Multimodal Technologies and Interaction

MDPI

Article

Perspective-Taking in Virtual Reality and Reduction of Biases against Minorities

Vivian Hsueh Hua Chen [1,*], Sarah Hian May Chan [2] and Yong Ching Tan [2]

[1] Wee Kim Wee School of Communication and Information, Nanyang Technological University, 31 Nanyang Link, Singapore 637718, Singapore
[2] College of Humanities, Arts and Social Sciences, Department of Psychology, Nanyang Technological University, 48 Nanyang Avenue, Singapore 639818, Singapore; sara0057@e.ntu.edu.sg (S.H.M.C.); ytan142@e.ntu.edu.sg (Y.C.T.)
* Correspondence: chenhh@ntu.edu.sg

Abstract: This study examines the effect of perspective-taking via embodiment in virtual reality (VR) in improving biases against minorities. It tests theoretical arguments about the affective and cognitive routes underlying perspective-taking and examines the moderating role of self-presence in VR through experiments. In Study 1, participants embodied an ethnic minority avatar and experienced workplace microaggression from a first-person perspective in VR. They were randomly assigned to affective (focus on emotions) vs. cognitive (focus on thoughts) perspective-taking conditions. Results showed that ingroup bias improved comparably across both conditions and that this effect was driven by more negative perceptions of the majority instead of more positive perceptions of minorities. In Study 2, participants experienced the same VR scenario from the third-person perspective. Results replicated those from Study 1 and extended them by showing that the effect of condition on ingroup bias was moderated by self-presence. At high self-presence, participants in the affective condition reported higher ingroup bias than those in the cognitive condition. The study showed that in VR, the embodiment of an ethnic minority is somewhat effective in improving perceptions towards minority groups. It is difficult to clearly distinguish between the effect of affective and cognitive routes underlying the process of perspective-taking.

Keywords: cognitive perspective-taking; affective perspective-taking; VR avatar; embodiment in VR; virtual reality; presence; ingroup bias

Citation: Chen, V.H.H.; Chan, S.H.M.; Tan, Y.C. Perspective-Taking in Virtual Reality and Reduction of Biases against Minorities. *Multimodal Technol. Interact.* **2021**, *5*, 42. https://doi.org/10.3390/mti5080042

Academic Editors: Kangsoo Kim, Sun Joo (Grace) Ahn and Gerd Bruder

Received: 7 May 2021
Accepted: 26 July 2021
Published: 31 July 2021

1. Introduction

Embodiment in virtual reality (VR) has been an ongoing research field. The term *embodiment* has been applied across various multidisciplinary contexts, and therefore its conceptualization differs largely based on the context of which embodiment is being considered. In the context of VR, however, embodiment can be defined as sensations that result from being inside, having, and controlling any object in VR [1]. For VR particularly, embodiment has been linked to presence (the sense of being in a virtual location), in which embodiment plays a role in an individual's self-representation [2–4]. The experience of individuals embodying a different identity reduces cognitive boundaries between the self and the other, effectively enabling individuals to adopt the social identity of the other [5]. Past studies have examined how VR can be used to mitigate prejudice by allowing users to embody an avatar of a different racial group. Prejudice, in most of these studies, was measured as implicit racial bias using the implicit association test (IAT) [6]. However, the results of these studies have been inconclusive. While some studies have found that VR can be used to reduce prejudice [7–9], one study found that VR led to increased prejudice instead [10]. Moreover, Hasler, Spanlang and Slater [11] found no difference in implicit prejudice change between White participants who embodied a White ingroup avatar and

those who embodied a Black outgroup avatar. One of the reasons for the inconclusive results might be due to how perspective-taking occurs in VR.

Perspective-taking is a person's ability to interpret the world from other points of view, and it enables them to predict other individuals' behaviors and reactions [12,13]. Studies show that perspective-taking is effective in reducing racial prejudice [14,15] and promoting prosocial behavior towards outgroup members [16–18]. Therefore, most past studies assume VR embodiment allows participants to take the perspective of racial others by simply putting them into another identity in VR, and that simple embodiment subsequently influences participants' attitudes towards racial outgroup members [7–9].

Based on this conceptualization, embodiment is often used interchangeably with cognitive perspective-taking in VR [8,9,19]. However, Todd and Galinsky [20] delineated perspective-taking mechanisms as being affective or cognitive. Cognitive perspective-taking is an individual's ability to deduce another's beliefs or thoughts, while affective perspective-taking is the individual's ability to deduce the feelings or emotions of another [21]. Theoretically, both cognitive and affective perspective-taking mechanisms, when studied separately, can lead to prosocial behaviors [22]. Only a few studies have empirically tested multiple perspective-taking mechanisms together. Mixed results have been obtained regarding the effect of perspective-taking on improving intergroup attitudes. One study found a cognitive mediator (in the form of situational attributions, which is related to one's beliefs or thoughts) to be the most important in reducing prejudice [23], while it was found to be an affective mediator (in the form of feelings of perceived injustice for the outgroup, which is related to one's feelings and emotions) in another [24]. To the best of our knowledge, no study has looked at affective perspective-taking mechanisms or comparing multiple perspective-taking mechanisms simultaneously for their role in changing perceptions of outgroup ethnic minorities in VR. As such, to address this research gap, the current study aims to compare the effect of affective and cognitive modes of perspective-taking through racial embodiment on intergroup attitudes in a VR environment.

A related issue that has been discussed in the VR embodiment literature is sex differences. Kessler and Wang [25] showed that female participants were more strongly embodied than males. This same effect was verified in a Western sample, but the opposite was found in an East Asian sample, where male participants were more embodied than females [26]. In another study [27], female participants perceived lower levels of presence and more eeriness when they embodied male avatar hands, whereas male participants did not react to the difference in the sex of the virtual hands in terms of perceived presence in VR. Embodying female avatars has also been found to lead to higher levels of implicit gender bias than embodying male avatars [28]. These inconclusive results about sex differences in VR embodiment suggest more studies are needed to add to the literature. This study, therefore, also explores the potential effects of embodying a male minority avatar in VR.

Furthermore, the majority of studies on embodiment in VR mentioned earlier have simply put participants into a partial virtual body that represents racial others and involved simple tasks, such as body movement. Past studies have found that social interaction may instead enhance the effects of immersion in VR, especially if the interactions have high fidelity, due to having common goals that allow them to engage in the virtual experience more deeply [29–31]. Therefore, the current study not only allowed participants to embody an ethnic minority but also involved them interacting with non-player VR characters of the majority group who displayed microaggression.

The present study examined whether perspective-taking instructions given in a cognitive or affective manner have an effect on reducing ingroup biases among participants from the majority ethnicity through the virtual embodiment of a minority in Singapore.

2. Cognitive vs. Affective Perspective-Taking

Generally, perspective-taking is regarded as a critical social thinking skill that is fundamental to social group participation [32] and proper social functioning [14]. The ability to take the perspectives of others is significant in many social domains, such as

moral reasoning [33], altruism [34], social aggression [35], empathy [36], and fundamental attribution error [37].

Two types of mechanisms underlying perspective-taking—affective and cognitive—have been identified in past research. Affective mechanisms include parallel empathy—feeling the same emotions a target experiences—and reactive empathy—empathic concern or emotions felt in response to a target's experience [38]. Cognitive mechanisms, on the other hand, include the process of self-other merging, which entails greater overlap between mental representations of the self and the other [39], as well as shifts in attributional thinking—from dispositional to situational attributions of target behavior [40]. When people are encouraged to take the perspective of an outgroup member, they are more likely to adopt a pattern of attributional thinking that they would apply to ingroup members or themselves [23]. That is, they are more likely to attribute a negative outcome to external situational factors instead of stereotype-consistent dispositional factors.

Despite the neurological evidence that there is a difference between cognitive and affective perspective-taking [21], there are very few empirical studies that have attempted to distinguish between cognitive and affective perspective-taking. Batson and colleagues [41] investigated whether affective perspective-taking (empathy) towards members of stigmatized groups could improve the individual's attitudes towards the group in general. Two experiments found that inducing empathy towards a young woman with AIDS and towards a homeless man resulted in more positive attitudes towards the aforementioned two groups. A third study used convicted murderers, a highly stigmatized group, as the target, and found significantly improved attitudes towards them about one to two weeks later. This study only studied affective perspective-taking.

Two studies have empirically tested the effect of both affective and cognitive perspective-taking on intergroup attitudes. Dovidio and colleagues [24] examined the effect of perspective-taking on White participants' attitudes towards Blacks and further explored the mediating roles of various affective (empathic concern, personal distress, feelings of injustice, liking) and cognitive (self-other overlap, cognitive representations of the victim, stereotyping) mediators. The results found participants in the perspective-taking condition showed better attitudes towards Blacks compared to the control conditions and that the only reliable mediator was an affective one—feelings of injustice. However, the opposite result was found in Vescio, Sechrist, and Paolucci's [23] study. They examined the effects of perspective-taking on intergroup attitudes and investigated the mediating roles of affective (empathy) and cognitive (situational attributions) mechanisms. The results found that perspective-taking led to better intergroup attitudes compared to taking a detached and objective perspective and that situational attributions (cognitive) was a more reliable mediator of this relationship compared to empathy (affective).

Therefore, it remains unclear whether affective or cognitive modes of perspective-taking will exert differential effects on intergroup attitudes. To fill this research gap, the current study directly compares the two mechanisms using a between-subject design.

3. Self-Presence

Self-presence refers to the extent to which people are able to perceive their virtual self through the embodiment of a virtual body [42]. It is a state in which individuals perceive their virtual self-representation as if it were their actual self [3] and gives them an awareness that they are inside a virtual environment [2]. Through experiencing self-presence, a person's identity becomes intertwined with their virtual self-representation, which then impacts their offline behavior [43]. Attributes and experiences characteristic of their embodied outgroup may also be internalized and integrated into their own perception of themselves [2]. It is worth noting that perspective-taking and self-presence are two distinct concepts in the current study. Perspective-taking refers to the ability of an individual to either (1) take on the viewpoint of another individual's thoughts, and beliefs (cognitive perspective-taking) or (2) feel another individual's feelings and emotions (affective perspective-taking) [20,21]. The emphasis is on shifting the perception to that

of others. Self-presence, on the other hand, focuses on the overlapping of the virtual and actual self.

The literature has suggested that presence and self-presence in VR can influence real-world attitudes and trigger behavioral change [44]. Self-presence in a virtual environment affects one's perception of their identity and body image [43,45]. The greater the level of self-presence, the more likely one would use their virtual representation to make judgments of themselves and others. Self-presence is also the mechanism through which mirrored selves are realized [43]. Mirrored selves are a phenomenon proposed by Behm-Morawitz [43], where the mirror version of the self (virtual representation) is reflective of the real self (offline self). The mirror self is not just a copy of the self but a simulated extension that can influence attitudes and behavior, both online and offline. In her study on health and appearance, Behm-Morawitz [43] found that self-presence had a strong influence over how participants perceived their mirrored selves, significantly predicting offline behavior.

Through stimulating a heightened sense of realism, participants undergo an attitude change in the online world that can be extended to the offline world [46,47]. For example, participants who experienced a VR simulation of being color-blind were found to be twice as more likely to help a color-blind person compared to participants who had only imagined being color-blind [46]. Therefore, in Study 2, we investigate the moderating role of self-presence in the relationship between perspective-taking and intergroup attitude.

4. Overview of Studies

Two experiments were conducted to test the two proposed perspective-taking mechanisms (affective vs. cognitive) via VR embodiment of an ethnic minority avatar in changing attitudes towards minorities in Singapore. Singapore is a multiracial country. However, ethnic Chinese are by far the largest majority group, making up more than 75% of the population [48]. A 2016 survey of 2000 Singapore residents aged 21 and older found that 60% have heard racist comments and that almost half of those were made by a colleague, highlighting the problem of pervasive racial prejudice in the society [49]. In the present studies, ethnic Chinese (majority group) participants embodied an ethnic minority avatar and experienced microaggression in a work setting. Both studies employed a between-subject design to compare the proposed affective and cognitive mechanisms of perspective-taking.

In Study 1, VR was experienced from the first-person perspective. The study sought to test the effectiveness of embodying a minority on improving perceptions of minorities, ingroup bias, empathy, and attributional thinking. The main aim of this study was to compare affective and cognitive mechanisms of perspective-taking on these outcomes. In Study 2, VR was experienced from the third-person perspective. The study sought to replicate the results from Study 1 and extend them by including a behavioral measure of helping behavior and examining the moderating role of self-presence.

4.1. Study 1

Study 1 examined the effectiveness of a VR avatar embodiment from the first-person perspective on reducing biases against minorities. It aims to empirically test the effect of affective vs. cognitive perspective-taking mechanisms in changing the majority groups' attitude, closeness, and ingroup bias towards minorities. Ingroup bias refers to differential treatment towards the ingroup and outgroup. While implicit measures of prejudice take this relative nature into consideration [6,50,51], studies that examine explicit measures of prejudice typically do not and instead solely focus on attitudes toward the outgroup. One exception is a study conducted by McConnell and Leibold [52] where explicit racial attitudes were operationalized as the relative difference between attitudes toward ingroup and outgroup and were found to correlate with implicit racial prejudice (implicit association test) and a relative behavioral measure of social interaction (ingroup vs. outgroup experimenter ratings). Study 1 expands this literature by including ingroup bias as a variable. The following hypotheses are proposed.

Hypothesis 1. *Embodying a minority avatar in VR will lead to more positive attitudes towards minorities.*

Hypothesis 2. *VR embodiment will reduce ingroup bias, as measured by attitudes.*

Hypothesis 3. *Embodying a minority avatar in VR will lead to greater self-other overlap with minorities.*

Hypothesis 4. *VR embodiment will reduce ingroup bias, as measured by self-other overlap.*

Hypothesis 5. *The relationship between affective condition and ingroup bias will be mediated by empathy.*

Hypothesis 6. *The relationship between cognitive condition and ingroup bias will be mediated by situational attribution.*

As reviewed earlier, few studies have directly compared affective vs. cognitive mechanisms of perspective-taking, and results have been mixed [23,24]. Thus, we took an exploratory approach to the following:

Research Question 1. Will there be differences in the effect of VR embodiment between affective and cognitive conditions, on attitudes toward minorities, self-other overlap with minorities, ingroup bias measured by attitudes, or ingroup bias measured by self-other overlap?

4.1.1. Method

Participants

Participants were recruited through email sent to randomly selected email lists in a public university in Singapore. Recruitment criteria required participants to be Singaporean citizens of Chinese ethnicity (majority group) and aged 21 and above. Based on a medium effect size of $f = 0.25$, an a priori power analysis performed with G*Power 3.1 [53] for alpha = 0.05 and power = 0.80 indicated a sample size estimate of $n = 62$ based on a repeated-measures ANOVA with within-between interaction.

The final sample consists of 71 participants (33 females; age: M = 24.28, SD = 1.75). The experiments were completed on an individual basis, and participants were randomly assigned to the affective ($n = 35$) and cognitive ($n = 36$) conditions. Participants were paid SGD 5. The study protocol and all procedures performed were approved by the University ethics committee and in accordance with the 1964 Helsinki declaration. Informed consent was obtained from all participants.

Apparatus

The VR simulation was developed with the Unity platform. Participants wore an HTC Vive head-mounted display (HMD) headset with full auditory and visual immersion. The experimental setup involved two computers: the survey computer, in which participants filled out questionnaires, and the computer that ran the VR simulation, which was operated by a researcher. A chair was fixed in the middle of the room, where participants were seated and equipped with the VR headset to view the VR simulation. Participants also held one controller in each hand to simulate hand movements and interact with objects in the VR environment.

VR Simulation

All participants viewed the simulation from the first-person perspective (see Figure 1). The participant embodied a male ethnic minority office worker in the VR simulation that consisted of three different scenes. In the first scene, the participant read instructions to arrange items on a desk. This was done to orientate them in the virtual environment. A mirror was placed on the desk for the participant to view the minority avatar they embodied. In addition, there was a name holder on the desk that showed the embodied

avatar's name, which was a common Malay name in Singapore. The second scene began once the participant finished rearranging their items. The participant was now seated in a meeting room and listened to a discussion regarding the distribution of workload. During the discussion, a female Chinese colleague made stereotypical remarks towards the participant. The remarks implied that the participant was incapable of performing a difficult financial task because of his ethnicity. The third scene then began. The participant was now seated in a conference room and watched another male Chinese colleague make condescending remarks towards a fellow ethnic minority colleague. The remarks mocked the colleague's dietary restrictions associated with his ethnic group.

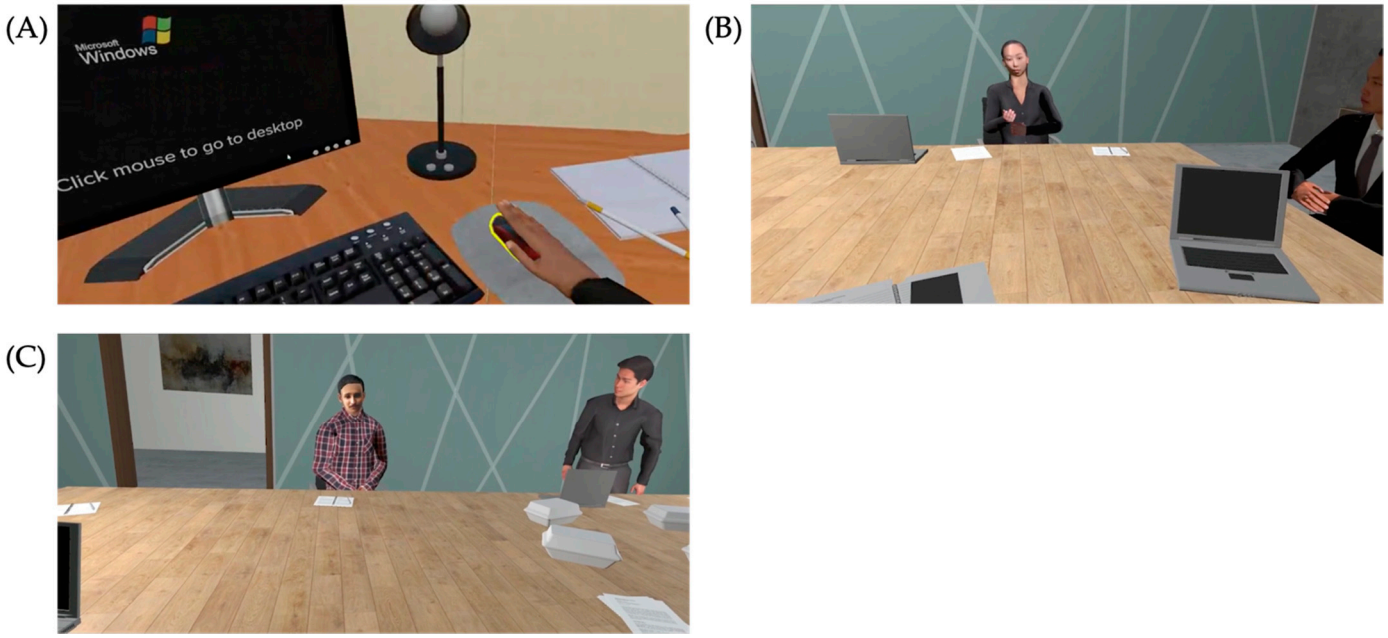

Figure 1. Screenshots depicting (**A**) scene 1, (**B**) scene 2, and (**C**) scene 3 in Study 1 (first-person perspective).

Procedure

Upon arrival at the lab, participants completed a pre-test survey that measured their pre-VR baseline (a) attitudes towards and (b) self-other overlap with members of the majority and minority groups. Then participants were randomly assigned to read the following instructions for the affective or cognitive conditions:

Affective instructions: You will now start your VR experience. As you are doing so, please focus on your feelings about the situations that occur. What are your emotional responses to these situations? How do these situations make you feel? Remember, please pay attention to how you are feeling.

Cognitive instructions: You will now start your VR experience. As you are doing so, please focus on your thoughts about the situations that occur. How would you analyze these situations? What thoughts come to mind in response to these situations? Remember, please pay attention to what you are thinking.

After this, participants indicated that they understood the instructions clearly before proceeding. Next, participants were directed to sit on the chair in the middle of the room and received identical, short briefings on how to use the controllers in the simulation. Once participants were ready, the researcher started the simulation. Once the simulation ended, participants were redirected to the survey computer to finish the post-test survey, which measured post-VR attitudes, self-other overlap, and proposed affective and cognitive mediators.

Measures

Attitudes. Participants' attitudes were measured using feeling thermometers. The feeling thermometer measures favorability [54] and allows participants to make fine-grained distinctions using a continuous scale [55]. Three thermometers from a scale of 0 to 100° ("Very Cold–Very Warm", "Unfavourable–Favourable", "Dislike–Like") were used to measure participants' attitudes towards majorities and minorities, respectively. The scale showed good internal reliability (majorities: pre-test Cronbach's $\alpha = 0.95$, post-test Cronbach's $\alpha = 0.98$; minorities: pre-test Cronbach's $\alpha = 0.96$, post-test Cronbach's $\alpha = 0.97$).

Ingroup bias for attitudes was computed as the difference between attitudes towards majorities and minorities, with larger positive scores reflecting greater ingroup bias [52].

Self-other overlap. The inclusion of others in the self scale [56] was used to measure how close the participant felt towards majorities and minorities. The scale consists of seven depictions of two circles with increasing overlap, the first representing the self and the second representing the other. The scale ranged from 1 (no overlap at all) to 7 (almost completely overlapping).

Ingroup bias for self-other overlap was computed as the difference between self-other overlap with majorities and minorities (higher scores reflect greater ingroup bias).

Empathic feelings. Four items adapted from Batson et al. [41] were used to measure empathy. Participants rated the degree they felt "moved", "compassionate", "soft-hearted", and "warm" when they thought back to the experience of microaggression in VR, using a seven-point Likert scale (1 = "Not at all", 7 = "Extremely"). Responses to each emotion were averaged to compute a score for empathy ($\alpha = 0.75$).

Situational attributions. Participants were asked to think about the two scenarios in VR where they experienced and witnessed prejudiced remarks. Specifically, they were asked to think about (a) the scene when the colleague from the majority ethnicity made certain remarks regarding workload division and (b) the scene when the colleague from the majority ethnicity made certain remarks to another colleague from a minority ethnicity during the lunch meeting. For each scenario, participants rated how important situational factors were in causing what happened on a scale of 1 = "Extremely unimportant" to 9 = "Extremely important" [23]. Situational factors were defined as the circumstances of the situation or factors beyond the victims' control. Ratings for both scenarios were averaged to create a score for situational attributions (Cronbach's $\alpha = 0.79$).

Data Analysis

To investigate differences in attitudes towards minorities and majorities from pre-test to post-test and how this differed by condition, a mixed factorial analysis of variance (ANOVA) with time (pre vs. post) and group (minority vs. majority) as within-subject factors, and condition (affective vs. cognitive) as a between-subject factor was conducted. Post hoc paired *t*-tests were conducted with a Bonferroni corrected alpha level of 0.013. This was repeated for self-other overlap.

To examine the mediational roles of empathy and situational attributions in affective and cognitive conditions, respectively, we first compared if the conditions had an effect on these variables by conducting independent samples *t*-tests. Mediational analyses were conducted using Model 4 of the PROCESS macro (version 3.5) in SPSS [57].

We further investigated if there were any sex differences. Chi-square tests on the distribution of sex between groups were first conducted. Next, sex was included as a between-subject factor in a mixed factorial ANOVA (sex × condition × time × group) for attitudes and self-other overlap, and in a factorial ANOVA (sex × condition) for empathy and situational attributions.

4.1.2. Results

Attitudes

There was no main effect of condition $F(1, 69) = 2.30$, $p = 0.13$, $\eta_p^2 = 0.03$, and no main effect of group $F(1, 69) = 0.55$, $p = 0.46$, $\eta_p^2 = 0.01$. The main effect of time was significant $F(1, 69) = 26.28$, $p < 0.001$, $\eta_p^2 = 0.28$. The time × group interaction effect was significant $F(1, 69) = 21.08$, $p < 0.001$, $\eta_p^2 = 0.23$. The remaining interaction effects all failed to reach statistical significance—time × condition $F(1, 69) = 2.56$, $p = 0.11$, $\eta_p^2 = 0.04$; group × condition $F(1, 69) = 0.38$, $p = 0.54$, $\eta_p^2 = 0.01$; time × group × condition $F(1, 69) = 1.55$, $p = 0.22$, $\eta_p^2 = 0.02$. Post hoc tests for effects of time within condition showed that attitudes towards minorities did not significantly change in either condition (affective pre: M = 72.55, SD = 10.82; post: M = 70.01, SD = 12.32; $t(35) = -1.65$, $p = 0.11$, $d = -0.28$; cognitive pre: M = 66.68, SD = 16.37; post: M = 68.46, SD = 14.82; $t(34) = 1.61$, $p = 0.12$, $d = 0.27$). In contrast, attitudes towards majorities significantly worsened in both conditions (affective pre: M = 77.05, SD = 13.11; post: M = 69.40, SD = 16.90; $t(35) = -4.09$, $p < 0.001$, $d = -0.68$; cognitive pre: M = 71.30, SD = 15.92; post: M = 64.18, SD = 17.13; $t(34) = -4.96$, $p < 0.001$, $d = -0.84$). Post hoc tests for effects of group within condition showed that attitudes towards minorities was significantly worse than majorities at the pre-test in the affective condition $t(35) = -2.85$, $p = 0.01$, $d = -0.47$. It was also worse in the cognitive condition $t(34) = -2.14$, $p = 0.04$, $d = -0.36$), but this contrast did not survive Bonferroni correction. At post-test, attitudes towards minorities did not significantly differ from majorities in both conditions (affective $t(35) = 0.23$, $p = 0.82$, $d = 0.04$; cognitive $t(34) = 1.63$, $p = 0.11$, $d = 0.28$). Results are depicted in Figure 2.

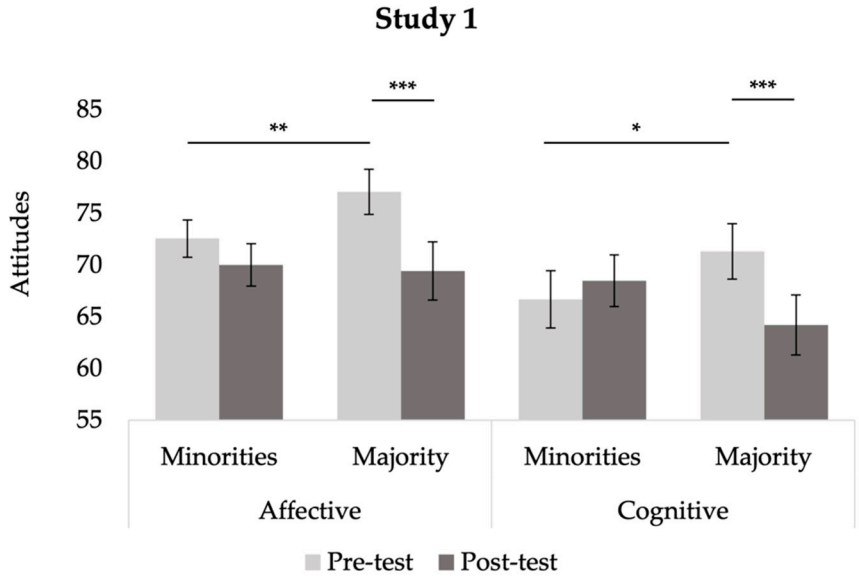

Figure 2. Plot depicting participants' attitudes towards minorities and majorities at pre-test and post-test within each condition in Study 1. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Self-Other Overlap

There was no main effect of condition $F(1, 69) = 0.96$, $p = 0.33$, $\eta_p^2 = 0.01$. There was a significant main effect of group $F(1, 69) = 63.39$, $p < 0.001$, $\eta_p^2 = 0.48$ and time $F(1, 69) = 9.88$, $p = 0.002$, $\eta_p^2 = 0.13$. The time × group interaction effect was significant $F(1, 69) = 33.80$, $p < 0.001$, $\eta_p^2 = 0.33$. The remaining interaction effects all failed to reach statistical significance—time × condition $F(1, 69) = 1.79$, $p = 0.19$, $\eta_p^2 = 0.03$; group × condition $F(1, 69) = 0.82$, $p = 0.37$, $\eta_p^2 = 0.01$; time × group × condition $F(1, 69) = 1.02$, $p = 0.32$, $\eta_p^2 = 0.02$. Post hoc tests for effects of time within condition showed that self-other with minorities did not significantly change in the affective condition (pre: M = 3.14, SD = 1.10; post: M = 3.11, SD = 1.12; $t(35) = -0.29$, $p = 0.77$, $d = -0.05$). In contrast, it significantly increased in the cognitive condition (pre: M = 2.89, SD = 1.10; post: M = 3.17, SD = 1.20;

$t(34) = 3.69$, $p = 0.001$, $d = 0.61$). Self-other overlap with majorities significantly worsened in both conditions (affective pre: M = 5.03, SD = 1.48; post: M = 4.42, SD = 1.70; $t(35) = -2.99$, $p = 0.01$, $d = -0.50$; cognitive pre: M = 4.57, SD = 1.75; post: M = 4.03, SD = 1.60; $t(34) = -4.89$, $p < 0.001$, $d = -0.82$). Post hoc tests for effects of group within condition showed that self-other overlap with minorities was significantly lower than majorities at pre-test in both conditions (affective $t(35) = -8.04$, $p < 0.001$, $d = -1.34$; cognitive $t(34) = -5.84$, $p < 0.001$, $d = -0.99$. At post-test, self-other overlap with minorities was also significantly lower than majorities in both conditions (affective $t(35) = -5.47$, $p < 0.001$, $d = -0.91$; cognitive $t(34) = -2.78$, $p = 0.01$, $d = -0.47$). The results are depicted in Figure 3.

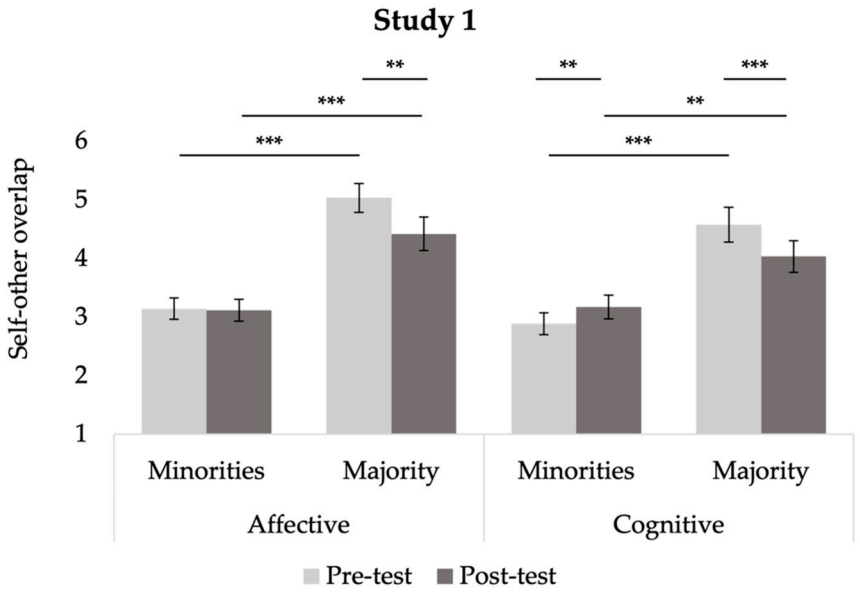

Figure 3. Plot depicting participants' self-other overlap with minorities and majorities at pre-test and post-test within each condition in Study 1. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Perspective-Taking Mechanisms

The conditions did not differ on empathy (affective: M = 4.13, SD = 1.30; cognitive: M = 4.20, SD = 1.25; $t(69) = 0.23$, $p = 0.82$, $d = 0.05$). The conditions also did not differ on situational attributions (affective: M = 6.22, SD = 1.42; cognitive: M = 5.86, SD = 2.23; $t(69) = -0.82$, $p = 0.41$, $d = 0.19$).

A parallel mediation analysis with 10,000 bootstrap samples was conducted using Model 4 in PROCESS [57]. We examined the direct and indirect pathways from condition (IV; cognitive = 0, affective = 1) on post-test ingroup bias measured by attitudes (DV), with two mediators—empathy (M1) and situational attributions (M2). We controlled for pre-test ingroup bias measured by attitudes by adding it as a covariate in the model. The indirect effect through empathy was not significant ($b = -0.06$, bootstrapped SE = 0.55, bootstrapped 95% CI: −1.41, 0.93). The indirect effect through situational attributions was also not significant ($b = 0.15$, bootstrapped SE = 0.58, bootstrapped 95% CI: −1.11, 1.37).

The same procedure was conducted with ingroup bias measured by self-other overlap. The indirect effect through empathy was not significant ($b = 0.01$, bootstrapped SE = 0.04, bootstrapped 95% CI: −0.09, 0.10). The indirect effect through situational attributions was also not significant ($b = 0.04$, bootstrapped SE = 0.06, bootstrapped 95% CI: −0.07, 0.20).

Potential Sex Differences

There were no differences between conditions in the distribution of sex (affective 52.8% female; cognitive 40% female; $\chi^2(1) = 1.17$, $p = 0.28$). There were no main effects or interaction effects of sex on attitudes, self-other overlap, and empathy. There was a significant sex × condition interaction effect for situational attributions $F(1, 67) = 6.13$, $p = 0.02$, $\eta_p^2 = 0.08$. Among females, situational attributions did not differ by condition

(affective M = 5.71, SD = 1.69; cognitive M = 6.50, SD = 1.13; $t(31) = 1.52$, $p = 0.14$, $d = 0.55$). Among males, however, situational attributions was significantly higher in the affective (M = 6.79, SD = 0.75) than cognitive (M = 5.43, SD = 2.68) condition $t(36) = -2.03$, $p = 0.05$, $d = -0.69$).

4.1.3. Discussion

While changes in attitudes towards minorities did not reach conventional statistical significance, they worsened in the affective condition but improved in the cognitive condition. Attitudes towards minorities were significantly lower than attitudes towards majorities at pre-test. However, post-test attitudes towards minorities did not significantly differ from attitudes towards majorities in both conditions. The results suggest that this was driven by changes in attitudes towards majorities, which significantly decreased in both conditions. Self-other overlap with minorities did not change in the affective condition, whereas it increased in the cognitive condition. Self-other overlap with minorities was significantly lower than self-other overlap with majorities at both pre-test and post-test, for both conditions. Contrary to expectations, the affective and cognitive conditions did not differ on empathy and situational attributions. Mediational analyses also found no support that either variable was a significant mediator of the relationship between condition and ingroup bias measured by attitudes or self-other overlap. We further found that there were no sex differences in the results. The only exception was for situational attributions, whereby for males, it was significantly higher in the affective compared to cognitive condition; there were no differences for females. Overall, the results suggest that the cognitive condition was more effective in improving self-other overlap with minorities compared to the affective condition.

4.2. Study 2

Study 2 uses the third-person perspective in VR and examines the same hypotheses (Hypotheses 1 to 6) and research question (RQ1) from Study 1. As an extension, it added a measure of helping behavior in VR and also explored the moderating role of self-presence. The following research questions were added:

Research Question 2. Will there be differences in helping behavior between affective and cognitive perspective-taking?

Research Question 3. How will self-presence impact the effect of affective and cognitive perspective-taking on attitudes to minorities, self-other overlap with minorities, ingroup bias measured by attitudes, and ingroup bias measured by self-other overlap?

4.2.1. Method

Participants

Participants were recruited through email sent to randomly selected email lists at a public university in Singapore. Recruitment criteria required participants to be Singaporean citizens of Chinese ethnicity (majority group) and aged 21 and above. Based on a medium effect size of $f = 0.25$, an a priori power analysis performed with G*Power 3.1 [53] for alpha = 0.05 and power = 0.80 indicated a sample size estimate of $n = 62$ based on a repeated-measures ANOVA with within-between interaction.

The final sample consists of 73 participants (39 females; age: M = 24.51, SD = 1.79). Participants were paid SGD 5. Experiments were completed on an individual basis, and participants were randomly assigned to the affective ($n = 36$) and cognitive ($n = 37$) conditions. The study protocol and all procedures performed were approved by the University ethics committee and in accordance with the 1964 Helsinki declaration. Informed consent was obtained from all participants.

Apparatus

The experimental setup and equipment were identical to that in Study 1.

VR Simulation

The VR simulation was identical to that of Study 1, with the exception of two changes. Firstly, participants experienced the simulation from the third-person perspective (see Figure 4). Secondly, after the participant witnessed a colleague from the majority ethnicity make racist remarks to a fellow colleague from a minority ethnicity (scene 3), participants could respond to the situation by choosing one of three different options: to say something (to the colleague from the majority ethnicity); to walk away; or to do nothing.

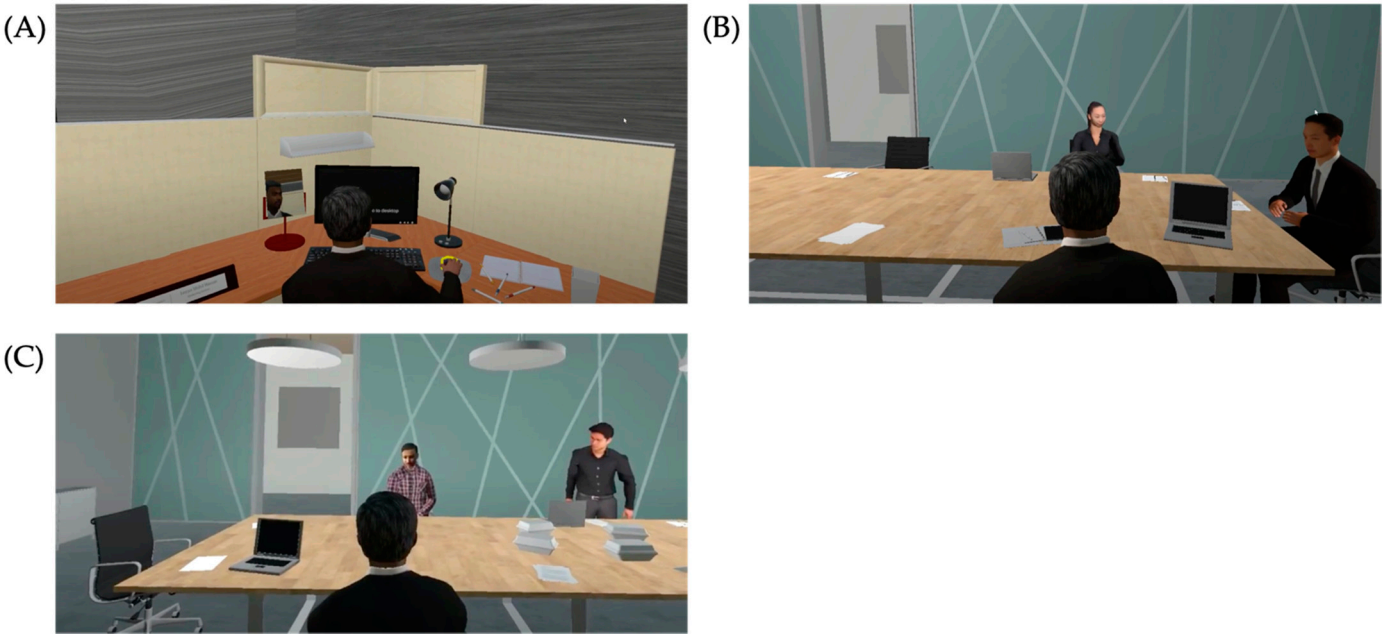

Figure 4. Screenshots depicting (**A**) scene 1, (**B**) scene 2, and (**C**) scene 3 in Study 2 (third-person perspective).

Procedure

The experimental procedure was identical to that in Study 1.

Measures

All the measures used in Study 1 were included in Study 2.

Attitudes. Feeling thermometers were administered to measure attitudes towards majorities and minorities (majorities: pre-test Cronbach's $\alpha = 0.94$, post-test Cronbach's $\alpha = 0.95$; minorities: pre-test Cronbach's $\alpha = 0.96$, post-test $\alpha = 0.95$). Ingroup bias was computed as the difference score between attitudes towards majorities and minorities (higher scores reflect greater ingroup bias).

Self-other overlap. Self-other overlap with majorities and minorities was measured. Ingroup bias was computed as the difference score between self-other overlap with majorities and minorities (higher scores reflect greater ingroup bias).

Empathic feelings. Responses to the same four adjectives (moved, compassionate, soft-hearted, warm) were averaged to compute a score of empathy ($\alpha = 0.78$).

Attributions. Situational attribution was computed as the average of ratings for situational factors in the two scenarios (Cronbach's $\alpha = 0.77$).

Other than the measures above, the following two measures were added:

Helping behavior. After participants heard the micro-aggressive comments made to a fellow colleague from a minority ethnicity in the last scene of the VR simulation, they were shown three options and asked to choose which action they would like to take. The three choices shown were (a) "Say something" (appearing in a text box above the head of the ethnic majority colleague who exhibited micro-aggression), (b) "Walk away" (appearing in a text box on top of the door), and (c) "Do nothing" (appearing in a text box on an empty

space of the wall). Helping behavior was coded as 1 if they chose option (a) and coded as 0 if they chose options (b) or (c).

Self-presence. The self-presence questionnaire [58] was used to assess self-presence. The scale is made up of 12 items and was rated on a scale of 1 (not at all) to 5 (extremely). The scale consists of two sub-scales—proto self-presence and core self-presence. Proto self-presence, also referred to as body-level self-presence, is the extent to which the VR self-representation is interpreted as part of the participant's body schema. A sample item is "when using your avatar, do you feel physically close to the objects and other avatars in the virtual environment?". Core self-presence is evoked when interactions within the virtual environment cause the participant to react emotionally. A sample item is "when sad events happen to your avatar, to what extent do you feel sad?" The overall scale showed good internal reliability (Cronbach's $\alpha = 0.84$).

Data Analysis

The same analytical strategy from Study 1 was employed to analyze attitudes, self-other overlap, empathy, situational attributions, and potential sex differences. A chi-square test of independence was conducted to examine the relationship between condition and helping behavior. To examine if self-presence moderated the effect of condition on our outcome variables, a two-step hierarchical regression analysis was conducted by regressing post-test scores on condition and self-presence in step 1, and then including the interaction term in step 2. Pre-test scores were added as a covariate in both models.

4.2.2. Results

Attitudes

There was no main effect of condition $F(1, 71) = 1.16$, $p = 0.29$, $\eta_p^2 = 0.02$. There was a significant main effect of group $F(1, 71) = 6.25$, $p = 0.02$, $\eta_p^2 = 0.08$. The main effect of time was also significant $F(1, 71) = 36.70$, $p < 0.001$, $\eta_p^2 = 0.34$. The time × group interaction effect was significant $F(1, 71) = 33.01$, $p < 0.001$, $\eta_p^2 = 0.32$. The remaining interaction effects all failed to reach statistical significance—time × condition $F(1, 71) = 0.02$, $p = 0.89$, $\eta_p^2 = 0.00$; group × condition $F(1, 71) = 0.10$, $p = 0.75$, $\eta_p^2 = 0.00$; time × group × condition $F(1, 71) = 0.58$, $p = 0.45$, $\eta_p^2 = 0.01$. Post hoc tests for effects of time within conditions showed that attitudes towards minorities did not significantly change in either condition (affective pre: M = 67.91, SD = 12.16; post: M = 66.05, SD = 12.39; $t(35) = -1.92$, $p = 0.06$, $d = -0.32$; cognitive pre: M = 64.52, SD = 15.38; post: M = 63.79, SD = 14.02 $t(36) = -0.70$, $p = 0.49$, $d = -0.11$). In contrast, attitudes towards majorities significantly worsened in both conditions (affective pre: M = 74.98, SD = 15.94; post: M = 67.17, SD = 15.49; $t(35) = -4.96$, $p < 0.001$, $d = -0.83$; cognitive pre: M = 71.59, SD = 16.95; post: M = 63.08, SD = 16.99; $t(36) = -4.77$, $p < 0.001$, $d = -0.79$). Post hoc tests for effects of group within condition showed that attitudes towards minorities was significantly worse than majorities at pre-test in both conditions (affective $t(35) = -3.27$, $p = 0.002$, $d = -0.54$; cognitive $t(36) = -2.77$, $p = 0.01$, $d = -0.46$. At post-test, attitudes towards minorities did not significantly differ from majorities in both conditions (affective $t(35) = -0.53$, $p = 0.60$, $d = -0.09$; cognitive $t(36) = 0.35$, $p = 0.73$, $d = 0.06$. The results are depicted in Figure 5.

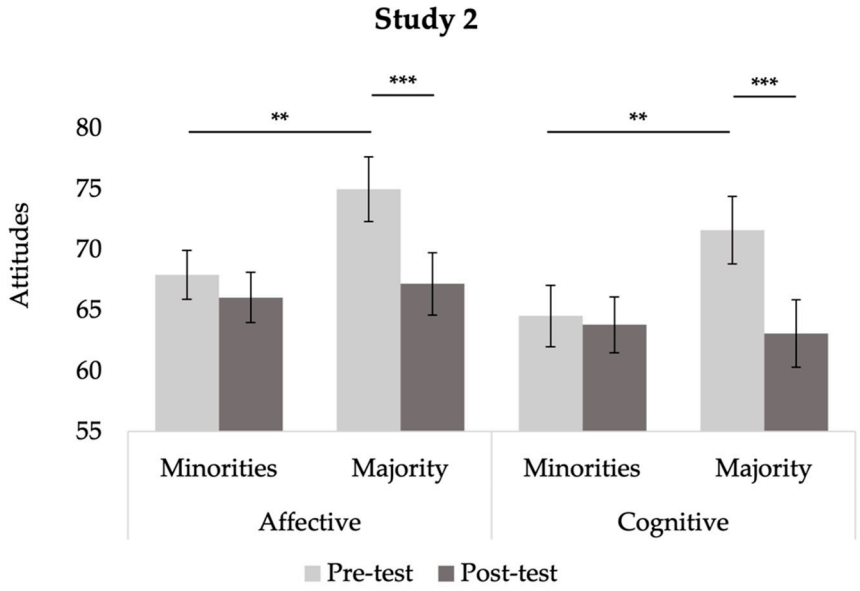

Figure 5. Plot depicting participants' attitudes towards minorities and majorities at pre-test and post-test within each condition in Study 2. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Self-Other Overlap

There was no main effect of condition $F(1, 71) = 0.21$, $p = 0.65$, $\eta_p^2 = 0.00$. There was a significant main effect of group $F(1, 71) = 94.00$, $p < 0.001$, $\eta_p^2 = 0.57$. The main effect of time was not significant $F(1, 71) = 2.75$, $p = 0.10$, $\eta_p^2 = 0.04$. The time × group interaction effect was significant $F(1, 71) = 4.52$, $p = 0.04$, $\eta_p^2 = 0.06$. The remaining interaction effects all failed to reach statistical significance—time × condition $F(1, 71) = 1.50$, $p = 0.22$, $\eta_p^2 = 0.02$; group × condition $F(1, 71) = 0.55$, $p = 0.46$, $\eta_p^2 = 0.01$; time × group × condition $F(1, 71) = 0.29$, $p = 0.60$, $\eta_p^2 = 0.00$. Post hoc tests for effects of time within condition showed that self-other with minorities did not significantly change in both conditions (affective pre: M = 2.79, SD = 1.15; post: M = 2.79, SD = 1.18; $t(35) = 0.00$, $p = 1.00$, $d = 0.00$; cognitive pre: M = 2.78, SD = 1.12; post: M = 2.86, SD = 1.12; $t(36) = 0.92$, $p = 0.36$, $d = 0.15$). Self-other overlap with majorities significantly worsened in the affective condition (pre: M = 5.08, SD = 1.44; post: M = 4.72, SD = 1.67; $t(35) = -3.00$, $p = 0.01$, $d = -0.50$). In contrast, it did not change in the cognitive condition (pre: M = 4.70, SD = 1.81; post: M = 4.57, SD = 1.85; $t(36) = -0.68$, $p = 0.50$, $d = -0.11$). Post hoc tests for effects of group within condition showed that self-other overlap with minorities was significantly lower than majorities at pre-test in both conditions (affective $t(35) = -7.06$, $p < 0.001$, $d = -1.18$; cognitive $t(36) = -6.91$, $p < 0.001$, $d = -1.14$. At post-test, self-other overlap with minorities was still significantly lower than majorities in both conditions (affective $t(35) = -5.81$, $p < 0.001$, $d = -0.97$; cognitive $t(36) = -6.30$, $p < 0.001$, $d = -1.04$). The results are depicted in Figure 6.

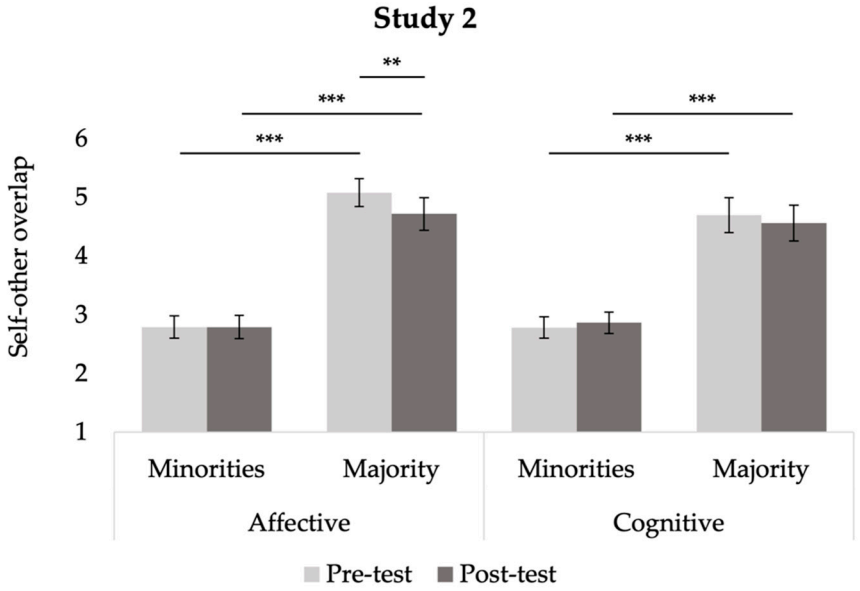

Figure 6. Plot depicting participants' self-other overlap with minorities and majorities at pre-test and post-test within each condition in Study 2. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Helping Behavior

A chi-square test of independence was conducted to examine the relationship between condition and helping behavior. The proportion of participants who chose to say something did not differ by condition (affective: 83.78%; cognitive: 83.33%; $\chi^2(1) = 0.003$, $p = 0.96$).

Perspective-Taking Mechanisms

The conditions did not differ on empathy (affective: M = 3.86, SD = 1.26; cognitive: M = 3.73, SD = 1.20; $t(71) = 0.46$, $p = 0.65$, $d = 0.11$). The conditions also did not differ on situational attributions (affective: M = 6.13, SD = 1.78; cognitive: M = 6.21, SD = 2.02; $t(71) = 0.17$, $p = 0.86$, $d = 0.04$).

A parallel mediation analysis with 10,000 bootstrap samples was conducted using Model 4 in PROCESS (Hayes, 2013). We examined the direct and indirect pathways from condition (IV; cognitive = 0, affective = 1) on post-test ingroup bias measured by attitudes (DV), with two mediators—empathy (M1) and situational attributions (M2). We controlled for pre-test ingroup bias measured by attitudes by adding it as a covariate in the model. The indirect effect through empathy was not significant ($b = -0.01$, bootstrapped SE = 0.30, bootstrapped 95% CI: −0.72, 0.60). The indirect effect through situational attributions was also not significant ($b = 0.11$, bootstrapped SE = 0.68, bootstrapped 95% CI: −1.07, 1.71).

The same procedure was conducted with ingroup bias measured by self-other overlap. The indirect effect through empathy was once again not significant ($b = -0.02$, bootstrapped SE = 0.04, bootstrapped 95% CI: −0.13, 0.07). The indirect effect through situational attributions was also not significant ($b = -0.01$, bootstrapped SE = 0.07, bootstrapped 95% CI: −0.18, 0.10).

Moderating Role of Self-Presence

The conditions did not differ on self-presence (affective: M = 3.38, SD = 0.67; cognitive: M = 3.16, SD = 0.89; $t(71) = 1.23$, $p = 0.22$, $d = 0.29$).

We first examined if self-presence moderated attitudes towards minorities (Analysis 1 in Table 1), ingroup bias measured by attitudes (Analysis 2 in Table 1), and attitudes towards majorities (Analysis 3 in Table 1). There were no main effects of condition or self-presence. There was however, a significant interaction effect for ingroup bias (Analysis 2: $b = 6.02$, SE = 2.68, $t(68) = 2.25$, $p = 0.03$, 95% CI (0.67, 11.37)). This suggests that self-presence moderated the effects of condition on ingroup bias measured by attitudes. Based on simple

slope analyses [59] at high levels of self-presence (+1 SD), the affective condition exhibited greater ingroup bias compared to the cognitive condition (b = 6.74, SE = 2.85, $t(68)$ = 2.36, p = 0.02, 95% CI (1.04, 12.43)). In contrast, at low levels of self-presence (−1 SD), condition did not have an effect on ingroup bias (b = −2.81, SE = 3.00, $t(68)$ = −0.94, p = 0.35, 95% CI (−8.79, 3.18)). Using the Johnson–Neyman technique, the region of significance [60] of condition's effect on ingroup bias was identified as values of self-presence that are equal or greater than 3.69 (see Figure 7).

Next, we examined if self-presence moderated self-other overlap with minorities (Analysis 1 in Table 2), ingroup bias measured by self-other overlap (Analysis 2 in Table 2), and self-other overlap with majorities (Analysis 3 in Table 2). As seen in Table 2, none of the interaction effects were statistically significant (all $p > 0.05$); thus there was no evidence to suggest that self-presence had a moderating effect on these self-other overlap.

Table 1. Attitudes Regression Analyses (Study 2; n = 73).

	b	SE	95% CI	*t*	df	*p*
Analysis 1: Attitudes to minorities						
Condition	−0.93	1.38	(−3.69, 1.83)	−0.67	69	0.50
Self-presence	1.17	0.87	(−0.57, 2.91)	1.34	69	0.18
Pre-test attitudes	0.86	0.05	(0.76, 0.96)	17.38	69	<0.001
Self-presence X Condition	−2.50	1.88	(−6.25, 1.25)	−1.33	68	0.19
Analysis 2: Ingroup bias						
Condition	2.19	2.07	(−1.94, 6.32)	1.06	69	0.29
Self-presence	−1.62	1.38	(−4.36, 1.13)	−1.18	69	0.24
Pre-test attitudes	0.65	0.08	(0.50, 0.81)	8.62	69	<0.001
Self-presence X Condition	6.02	2.68	(0.67, 11.37)	2.25	68	0.03
Analysis 3: Attitudes to the majority						
Condition	1.64	2.30	(−2.95, 6.23)	0.71	69	0.48
Self-presence	−1.34	1.49	(−4.31, 1.63)	−0.90	69	0.37
Pre-test attitudes	0.81	0.07	(0.67, 0.95)	11.34	69	<0.001
Self-presence X Condition	2.96	3.11	(−3.24, 9.16)	0.95	68	0.34

Note. Condition was coded as cognitive = 0, affective = 1. All continuous variables were first grand-mean centered prior to analysis. For Analyses 1, 2, and 3: the main effects are from step 1 of hierarchical regression analysis; the interaction effect is from step 2. Unstandardized coefficients reported.

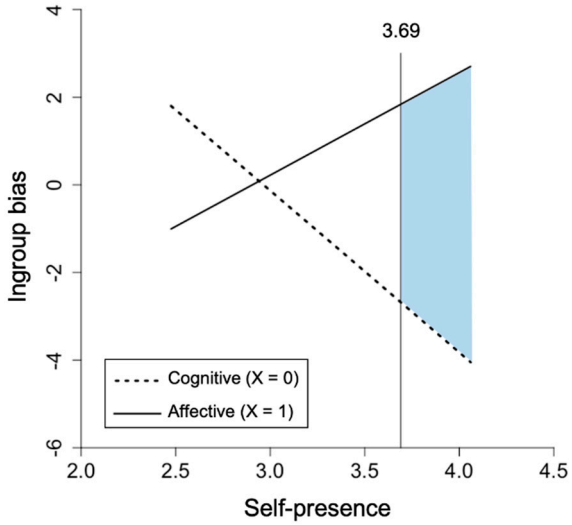

Figure 7. Condition x Self-Presence Interaction with Simple Slope Analysis (± 1SD) for Ingroup Bias Measured By Attitudes. **Note.** Condition is significant within the shaded (Johnson–Neyman) regions.

Table 2. Self-other Overlap Regression Analyses (Study 2; $n = 73$).

	b	SE	95% CI	*t*	df	*p*
Analysis 1: Self-other overlap with minorities						
Condition	−0.10	0.12	(−0.34, 0.13)	−0.90	69	0.37
Self-presence	0.10	0.07	(−0.04, 0.25)	1.40	69	0.17
Pre-test self-other overlap	0.92	0.05	(0.81, 1.02)	17.84	69	<0.001
Self-presence X Condition	−0.21	0.16	(−0.52, 0.10)	−1.33	68	0.19
Analysis 2: Ingroup bias						
Condition	−0.07	0.27	(−0.60, 0.46)	−0.27	69	0.79
Self-presence	0.01	0.17	(−0.33, 0.36)	0.08	69	0.93
Pre-test self-other overlap	0.80	0.08	(0.65, 0.95)	10.64	69	<0.001
Self-presence X Condition	−0.31	0.35	(−1.01, 00.40)	−0.87	68	0.39
Analysis 3: Self-other overlap with majority						
Condition	−0.20	0.24	(−0.67, 0.27)	−0.84	69	0.41
Self-presence	0.07	0.16	(−0.24, 0.38)	0.45	69	0.65
Pre-test self-other overlap	0.88	0.08	(0.74, 1.03)	11.87	69	<0.001
Self-presence X Condition	−0.54	0.31	(−1.16, 0.08)	−1.75	68	0.08

Note. Condition was coded as cognitive = 0, affective = 1. All continuous variables were first grand-mean centered prior to analysis. For Analyses 1, 2, and 3: the main effects are from step 1 of hierarchical regression analysis; the interaction effect is from step 2. Unstandardized coefficients reported.

Potential Sex Differences

There were no differences between conditions in distribution of sex (affective 50% female; cognitive 56.8% female; $\chi^2(1) = 0.34$, $p = 0.56$). There were no main effects or interaction effects of sex on attitudes, empathy, situational attributions, and presence. There was a significant sex × group interaction effect for self-other overlap $F(1,69) = 4.83$, $p = 0.03$, $\eta_p^2 = 0.07$. Collapsing across time, self-overlap with majorities was higher among females (M = 5.04, SD = 1.61) than males (M = 4.46, SD = 1.60), however this was not significant $t(71) = 1.55$, $p = 0.13$, $d = 0.36$. There were no sex differences for self-other overlap with minorities (female M = 2.69, SD = 1.00; male M = 2.95, SD = 1.21; $t(71) = -1.01$, $p = 0.32$, $d = 0.23$).

4.2.3. Discussion

The results from Study 1 were largely replicated in Study 2. Attitudes towards minorities did not significantly decrease in both conditions. Attitudes towards minorities were significantly lower than attitudes towards majorities at pre-test. However, post-test attitudes towards minorities did not significantly differ from attitudes towards majorities in both conditions. The results suggest that this was driven by changes in attitudes towards majorities, which significantly decreased in both conditions. There were no changes in self-other overlap with minorities in either condition. Self-other overlap with minorities was significantly lower than self-other overlap with majorities at both pre-test and post-test, for both conditions. Self-other overlap with majorities significantly decreased in the affective condition but did not change in the cognitive condition. Helping behavior did not differ between conditions. As in Study 1, neither empathy nor situational attributions differed by condition and no mediational support for either variable was found. Self-presence was found to moderate the effect of condition on ingroup bias measured by attitudes. At low levels of self-presence, the conditions did not differ on ingroup bias. In contrast, at high levels of self-presence, the cognitive condition showed lower ingroup bias compared to the

affective condition. No significant sex differences were found in this study. Taken together, the results appear to be mixed as to whether affective or cognitive condition was more effective. While the affective condition led to lower ingroup bias measured by self-other overlap, the moderating role of self-presence suggests that the cognitive condition led to lower ingroup bias measured by attitudes at high levels of self-presence.

5. General Discussion

5.1. Effects of VR Embodiment

The embodiment of an ethnic minority avatar in VR enables perspective-taking of a minority, which theoretically would lead to improved perceptions towards the minority group. Some evidence is found in both studies that the embodiment of an ethnic minority experiencing microaggression improved intergroup perceptions. Contrary to expectations, attitudes towards minorities did not change following the VR embodiment in either study, thus finding no support for H1. Nevertheless, we found that across both studies, ingroup bias measured by attitudes reduced after VR—providing support for H2. The reduction in ingroup bias was driven by shifts in attitudes towards the majority. In both studies, we found that attitudes towards the majority worsened after VR.

This pattern of results was largely corroborated by findings on the self-other overlap. Self-other overlap with minorities increased following VR embodiment in Study 1, but only for the cognitive condition and not the affective condition. In Study 2, overlap with minorities showed no change in either condition. Therefore, H3 is only partially supported. Ingroup bias measured by self-other overlap did not change after VR in both studies. Therefore, H4 is not supported. In Study 1, self-other overlap with majorities decreased after VR in both conditions. In Study 2, self-other overlap with majorities decreased after VR only for the affective condition, while it did not change in the cognitive condition.

A possible explanation for why we find that changes in ingroup bias is driven more by shifts in perceptions of majorities rather than minorities may relate to the nature of social interactions in our VR simulation. One major approach to ingroup bias is its role as a motivational process in the creation of a meaningful and positive social identity for the individual [61]. Therefore, when participants in our study experienced and witnessed an avatar from the majority ethnicity make micro-aggressive comments towards them, the function of the majority ingroup may no longer have been positive nor meaningful for the participants, leading to a reduction of ingroup bias. Taking into account the relative nature of ingroup bias, the present research highlights the potential of directly targeting attitudes towards ingroup as an intervention for reducing ingroup bias.

5.2. Affective vs. Cognitive Modes of Perspective-Taking

The main objective of the current research was to examine the theoretical argument that affective and cognitive perspective-taking occur through different pathways [20]—affective via empathy; cognitive via situational attributions. To the best of our knowledge, this is the first of its kind to empirically compare the two using a between-subject design in a VR environment. The results from both studies found no supporting evidence that the conditions had an effect on the proposed mediators. Participants in the affective and cognitive conditions reported similar levels of empathy and situational attributions in both studies. Mediational analyses also found no support that either variable mediated the effects of condition on ingroup bias. Hence, neither H5 nor H6 is supported. The findings suggest that the two mechanisms are not easily distinguishable and that both mechanisms may occur simultaneously regardless of whether an individual focuses on their emotions or thoughts.

Although no effects were found on the proposed mediators, the results show that the conditions had an effect on ingroup biases when analyzed at the level of minorities and majorities. In addressing RQ1, we first discuss outcomes for minorities. In Study 1, attitudes towards minorities worsened in the affective condition whereas it improved in the cognitive condition, although it must be noted that these differences did not reach conventional levels

of statistical significance. Similarly, in Study 2, attitudes towards minorities worsened in the affective condition, whereas no differences were observed in the cognitive condition. For self-other overlap with minorities, it did not change in the affective condition, while it significantly increased in the cognitive condition in Study 1. In contrast, no changes were found in either condition for Study 2. One explanation for the inconsistent findings between studies on self-other overlap with minorities relates to how the first- vs. third-person perspective influences the illusion of body ownership [62]. The first-person perspective allows users to experience a virtual body in the natural manner that their real bodies are subjectively experienced [63]. This can result in a greater sense of body ownership compared to the third-person perspective [63,64]. Thus, embodiment from the first-person perspective in Study 1 may have encouraged greater body ownership of the minority avatar, resulting in increased self-other overlap with minorities—a finding that was not replicated in Study 2 (third-person perspective). Overall, the consistency of both studies in showing that the cognitive condition outperforms the affective condition in improving perceptions of minorities suggests that the former may be a more effective strategy in VR. This supports the argument that embodiment in VR is a cognitive process [65]. Past research has not contrasted cognitive processes against affective processes in VR embodiment. Thus, our findings shed new insights by providing empirical evidence that suggests cognitive processes may play a more important role compared to affective ones in VR embodiment.

Moving on to the discussion on outcomes for majorities, both studies found that attitudes towards the majority worsened to a comparable extent across the two conditions. For self-other overlap with the majority, Study 1 found that it decreased to a comparable extent in both conditions. In contrast, Study 2 found that it decreased in the affective condition only and did not change in the cognitive condition. Psychological distance offers a possible explanation for the studies' inconsistencies in self-other overlap with the majority. Psychological distance refers to the subjective experience of something being further away or closer to the self [66]. In general, greater psychological distance reduces the intensity of affective responses, such as anger and sadness, to the event [67]. The third-person perspective increases psychological distance by depicting objects and events at a further spatial distance from the individual [66,68]. Moreover, events are perceived as less psychologically distant when described emotionally, compared to when they are described in a neutral manner [68]. Thus, it is possible that participants in Study 1 (first-person perspective; lower psychological distance) and those in the affective condition (focus on emotions; lower psychological distance) in Study 2 felt more intense negative emotions towards the aggressors from the majority ethnicity in VR. In turn, this could have resulted in them distancing themselves from the majority group in order to reduce their heightened negative emotions. This is supported by previous research on group disidentification, in which individuals minimize their membership and actively create psychological distance from the group [69,70]. Group disidentification can occur when there are threats made to the value of the individual's ingroup, such as when the ingroup violates personally important moral standards, causing the individual to feel uncomfortable about being a member of the group [71,72]. Therefore, it could be that group disidentification was aroused upon watching an avatar from the ingroup display microaggression towards minorities during the VR simulation. In contrast, those in the cognitive condition in Study 2 may have felt less intense negative emotions towards the aggressors in VR and thus did not distance themselves, thereby reporting no change in self-other overlap with the majority.

5.3. Helping Behavior in VR

In Study 2, we extended the VR simulation to include a measure of helping behavior. Specifically, at the end of the final scene, participants were allowed to choose between (a) say something to the aggressor, (b) walk away, or (c) do nothing. Helping behavior was determined by whether participants chose option (a). Addressing RQ2, we found that there were no differences in helping behavior between affective and cognitive conditions for both

studies. Nonetheless, an overwhelming proportion of participants chose to say something to the aggressor in VR (more than 80%). Although we cannot rule out the influence of social desirability, the present findings remain promising. Future research should examine if helping behavior in VR extends to the real world. In addition, this could be expanded further to examine whether training helping behavior in VR can lead to greater self-efficacy and thus higher helping behavior in real life.

5.4. Moderating Role of Self-Presence

We explored the moderating role of self-presence in Study 2 (RQ3). The results show that self-presence moderated the effects of condition on ingroup bias measured by attitudes. At low levels of self-presence, the conditions did not differ on ingroup bias. However, at high levels of self-presence, participants in the cognitive condition reported significantly lower ingroup bias compared to those in the affective condition. This adds more support for our earlier discussion that cognitive processing in VR may be more beneficial than affective processing at improving intergroup attitudes. Given the interactive relationship between presence and emotions—where presence increases in emotional environments and emotional states are influenced by the level of presence [73], along with past findings where it was suggested that a greater level of presence experienced would result in a reduction in racial biases [8,9,74]—our findings suggest that high emotional arousal, in relation with self-presence, may not be ideal for improving intergroup attitudes. Although presence, in general, plays an important role in VR experiences, more recent studies have identified more distinct subcategories of presence, one of which is self-presence [3,75]. However, self-presence was not singled out as a specific variable in past studies, even though measures used seemed to be capturing the concept of self-presence rather than presence [8]. Considering the difference between telepresence (the extent to which an individual feels present in the mediated environment, which is used interchangeably with presence) and self-presence (the extent to which virtual selves are experienced as actual selves), it may be valuable for future studies to directly examine the effects of self-presence specifically on perspective-taking in VR and how it influences affective vs. cognitive processes. This is especially so, given the potential of self-presence, in the form of mirrored selves, in influencing individuals' attitudes and behaviors outside of VR [43].

5.5. Potential Sex Differences

Across both studies, we found little evidence to suggest that sex differences influenced the results. Past studies showed contradictory evidence on whether female or male participants are more embodied, as measured by presence [25–27]. It is, therefore, not too surprising that this study did not find any sex differences in self-presence. This means that the field does not have a concrete understanding about sex differences in VR embodiment with regards to the various dimensions of presence. Future studies can further investigate it. Even though past studies found that women tend to have higher empathy than men [76,77], the current finding did not show such a trend. This may be due to other factors, such as the context and gender role expectations [76], rather than simply self-reported biological sex in the questionnaire. A meta-review on empathy and sex differences [78] has also identified a few important factors that future studies can consider for further investigation of sex differences and empathy. The only sex difference we found was in Study 1, in that male participants showed higher situational attributions in the affective perspective-taking condition than the cognitive one. Little is known about how attribution and perspective-taking relate to each other in a VR environment. Future research can examine if embodying an avatar of the same or different sex influences attribution in VR.

5.6. Limitations

There are several limitations in the present research. First, there was no control condition in which no perspective-taking occurred. This meant that we could not examine the

effects of perspective-taking in general, regardless of whether one focuses on emotions or thoughts, on several outcome variables (empathy, attributional thinking, helping behavior).

Second, all participants, regardless of sex, embodied the same male avatar in VR. Our primary research objective was to compare the affective and cognitive mechanisms of perspective-taking; thus we chose not to complicate the design by additionally accounting for sex effects. Future research should investigate if embodying an avatar of the same or different sex would interact with affective and cognitive mechanisms of perspective-taking.

Third, the measure of helping behavior in Study 2 was assessed in VR, which required little effort and held minimal real-life consequences for participants. However, it should be noted that at the point of choosing which action to take in VR, participants were unaware that the VR simulation would end right after. Thus, participants who chose to say something to the aggressor may well have thought that they would be expected to give a verbal response upon choosing the action.

Fourth, the result of the study could have been more conclusive if control conditions were included. For example, it could have a condition where participants embodied an avatar from the ethnic majority group or where there is no instruction for perspective-taking. The effect of reduced ingroup bias found in this study, therefore, could have been due to participants' experience of VR in a social context and not just the embodiment of the ethnic minority avatar. Future research should include additional conditions to provide more conclusive results on whether it was the embodiment of an ethnic minority avatar that led to the reduction of ingroup biases.

Fifth, the three-choice options provided to participants in study 2 included saying something to the college of the majority ethnicity who exhibited microaggression, doing nothing, or walking out. This could have biased participants disagreeing with the virtual ethnic majority colleague's behavior. Including other options, such as one where the participant agrees with the majority colleague, may provide a more balanced range of choices. Future studies can also further investigate how the range of choices of actions and the representations of them in VR might play a role.

Finally, the current research took an exploratory approach to various research questions and thus, the conclusions drawn remain speculative. Future research should be undertaken to formally test the propositions that have been put forward.

6. Conclusions

In this research, we examined the effectiveness of embodying an ethnic minority on improving attitudes towards minorities, self-other overlap with minorities, and ingroup bias as measured by both attitudes and self-other overlap. A between-subject design was employed to compare the roles of affective (focus on emotions) and cognitive (focus on thoughts) mechanisms of perspective-taking. We found that ingroup bias reduced after VR embodiment from both the first-person (Study 1) and third-person (Study 2) perspective. Although we found no evidence for the proposed mediators—empathy for affective condition and situational attributions for cognitive condition—the findings provide empirical evidence that focusing on emotions or thoughts exerted differential effects on attitudes and self-other overlap. Moreover, Study 2 showed that self-presence moderated the effects of condition on ingroup bias.

Author Contributions: Conceptualization, V.H.H.C.; methodology, V.H.H.C., S.H.M.C. and Y.C.T.; validation, S.H.M.C.; formal analysis, S.H.M.C.; investigation, V.H.H.C., S.H.M.C. and Y.C.T.; resources, V.H.H.C.; data curation, Y.C.T.; writing—original draft preparation, V.H.H.C., S.H.M.C. and Y.C.T.; writing—review and editing, V.H.H.C., S.H.M.C. and Y.C.T.; visualization, S.H.M.C.; supervision, V.H.H.C.; project administration, V.H.H.C.; funding acquisition, V.H.H.C. All authors have read and agreed to the published version of the manuscript.

Funding: This research is supported by the Ministry of Education, Singapore, under its Academic Research Fund Tier 2 Grant (MOE2017-T2-2-145) and Academic Research Fund Tier 1 Grant (RG41/20).

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Institutional Review Board of Nanyang Technological University (IRB 201811013, 11 December 2018).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: All research data are available upon request, if accepted, and in accordance with the restrictions by the funding agency and institution.

Acknowledgments: We would like to acknowledge and thank Tay Sze Min Eleanor for her help in reviewing the literature; Mohammad Rafiq bin Mohd Rashid and Siti Khadijah Binte Abdul Ghani for their help in designing the VR environments.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Kilteni, K.; Groten, R.; Slater, M. The sense of embodiment in virtual reality. *Presence* **2012**, *21*, 373–387. [CrossRef]
2. Biocca, F. The cyborg's dilemma: Progressive embodiment in virtual environments. *J. Comput. Mediat. Commun.* **1997**, *3*, JCMC324. [CrossRef]
3. Lee, K.M. Presence, Explicated. *Commun. Theory* **2004**, *14*, 27–50. [CrossRef]
4. Slater, M.; Spanlang, B.; Corominas, D. Simulating virtual environments within virtual environments as the basis for a psychophysics of presence. *ACM Trans. Graph.* **2010**, *29*, 1–9. [CrossRef]
5. Behm-Morawitz, E.; Pennell, H.; Speno, A.G. The effects of virtual racial embodiment in a gaming app on reducing prejudice. *Commun. Monogr.* **2016**, *83*, 396–418. [CrossRef]
6. Greenwald, A.G.; Nosek, B.A.; Banaji, M.R. Understanding and using the implicit association test: I. An improved scoring algorithm. *J. Pers. Soc. Psychol.* **2003**, *85*, 197. [CrossRef] [PubMed]
7. Banakou, D.; Hanumanthu, P.D.; Slater, M. Virtual embodiment of white people in a black virtual body leads to a sustained reduction in their implicit racial bias. *Front. Hum. Neurosci.* **2016**, *10*, 601. [CrossRef]
8. Peck, T.C.; Seinfeld, S.; Aglioti, S.M.; Slater, M. Putting yourself in the skin of a black avatar reduces implicit racial bias. *Conscious. Cogn.* **2013**, *22*, 779–787. [CrossRef]
9. Yee, N.; Bailenson, J.N. Walk a mile in digital shoes: The impact of embodied perspective-taking on the reduction of negative stereotyping in immersive virtual environments. *Proc. PRESENCE* **2006**, *24*, 26.
10. Groom, V.; Bailenson, J.N.; Nass, C. The influence of racial embodiment on racial bias in immersive virtual environments. *Soc. Influ.* **2009**, *4*, 231–248. [CrossRef]
11. Hasler, B.S.; Spanlang, B.; Slater, M. Virtual race transformation reverses racial in-group bias. *PLoS ONE* **2017**, *12*, e0174965.
12. Davis, M.H. Measuring individual differences in empathy: Evidence for a multidimensional approach. *J. Personal. Soc. Psychol.* **1983**, *44*, 113–126. [CrossRef]
13. Galinsky, A.D.; Maddux, W.W.; Gilin, D.; White, J.B. Why it pays to get inside the head of your opponent: The differential effects of perspective taking and empathy in negotiations. *Psychol. Sci.* **2008**, *19*, 378–384. [CrossRef]
14. Galinsky, A.D.; Moskowitz, G.B. Perspective-taking: Decreasing stereotype expression, stereotype accessibility, and in-group favoritism. *J. Personal. Soc. Psychol.* **2000**, *78*, 708–724. [CrossRef]
15. Pettigrew, T.F.; Tropp, L.R. How does intergroup contact reduce prejudice? Meta-analytic tests of three mediators. *Eur. J. Soc. Psychol.* **2008**, *38*, 922–934. [CrossRef]
16. Batson, C.D.; Johee, C.; Ryan, O.; Jennifer, R. Empathy, Attitudes, and action: Can feeling for a member of a stigmatized group motivate one to help the group? *Personal. Soc. Psychol. Bull.* **2002**, *28*, 1656–1666. [CrossRef]
17. Shih, M.; Wang, E.; Trahan Bucher, A.; Stotzer, R. Perspective taking: Reducing prejudice towards general outgroups and specific individuals. *Group Process. Intergroup Relat.* **2009**, *12*, 565–577. [CrossRef]
18. Mallett, R.K.; Huntsinger, J.R.; Sinclair, S.; Swim, J.K. Seeing through their eyes: When majority group members take collective action on behalf of an outgroup. *Group Process. Intergroup Relat.* **2008**, *11*, 451–470. [CrossRef]
19. Oh, S.Y.; Bailenson, J.; Weisz, E.; Zaki, J. Virtually old: Embodied perspective taking and the reduction of ageism under threat. *Comput. Hum. Behav.* **2016**, *60*, 398–410. [CrossRef]
20. Todd, A.R.; Galinsky, A.D. Perspective-taking as a strategy for improving intergroup relations: Evidence, mechanisms, and qualifications. *Soc. Personal. Psychol. Compass* **2014**, *8*, 374–387.
21. Healy, M.L.; Grossman, M. Cognitive and affective perspective-taking: Evidence for shared and dissociable anatomical substrates. *Front. Neurol.* **2018**, *9*, 1–8. [CrossRef]
22. Batson, C.D.; Powell, A.A. Altruism and prosocial behavior. In *Handbook of Psychology: Personality and Social Psychology*; John Wiley & Sons Inc.: Hoboken, NJ, USA, 2003; Volume 5, pp. 463–484.
23. Vescio, T.K.; Sechrist, G.B.; Paolucci, M.P. Perspective taking and prejudice reduction: The mediational role of empathy arousal and situational attributions. *Eur. J. Soc. Psychol.* **2003**, *33*, 455–472. [CrossRef]

24. Dovidio, J.F.; Ten Vergert, M.; Stewart, T.L.; Gaertner, S.L.; Johnson, J.D.; Esses, V.M.; Riek, B.M.; Pearson, A.R. Perspective and prejudice: Antecedents and mediating mechanisms. *Pers. Soc. Psychol. Bull.* **2004**, *30*, 1537–1549. [CrossRef] [PubMed]
25. Kessler, K.; Wang, H. Spatial perspective taking is an embodied process, but not for everyone in the same way: Differences predicted by sex and social skills score. *Spat. Cogn. Comput.* **2012**, *12*, 133–158. [CrossRef]
26. Kessler, K.; Cao, L.; O'Shea, K.J.; Wang, H. A cross-culture, cross-gender comparison of perspective taking mechanisms. *Proc. R. Soc.* **2014**, *281*. [CrossRef]
27. Schulze, S.; Pence, T.; Irvine, N.; Guinn, C. The Effects of embodiment in virtual reality on implicit gender bias. In *International Conference on Human-Computer Interaction*; Springer: Cham, Switzerland, 2019; pp. 361–374. [CrossRef]
28. Lopez, S.; Yang, Y.; Beltran, K.; Kim, S.J.; Cruz, H.J.; Simran, C.; Yang, B.; Yuksel, B.F. Investigating implicit gender bias and embodiment of white males in virtual reality with full body visuomotor synchrony. In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems, Glasgow, UK, 4–9 May 2019.
29. Hudson, S.; Matson-Barkat, S.; Pallamin, N.; Jegou, G. With or without you? Interaction and immersion in a virtual reality experience. *J. Bus. Res.* **2018**, *100*, 459–468. [CrossRef]
30. Cairns, P.; Cox, A.L.; Day, M.; Martin, H.; Perryman, T. Who but not where: The effect of social play on immersion in digital games. *Int. J. Hum. Comput. Stud.* **2013**, *71*, 1069–1077. [CrossRef]
31. Grinberg, A.M.; Careaga, J.S.; Mehl, M.R.; O'Connor, M.-F. Social engagement and user immersion in a socially based virtual world. *Comput. Hum. Behav.* **2014**, *36*, 479–486. [CrossRef]
32. Winner, M.G.; Crooke, P.J. Social Thinking: A training paradigm for professionals and treatment approach for individuals with social learning/social pragmatic challenges. *Perspect. Lang. Learn. Educ.* **2009**, *16*, 62–69. [CrossRef]
33. Kohlberg, L. Moral stages and moralization: The cognitive-developmental approach. In *Moral Development and Behavior: Theory, Research and Social Issues*; Lickona, T., Ed.; Holt, Rinehart and Winston: New York, NY, USA, 1976; pp. 31–53.
34. Batson, C.D. Altruism and prosocial behavior. In *The Handbook of Social Psychology*; Gilbert, D.T., Fiske, S.T., Lindzey, G., Eds.; McGraw-Hill: New York, NY, USA, 1998; pp. 282–316.
35. Richardson, D.R.; Hammock, G.S.; Smith, S.M.; Gardner, W.; Manuel, S. Empathy as a cognitive inhibitor of interpersonal aggression. *Aggress. Behav.* **1994**, *20*, 275–289. [CrossRef]
36. Batson, C.D. *The Altruism Question. Toward a Social-Psychological Answer*; Lawrence Erlbaum: Hillsdale, NJ, USA, 1991.
37. Hooper, N.; Erdogan, A.; Keen, G.; Lawton, K.; McHugh, L. Perspective taking reduces the fundamental attribution error. *J. Contextual Behav. Sci.* **2015**, *4*, 69–72. [CrossRef]
38. Stephan, W.G.; Finlay, K. The role of empathy in improving intergroup relations. *J. Soc. Issues* **1999**, *55*, 729–743. [CrossRef]
39. Davis, M.H.; Conklin, L.; Smith, A.; Luce, C. Effect of perspective taking on the cognitive representation of persons: A merging of self and other. *J. Pers. Soc. Psychol.* **1996**, *70*, 713–726. [CrossRef]
40. Regan, D.T.; Totten, J. Empathy and attribution: Turning observers into actors. *J. Pers. Soc. Psychol.* **1975**, *32*, 850. [CrossRef]
41. Batson, C.D.; Polycarpou, M.P.; Harmon-Jones, E.; Imhoff, H.J.; Mitchener, E.C.; Bednar, L.L.; Klein, T.R.; Highberger, L. Empathy and attitudes: Can feeling for a member of a stigmatized group improve feelings toward the group? *J. Pers. Soc. Psychol.* **1997**, *72*, 105–118. [CrossRef] [PubMed]
42. Ratan, R. Self-presence, explicated: Body, emotion, and identity extension into the virtual self. In *Handbook of Research on Technoself: Identity in a Technological Society*; IGI Global: Hershey, PA, USA, 2013; pp. 322–336.
43. Behm-Morawitz, E. Mirrored selves: The influence of self-presence in a virtual world on health, appearance, and well-being. *Comput. Hum. Behav.* **2013**, *29*, 119–128. [CrossRef]
44. Fox, J.; Christy, K.R.; Vang, M. The experience of presence in persuasive virtual environments. In *Interacting with Presence: HCI and the Sense of Presence in Computer-Mediated Environments*; Riva, G., Waterworth, J., Murray, D., Eds.; DeGruyter: Warsaw, Poland, 2014; pp. 164–178. [CrossRef]
45. Tamborini, R.; Skalski, P. The role of presence in the experience of electronic games. In *Playing Video Games: Motives, Responses and Consequences*; Vorderer, P., Bryant, J., Eds.; Lawrence Erlbaum Associates Publishers: New York, NY, USA, 2006; pp. 225–240.
46. Ahn, S.J.; Le, A.M.T.; Bailenson, J. The effect of embodied experiences on self-other merging, attitude, and helping behavior. *Media Psychol.* **2013**, *16*, 7–38. [CrossRef]
47. Gillath, O.; McCall, C.; Shaver, P.R.; Blascovich, J. What can virtual reality teach us about prosocial tendencies in real and virtual environments? *Media Psychol.* **2008**, *11*, 259–282. [CrossRef]
48. What are the Racial Proportions among Singapore Citizens? Available online: https://www.gov.sg/article/what-are-the-racial-proportions-among-singapore-citizens (accessed on 7 May 2021).
49. Yong, C. Singaporeans respect all races, but racism still an issue: Survey. In *The Straits Times*; Singapore Press Holdings: Singapore, 2016.
50. Dovidio, J.F.; Kawakami, K.; Gaertner, S.L. Implicit and explicit prejudice and interracial interaction. *J. Pers. Soc. Psychol.* **2002**, *82*, 62. [CrossRef]
51. Dovidio, J.F.; Kawakami, K.; Johnson, C.; Johnson, B.; Howard, A. On the nature of prejudice: Automatic and controlled processes. *J. Exp. Soc. Psychol.* **1997**, *33*, 510–540. [CrossRef]
52. McConnell, A.R.; Leibold, J.M. Relations among the implicit association test, discriminatory behavior, and explicit measures of racial attitudes. *J. Exp. Soc. Psychol.* **2001**, *37*, 435–442. [CrossRef]
53. Faul, F.; Erdfelder, E.; Buchner, A.; Lang, A.G. Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behav. Res. Methods* **2009**, *4*, 1149–1160. [CrossRef] [PubMed]

54. Wilcox, C.; Sigelman, L.; Cook, E. Some like it hot: Individual differences in responses to group feeling thermometers. *Public Opin. Q.* **1989**, *53*, 246–257. [CrossRef]
55. Alwin, D.F. Feeling thermometers versus 7-point scales: Which are better? *Sociol. Methods Res.* **1997**, *25*, 318–340. [CrossRef]
56. Aron, A.; Aron, E.N.; Smollan, D. Inclusion of the other in the self scale and the structure of interpersonal closeness. *J. Personal. Soc. Psychol.* **1992**, *63*, 595–612. [CrossRef]
57. Hayes, A.F. *Introduction to Mediation, Moderation, and Conditional Process. Analysis: A Regression-Based Approach*, 2nd ed.; Little, T.D., Ed.; Guilford Press: New York, NY, USA, 2013.
58. Ratan, R.; Hasler, B.S. Exploring self-presence in collaborative virtual teams. *PsychNology J.* **2010**, *8*, 11–31.
59. Cohen, J.; Cohen, P.; West, S.G.; Aiken, L.S. *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*, 3rd ed.; Routledge: New York, NY, USA, 2002. [CrossRef]
60. Spiller, S.A.; Fitzsimons, G.J.; Lynch, J.G., Jr.; McClelland, G.H. Spotlights, floodlights, and the magic number zero: Simple effects tests in moderated regression. *J. Mark. Res.* **2013**, *50*, 277–288. [CrossRef]
61. Scheepers, D.; Spears, R.; Doosje, B.; Manstead, A.S.R. The social functions of ingroup bias: Creating, confirming, or changing social reality. *Eur. Rev. Soc. Psychol.* **2006**, *17*, 359–396. [CrossRef]
62. Costantini, M.; Haggard, P. The rubber hand illusion: Sensitivity and reference frame for body ownership. *Conscious. Cogn.* **2007**, *16*, 229–240. [CrossRef]
63. Debarba, H.G.; Bovet, S.; Salomon, R.; Blanke, O.; Herbelin, B.; Boulic, R. Characterizing first and third person viewpoints and their alternation for embodied interaction in virtual reality. *PLoS ONE* **2017**, *12*, e0190109. [CrossRef]
64. Petkova, V.; Khoshnevis, M.; Ehrsson, H.H. The perspective matters! Multisensory integration in ego-centric reference frames determines full-body ownership. *Front. Psychol* **2011**, *2*. [CrossRef]
65. Stolz, S.A. Embodied learning. *Educ. Philos. Theory* **2015**, *47*, 474–487. [CrossRef]
66. Trope, Y.; Liberman, N. Construal-level theory of psychological distance. *Psychol. Rev.* **2010**, *117*, 440. [CrossRef] [PubMed]
67. Liberman, N.; Trope, Y.; Stephan, E. Psychological distance. In *Social Psychology: Handbook of Basic Principles*, 2nd ed.; Kruglanski, A.W., Higgins, E.T., Eds.; The Guilford Press: New York, NY, USA, 2007; pp. 353–381.
68. Van Boven, L.; Kane, J.; McGraw, A.P.; Dale, J. Feeling close: Emotional intensity reduces perceived psychological distance. *J. Pers. Soc. Psychol.* **2010**, *98*, 872. [CrossRef]
69. Levin, S.; Van Laar, C. *Stigma and Group Inquality: Social Psychological Approaches*; Lawrence Erlbaum: Mahwah, NJ, USA, 2006.
70. Becker, J.C.; Tausch, N. When group memberships are negative: The concept, measurement, and behavioral implications of psychological disidentification. *Self Identity* **2013**, *13*, 294–321. [CrossRef]
71. Ikegami, T. Precursors and consequences of in-group disidentification: Status system beliefs and social identity. *Identity* **2010**, *10*, 233–253. [CrossRef]
72. Glasford, D.E.; Pratto, F.; Dovidio, J.F. Intragroup dissonance: Responses to ingroup violation of personal values. *J. Exp. Soc. Psychol.* **2008**, *44*, 1057–1064. [CrossRef]
73. Riva, G.; Mantovani, F.; Capideville, C.S.; Preziosa, A.; Morganti, F.; Villani, D.; Gaggioli, A.; Botella, C.; Alcaniz, M. Affective interactions using virtual reality: The link between presence and emotions. *Cyberpsychology Behav.* **2007**, *10*, 45–56. [CrossRef]
74. De la Peña, N.; Weil, P.; Llobera, J.; Giannopoulos, E.; Pomés, A.; Spanlang, B.; Friedman, D.; Sanchez-Vives, M.V.; Slater, M. Immersive journalism: Immersive virtual reality for the first-person experience of news. *Presence Teleoperators Virtual Environ.* **2010**, *19*, 291–301. [CrossRef]
75. Oh, C.S.; Bailenson, J.N.; Welch, G.F. A systematic review of social presence: Definition, antecedents, and implications. *Front. Robot. AI* **2018**, *5*. [CrossRef]
76. Löffler, C.S.; Greitemeyer, T. Are women the more empathetic gender? The effects of gender role expectations. *Curr. Psychol.* **2021**. [CrossRef]
77. O'Brien, E.; Konrath, S.H.; Grühn, D.; Hagen, A.L. Empathic concern and perspective taking: Linear and quadratic effects of age across the adult life span. *J. Gerontol. Ser. B* **2013**, *68*, 168–175. [CrossRef]
78. Christov-Moore, L.; Simpson, E.A.; Coudé, G.; Grigaityte, K.; Iacoboni, M.; Ferrari, P.F. Empathy: Gender effects in brain and behavior. *Neurosci. Biobehav. Rev.* **2014**, *46*, 604–627. [CrossRef]