

The Influence of Racial Embodiment on Racial Bias in Immersive Virtual Environments

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Abstract

Increasingly, people interact with others via digital representations, or avatars, that feature indicators of race. Nonetheless, little is known about the effects of avatar race on attitudes and behaviors. We conducted a study to determine how people's implicit racial bias is affected by the race of their avatar in an immersive virtual environment (IVE). Our results indicate that the effects of avatar race extend beyond digital spaces. People embodied by Black avatars in an IVE demonstrated greater implicit racial bias outside the IVE than people embodied by White avatars. These findings have important implications for strategies to reduce racial prejudice and provide new insights into the flexibility of racial identity and racial attitudes afforded by virtual technologies.

Introduction

Race—the categorization of people based on characteristics perceived indicative of a common ancestry ("AAPA Statement on Biological Aspects of Race", 1996)—plays a fundamental role in how people think of themselves and others. People categorize others by race immediately upon seeing them (Ito & Urland, 2003), and people's attitudes and behaviors towards others are consequently influenced by this categorization, even when people are unaware of this influence (Bargh, 1994; Hamilton & Sherman, 1994). Psychologists have long studied race and racial bias, because racial prejudice can generate extremely negative consequences for individuals and society. While this field continues to grow, a majority of research approaches race as an unchangeable trait. However, emerging digital technologies have rendered race somewhat flexible, enabling people to appear to others as one race while personally identifying with another.

Digital technologies now allow users to select the race of their avatars in forums like chat rooms, video games, and online communities like Second Life. Despite ample theoretical discussion of the impact of digital identities on race (see Turkle, 1995, for an early example), the tangible impact of digital race on technology users remains unknown. In this paper, we present a study which examined how racial representation in an immersive virtual environment (IVE) affects racial bias. Some participants viewed themselves in the IVE embodied as Black avatars and others viewed themselves as White avatars. We then measured the effects of the embodiment on implicit and explicit racial bias.

IVEs and Social Influence

Blascovich, Loomis, Beall, Swinth, Hoyt, and Bailenson (2002) argued that IVE technology provides a powerful methodological tool for studying issues of social influence. They developed a model of social influence in IVEs based on Allport's (1985) definition of social psychology as the study of actual, imagined, or implied others. According to their model, when IVEs feature sufficient behavioral realism and social presence, social influence effects can occur. For example, people performing tasks in IVEs while in the presence of avatars demonstrate classic social inhibition effects (Hoyt, Blascovich, & Swinth, 2003). Playing a violent video game in an IVE generates more violent attitudes and behaviors than playing on a less immersive platform (Persky & Blascovich, 2008). Digital environments do not need to be three-dimensional and fully immersive for social influence to occur, as these effects have been found in simple two-dimensional environments. Williams, Cheung, and Choi (2000) demonstrated that people can feel ostracized when playing an online game with competitors they visualize, even when what they see on the screen are simple colored representations. Even when people are told that the game is controlled by a computer, the effects of ostracism are about as negative as when they are ostracized by actual others (Zadro, Williams, & Richardson, 2004).

Understanding the effects of social influence in digital environments is increasingly important, as literally millions of people are having meaningful social, economic, and medical interactions on a daily basis via avatars in online communities (Miller, 2007). Features that identify race, such as skin color and facial structure, are inherent in these virtual representations. Moreover, racial cues are not ignored in these contexts: people automatically apply social principles in response to indicators of virtual

identity, like a voice or body, even if those cues are generated by a technology (Donath, 2001; Reeves & Nass, 1996). Only recently have researchers begun to examine the effects of race using IVEs. Dotsch and Wigboldus (2008) found that people with real-world aversions to a racial group demonstrate racial bias when interacting with avatars appearing of that race in IVEs. Eastwick and Gardner (2008) showed that the race of an avatar requesting help influences people's likelihood to comply. In their study of aggression and proxemic behavior in IVEs, McCall, Blascovich, Young, and Persky (in press) demonstrated that people's proxemic response to agents—digital human representations controlled by algorithms—is determined in part by agent race.

Consequently, understanding how users respond to race in IVEs is necessary for predicting and mitigating the activation and expression of stereotypes in IVEs. We next examine two potential theoretical frameworks that provide predictions for the effect of utilizing avatars of different races.

Perspective-taking

Imagining oneself in a different situation with different attitudes can have a powerful effect on attitudes and behaviors (Petrova & Cialdini, 2008). Explicitly assuming the perspective of a member of an out-group and imagining oneself as that person can reduce stereotypes about that out-group (Galinsky & Moskowitz, 2000). In traditional studies of perspective-taking, participants are briefly exposed to an image of another person—the model—and given verbal instructions to imagine themselves as the model. Assuming another's perspective encourages the use of neural processes typically used to evaluate the self (Ames, Jenkins, Banaji, & Mitchell, 2008), which in turn promotes an overlap in positive attitudes towards the self and the model. In many digital environments, people spend extended periods of time viewing and controlling their avatars. Because the experience of viewing oneself embodied as a different person is far more visceral than simply imagining oneself as that person, viewing oneself as an avatar of a different race could produce an even greater overlap in the concepts of self and other than occurs with implicit and explicit perspective-taking. For example, viewing oneself embodied as elderly in immersive virtual environments has been demonstrated to reduce stereotypical attitudes towards the elderly (Yee & Bailenson, 2007). The current work is the first to use IVEs to examine the effects of racial perspective-taking.

Stereotype activation

Contemporary social psychological research has demonstrated that indicators of social group identification, such as physical features indicating gender or race, can activate concepts relating to those social groups (Bargh, Chen, & Burrows, 1996). Often these concepts are widely-held stereotypes—in many cases negative—which can directly affect cognition, attitudes, and behavior. For example, the well-documented stereotype of Black Americans as prone to violence (Allport & Postman, 1947) has been demonstrated to make people better at detecting weapons following exposure to a Black face (Eberhardt, Goff, Purdie, & Davies, 2004). Stereotyping and prejudice of this kind can happen automatically, without intention or awareness (Bargh, 1994; Hamilton & Sherman, 1994).

Stereotypes are culturally defined, and knowledge of a stereotype does not indicate agreement. Because stereotypes are well-known, when stereotypes are activated in the presence of a stereotyped other or symbolic representation, implicit measures reveal bias, even in those low in prejudice (Devine, 1989). Those motivated to act

without prejudice control the explicit expression of prejudice, though these attempts are not always successful. They require not only awareness of the stereotype and its affect on judgment, but also the motivation and ability to control the stereotype (Bargh, 1999; Devine & Monteith, 1999).

Race detection happens very early in the processing of the face, even faster than detection of other social differences, such as gender, age, or emotional expression (Montepare & Opeyo, 2002). While perspective-taking theory suggests that viewing a picture of a person of another race and imagining oneself as that person could reduce implicit racial bias, the act of simply viewing a person of another race primes racial stereotypes.

Digital environments allow one to view oneself as a person of another race and interact with others as a person of that race. On the one hand, this might promote extension of positive concepts of the self to others. On the other hand, inaccurate embodiment may simply make race extremely salient and highlight the differences between the race of the person and the race of the avatar. Even if people suppress explicit expressions of prejudice, the salience of race as a differentiator could overwhelm the positive effects of perspective-taking and produce greater demonstrations of implicit racial bias.

Experiment

In this experiment, we studied how the race of a perspective-taking model (Black vs. White) and the representation of the model (imagined vs. embodied) affected racial prejudice. We were interested in determining if racial bias could be reduced, and because Whites demonstrate implicit racial bias favoring Whites, we also studied how participant race (White vs. non-White) interacted with model race and model representation. We measured both implicit and explicit racial bias because the theories of perspective-taking and stereotype activation offer competing predictions. Studies of perspective-taking show changes in both implicit and explicit bias (Galinsky & Moskowitz, 2000). Studies on stereotype activation demonstrate effects on implicit bias, but typically find that those motivated to behave without prejudice suppress explicit expressions of bias. We developed three hypotheses. First, because of the increased immersiveness of embodiment:

H1. Participants embodied as their models will produce larger shifts in racial bias than those who imagine their models, generating larger differences in implicit racial bias between participants embodied with Black and White models.

To compare perspective-taking theory and stereotype-activation theory, we developed two competing hypotheses representing their respective predictions:

H2. Perspective-taking theory: People with Black models will demonstrate less explicit and implicit racial bias than people with White models.

H3: Stereotype activation theory: People with Black models will demonstrate comparable explicit racial bias and more implicit racial bias than people with White models.

Method

Design

We used a 2 (participant race: White vs. non-White) x 2 (model race: Black vs. White) x 2 (model representation: imagined vs. embodied) between-participants design to determine if viewing oneself embodied as a model affected racial bias differently than

using text only to imagine oneself as a model. All participants began the experiment by engaging in a perspective-taking task outside the IVE. They were given a photograph of a model and were instructed to imagine themselves as the model. Participant race was determined by categorizing all self-reported White participants as White and all others as non-White. Model race was manipulated by presenting participants with models that were pre-screened to be either unambiguously Black or White. Model representation was varied by manipulating whether subjects were exposed only to verbal perspective-taking instructions to imagine themselves as the model and a two-dimensional picture of their model (imagined) or also viewed themselves embodied as their model in an IVE (embodied).

Participants

Ninety-eight undergraduate students (59 women and 39 men) participated in the study for class credit or pay. Participant race was categorized according to participants' responses to a racial self-identification question asked of all participants. There were 46 Whites, 21 Asians, 16 African Americans, 7 Hispanics and 8 "Other."

Materials

Face Pretest. All avatars were created from photographs of undergraduate-aged people who were not students from the university at which the study was conducted. These digital photographs were frontal photographs of individuals with neutral expressions, no facial hair, and no glasses, and consisting of at least 400 by 400 pixels. To minimize the risk that characteristics of a particular avatar face would influence participants' responses, we ran a pretest of fifty-seven screenshots of two-dimensional avatars, displayed from the shoulders up. The test included photographs of fifteen African American males, thirteen African American females, twelve White males, and seventeen White females. Thirteen participants from a population distinct from the main experimental population completed a web-based questionnaire to rate the attractiveness, racial ambiguity, and aggressiveness of the faces, and the ratings of all faces were averaged. Attractiveness was rated on a seven point bi-polar scale ranging from "Extremely attractive" to "Extremely unattractive." Participants rated racial ambiguity on a five point bi-polar scale ranging from "Definitely African American" to "Definitely White." Aggressiveness was rated on a five point uni-polar scale ranging from "Not aggressive at all" to "Extremely aggressive."

To ensure that the race of the avatars was clear to participants, all faces receiving an average rating other than "Definitely White" or "Definitely African American" were eliminated. Faces receiving average ratings of aggressiveness greater than "Slightly aggressive" were also eliminated. Of those remaining faces, those two faces in each gender-race combination receiving average attractiveness scores closest to "Neutral" were selected. Two additional White faces of each gender were selected to represent the confederate. The faces selected for the confederate received average attractiveness ratings of "Neutral," average aggressiveness ratings of "Somewhat aggressive" and average racial ambiguity scores of "Definitely White." Figure 1 provides examples of the faces selected for use in the experiment.



Figure 1. Example photographs of models, selected by pre-test. Photographs were viewed by participants during initial perspective-taking task. In the virtual environment, participants in the embodied perspective-taking condition viewed themselves embodied as avatars featuring their models' two-dimensional faces.

The Physical Lab Setting. The lab consisted of two rooms connected by an open doorway. A curtain divided the room where the study took place and was drawn back once the interaction began. This prevented the participant and confederate from ever seeing the other's face. (See Figure 2 for a photograph of the physical lab space.)



Figure 2. Equipment setup: A) head-mounted display and orientation tracker, B) positional tracking camera, C) rendering machine.

The Virtual Setting. The virtual interaction took place in a white room exhibiting the same dimensions as the physical lab room. A virtual mirror was displayed two meters behind the participant that tracked and then reflected the z-rotation (roll) of the participant's head and the body translation (translation on X, Y, and Z) of the participant, making participants' assigned avatars appear as their mirror images. As participants faced the mirror and moved their head and body, their avatar's "reflection" moved synchronously. For the interview portion of the experiment, the confederate's avatar appeared 5 meters in front of the participant. The confederate's avatar blinked naturally and exhibited lip movements that corresponded with the volume of the confederate's speech.

Apparatus. Perspectively-correct stereoscopic images were rendered by a 1700 MHz Pentium IV computer with an NVIDIA 5950 graphics card. Images were updated at an average frame rate of 60 Hz. Participants' head movements were tracked by a three-axis orientation sensing system (Intersense IS250, update rate of 150 Hz) and used to continually update the simulated viewpoint. The position of the participant along the x, y, and z planes were tracked via an optical tracking system (WorldViz PPT, update rate of 60 Hz). The system latency, or delay between a participant's movement and the resulting concomitant update in the head-mounted display (HMD), was 45 ms maximum. Vizard 2.5 software was used to assimilate the rendering and tracking. Participants wore an nVisor SX Head-Mounted Display (HMD) that featured dual 1280 horizontal by 1024 vertical pixel resolution panels that refreshed at 60 Hz. The display optics presented a visual field subtending approximately 50 degrees horizontally by 38 degrees vertically.

Procedure

One lead researcher and two additional research assistants--one male confederate and one female confederate--were present for each trial. Before the participant arrived, the lead researcher reviewed the list indicating each participant's randomly assigned condition. The lead researcher greeted each participant and offered the participant the informed consent form to review and sign. All participants were informed that the study examined social responses in IVEs.

All participants were presented with one of the photographs selected in the pretest. Participants in the Black model condition were presented with one of two images of Black faces of their gender (chosen according to a counterbalancing scheme), and participants in the White model condition were presented with one of two images of White faces of their gender. Utilizing similar language to the instructions given by Galinsky and Moskowitz (2000), all participants were instructed to, "Imagine a day in the life of this individual as if you were that person." They were then asked to imagine that this person was about to be interviewed for a job. Participants were informed that they would be presented with a series of interview questions in an IVE and were instructed to answer the questions "as you would if you were the person in the picture." (For the complete instructions, see Appendix A.)

Participants were led to the area of the lab where the virtual interaction took place, separated from the confederate with a curtain, and were assisted in putting on and the head-mounted display (HMD). The researcher then loaded the IVE and pulled back the curtain.

Participants were instructed to turn around 180 degrees. After turning, subjects in the embodied condition faced a virtual mirror. To ensure that participants viewed their

avatar for 60 to 75 seconds, participants were instructed to respond to a series of tests. First, participants were asked to confirm that they saw the reflection of their avatar in the mirror in front of them. They were informed that the image they saw in the mirror had the face of the person they had seen in the photograph and that this was how they would appear to others in the virtual environment. They were reminded to respond to the interviewer's questions as they would if they were the person they saw in the mirror. They were then asked to move their head and confirm that their movements were accurately mirrored. They were asked to walk closer to the mirror and confirm that their appearance in the mirror appeared normal. Lastly, they were asked to kneel on one knee such that they could no longer see themselves in the mirror and then rise again. They were asked to confirm that mirror properly displayed their movements.

Participants in the imagined condition performed the same series of tests as those in the embodied condition. Instead of seeing their avatar's reflection in a mirror, they saw a "window" which displayed a room identical to the one they were in (i.e., a mirror without their reflection in it). As participants completed the tests, they were asked to confirm that the window was still displayed correctly. Contrary to the embodied condition, subjects did not see their avatars and were not told how they appeared to others. (See Figure 3 for images of the virtual mirror and window.)

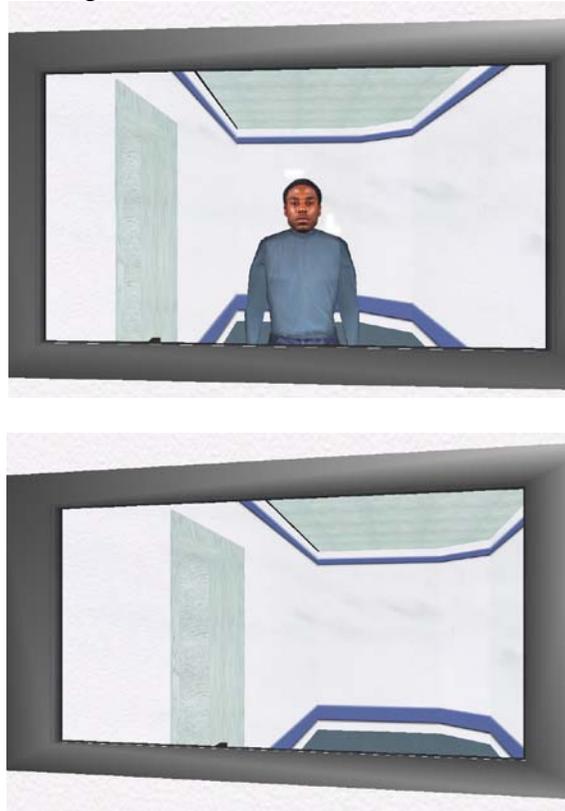


Figure 3. Virtual environments viewed by participants. Top image is virtual “mirror” seen by participants in the embodied perspective-taking condition (embodied here as Black male model). Bottom image is virtual “window” viewed by participants in the imagined perspective-taking condition.

After viewing either their avatar in the mirror or a window, all participants were asked to turn back around 180 degrees. As the participant turned, the researcher activated the display of the confederate avatar. The confederate was blind to the participant's race condition, as the participant's avatar face was represented to the confederate with an uncolored human-like face exhibiting no racial characteristics. The confederate gave a brief introduction explaining the interview process. Before the confederate began the interview, he or she asked the participant to move closer. The distance moved by the participant was recorded by the VR system and noted as *Distance 1*. The confederate asked the participant to again move closer, and the additional distance was noted as *Distance 2*. The interviewer then asked the participant a series of questions typical of a job interview, such as, "What is your prior job experience?" The complete script is included in Appendix B. During the course of the interaction, if the participant asked any questions of the confederate, he or she responded, "I'm sorry. I can't answer that question. Let's continue." After the participant responded to the last interview question, the confederate thanked the participant for her participation, and the lead researcher led the participant back across the room and drew the curtain, preventing the participant from viewing the confederate. After completing the experimental task, participants exited the virtual environment and were seated at a computer where they completed the Implicit Association Test (IAT) as well as a number of questionnaires, which included measures of explicit racial bias.

Measures

The Implicit Association Test. Immediately following participants' interactions in the virtual environment, the Implicit Association Test (Greenwald, McGhee, & Schwartz, 1998), or IAT, was administered. The IAT assesses implicit racial bias by comparing the strength of people's associations between two groups of concepts: pleasant and unpleasant and White American and African American. Words are displayed on a computer screen with positive or negative associations—"love" or "evil," for example—or names typically associated with White Americans or Black Americans—"Josh" or "Temeka," for example. Racial bias is determined by calculating the difference in the speed with which people sort words into concept categories, with almost all Whites and many Blacks sorting faster when positive concepts are paired with Whites and negative concepts paired with Blacks (Nosek, Banaji, & Greenwald, 2002). The list of names prescreened by Greenwald, McGhee, and Schwartz (1998) to be strongly associated with either White or Black Americans was used. Participants' IAT scores were calculated using the D1 algorithm, which divides differences between text blocks means by the standard deviation of overall latency to adjust for variability (Greenwald, Nosek, & Banaji, 2003).

Interpersonal Distance. Yee and Bailenson (2007) found that avatar features, such as gender and attractiveness, influence interpersonal distance in a similar way to real life. People with attractive avatars maintain smaller distances, just as attractive people do in real life (Bailenson, Blascovich, Beall, & Loomis, 2003). Recently, interpersonal distance between participants and avatars of another race has been used in virtual environments as a measure of racial bias (Dotsch & Wigboldus, 2008). To determine if racial embodiment affects interpersonal distance, participants' locations within the virtual environment were tracked in the IVE. Interpersonal distance was measured by how far away from the confederate the participant stood. All participants were placed at the same location in the

room before the interview began. Interpersonal distance was measured after the first and second times the interviewer asked the participant to come closer.

Self-Esteem. Self-esteem was measured following the IAT using Rosenberg's (1965) Self-Esteem scale. Self-esteem was included as a covariate because it has been demonstrated to moderate the effects of perspective-taking on prejudice. Because perspective-taking relies on the application of self-concept to an out-group, people with higher self-esteem produce more positive evaluations of an out-group following perspective-taking (Galinsky & Ku, 2004). Participants responded to 10 items on a 5-point fully-labeled scale, from "Strongly Disagree" to "Strongly Agree." The index was very reliable (Cronbach's $\alpha=.83$).

MRS and RAS. To measure conscious, self-reported beliefs and attitudes towards African Americans, the Racial Argument Scale (RAS) (Saucier & Miller, 2003) and portions of the Modern Racism (MRS) scale (McConahay, 1986) were administered. The RAS asked subjects to evaluate the strength of arguments that were either positive or negative towards African Americans. The RAS consisted of 8 positive and 8 negative arguments, and subjects were asked to indicate how well the argument supported its conclusion on a fully-labeled four-point scale ranging from "Does Not Support at All" to "Supports Very Well." The reliability of the RAS scale had an alpha of .70. A portion of the MRS scale was used to further assess participants' attitudes towards African Americans. Subjects were asked to rate their agreement with four statements about the current experiences of African Americans. Participants indicated their agreement with the statements on a fully-labeled five-item scale ranging from "Disagree Strongly" to "Agree Strongly." The reliability of this scale had an alpha of .67.

Results

The Implicit Association Test. A 2 (participant race: White or non-White) x 2 (model race: Black or White) x 2 (model representation: imagined or embodied) analysis of covariance, controlling for self-esteem, was conducted with participants' D1 IAT scores as the dependent measure. Analysis revealed a main effect for participant race $F(1, 89) = 15.7, p < .01$, partial $\eta^2 = .15$, with White participants ($M = 0.59, SD = 0.37$) demonstrating a greater White preference than non-White participants ($M = 0.24, SD = 0.47$). A main effect was also found for model race $F(1, 89) = 6.70, p = .01$, partial $\eta^2 = .07$, with subjects with Black models ($M = 0.52, SD = 0.47$) demonstrating greater White preference than those with White models ($M = 0.29, SD = 0.42$).

As indicated in Figure 4, this main effect of model race is largely driven by the interaction between model race and model representation $F(1, 89) = 4.67, p = .05$, partial $\eta^2 = .05$. In line with H1, participants who never viewed their avatars (imagined model representations) produced nearly identical IAT scores regardless of whether the model was White or Black. Post-hoc analyses (Tukey's LSD with an alpha of .05) revealed only one significant difference among the four conditions: Black embodied avatar participants demonstrated greater White preference than White embodied avatar participants. These results support H3, specifying stereotype activation.

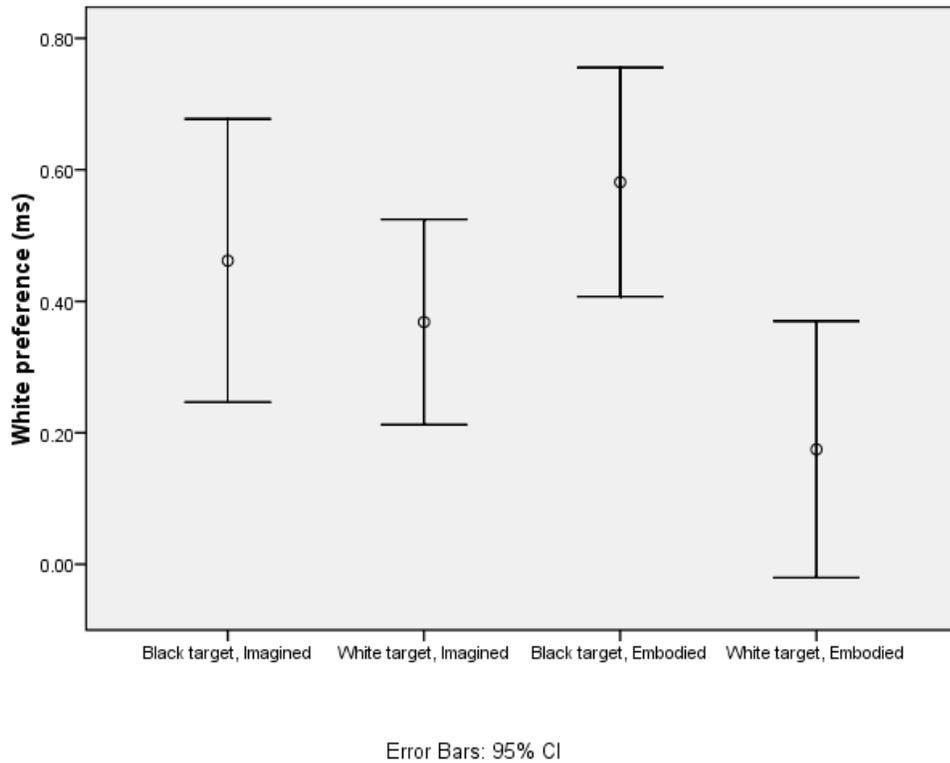


Figure 4. Mean IAT scores (D1 measure).

Interpersonal Distance. A 2 (participant race: White or non-White) x 2 (model race: Black or White) x 2 (model representation: imagined or embodied) analysis of covariance, controlling for self-esteem, revealed no significant effects for interpersonal distance.

Self-Esteem. To determine if self-esteem was affected by experimental condition, a 2 (participant race: White or non-White) x 2 (model race: Black or White) x 2 (model representation: imagined or embodied) analysis of variance was conducted. The analysis revealed no significant effects for self-esteem, though self-esteem was used as a covariate in all other analyses.

RAS Score. Results of a 2 (participant race: White or non-White) x 2 (model race: Black or White) x 2 (model representation: imagined or embodied) analysis of covariance, controlling for self-esteem, revealed no significant effects on RAS Score.

MRS Score. A 2 (participant race: White or non-White) x 2 (model race: Black or White) x 2 (model representation: imagined or embodied) analysis of covariance, controlling for self-esteem, revealed a significant main effect for participant race on MRS score, $F(1, 89) = 4.43$, $p < .05$, $\eta^2 = .05$. White subjects generated higher scores ($M = 2.84$, $SD = 2.05$), indicating higher levels of racism, than non-White subjects ($M = 0.84$, $SD = 2.07$).

Discussion

The results indicate that the experience of being embodied by an avatar in an immersive virtual environment affects users enough to change automatic tests of racism outside the virtual environment. With embodied perspective-taking, people's implicit

racial bias varied depending on the model race, while with imagined perspective-taking no significant differences were found between participants with White and Black models. These findings generate preliminary support Hypothesis 1 and indicate that the experience of embodying another person is fundamentally different than imagining oneself as another person.

Participants embodied as Black demonstrated levels of implicit racial bias favoring Whites that were higher than participants embodied as White. In addition, the only difference in explicit racism was between Whites and non-Whites. This finding is typical and is not attributable to the experimental manipulation. The implicit and explicit results provide support for the stereotype activation theory (H3), which predicted that participants embodied as Black would demonstrate the highest levels of implicit racial bias and levels of explicit bias comparable to participants embodied as White. While the absence of a main effect for participant race on implicit bias may seem surprising at first, it is consistent with the stereotype activation hypothesis. People aware of stereotypes express implicit bias when stereotypes are activated, regardless of their agreement with them, while people low in prejudice control the explicit expression of stereotypes (Devine, 1989). The findings do not support the predictions of perspective-taking theory (H2) and indicate that automatic racial bias is not reduced by embodying a person of a disfavored racial group. Further research is needed to determine the mechanism responsible for this outcome, although the results suggest that negative stereotypes associated with Blacks were more salient for participants embodied as Black.

It is important to note that the only difference in implicit bias was between the two embodied conditions. Participants who imagined their White or Black models demonstrated similar, middling levels of racial bias. Given the body of literature on perspective taking, this result is unanticipated. The absence of an effect may be the result of our relatively small sample size and a larger sample may have generated significant differences. While stereotype activation explains the difference between the embodied conditions, it does not explain the results of the imagined conditions. Future studies with larger samples are needed to further investigate perspective taking in IVEs.

There are several limitations to the study. First, our participant pool was limited to college-aged students living in the United States. People of different ages, backgrounds, and cultures could have different responses, and replicating this study with different populations in different locations is an important next step. Second, with our sample size we were unable to draw conclusions about the responses of specific racial groups other than Whites. Future studies should study the responses associated with individuals of different races as well as avatars of different races. Third, this study featured a specific context (interview) led by a White confederate using only Black or White perspective-taking models. Fourth, the study examined only short-term effects of racial embodiment. It is possible that short-term effects weaken or strengthen over time. Likewise, long-term embodiment may produce very different effects from the ones reported here.

The results of the current study suggest that the immersiveness of IVEs encourages stereotype activation to the point that it overwhelms any positive effects of perspective-taking. Additional studies should vary the immersiveness of the virtual environment, perhaps featuring non-immersive two-dimensional environments, to clarify the relationship between immersiveness, stereotype activation, and perspective-taking. Other future studies should examine the effects of racial embodiment more precisely.

Because the IAT confounds positive-White associations and negative-Black associations, the results do not specify the extent to which racial embodiment affects positive and negative associations. Future studies should use alternate measures to examine this relationship more closely.

Those who have championed digital technologies as a means to render race flexible and racism obsolete may be disheartened by these results, which indicate that stereotypes and prejudice play a powerful role in digital environments. However, the results do not provide a complete or conclusive explanation of the role of race in digital environments. Additional studies are necessary to reproduce and extend the results reported here. Interventions using IVEs have shown successful reductions in ageism (Yee & Bailenson, 2006), so further investigation is needed to determine if IVEs can produce reductions in other forms of prejudice. Researchers hoping to leverage digital technologies to reduce prejudice should continue to examine virtual reality interventions.

While it is currently uncertain what impact digital technologies will ultimately have on the social problem of racial prejudice, it is certain that with the increasing use of avatars in digital technologies and the increased immersiveness of these technologies, the influence of avatar race on implicit racial bias has serious implications. With the increased flexibility of identity afforded by emerging technology, racial attitudes and displays of prejudice may be affected in unexpected ways. Investigating the role of race in digital environments is not only important for those participating in digital environments. As this study demonstrates, users' experiences with race in digital environments affect their attitudes and behaviors in the real world.

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Appendix A

Imagine a day in the life of this individual as if you were that person, looking at the world through his/her eyes and walking through the world in his/her shoes. Today you are interviewing for a job as an administrative assistant. If you are hired, you will work directly for the person interviewing you today. Respond to the interviewer's questions as you would if you were the person in the picture.

Appendix B

"Thank you for coming in to interview today. I am looking to hire a well-qualified candidate to serve as my administrative assistant. Now, to determine if you would be a good fit, I'd like to ask you a few questions. Are you ready to begin? Come towards me."

1. What are your skills?
2. What is your prior job experience?
3. What are your weaknesses?
4. Do you take pride in your personal appearance?
5. Where do you see yourself in five years from now?
6. Do you consider yourself a hard worker?
7. How would your friends describe you?
8. How do you handle conflict?
9. Describe your attitude and behavior when interacting with superiors.
10. How do you respond to constructive criticism?

"Please come closer"

11. Can you give an example from your past of a time you had to struggle to achieve your goals?
12. If someone else received a promotion that you felt you deserved, how would you respond?
13. Why do you deserve this job?
14. What else should we know about you?
15. What do you think about our interview process?

"Thank you for time. If we determine that you are the best candidate for the job, we will contact you."