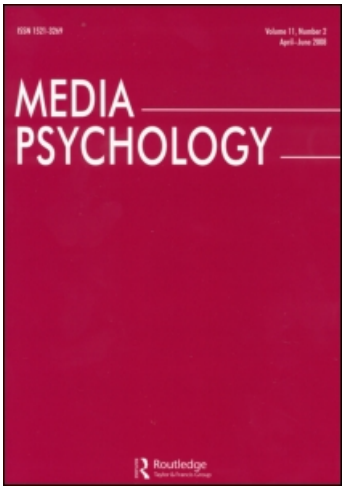

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The Difference Between Being and Seeing: The Relative Contribution of Self-Perception and Priming to Behavioral Changes via Digital Self-Representation

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The Difference Between Being and Seeing: The Relative Contribution of Self-Perception and Priming to Behavioral Changes via Digital Self-Representation

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Studies in the Proteus Effect (N. Yee & J. Bailenson, 2007) have shown that the appearance of avatars (i.e., digital representations of ourselves) can lead to behavioral changes in users. For example, participants in attractive avatars became friendlier to confederate strangers than participants in unattractive avatars. While the Proteus Effect is premised on self-perception theory (D. Bem, 1972)—the notion that we infer our own attitudes by observing ourselves as if from a third party—it is also possible that the previous findings were caused by priming (i.e., behavioral assimilation; J. Bargh, M. Chen, & L. Burrows, 1996). In our study, we used immersive virtual environment technology to experimentally tease apart embodiment from perception of the same visual stimulus. Our results showed that embodiment produced significantly larger behavioral changes than mere observation of the same visual stimuli. These findings support the claim that our avatars provide a unique lever to behavioral change; however, more work is needed to pin down the exact mechanism behind the effect.

An increasing number of digitally mediated spaces allow users to interact via avatars (digital representations of ourselves). These include Internet chat rooms, online games, and instant messaging systems. While the practice of creating self-representations has a long history in physical reality, such as with statues and portraits, digital avatars are unique in that they provide users with a flexibility and ease of use not possible elsewhere. With the

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click of a mouse, users can change their avatar's height, weight, skin tone, and gender. Moreover, avatar customization doesn't merely serve a cosmetic function; avatar choice has been shown to increase physiological arousal during game play (Reeves & Lim, 2006).

In this article, we examine how avatars affect other psychological processes in virtual environments. While it is natural to assume that it is the users who modify and drive their avatars, the avatars that people choose actually change how they behave in digital environments. This has been referred to as the Proteus Effect (Yee & Bailenson, 2007) and it has been shown that this effect occurs independent of how others perceive the user (i.e., behavioral confirmation; see Snyder, Tanke, & Berscheid, 1977).

Although the flexibility in self-representation is a significant component of online environments, the empirical research in computer-mediated communication (CMC) has often focused instead on the perceived lack of socioemotional content (Culnan & Markus, 1987; Kiesler, Siegel, & McGuire, 1984). On the other hand, more recent research has shown that while relationships develop slower in CMC, they are not impoverished in the long run (Walther, 1996; Walther, Anderson, & Park, 1994; Walther & Burgoon, 1992). In the current work, we continue to explore how the technical features of CMC can affect interpersonal relationships; however, rather than focusing on the channels of communication, we focus on the relationship between the user and the avatar.

SELF-PERCEPTION THEORY AND THE PROTEUS EFFECT

The Proteus Effect builds on existing studies in *self-perception theory*, which showed that people infer their own attitudes and expected behaviors by observing themselves as if from a third party (Bem, 1972; Valins, 1966). More specifically, it has been demonstrated that observations of one's own appearance can lead to changes in behavior. Frank and Gilovich's (1988) article on the effect of wearing black uniforms best illustrates the causal chain underlying the process. In their fourth study, participants were asked to wear either black or white uniforms. As the dependent measure, participants were asked to select 5 games (from a list of 20 games) in which they would like to compete. The list of games had been previously rated in terms of aggressiveness. It was found that participants in black uniforms selected games rated as being significantly more aggressive than participants in white uniforms.

We will now step through the underlying psychological process in Frank and Gilovich's (1988) fourth study in detail. In line with self-perception theory, it is argued that participants in black uniforms observed themselves as if from a third party to infer their expected attitudes and behavior. In

this case, as Frank and Gilovich showed in their first study, people in black uniforms are perceived to be aggressive. Participants in black uniforms thus inferred that they are aggressive and behaved accordingly. When presented with the choice of games, they selected the games that were more aggressive. As Frank and Gilovich argued, "just as observers see those in black uniforms as tough, mean, and aggressive, so too does the person wearing that uniform" (p. 83). To summarize, an observation of their appearance (i.e., "I am wearing a black uniform") led participants to make implicit inferences about their disposition (i.e., "I am an aggressive person"), which in turn led to changes in behavior (i.e., "I will select more aggressive games"). This effect has also been replicated in a digital game-like setting, where users who were given avatars in a black robe expressed a higher desire to commit antisocial behaviors than users given avatars in a white robe (Peña, Hancock, & Merola, 2008).

The effect of clothing on behavior has been observed more directly in studies in deindividuation—situations where individuals are made to feel more anonymous. In a study by Johnson and Downing (1979), participants were asked to wear either a nurse's uniform or a costume that resembled a Ku Klux Klan (KKK) robe. They were then asked to interact with a confederate in a teacher–learner paradigm where they took on the role of the teacher. They were allowed to increase the amount of electric shock delivered to the learner when mistakes were made. It was found that participants in nurses' uniforms delivered less severe shocks than participants in the KKK robes. This study illustrates more directly how identity cues can lead to a change in behavior. In particular, these studies show that self-perception via identity cues may have an augmented effect in scenarios where people are deindividuated, such as in many online environments. Indeed, researchers have replicated this study in a virtual environment based on an online game with KKK uniforms and doctors uniforms (Peña et al., 2008).

While previous studies in self-perception and deindividuation have largely relied on costumes and uniforms, digital environments allow much more extensive avatar customizations. Thus, these environments allow us to explore how, for example, an avatar's attractiveness may change a user's behavior. In the case of attractiveness, studies have shown that attractive individuals are perceived to possess a constellation of positive traits (Dion, Berscheid, & Walster, 1972)—that they are more extraverted, friendlier, and so forth. In light of self-perception theory, just as participants in black uniforms infer an aggressive disposition and in turn behave more aggressively, participants in attractive avatars may infer a friendly and extraverted disposition and behave in a friendlier and more extraverted manner. Indeed, this has been demonstrated in an experimental study in an immersive virtual reality setting (Yee & Bailenson, 2007), where it was found that participants with attractive avatars walked closer to and were more gregarious with a confederate stranger than participants with unattractive avatars.

BEHAVIORAL ASSIMILATION AS AN ALTERNATIVE EXPLANATION

Even though self-perception theory has been used to explain the Proteus Effect, *behavioral assimilation* is another plausible explanation. Studies have shown that brief exposure to words related to specific concepts (i.e., priming) can influence social perception—how we evaluate and judge others. One of the earliest studies to isolate the effect of priming on social perception (Higgins, Rholes, & Jones, 1977) manipulated the presentation of the terms "reckless" and "adventurous" in a lexical task (e.g., unscrambling or completing words) and then, in an ostensibly unrelated task, elicited participants' impression of a person who was planning to sail across the Atlantic in a sailboat. It was found that participants who had been exposed to the term reckless had a more negative impression of the person than participants exposed to the term adventurous. Other studies have replicated this effect (Higgins, King, & Mavin, 1982; Higgins et al., 1977; Srull & Wyer, 1979, 1980) and have also shown that priming can affect social perception even when the primes are presented subliminally (Bargh & Pietromonaco, 1982).

While a great deal of research has shown that priming can affect how we perceive and evaluate other people, perhaps the most provocative extension was research showing that priming can in fact change how a person behaves and interacts with other people. In one study (Bargh et al., 1996), participants primed with elderly related words walked slower than participants primed with neutral words. In another study, participants primed with African-American faces behaved in a more hostile manner. In yet another study (Dijksterhuis & van Knippenberg, 1998), participants primed with "professor" performed better than participants primed with "hooligan" on a general knowledge task. Dijksterhuis and van Knippenberg argued that the observed difference in cognitive performance was likely the outcome of changes in behavioral repertoire rather than in actual intelligence. In other words, participants primed with a typical professor may be more inclined to concentrate harder or to perform more thorough searches. Thus, these findings suggest that it is plausible that behavioral changes in the aforementioned avatar attractiveness study were driven entirely by behavioral assimilation. In the same way that participants primed with African-American faces became more hostile, participants primed with an attractive face may be expected to become friendlier.

More recent work in this area has shown that some of the earlier findings can be accounted for via motivated preparation (Cesario, Plaks, & Higgins, 2006). For example, participants primed with the elderly group moved slower because they were preparing to interact with someone from that social group. In other words, it is not entirely clear when behavioral assimilation occurs and when motivated preparation occurs; however, in the

case of attractiveness, the outcome should be identical. Attractive individuals are stereotyped as being friendlier and more charming (Dion et al., 1972), and people are more likely to be friendly to attractive individuals (Friend & Vinson, 1974). Thus, we should expect participants primed with attractiveness to behave in a friendlier manner whether the underlying mechanism is behavioral assimilation or motivated preparation.

BEING ATTRACTIVE VERSUS SEEING SOMEONE ATTRACTIVE

In fact, other researchers have suggested that priming is the main mechanism that underlies the Proteus Effect (Peña et al., 2008). In their study, participants given KKK avatars associated more negative themes with an ambiguous image than participants given doctor avatars. On the other hand, we believe that there is a fundamental difference between being attractive and seeing someone who is attractive. Given that our avatars are our primary representation in virtual environments, there is reason to believe that being and interacting with others in an attractive body leads to a significantly larger behavioral change than from seeing someone in an attractive body. Thus, the study by Peña and colleagues presents the interesting theoretical question as to whether there would have been a difference between being in the doctor avatar as opposed to seeing someone else in a doctor avatar.

In our study, to determine the relative contribution from behavioral assimilation and self-perception, we leveraged the affordances of immersive virtual environment technology (IVET; see Blascovich et al., 2002). IVET immerses a user in a virtual environment via a series of sensors and display devices. The sensors continually track the user's position and orientation, and the corresponding first-person point of view is shown to the user stereoscopically. Thus, IVET provides users with the psychological experience of being able to move naturalistically in a different surrounding.

METHOD

In this study, we used IVET to experimentally tease apart the relative contributions of the visual stimulus (the priming component) and the digital embodiment (the self-perception component). We hypothesized that:

H1: The observed behavioral changes would be significantly larger when embodiment was involved than when the same visual stimulus was presented without embodiment.

Participants

Seventy-three undergraduate students (37 female, 36 male) participated in the study for either course credit or $5.

Design

In a 2 × 2 between-subjects design, participants were randomly assigned to an attractiveness condition (*attractive* and *unattractive*) and a presentation condition (*mirror* and *playback*) and interacted with a confederate. Participants were assigned avatars with faces that had been pretested for attractiveness. Avatars in the attractive condition had faces that were rated as being significantly more attractive than avatars in the unattractive condition. Confederates were blind to condition and always saw the participant as having an average attractiveness face. In the mirror condition, participants were exposed to their avatar in a virtual mirror. In the playback condition, participants were shown the virtual recording of a previous participant in the same attractiveness condition (cycling through a different participant for each trial). In other words, participants in the playback condition saw the same visual stimulus as participants in the mirror condition. Thus, differences between these two conditions could isolate the unique contribution of the Proteus Effect—the degree to which *being in* an attractive avatar changes one's behavior above the amount provided by priming with the same visual stimulus. Measures were included to examine behavioral changes both within and outside the virtual environment after using the avatar.

Apparatus

Participants wore an nVisor SX head-mounted display (NVIS, Reston, VA) with a resolution of 1280 × 1024 and a refresh rate of 60 Hz. An optical tracking system (WorldViz PPT, Santa Barbara, CA) along with an orientation sensor (Intersense IS300, Bedford, MA) provided tracking on six degrees of freedom. The virtual environment was generated and programmed using Vizard 2.5 (WorldViz, Santa Barbara, CA). See Figure 1 for apparatus and example screen captures from the visual display.

Materials

Avatar attractiveness pretest. The avatar faces used in this study were the same as those in an earlier published study (Yee & Bailenson, 2007). As such, the pretest procedure is only briefly summarized here. We ran a pretest to select the attractive, unattractive, and average faces used in the study. Digital photographs of 34 undergraduate students (17 male and 17 female) from a different academic institution than the main study were used

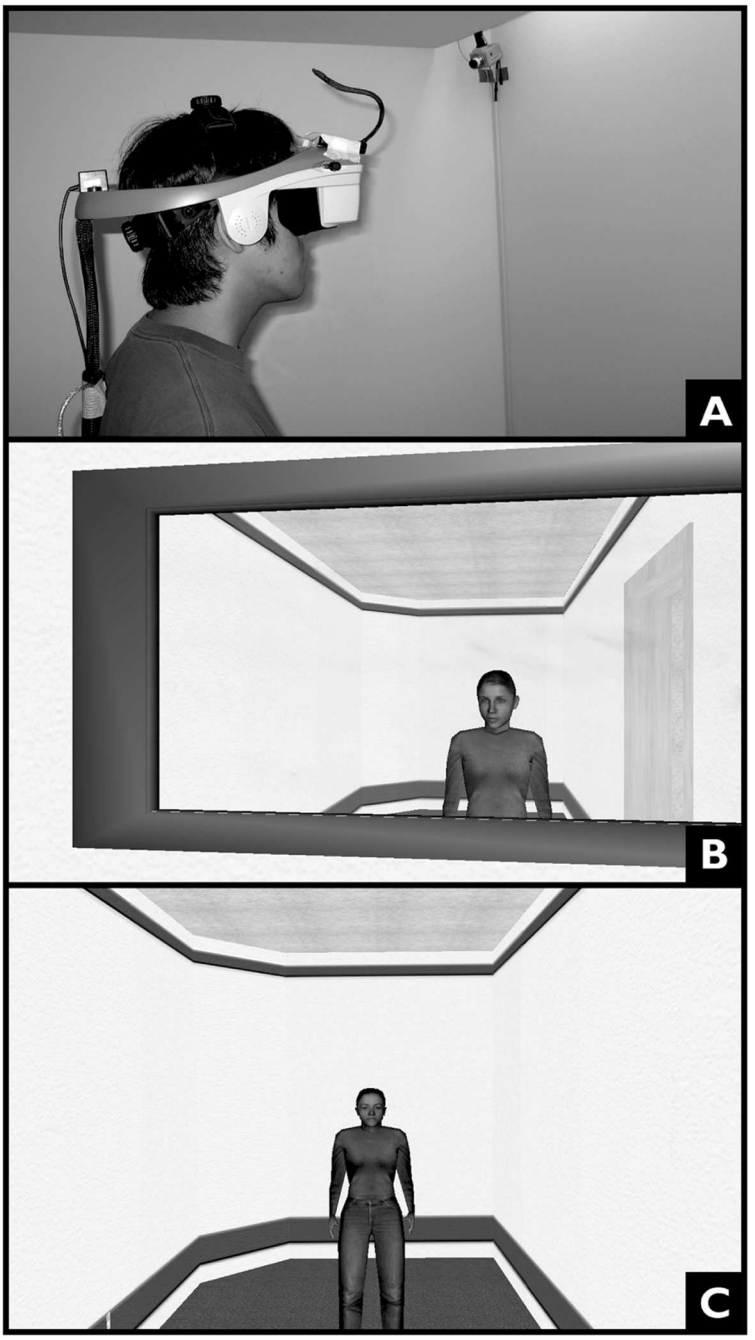

FIGURE 1 A) A participant wearing the head-mounted display; a camera that is part of the optical tracking system can be seen in the background. B) the participant's view of the virtual mirror (i.e., their virtual reflection); C) the confederate's avatar and the appearance of the virtual room.

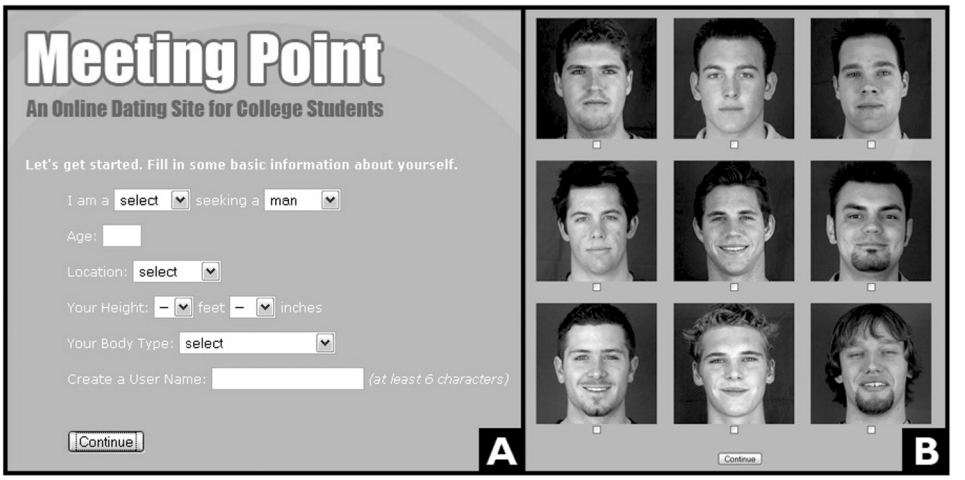

FIGURE 2 A) The layout and presentation of the profile generation page for the mock dating website. B) An example of the panel of photographs shown to participants.

in the pretest. Fourteen undergraduates from a separate subject population than the main study used a Web-based survey to rate the attractiveness of every screenshot's face on a unipolar 7-point fully labeled construct-specific scale (from *not attractive at all* to *extremely attractive*). Faces selected for the attractive condition were rated as being significantly more attractive than those in the unattractive condition, all p values $<.05$.

Mock dating web site. To measure potential behavior changes outside of the virtual environment, a mock dating Web site was created (see Figure 2a). Photographs of 10 male and 17 female undergraduates from another university were rated by 13 undergraduates selected from a different pool than those in the study itself. All the photographs were frontal portraits taken under similar lighting conditions of each individual smiling and standing in front of a blue screen. These undergraduates were asked to rate the attractiveness of each photographed individual on a fully labeled scale from 1 (*extremely unattractive*) to 7 (*extremely attractive*). Then for each gender, nine photographs were chosen that spanned as much of the attractiveness scale as evenly as possible. For the set of male photographs, the range was from 1.77 ($SD = 0.73$) to 6.08 ($SD = 0.76$), with a resulting mean of 3.84 and a standard deviation of 1.32. For the set of female photographs, the range was from 2.38 ($SD = 0.87$) to 6.23 ($SD = 0.60$), with a resulting mean of 4.06 and a standard deviation of 1.30 (see Figure 2b).

Procedure

When participants arrived at the study site, they were told that they would be participating in two studies. The first involved social interaction in a virtual

reality while the second involved romantic relationships in online dating Web sites. After informed consent, the experimenter helped the participants put on the head-mounted display for the first study.

Once immersed in the virtual environment, participants saw themselves in a room resembling the physical lab room they were in—a white room approximately 3 m by 10 m. Participants were then asked by the experimenter to turn around 180 degrees. In the mirror condition, participants were told that the reflection in the mirror was how others in the virtual environment saw them. To better convince participants that this was their reflection, they were asked to walk toward the mirror, tilt their heads from shoulder to shoulder, and bend at their knees while watching their reflection perform the corresponding actions. In the playback condition, participants were told that they were looking at a large television screen playing back a recording of someone who was in the room some time ago. To ensure that participants in both conditions had the same amount of experience walking and moving around, participants in the playback condition were also asked to walk closer to the "TV screen" and tilt their heads and bend their knees as in the mirror condition.

Participants then turned back around and saw the confederate's avatar on the other side of the room. The confederate was always of the opposite gender and was blind to condition; the confederate always saw the participant as having an average face (selected from the pretest). The confederate followed a script. First, participants were greeted and asked to walk closer to the confederate. To allow time for participants to socially interact with their avatars, the confederate asked the participant about their hobbies, interests, and plans after graduation. After the interaction, participants were taken out of the virtual environment.

Participants were then introduced to the second study. They were told that the second study involved understanding interpersonal compatibility on online dating websites. Specifically, participants were told that the goal was to understand how well people can identify compatible partners based on photographs alone. Participants were then asked to stand in front of a large blue screen and smile while the researcher took a photograph of them. This was done to increase the plausibility of the task when the participants later saw the photographs in the mock Web site (also taken in front of blue screens).

Participants were then seated in front of a computer and asked to complete a short profile on the prepared online dating Web site. They were then presented with nine photographs that they were told were chosen from the database based on their profile information. In reality, the same two sets of photographs were used based on the gender of romantic interest designated by the participant in the profile. Participants were asked to pick the two people in the photographs who they were most interested in and who they thought would be most likely be interested in them.

Measures

Partner choice. For each participant, we summed the attractiveness scores of the two individuals they chose from the photographs presented to them at the end of the mock dating Web site. We hypothesized that participants in the attractive condition would select significantly more attractive images than participants in the unattractive condition.

Reported height difference. While completing their profiles for the dating Web site task, participants were asked to self-report their own height. Unknown to them, their actual height was measured by the optical tracking system during the virtual reality portion of the study. This allowed us to calculate a difference between their reported height and their real height.

Given that previous research has shown that less attractive people are more likely to lie about their height in online dating Web sites (Toma, Hancock, & Ellison, 2008), we hypothesized that participants in the unattractive condition would be significantly more likely to boost their height than participants in the attractive condition.

Interpersonal distance. The virtual reality system tracked how close participants were willing to move toward the confederate. We hypothesized that participants in the attractive condition would walk significantly closer to the confederate than participants in the unattractive condition.

Participant attractiveness. Each participant's photograph was rated by 12 individuals drawn from a separate population than the participants in the study. Each participant was rated on a fully labeled 7-point scale, ranging from 1 (*extremely unattractive*) to 7 (*extremely attractive*). Participant attractiveness was used as a covariate in the analyses.

Demand characteristics. To show that the avatar manipulations were not so blatant as to create demand characteristics, participants were asked to guess the goals of the experiment. Two blind coders rated each open-ended response for the detection of the experimental manipulation.

RESULTS

To test H1, we conducted a series of analyses of variance (ANOVAs) with the attractiveness (attractive/unattractive) and presentation conditions (mirror/playback) as the independent variables, participant attractiveness as a covariate, and each of the measures as dependent variables in turn.

Partner Choice

In the ANOVA, participant attractiveness was not a significant covariate, $F(1, 68) = .02$, $p = .89$ $\eta^2 < .001$. The effect of attractiveness condition

was not significant, $F(1, 68) = 1.81$, $p = .18$, $\eta^2 = .02$. The effect of presentation condition was also not significant, $F(1, 68) = .04$, $p = .84$, $\eta^2 < .001$. The interaction was significant, $F(1, 68) = 5.31$, $p = .02$, $\eta^2 = .07$. A post hoc comparison using Fisher's least significant difference (LSD) test showed that in the mirror condition, participants in the attractive condition ($M = 10.47$, $SD = 0.98$) had a higher partner choice score than participants in the unattractive condition ($M = 9.43$, $SD = 1.39$), $p = .01$. In the playback condition, participants in the attractive condition ($M = 9.75$, $SD = 1.10$) did not have significantly higher partner choice scores than participants in the unattractive condition ($M = 10.02$, $SD = 1.31$), $p = .50$.

Reported Height Difference

In the ANOVA, participant attractiveness was not a significant covariate, $F(1, 68) = .14$, $p = .71$, $\eta^2 = .002$. The effect of attractiveness condition was not significant, $F(1, 68) = .46$, $p = .50$, $\eta^2 = .007$. The effect of presentation condition was also not significant, $F(1, 68) = .55$, $p = .46$, $\eta^2 = .008$. The interaction was significant, $F(1, 68) = 4.26$, $p = .04$, $\eta^2 = .06$. A post hoc comparison with Fisher's LSD test showed that in the mirror condition, participants in the unattractive condition ($M = 1.17$, $SD = 1.41$) were significantly more likely to increase their reported height than participants in the attractive condition ($M = .17$, $SD = 1.65$), $p = .05$. This is consistent with research on deception in online dating Web sites in that people lie strategically in dimensions that purportedly make them more socially attractive (Toma et al., 2008). In the playback condition, participants in the attractive ($M = .69$, $SD = 1.49$) and unattractive conditions ($M = 1.21$, $SD = 1.53$) did not have significantly different reported height differences, $p = .34$.

Interpersonal Distance

In the ANOVA, participant attractiveness was not a significant covariate, $F(1, 68) = .27$, $p = .60$, $\eta^2 < .001$. The main effect of the attractiveness condition was also not significant, $F(1, 68) = 1.34$, $p = .25$, $\eta^2 = .02$. The main effect of presentation condition was also not significant, $F(1, 68) = .05$, $p = .83$, $\eta^2 < .001$. The interaction was also not significant, $F(1, 68) = 1.39$, $p = .24$, $\eta^2 = .02$. While the interaction was not significant, the means showed that in the mirror condition, participants in the attractive condition ($M = 1.94$, $SD = 1.22$) walked closer to the confederate than in the unattractive condition ($M = 2.53$, $SD = 1.02$). In the playback condition, the distance for both attractive ($M = 2.19$, $SD = 1.09$) and unattractive conditions ($M = 2.18$, $SD = .92$) was very similar.

Demand Characteristics

Of the 73 participants, most thought the study tested the realism of virtual people or interactions with strangers. Six guessed that the goal of the experiment had something to do with a manipulation of virtual appearance. Of these six responses, only one specifically mentioned attractiveness as a variable that might have been manipulated—"maybe to determine interaction variation depending on relative attractiveness of avatars, or friendliness." Thus, overall, participants were not aware of the experimental manipulation of avatar attractiveness.

DISCUSSION

In our study, we found that identity cues in a digital self-embodiment led to a significantly greater amount of behavioral change than in the condition where the identical visual stimulus was provided without digital self-embodiment. Thus, while others have suggested that priming may underlie the Proteus Effect (Peña et al., 2008), our findings suggest that there is more to the picture. We argue that this additional mechanism is likely based on self-perception; identity cues provided via a digital self-embodiment augment behavioral effects above and beyond that created by priming and behavioral assimilation.

While more research is needed to pin down the exact psychological mechanism for the effect (and how priming might interplay with self-perception), these findings suggest that embodiment plays an important role in the Proteus Effect. Perceiving the exact same visual stimulus in and of itself did not produce significant behavioral changes in the study. In other words, it is some combination of believing that you are really in a different body or the sense of agency or interactivity in a new body that leads to the effects observed. Thus, embodiment and digital self-representation are important factors leading to the observed behavioral changes in the Proteus Effect studies and the current study. Moreover, this implies that digital embodiment is a unique lever for behavioral change.

One potential alternative explanation for the study findings is that cognitive load augments assimilative responses to priming (Dijksterhuis, Spears, & Lepinasse, 2001). One might argue that the mirror condition produced more behavioral assimilation because the cognitive load associated with operating an avatar is higher than that associated with simply watching an avatar in the playback condition. Given that immersive virtual environments are novel to the general population, the observed effects may have been due to a difference in cognitive loads; however, participants in both conditions operated and watched a digital representation in immersive virtual reality. And all participants were exposed to a novel technological environment.

Of course, we are not making the case that the Proteus Effect is either entirely driven by behavioral assimilation or self-perception (as both may occur at the same time), but rather, our study design isolated the effect of priming and thus allowed us to examine whether digital embodiment added anything to the behavioral outcome. Digital embodiment is an aspect of the phenomenon of interest that priming in and of itself does not address. On the other hand, self-perception provides a plausible explanation for why digital embodiment produced a significantly different outcome than when the identical visual stimulus was provided without digital self-embodiment.

The current work also hints at a variety of future studies. First of all, while participants perceived the virtual environment via first-person perspective in our study (and thus only had brief exposure to their avatar's appearances), other research has suggested that third-person perspectives can be more physiologically arousing (Reeves & Lim, 2006) and would allow the avatar to remain in the view of the user throughout their time in the virtual environment. Thus, a comparison of first-person and third-person perspectives might show that the effects can be enhanced in third-person perspective. The findings in the study demonstrated that our avatars can lead to behavioral changes even when the user is no longer in the virtual environment; behavioral changes from the Proteus Effect appear to persist in other kinds of social tasks, at least for a short duration. It would be interesting to further explore how long the Proteus Effect persists outside of the virtual environment. In particular, for regular gamers or users of online environments, how does regular reinforcement affect the duration of the lingering behavioral changes?

Every day, millions of users interact with each other via graphical avatars in real time in online games (Chan & Vorderer, 2006). All of them are using an avatar that differs from their physical appearance to some degree. In fact, most of them are using avatars that are attractive, powerful, youthful, and athletic. Theoretical frameworks of understanding our digital self-representations are important because choosing who we are is a fundamental part of being in a virtual environment. While it is easy to assume that avatars are entities we create and direct in virtual environments, research in the Proteus Effect shows that avatars are unique in their ability to recreate and direct us in turn.

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