a self that reflected their current attributes (Jin, 2009).

Examining how and why avatars influence user experiences is crucial to assessing the effects of avatars. The theoretical concept of self-presence explains the link between users and avatars. As one of three types of presence (i.e., physical, social, and self-presence), self-presence refers to technology users' sense that a virtual self (e.g., an avatar) is felt like an actual, physical self (Lee, 2004). That is, technology users experience self-presence through the relationship between their actual body and the avatars' body, emotion, and identity (Ratan & Hasler, 2010; Ratan, 2010). Various empirical studies found a significant mediating role of presence in various virtual experiences (e.g., Jin & Park, 2009; Song, Kim, Tenzek, & Lee, 2010). For example, Song et al. (2010) found that competition in game increases enjoyment through presence.

In sum, based upon the existing empirical and theoretical evidence, the current study examines how the use of a virtual body through an avatar affects individuals' exercise experiences. Particularly, the study explores whether BID would be attenuated in virtual environments and whether BID would impact exercise experiences in solitary or group play. Finally, the study explores a role of self-presence during exergame play.

RQ1a–c: How do body image dissatisfaction and exercise context affect individuals' (a) enjoyment, (b) mood, and (c) perceived exercise accomplishment during exergame play?

RQ2: In the group context, will social physique anxiety be reduced during exergame play?

RQ3: What is a role of self-presence in predicting perceived exercise accomplishment?

3. Method

3.1. Participants

The study employed an experiment using a 2 (BID: High vs. Low) \times 2 (Exercise context: Solitary vs. Group) between-subjects design. Initially, a total of 225 students were recruited from a mid-sized Midwestern university in the U.S. Upon participants' agreement, an online survey was administered to identify participants who meet the criteria of the study. Based upon the score of BID ($M = 4.97$, $SD = 1.77$, $Me = 5.44$), a high BID group (upper 30%, participants with a BID score higher than 6.3 out of 10) and a low BID group (lower 30%, participants with a BID score lower than 4.5 out of 10) were identified. Respondents meeting the criteria were invited to the experiment, and the remaining group of respondents, who did not meet the criteria, were thanked and dismissed from the study.

Thus, a total of 72 individuals participated in the study. A total of 33 individuals (45.8%) were placed in a low BID group ($M = 2.6$, $SD = 0.9$), and 39 individuals (54.2%) were placed in a high BID group ($M = 7.0$, $SD = 1.1$). There were slightly more males ($n = 38$; 52.8%) than females ($n = 34$; 47.2%) in the sample.

3.2. Procedure

Participants were invited to come to a research lab at a scheduled time. They were randomly assigned to either group ($n = 38$) or solitary ($n = 38$) context, and asked to play Nintendo Wii's boxing video game. In the group context, each group was composed of two to six strangers and included mixed gender and mixed BID groups. In other words, it was ensured that each group has both male(s) and female(s) and nature of high BID and low BID. Group were allowed to play a game for a total of 20 min, continuously rotating turns throughout the allotted time. Participants played against the computer by sharing the same generic avatar, which was randomly pre-picked from the default set; body sizes of all the avatars were the same in medium range. The rationale for using the same avatar for each participant in groups is to avoid any potential for perceived differences of avatar's body image.

In the solitary context, participants played the game alone for a minimum of five minutes, but were allowed to play up to 20 min if they wished. Game conditions were identical to those of the group context, except that no other players were present during the play. In both contexts (group and solitary), experiments were conducted in the lab without any outside observation to avoid any possible effects of researchers' presence. After the game play, all participants completed follow-up questionnaires.

3.3. Measures

The screening test included items measuring BID and social physique anxiety. BID ($\alpha = .88$) was measured with nine items (e.g., "I feel satisfied with the shape of my body," a reversed item), adopted from an existing measure (Garner, Olmstead, & Polivy, 1983). Social physique anxiety ($\alpha = .88$) was measured with seven items (e.g., "I am concerned about how others might judge my appearance"), modified from previous research (Yao & Flanagan, 2004).

After game play, participants filled out questionnaires measuring exergame experiences. Enjoyment ($\alpha = .86$) was measured with six items (e.g., "It was fun"), modified from previous research (Klimmt, Rizzo, Vorderer, Koch, & Fischer, 2009). Mood ($\alpha = .82$) was measured with five items (e.g., "I feel refreshed after exercising with this game"), modified from previous research (Song, Peng, & Lee, 2011). Self-presence ($\alpha = .81$) was measured with four items

(e.g., “When my character in the video game was hit, I felt as if I was hit”), modified from existing research (Song et al., 2010). *Perceived exercise accomplishment* ($\alpha = .86$), developed for the study, was measured with six items (e.g., “I was out of breath after playing the game”). *Social physique anxiety* ($\alpha = .88$) was measured again with the same items used in the screening test. In the post-test, social physique anxiety was measured only in the group context. All of the responses were obtained using a 10-point Likert-type scale (e.g., 1 = Strongly Disagree. 10 = Strongly Agree).

4. Results

A series of ANOVA was conducted to address RQ1a–c that sought to explore the effect of BID and exercise context upon (a) enjoyment, (b) mood, and (c) perceived exercise accomplishment. First, with regard to enjoyment, the main effect of BID was significant, $F(1, 68) = 4.47, p < .05, \eta_p^2 = .06$. Interestingly, individuals with high BID ($M = 8.27, SD = 0.91$) enjoyed game play significantly more than those with low BID ($M = 8.77, SD = 0.95$). There was no significant effect of exercise context, $F(1, 68) = 2.90, p > .05, \eta_p^2 = .04$. No significant interaction effect was found, $F(1, 68) = 0.96, p > .05, \eta_p^2 = .01$.

Regarding mood, people who exercised alone ($M = 8.44, SD = 0.94$) showed significantly more positive mood, $F(1, 68) = 13.50, p < .001, \eta_p^2 = .17$, than those who exercised with others ($M = 7.43, SD = 1.42$). Neither the main effect of BID, $F(1, 68) = 0.13, p > .05, \eta_p^2 = .002$, nor interaction effect, $F(1, 68) = 1.22, p > .05, \eta_p^2 = .02$, were significant.

Similarly, a significant main effect of exercise context was found for perceived exercise accomplishment, $F(1, 68) = 24.44, p < .001, \eta_p^2 = .26$. Individuals who exercised alone ($M = 6.76, SD = 1.61$) showed stronger perceived exercise accomplishment than those who exercised with others ($M = 4.66, SD = 1.90$). Neither the main effect of BID, $F(1, 68) = 0.20, p > .05, \eta_p^2 = .003$, nor the interaction effect were significant, $F(1, 68) = 0.49, p > .05, \eta_p^2 = .01$.

A set of *t*-tests was performed to test RQ2 by comparing the levels of social physique anxiety before and after the experiment. First, a paired *t*-test was conducted for individuals with high BID. Results showed that preexisting levels of social physique anxiety ($M = 6.68, SD = 1.29$), measured prior to game play, were significantly reduced, $t(15) = -4.93, p < .001$, during the game play ($M = 3.82, SD = 2.31$). The same pattern was observed among those with low BID. Preexisting levels of social physique anxiety ($M = 4.9, SD = 2.2$) significantly dropped, $t(16) = 3.59, p < .01$ during game play ($M = 3.4, SD = 2.2$). To assess whether changes in social physique anxiety were significantly different between individuals with high and low BID, an independent *t*-test was performed. Individuals with high BID ($M = 2.86, SD = 2.32$) demonstrated more changes in social physique anxiety than individuals with low BID ($M = 1.53, SD = 1.76$), $t(31) = -1.86, p < .05$.

To examine the role of self-presence (RQ3), a multiple regression was conducted. Results found exercise context to be a significant predictor of perceived exercise accomplishment when controlling for gender. However, when self-presence was added to the model, the effect of social context was decreased. The results indicate that self-presence was the most significant predictor of perceived exercise accomplishment during exergame play (Table 1).

Further, a Bootstrap test (Preacher & Hayes, 2004) was performed to assess a potential mediating role of self-presence. Based on the 95% confidence interval [CI], the mean score for the indirect effect of social presence was -0.93 ($SE = 0.28$; $CI = [-1.53, -0.43]$). The result shows that self-presence fully mediates the relationship between exercise context and perceived exercise accomplishment. That is, exercising alone increased the feeling of self-presence,

Table 1

Result of multiple regression predicting the perceived exercise accomplishment.

Variables	Model 1	Model 2	Model 3
Social context	-.589***	-.595***	-.299*
Body image dissatisfaction	-.026	-.007	.049
Social context \times body image dissatisfaction	.121	.118	.002
Gender		.034	.051
Self-presence			.527***
R^2	.275	.275	.496

Standardized coefficients (Beta).

* $p < .05$.

** $p < .01$.

*** $p < .001$.

which then led to stronger perceived exercise accomplishment (Table 2).

5. Discussion

5.1. Primary findings and implications

Research indicates that individuals with high BID do not benefit from exercising with others in group settings. The current study tested whether an exergame that utilizes virtual body through avatars could serve as a unique exercise intervention targeted at high BID populations. Our results did show that avatar-based exergame play could significantly improve exercise experiences especially for those with high BID. More specifically, results indicated that social physique anxiety was significantly reduced during exergame play for both individuals with high and low BID, while greater attenuation rate was observed among individuals with high BID compared to those with low BID. Moreover, those with high BID also reported higher levels of enjoyment in playing exergames compared to those with low BID, while both groups reported similar levels of positive mood and perceived exercise accomplishment. These findings suggest that, in virtual exercise settings, individuals would enjoy exercise without concerning their body image. In other words, concerns associated with the real, physical body seem decreased in favor of experiencing the virtual body.

The findings have significant implications for health professionals who attempt to promote exercise. Our results suggest that exergames can provide a promising way to encourage individuals with BID to exercise by attenuating social physique anxiety. Given that “feeling too fat to exercise” is reported as one of the biggest exercise barriers among overweight individuals (Kruger et al., 2008), the finding provides an effective alternative for this particular population.

Another worthwhile finding is the important role of self-presence in promoting exercise. Controlling for both contextual and individual variables as well as the interaction effect of both variables, self-presence turned out to be by far the most influential predictor of exercise accomplishment. That is, regardless of the exercise contexts and body image concerns, self-presence enhanced exercise accomplishment. In addition, self-presence was found to play a mediating role between exercise contexts and accomplishment. Exercise contexts influenced self-presence; and subsequently, the feeling of self-presence enhanced exercise accomplishment. Based on these findings, exercise promoters should pay more attention to the key aspect of self-presence when designing exergame-based health campaigns.

5.2. Limitations and future research directions

Although the study identified meaningful findings, it also possessed some limitations. First, perceived ownership of avatar may have played a role. In the current study, only one avatar was

Table 2
Mediation effect of self-presence between exercise context and perceived exercise accomplishment.

Outcome variable	Mean for indirect effect	SE	Lower confidence limit	Upper confidence limit	Z value
Perceived exercise accomplishment	-.93	.28	-1.53	-.43	-3.21**

** $p < .01$.

created in each group, and it was shared with other group members. This setting was created to maximize players' perception that "my avatar's body image is not different from others", so that we could eliminate the possibility of inaccurately perceiving that one's avatar looked heavier than other avatars. The experiment setting, however, inevitably made participants in the group context share the same avatar. Sharing avatar may have reduced the connection participants felt about their avatar, which may have affected their exergame experience. In this regard, future studies should explore how results may be different (or the same) when each player uses an avatar of their choosing.

Another limitation is that results from the current study may not be applied to group exercise with friends or family members. Because the current study tested exercising in groups of strangers, it is not clear if exercising in groups with friends or family members would have the same results as suggested in the study. Given that it is common to play exergames with friends or family members, future studies should be conducted in a variety of group exercise settings.

5.3. Conclusion

The current study investigated whether exergames can provide unique opportunities for exercise intervention, particularly for individuals with BID. Overall findings suggest that avatar-based exergame offers an improved exercise experience, where individuals feel connected to their avatar's virtual body. Furthermore, use of an avatar in an exergame attenuates the detrimental effect of social physique anxiety on exercise outcomes. We believe that more investigations should further reveal ways to promote exercise by fully taking advantage of the opportunities for unique exercise experiences that exergames offer.

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