Computers in Human Behavior 41 (2014) 262–267

Contents lists available at ScienceDirect

Computers in Human Behavior

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

Increasing exergame physical activity through self and opponent avatar appearance

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ARTICLE INFO

Article history:
Available online 21 October 2014

Keywords:
Avatars
Physical activity
Exergames
Priming
Social comparison

ABSTRACT

We investigated how manipulating self and opponent avatar weight (normal vs. obese) affected people's physical activity in real life as they played an exergame. While playing virtual tennis, female players operating a normal weight self avatar were more physically active relative to those using an obese self avatar. Participants physically exerted themselves the most when both self and opponent had normal weight avatars, implying increased physical activity when self and opponent avatars look equally fit. The study also identified conditions that discouraged physical activity (e.g., normal weight self avatar vs. an obese opponent). The findings were congruent with priming and social comparison models, and illustrated how virtual social cues can be leveraged to influence health behaviors via exergames.

1. Introduction

Interactive technologies are fertile grounds to examine how virtual experiences can instigate changes in health behaviors (Peng, Lin, & Crouse, 2011). For instance, companies are nowadays invested in developing motion-based interfaces (e.g., Microsoft Kinect, Nintendo Wii), along with health-related games and apps to help people track their physical activity and achieve their health goals (Staiano & Calvert, 2011). Another example includes *exergames* or videogames requiring users to perform physical gestures and exert themselves physically (e.g., dance, exercise, play tennis, etc., Peng et al., 2011).

In such interactive environments, *avatars* or characters that serve as users' virtual self-representation play a major role in the effects of exergames. For instance, Fox and Bailenson (2009) assigned participants to a self avatar that lost or gained weight in accordance with participants' real-life physical exercising or resting while on a treadmill (i.e., vicarious reinforcement condition), or to an avatar that did not change weight regardless of real-life treadmill exercising (i.e., no change condition), or to a no avatar condition to ensure that the effect was not explained by seeing a virtual self while exercising in real life. After this, participants could end the experiment or continue exercising voluntarily. Participants in the vicarious reinforcement group voluntarily exercised more than those in the remaining conditions (Fox & Bailenson, 2009). Participants also exercised more when viewing avatars donning their own face compared to when viewing avatars with someone else's face (Fox & Bailenson, 2009). In addition, player's self-concept and personal goals can affect the perceptual outcomes of using avatars in exergames (Jin, 2009). Participants that created Wii Fit avatars reflecting their ideal self reported increased interactivity than those who crafted avatars reflecting their actual self. In addition, among participants primed with hope, those who crafted avatars depicting their real selves reported more game immersion than those who crafted avatars portraying their ideal self. Among players primed with duty, on the other hand, those who created avatars reflecting their ideal selves reported more immersion than those who created avatars mirroring their actual self (Jin, 2009).

Though previous studies have examined how self avatar appearance sets in motion vicarious reinforcement processes that affect physical activity outcomes (Fox & Bailenson, 2009), researchers have not investigated how the physical appearance of self and opponent avatars affect player physical activity in real life while playing an exergame. In order to expand on previous research, this study examines how using a normal weight or obese self avatar activate perception-behavior mechanisms (Chartrand & Bargh, 1999) that translate into increased or decreased physical activity while playing an exergame. Perception-behavior mechanisms predict that avatar appearance primes memories, stereotypes, and behavioral scripts stored in memory (Chartrand & Bargh, 1999). Obese avatars may remind participants of concepts such as "sluggishness" and, thus, using an obese self avatar may decrease phys-

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http://dx.doi.org/10.1016/j.chb.2014.09.038
0747-5632/

ical activity while playing an exergame compared to playing with a normal weight self avatar.

This study also examines the physical activity effects of self and opponent avatars from the perspective of social comparison theory (Festinger, 1957). When drawing social comparisons, people should compare salient information about the self against a comparison standard (e.g., an opponent) to establish whether the self or the comparison standard possesses critical features or skills. If critical features are present in their own avatars (e.g., normal weight self avatar vs. normal weight opponent avatar), people may conclude that they are as good as their opponent and, thus, exert themselves physically. If critical features are absent in their own avatars (e.g., obese weight self avatar vs. normal weight opponent avatar), people may conclude that they are not as good as their opponent, and such perceptions are likely to affect the level of their physical activity. This study uses a tennis exergame to examine these perception-behavior and social comparison predictions. Building upon these frameworks, this study hopes to advance our understanding of the effects of avatar appearance on exergame physical activity outcomes. Finally, the findings may shed light on the role of avatars and virtual representations as a reliable tool for changing health-related behaviors.

2. Theoretical background and hypotheses

2.1. The effects of self avatar appearance on physical activity

Several theories rationalize the *Proteus effect* or the prediction that avatar appearance influences operator's perceptions and behavior. Yee and Bailenson (2007) attributed the Proteus effect to self-perception theory (Bem, 1972) and, thus, hypothesized that people operating avatars examine their own behavior from the perspective of an imaginary third party in order to explain what attitudes caused the behavior. Just as observers see physically attractive avatars as more confident, so too does the person operating the avatar (Yee & Bailenson, 2007). For example, participants operating more physically attractive avatars showed increased confidence and kept shorter personal distances and also disclosed more information in virtual interactions relative to participants operating less physically attractive avatars (Yee & Bailenson, 2007). The Proteus effect is also attributed to priming mechanisms (Peña, Hancock, & Merola, 2009; Peña, McGlone, & Sanchez, 2012). Priming refers to how exposure to situational cues and social stereotypes activates concepts and behaviors stored in memory (Bargh & Chartrand, 2000). For instance, in a virtual discussion, participants using avatars in dark uniforms developed more aggressive attitudes and intentions in comparison to those using avatars in light uniforms (Peña et al., 2009). Participants using KKK-like avatars created more aggressive and less affiliative stories when responding to an ambiguous projective test compared to those using doctor and control group transparent avatars (Peña et al., 2009). Priming models hypothesize a direct perception-behavior link (i.e., "perceiving is for doing") and, thus, the activation of a concept increases the likelihood of acting in accordance to that idea (Chartrand & Bargh, 1999). In theory, perceptual inputs are translated automatically into behavioral outputs with no involvement of motivation, intention, or conscious goals (Chartrand & Bargh, 1999). Consider, for example, that overweight and obese individuals face more stigmatization and negative judgments than normal weight people (Puhl & Latner, 2007). Based on priming principles, operating an obese avatar may remind participants of negative judgments including "sluggishness" while a slim but normal weight avatar can potentially activate concepts such as "agility" and increased physical movement on users. Based on the perception-behavior link, we predict that:

H1. When playing a tennis exergame, people using normal weight avatars will physically exert themselves more than those using obese avatars.

2.2. Increasing health behaviors through opponent's avatar appearance

Though the effects of opponent's attributes on exergame outcomes have not been examined (Peng et al., 2011), *social comparison theory* can greatly inform how people may play competitively against exergame rivals. According to Festinger (1957), people are motivated to compare and evaluate their opinions and abilities. Festinger (1957) also assumed that people engage in social comparisons to obtain information about their abilities and opinions. This allows people to predict outcomes and select activities that match their skills and values. Though there are other important motives for social comparisons (e.g., self-enhancement), people tend to seek realistic and diagnostic information about their skills and preferences because holding inaccurate appraisals of one's abilities can be embarrassing, punishing, or fatal (Festinger, 1957). In comparative contexts, people compare their knowledge about the self that is stored in memory to the comparison standard (e.g., an opponent) and may engage in a "positive hypothesis testing strategy" and, thus, selectively retrieve information to prove or disprove the assumption that the self is similar to the comparison standard.

Mussweiler and Strack (1995) exemplify social comparison theory using tennis players. Imagine that you are a very good tennis player that cares about winning, and you just enrolled in a local tournament. Your neighbor is also planning to compete, and s/he is a very good player as well. Do you have a chance of winning? In this context, people are expected to retrieve information from memory that is consistent with the positive similarity hypothesis (i.e., you are as good a tennis player as your neighbor). If you are a good tennist, comparing yourself to your neighbor should also increase the accessibility of information in memory indicating that you are indeed a very good player (e.g., your killer backswing). Increases in information selectivity and accessibility should augment the likelihood that people will use this information to draw a comparison. The influence of selectively accessible information depends on its *applicability* and *representativeness*. Accessible information that you are a good tennist should affect social comparisons more strongly than information that you are a good soccer player because information about tennis is more applicable to the present context. In addition, accessible knowledge about present tennis skills is likely to be more representative than memories of one's own skills as a beginner tennist or back when in our prime (Mussweiler & Strack, 1995).

The most efficient way to make a social comparison is finding critical features that are indicative of an opponent's tennis abilities and then assess if you possess those features as well (Mussweiler & Strack, 1995). If the critical feature is present, one may be as good a tennist as our opponent or even better. If not then people may reach the opposite conclusion. For example, tennis players are fit and agile in general (Harris & Foltz, 1999). If so, a normal weight exergame opponent avatar will likely be judged as more fit and likely better at tennis compared to an obese opponent avatar. In the present context, social comparison theory predicts that participants playing against normal weight avatar opponents will show more physical activity compared to those playing against obese avatars. In addition, it is likely that people will exert themselves the most when both self avatars and opponents have a normal weight but exert themselves the least when self and opponent avatars are obese. When both avatars have a normal weight, people may estimate that both their self and their opponent avatars have