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Multisensory stimulation with other-race faces and the reduction of racial prejudice

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Abstract

This study investigated whether multisensory stimulation with other-race faces can reduce racial prejudice. In three experiments, the faces of Caucasian observers were stroked with a cotton bud while they watched a black face being stroked in synchrony on a computer screen. This was compared with a neutral condition, in which no tactile stimulation was administered (Experiment 1 and 2), and with a condition in which observers' faces were stroked in asynchrony with the onscreen face (Experiment 3). In all experiments, observers experienced an enfacement illusion after synchronous stimulation, whereby they reported to embody the other-race face. However, this effect did not produce concurrent changes in implicit or explicit racial prejudice. This outcome contrasts with other procedures for the reduction of self-other differences that decrease racial prejudice, such as behavioural mimicry and intergroup contact. We speculate that enfacement is less effective for such prejudice reduction because it does not encourage perspective-taking.

Introduction

The cognitive representation of our own body is flexible and constantly updated. A striking illustration of this effect comes from the rubber hand illusion. Watching a rubber-hand being stroked in synchrony with one's own hand produces the feeling that the rubber hand is, in fact, one's own (Botvinick & Cohen, 1998; Tsakiris & Haggard, 2005). This illusion does not appear when observers simply watch a rubber hand (that is not stroked) or when asynchronic stimulation is given, by inducing a delay between the stroking of the rubber hand and an observer's own. Moreover, a similar effect has also been observed with other body parts, such as arms (Guterstam, Petkova, & Ehrsson, 2011), and even the whole body (Lenggenhager, Tadi, Metzinger, & Blake, 2007; Petkova et al., 2011).

Interestingly, faces are also susceptible to rubber hand-like effects (see, e.g., Maister, Tsiakkas, & Tsakiris, 2013b; Sforza, Bufalari, Haggard, & Aglioti, 2010; Tajadura-Jiménez, Grehl, & Tsakiris, 2012a; Tsakiris, 2008). When observers' own faces are stroked in synchrony with a target face, they tend to perceive the target face as more similar to their own (see, e.g., Paladino, Mazzurega, Pavini, & Schubert, 2010; Sforza et al., 2010; Tajadura-Jiménez et al., 2012a; Tsakiris, 2008). This perceptual effect is accompanied by a phenomenological illusion that the other face *belongs* to the observer. This bias in self-recognition or "enfacement effect" (Sforza et al., 2010) is not found after asynchronous stimulation. This indicates that synchronous, but not asynchronous, multisensory stimulation supports the updating of cognitive representations of the own face.

These embodiment effects are not only informative about the characteristics of cognitive representations of the body, but also provide insight into social cognition. Embodied accounts suggest that the body experience determines sociocognitive processing (e.g., Gallese, Keysers, & Rizzolatti, 2004), and research of the rubber hand and enfacement illusion support this claim (e.g., Bufalari, Lenggenhager, Porciello, Serra-Holmes, & Aglioti, 2014; Fini, Cardini, Tajadura-Jiménez, Serino, & Tsakiris, 2013; Maister, Sebanz, Knoblich, & Tsakiris, 2013a; Maister et al., 2013b; Paladino et al., 2010). For example, after synchronous multisensory stimulation (SMS) with an unfamiliar face, observers report more positive affective reactions and more conformity behaviour toward the unfamiliar face than after asynchronous stimulation (Paladino et al., 2010). This effect is also seen in the domain of emotion recognition, as SMS of the face enhances observers' sensitivity to others' fearful facial expressions (Maister et al., 2013b). These findings suggest that synchronous multisensory stimulation blurs self-other boundaries not only with regard to physical appearance but also in a more social sense, by reducing differences between the self and an enfaced face. As a consequence, the enfaced face is held to be included in the self-space (Paladino et al., 2010; Schubert & Otten, 2002), by producing an overlapping of its mental representation with the self (see Tsakiris, 2010; Paladino et al., 2010).

Such *differences reduction* also seems to be an important concept for understanding other social behaviours, such as intergroup relations (Billing & Tajfel, 1973; Roccas & Schwartz, 1993; Hall, Crisp, & Suen, 2009). For example, when observers are asked to list attributes that people of their own and another race share, the differences between these groups are blurred, which produces a positive effect in the reduction of prejudice (Hall et al., 2009). Other tasks, such as behavioural mimicry and intergroup contact, are also based on the reduction of self-other differences and have been employed to decrease prejudice toward outgroup members (see Crips & Turner, 2009; Davis, Conklin, Smith, & Luce, 1996; Gaertner & Dovidio, 2000; Inzlicht, Gutsell, & Legault, 2012; Pettigrew & Tropp, 2006; Turner, Crisp, & Lambert, 2007). For example, when observers mimic actions of an other-race actor, such as reaching and grasping a glass, they subsequently show reduced implicit racial prejudice towards that race in the Affect Misattribution Paradigm (Inzlicht et al., 2012; Payne, Cheng, Govorun, & Stewart, 2005). Similarly, contact between members of different groups seems to reduce prejudice toward the outgroup (see Pettigrew & Tropp, 2006), even when this intergroup contact is imagined (Crips & Turner, 2009; Turner et al., 2007; Turner & Crisp, 2010). For example, observers who imagine contact with an elderly person subsequently demonstrate less implicit bias toward the elderly compared to control observers (Turner & Crisp, 2010; Experiment 1), and similar results are found when non-Muslim observers imagine contact with Muslims (Turner & Crisp, 2010; Experiment 2).

This research shows that SMS, intergroup contact and behavioural mimicry share two important features. Firstly, all of these tasks require that observers have some contact with other people. In SMS, this contact is produced through mirror-like reflection, as observers receive specular stimulation with the onscreen face (see, e.g., Sforza et al., 2010; Tsakiris, 2008). In behavioural mimicry, the contact with the other is produced through the imitation of others' actions (Inzlicht et al., 2012). And in the case of intergroup contact, the contact is produced face-to-face or simply can be imagined (see, e.g., Pettigrew & Tropp, 2006; Turner & Crisp, 2010). Secondly, in all of these tasks the difference between the self and others is reduced by increasing the overlap of their mental representations (see, e.g., Hall et al., 2009; Paladino et al., 2010; Farmer, Tajadura-Jiménez, & Tsakiris, 2012; Inzlicht et al., 2012; Turner & Crisp, 2010).

If SMS, imagined intergroup contact and behavioural mimicry share these features, and imagined intergroup contact and behavioural mimicry reduce prejudice toward outgroup members, then it is possible that SMS produces a similar effect on prejudice reduction. So far, the evidence on this is mixed (for a review, see Maister, Slater, Sanchez-Vives, & Tsakiris, 2015). For example, after the enfacement of an other-race face, observers exhibit a more pronounced *visual remapping of touch* effect for that particular face, which is an increased tactile sensitivity in observers when viewing another person being touched (see Cardini, Tajadura-Jiménez, Serino, & Tsakiris, 2012; Marcoux et al., 2013). This effect seems to be amplified in observers who have a stronger implicit bias against other-race people (Fini et al., 2013). However, this study did not include a post-stimulation measure of racial prejudice. Consequently, it is not possible to determine whether the increased visual remapping of touch was simply due to an increased preference toward the enfaced other-race face (see, e.g., Paladino et al., 2010) or whether this reflects a more general decrease of racial prejudice.

In another study, visuo-tactile stimulation increased participants' body-ownership experience over a rubber hand from another race (Farmer et al., 2012). This created an enhanced skin conductance response in observers when painful stimuli, such as a hypodermic syringe, were thrust into this rubber hand. Observers who reported a stronger sense of ownership over the other-race rubber hand also showed reduced implicit racial prejudice, as measured with the Implicit Association Task (IAT: Greenwald, McGhee, & Schwartz, 1998). However, these effects were independent of whether synchronous or asynchronous stimulation was delivered. Similarly, another study found reduced racial prejudice after observers embodied an other-race virtual body in comparison to same-race or purple-skinned avatars (Peck, Seinfeld, Aglioti, & Slater, 2013). However, whereas this effect was observed after synchronous visuo-motor stimulation, in which the virtual body mimicked participants' own movements, it was not reliable in comparison with a non-embodied condition in which such synchrony was absent. This indicates that it might be a general feeling of ownership over embodied hands and bodies, and not synchronous stimulation, that produced the reduction in racial prejudice in these studies (see also Maister et al., 2013a).

In light of these findings, the present study sought to investigate further whether *synchronous* multisensory stimulation can increase the feeling of ownership over an other-race person and whether this can specifically reduce racial prejudice. For this purpose, we focused on faces as these provide a particularly distinctive physical feature for the perception of the self and others (Devue & Brédart, 2011). Compared to hands and other body parts, the face also provides a richer source of information of others' emotional and mental states, which promotes social interaction (Richeson, Dovidio, Shelton, & Hebl, 2007). Consequently, the face might also act as an important stimulus for the reduction of racial prejudice through multisensory stimulation.

In Experiment 1 and 2, observers received facial tactile stimulation that was synchronous with the stroking of an other-race onscreen face, or received no stimulation while the other-race face was being watched (i.e., neutral stimulation). In Experiment 3, observers then received either synchronous or asynchronous stimulation with an other-race face. To measure the effect of this manipulation on racial prejudice, we employed the IAT (Greenwald et al., 1998), which provides an implicit measure of intergroup attitudes toward different ethnic groups, nationalities, religions and sexes (see Schnabel, Asendorpf, & Greenwald, 2008). In the current study, the IAT compares the fluency, in terms of reaction times, with which Caucasian observers match stimuli that correspond either to ingroup or outgroup categories (e.g., same- and other-race faces) with words that carry a positive or negative meaning (e.g., peace and anger). In this paradigm, an increase in reaction times to match outgroup related stimuli with positive words and a decrease to match outgroup related stimuli with negative words is considered to reflect implicit prejudice toward the outgroup. Racial prejudice was also measured explicitly with Lepore and Brown's (1997) subtle racial prejudice questionnaire. This questionnaire measures racial prejudice on Likert scales and is suitable for British participants (see Lepore & Brown, 1996).

If SMS of the face reduces racial prejudice similar to other procedures of differences reduction, such as imagined contact and behavioural mimicry (e.g., Inzlicht et al., 2012; Turner & Crisp, 2010), then observers should show less prejudice toward the outgroup after synchronous stimulation than in the neutral and asynchronous conditions. If, on the other hand, observers' general feeling of ownership over an other-race face is related to such prejudice reduction, independent of the type of stimulation (see Farmer et al., 2012; Maister et al., 2013a), then observers with the strongest sense of such ownership should show the least racial prejudice.

Experiment 1

This experiment investigated whether SMS of the face produces a modulation in prejudice toward outgroup members, as is the case in imagined intergroup contact and mimicry paradigms (see, e.g., Turner & Crisp, 2010; Inzlicht et al., 2012). Observers were exposed to synchronous and neutral stimulation with the onscreen face of an other-race model. After the stimulation stage, racial prejudice was measured implicitly, using the name-race IAT (Hall et al., 2009), and explicitly, with the subtle racial prejudice questionnaire (Lepore & Brown, 1997). If multisensory stimulation can reduce racial prejudice, then observers should show less prejudice toward the model's ethnic group after stimulation in the synchronous condition than in the neutral condition.

Method

Participants

Thirty Caucasian females, with a mean age of 19 years (SD = 2.1), participated in this study. All were students at the University of Kent, who gave their informed consent to take part, and received course credits or a small payment for participation. All reported normal or corrected-to-normal vision.

Stimuli

Preparation of multisensory stimuli

To create the stimuli for the multisensory stimulation, three black female models were video-recorded in full colour. Two different videos were recorded for each model. In both videos, the models look straight at the camera with a neutral expression. In the first video, which was recorded for the synchronous condition, the models' right cheek was stroked with a cotton bud every two seconds for two minutes. In the second video, the models did not receive any tactile stimulation. This video was used in the neutral condition

The videos were presented in full-screen mode on a 21'' screen monitor placed approximately 75 cm from observers. In full-screen mode, the faces measured approximately 9 (W) by 19 (H) degrees of visual angle. Example stills from this video footage are provided in Figure 1.

The name-face IAT

To measure racial attitudes, the Implicit Association Test (IAT; Greenwald et al., 1998) was displayed with Inquisit software (Millisecond Software). The stimuli in this IAT have been used in previous research (Hall et al., 2009) and comprise names for black and white people and words with a positive or negative meaning. The names were suitable for a British context and consisted of *John, Paul, Brian, Pete, Robert, Katie, Sara, Susie, Melanie,* and *Emily* for white people, and of *Latonya, Tanisha, Malika, Teretha, Lakisha, Leroy, Rasaan, Tyree, Deion,* and *Lamont* for black people. The positive words were *Rainbow, Gift, Joy, Paradise, Laughter, Cuddle, Glory, Gold, Kindness,* and *Peace*, while the negative words were *Sadness, Anger, Vomit, War, Hell, Slum, Slime, Filth, Stink,* and *Cockroach.*

In this name-race IAT, the observers' task is to classify words as quickly as possible as positive or negative, and names as black or white. These stimuli were presented in the centre of the screen in black Arial font at size 36. The task is comprised of seven blocks. In Block 1, observers were presented with words, which had to be classified as positive or negative by pressing the ‘z’ or ‘m’ key on a standard computer keyboard. In Block 2, observers were asked to classify names as ingroup (i.e., white names) or outgroup exemplars (i.e., black names) with the same two keys. In Block 3, observers performed the combined categorization of words and names, by requiring pressing, for example, the ‘z’ key if the stimulus was a white name or a positive word and the ‘m’ key if the stimulus was black or a negative word. This was followed by Block 4, which was identical to Block 3. Block 5 was identical to Block 1 but with reversed keys. In Block 6, observers then performed the combined categorization, but in this case the name-word relation was reverted compared to Blocks 3 and 4. Thus, if Blocks 3 and 4 combined white with positive and black with negative, then Block 6 combined white with negative and black with positive. Finally, Block 7 was identical to Block 6. Each block contained 24 trials. Assignment of the different categories to the response keys was counterbalanced across participants.

In line with previous work (e.g., Hall et al., 2009), Blocks 1, 2 and 5 were practise trials, whereas Blocks 3, 4, 6 and 7 were the critical blocks that were used to calculate a measure of prejudice. This prejudice measure was based on the reaction times with which Caucasian observers matched stimuli that correspond either to ingroup or outgroup categories (i.e., white and black names) when the same response keys are also used to classify words that carry a positive or negative meaning (i.e., peace and anger). As all of our observers were Caucasian, the pairings white/positive words and black/negative words were congruent in this framework. On the other hand, white/negative words and black/positive words were incongruent.

Prejudice scale

Lepore and Brown’s (1997) racial prejudice scale was used to measure subtle explicit racial prejudice. This scale comprises 15 statements to assess prejudice toward black people, which are listed in Table 1. Participants rate their agreement with each statement on a 7-point Likert scale, ranging from "*strongly disagree*" to "*strongly agree*". Scores on this scale range from 15 to 105, with a midpoint of 60 and high scores indicating lower prejudice. Previous research (see Lepore & Brown, 1997) has shown that this questionnaire is suitable for the British context and has good construct validity and a high internal reliability (Cronbach's α = .85).

Enfacement questionnaire

A questionnaire was administered to assess observers' enfacement experience. A set of 8 items was taken from Tajadura-Jiménez et al. (2012a; see also Maister et al., 2013b). These items consist of statements that assess the subjective enfacement experience and are provided in Table 2. Observers record their agreement with each statement on a 7-point Likert scale, ranging from *"strongly disagree"* to "*strongly agree*". These items are analysed separately but an overall enfacement score can also be calculated by summing all scores. A high overall score indicates that observers felt that the onscreen face had become integrated with the internal representation of their own face during the stimulation stage (see Tajadura-Jiménez, Longo, Coleman, & Tsakiris, 2012b).

Procedure

In this experiment, observers first watched a two-minute video of a black model being stroked on the cheek with a cotton bud (in the synchronous condition) or without any tactile stimulation (in the neutral condition). While watching the videos of the synchronous condition, an identical cotton bud to that seen in the video was used to provide specular tactile stimulation to the observers' cheek. During the neutral video, no tactile stimulation was administered. After each of the videos, observers performed the IAT, the prejudice scale and the enfacement questionnaire. Each participant performed this sequence twice, once for the synchronous condition and once for the neutral condition. The order of these conditions, and the identity of the model in each condition, was counterbalanced across observers over the course of the experiment.

Results

Enfacement questionnaire

To determine whether SMS affects how observers *feel* about the onscreen face, responses to the enfacement questionnaire were analysed. These data are provided in Figure 2 as mean Likert responses to each of the items for the synchronous and the neutral condition. As can be seen in Figure 2, SMS influenced observers' feelings about the onscreen face. This effects was such that observers were more likely to report that this face was their own face in the synchronous condition than in the neutral condition (items 1, 2 and 3), paired sample t-tests, all $ts(29) \geq 3.28$, $ps < .01$. Observers also reported feeling a greater resemblance between their own and the onscreen face in the synchronous than in the neutral condition (items 4 and 6), both $ts(29) \geq 2.42$, $ps < .05$. In addition, observers were more likely to report that their own face was out of control and that the experience of their face was less vivid than normal in the synchronous than in the neutral condition (items 5 and 7), both $ts(29) \geq 2.33$, $ps < .05$. However, observers did not feel that they were imitating the other person (item 8), $t(29) = 1.94$, $p = .06$.

In addition, the overall enfacement score was calculated for each observer by summing the scores for items 1 to 8. A 2 x 2 mixed-factor ANOVA, with the within-subjects factor stimulation (synchronous vs. neutral) and the between-subjects factor block order (synchronous first vs. neutral first) did not show a main effect of block order, $F(1,28) = 0.16$, $p = .68$, $\eta^2_p = .00$, or interaction between block order and stimulation, $F(1,28) = 1.13$, $p = .29$,

$\eta^2_p = .03$. However, a main effect of stimulation was found, $F(1,28) = 18.23$, $p < .001$, $\eta^2_p = .39$, which reflects a higher total enfacement score in the synchronous (M = 29.5, SD = 10.9) than the neutral condition (M = 22.1, SD = 9.8).

Racial prejudice measures

In a further step of our analysis, the scores for the IAT and the racial prejudice scale were analysed. For the IAT, D scores using the improved scoring algorithm (Greenwald, Nosek, & Banaji, 2003) were computed. This score is based on the differences between the average latency data from the combined critical blocks (i.e., blocks 4 and 7), divided by the standard deviation of all latencies for both blocks (for further details, see Greenwald et al., 2003). The resulting scores range between -2 and +2. In this study, the pairings of white/positive words and black/negative words were congruent. Thus, positive scores indicated a preference toward ingroup members (white people in our case), which is interpreted as a sign of racial prejudice (e.g., Hall et al., 2009). Individual D scores are presented in Figure 3 and show overall similar performance across stimulation conditions (synchronous M = 0.43, SD = 0.35; neutral M = 0.35, SD = 0.39). In fact, only 13 of 30 observers recorded a lower prejudice score in the synchronous than the neutral condition. In addition, these scores were also similar across block order (synchronous first M = 0.32, SD = 0.39; neutral first M = 0.45, SD = 0.42). A 2 (stimulation: synchronous vs. neutral) x 2 (block order: synchronous first vs. neutral first) mixed-factor ANOVA did not show a main effect of stimulation or block order, or an interaction, all $Fs(1,28) \leq 1.90$, $ps \geq .17$, $\eta^2_p \leq .06$.

For Lepore and Brown's racial prejudice scale, responses to items 1, 6, 10, 11 and 14 were reversed, in line with the standard evaluation of this questionnaire. An overall score was then calculated for each observer by adding items 1 to 15 for each condition. These scores were similar across stimulation conditions (synchronous: M = 71, SD = 10; neutral: M = 70, SD = 10) and block order (synchronous first: M = 70, SD = 14; neutral first: M = 71, SD = 15). The main effects of stimulation and order, and the interaction between these factors, were not significant, all $Fs(1,28) \leq 2.37$, $ps \geq .14$, $\eta^2_p \leq .01$.

Overall, the scores from the IAT and the racial prejudice scale therefore suggest that SMS did not affect observers' racial prejudice levels. However, it is conceivable that the absence of prejudice reduction here relates to the within-subject repetition of these measures. To explore this possibility, we repeated the data analysis for the first block only on a between-subject basis. These scores are also similar across the synchronous and neutral conditions for the IAT (synchronous M = 0.40, SD = 0.42; neutral M = 0.57, SD = 0.41), $t(28) = 1.13$, $p = .26$, and the prejudice scale (synchronous M = 70, SD = 11; neutral M = 70, SD = 8), $t(28) = .29$, $p = .97$.

Recent research has also shown that the degree of ownership that observers experience over an other-race rubber hand relates to their racial prejudice (Maister et al., 2013a). Thus, it is still possible that the feeling of ownership over the onscreen face affected racial prejudice in the current study, regardless of the type of stimulation delivered. To explore whether such a relationship exists, Pearson correlations were conducted between the total enfacement score and the IAT and the explicit prejudice scale. This showed no correlation between the total enfacement score and the IAT, $r(58) = -.05$, $p = .68$, or between the total enfacement score and the prejudice scale, $r(58) = -.01$, $p = .93$.

Discussion

Experiment 1 explored whether SMS of the face modulates racial prejudice. This was investigated by comparing a stimulation condition in which observers' faces were stroked in synchrony with an other-race face with a neutral condition in which neither the observers nor the onscreen face were stroked. The enfacement illusion was measured with an established questionnaire (Maister et al., 2013b; Tajadura-Jiménez, et al., 2012a), while racial prejudice was measured implicitly with the IAT (Greenwald et al., 1998) and with the explicit racial prejudice scale (Lepore & Brown, 1997). Observers' scores in the enfacement questionnaire indicated a persistent subjective enfacement effect after SMS that was evident in seven out of eight items. This result supports previous research, by showing that it is possible to enface other-race faces (Bufalari et al., 2014; Fini et al., 2013). However, we did not find an effect of SMS on racial prejudice, both when this was measured with the IAT and the racial prejudice scale. Thus, SMS did not appear to reduce implicit or explicit racial prejudice.

Two possible reasons may explain the absence of racial prejudice modulations in our experiment. Firstly, it remains possible that observers represent the onscreen model's features better after synchronous stimulation than in the neutral condition. However, this enhanced representation might not be strong enough to modulate racial prejudice. Secondly, it is also possible that SMS is able to modulate racial prejudice but neither our implicit (the IAT) or explicit (Lepore and Brown's subtle racial prejudice scale) measures are sufficiently sensitive to detect such a modulation. In line with this reasoning, recent research has questioned the validity of the name-race IAT to measure racial prejudice, as the preference toward ingroup names (i.e., white names in our case) could reflect an effect of familiarity toward those names rather than racial prejudice toward the outgroup (i.e., black people; see van Ravenzwaaij, van der Maas, & Wagenmakers, 2011). To rule out these possibilities, we conducted a second experiment in which a different version of the IAT was used.

Experiment 2

This experiment is identical to Experiment 1, except that the name-race IAT was replaced with a face-race version (Dasgupta, McGhee, Greenwald, & Banaji, 2000). In this test, the black- and white-associated names are replaced with black and white faces. This IAT cannot be undermined by (lack of) familiarity with the race stimuli (van Ravenzwaaij et al., 2011) and should therefore provide a more sensitive measure. As in Experiment 1, we used this face-race IAT to explore whether observers would show less racial prejudice after synchronous multisensory stimulation than in the neutral condition.

Method

Participants

Thirty new Caucasian students from the University of Kent, with a mean age of 19 years (SD = 3.1), participated in this study for course credits or payment. All were female, gave informed consent for participation, and reported normal or corrected-to-normal vision.

Stimuli and procedure

The stimuli and procedure were identical to Experiment 1, except for the IAT. In this experiment, the face-race IAT was applied (see Dasgupta et al., 2000). This particular IAT is comprised of eight white faces and eight black faces and words with positive or negative meaning (the same words as in Experiment 1). All face images were presented in greyscale format and measured maximally 104 by 138 pixels at a screen resolution of 72 ppi. As in Experiment 1, observers classified the faces according to their ingroup or outgroup status (i.e., white versus black faces) and the words according to their meaning (i.e., positive versus negative).

Results

Enfacement questionnaire

The data for the enfacement questionnaire are provided in Figure 4, as mean Likert responses to each of the items for the synchronous and neutral conditions. As can be seen in

Figure 4, SMS affected how observers reported to feel about the onscreen face. This effect was such that observers were more likely to report that this face was their own in the synchronous condition than in the neutral condition (items 1, 2 and 3), all $ts(29) \geq 2.06$, $ps < .05$. Observers also reported feeling a greater resemblance with the onscreen face in the synchronous than in the neutral condition (items 4 and 6), both $ts(29) \geq 2.72$, $ps < .05$. In addition, observers were more likely to report that the experience of their own face was less vivid in the synchronous than in the neutral condition (item 7), $t(29) = 2.05$, $ps < .05$. However, an effect of SMS was not always evident, as observers did not feel that their face was out of control (item 5), $t(29) = 1.50$, $p = .14$, or that they were imitating the onscreen face (item 8), $t(29) = 1.80$, $p = .08$. Finally, for the overall enfacement score, a 2 (stimulation: synchronous vs. neutral) x 2 (block order: synchronous first vs. neutral first) mixed-factor ANOVA showed a main effect of stimulation, $F(1,28) = 13.24$, $p < .001$, $\eta^2_p = .32$, due to a higher enfacement score in the synchronous (M = 27.1, SD = 10.0) than the neutral condition (M = 19.9, SD = 7.0). The main effect of order and the interaction between factors were not significant, both $Fs(1,28) \leq 0.47$, $ps > .49$, $\eta^2_p \leq .01$.

Racial prejudice measures

As in Experiment 1, a D score was computed for the IAT. Individual D scores are illustrated in Figure 5 and show overall similar performance across stimulation conditions (synchronous M = 0.21, SD = 0.27; neutral M = 0.25, SD = 0.28). In addition, the scores were also similar across block order (synchronous first M = 0.23, SD = 0.29; neutral first M = 0.44, SD = 0.30). This was confirmed by a 2 (stimulation: synchronous vs. neutral) x 2 (block order: synchronous first vs. neutral first) mixed-factor ANOVA, which did not show main effects or an interaction, all $Fs(1,28) \leq 0.38$, $ps > .54$, $\eta^2_p \leq .01$. Observers' scores were also similar across the stimulation conditions (synchronous: M = 72, SD = 12; neutral: M = 71, SD = 12) and block order (synchronous first: M = 73, SD = 16; neutral first: M = 70, SD = 17) in the subtle racial prejudice questionnaire, which did not show main effects or an interaction, all $Fs(1,28) \leq 0.74$, $ps > .39$, $\eta^2_p \leq .02$.

Once again, we also explored whether the absence of prejudice reduction is due to the repetition of the IAT and the prejudice scale, by analysing the first block only. These scores were similar across the synchronous and neutral conditions for both the IAT (synchronous M = 0.20, SD = 0.26; neutral M = 0.25, SD = 0.21), $t(28) = .58$, $p = .56$, and the prejudice scale (synchronous M = 74, SD = 13; neutral M = 69, SD = 10), $t(28) = 1.03$, $p = .31$. We also analysed again whether racial prejudice was modulated by the subjective feeling of ownership over the onscreen face, regardless of stimulation condition. No correlations were found between the total enfacement score and the IAT, $r(58) = -.06$, $p = .61$, or the prejudice scale, $r(58) = .17$, $p = .18$.

Discussion

Experiment 2 explored further whether SMS of the face modulates racial prejudice. In contrast to Experiment 1, the face-race IAT was used (Dasgupta et al., 2000). This test avoids possible familiarity effects of the name-race IAT test as consequence of the bigger experience that people might have with ingroup names (see van Ravenzwaaij, 2011). Despite these changes, the main findings of Experiment 1 were replicated. Thus, observers felt a stronger subjective enfacement illusion after synchronous stimulation than in the neutral condition. This effect was such that observers were more likely to feel that the onscreen face was their own. This result supports previous research by showing that it is possible to enface other-race faces (Bufalari et al., 2014; Fini et al., 2013). As in Experiment 1, however, we also did not find an effect of SMS or the subjective embodiment experience on implicit or explicit racial prejudice.

Although the face-race IAT in Experiment 2 does not suffer from the limitations of the name-face IAT in Experiment 1, it is still possible that this test is not sufficiently sensitive to detect differences in racial prejudice between conditions here. Both of these IATs compare two complementary categories (i.e., black and white people). Thus, these traditional versions of the IAT (Greenwald & Farnham, 2000; Karpinski & Steinman, 2006) give a measure of implicit attitudes toward the outgroup based on the *comparison* with the ingroup (Karpinski & Steinman, 2006; Maister et al., 2013a). Such relative measures can create ambiguity in the interpretation of IAT scores. For this reason, we conducted a third experiment in which a single-category IAT was employed. This test does not include same-race stimuli, but only measures attitudes toward other-race people to provide a more direct measure of racial prejudice (see Karpinski & Steinman, 2006).

We added a further manipulation in an attempt to improve the sensitivity of the stimulation paradigm. The synchronous and the neutral displays are similar, in the sense that the video content of both condition is congruent with observers' experience (i.e., either synchronous stimulation or no stimulation at all). Consequently, it is possible that these conditions are too similar to modulate racial prejudice. To provide a stronger contrast, the neutral condition was replaced with an asynchronous stimulation condition in Experiment 3. In this condition, observers watched the stroking of the onscreen face and also received concurrent tactile stimulation of their own face. However, this stimulation was applied with a one-second delay, so that it occurred out of synchrony with the onscreen face. A between-subjects design was employed to avoid potential confounding effects from receiving both types of stimulation (i.e., synchronous and asynchronous).

Experiment 3

Experiment 3 modified the stimulation paradigm and the IAT in a further attempt to increase the sensitivity of our measures. In the stimulation task, the neutral condition was replaced with asynchronous stimulation, which is a common comparison condition for both the rubber hand illusion and the enfacement paradigm (see, e.g., Tajadura-Jiménez et al., 2012a; Tsakiris & Haggard, 2005). In the asynchronous condition, observers receive the same tactile stimulation as in the synchronous condition, but this is administered with a one-second delay to the observed stimulation of the onscreen face. Compared with the synchronous condition, the asynchronous condition therefore provides temporal incongruence between what observers feel when they are touched and the touch that they see applied to the onscreen model. If such stimulation produces an enfacement effect that also modulates racial prejudice, then observers should show less prejudice toward the model's ethnic group after synchronous than asynchronous stimulation.

In addition, the IAT was also replaced with a single-category version, which does not contrast attitudes to the outgroup with the ingroup, but measures attitudes toward the outgroup only (see Karpinski & Steinman, 2006; Maister et al., 2013a). For this reason, the single-category IAT is considered a more direct measure of observers' attitudes toward other-race people (Karpinski & Steinman, 2006). In contrast to the preceding experiments, this IAT was administered on a between-subjects basis, so that observers were only exposed to one of the stimulation conditions (i.e., synchronous or asynchronous). However, observers now performed the single-category IAT twice, prior to and after the stimulation stage, to determine whether any change in racial prejudice occurred as a consequence of SMS of the face.

Method

Participants

Sixty Caucasian students from the University of Kent, with a mean age of 19 years (SD= 4.9), participated in the experiment for course credit or payment. All reported normal or corrected-to-normal vision. Half of these participants were allocated to the synchronous and half to the asynchronous stimulation condition.

Stimuli

This experiment is identical to the preceding experiments, except for the following changes. In the stimulation task, the neutral condition was replaced with an asynchronous stimulation condition. In this condition, observers always watched the same videos as in the synchronous condition, which the face of a models' right cheek being stroked with a cotton bud every two seconds for two minutes. While watching these videos, an identical cotton bud to that seen in the video was used to provide specular tactile stimulation to the observers' cheek either in temporal synchrony with the onscreen face, in the synchronous condition, or with a temporal offset of one second, in the asynchronous condition. To fully accommodate the asynchronous condition, two new items were also included in the enfacement questionnaire (see items 9 and 10 in Table 2). These items assessed the source of the tactile sensation and sought to determine the extent to which observers associated the touch of the cotton bud on their own face with that of the onscreen face.

In addition, the standard IAT was replaced with a single-category version. As in the preceding experiments, this IAT is comprised of words and faces but only black faces were included. Observers have to categorize words as either positive or negative and black faces, using either the 'z' or 'm' key on a standard computer keyboard. The task consisted of two different blocks. Positive words and black faces shared the same response key in one block, whereas negative words and black faces shared a response key in the other block. Each of these blocks contained 24 practice trials and 72 experimental trials (for further details, see

Karpinski & Steinman, 2006). Response keys for positive and negative words were counterbalanced.

Procedure

In the experiment, observers began by performing the single-category IAT and the score of this test was used as a baseline measure of racial prejudice. Synchronous or asynchronous stimulation was then administered by stroking observers' faces with a cotton bud at two-second intervals, while they watched a video of a black female being stroked at the same rate. In the synchronous condition, this stimulation was administered in time with the onscreen face. In the asynchronous condition, the tactile stimulation of the observer and the onscreen face was offset by one second. The allocation of observers to these conditions was randomized. The single-category IAT was repeated after this stimulation stage.

Results

Enfacement questionnaire

Observers were more likely to report that the black onscreen face was their own in the synchronous than the asynchronous condition (see items 1, 2 and 3 in Figure 6), all $ts(58) \geq 3.13$, $ps < .01$. Observers were also more likely to report that their face was out of control in the synchronous than the asynchronous condition (item 5), $t(58) = 2.25$, $p < .05$. In addition, observers were more likely to feel that they were imitating the onscreen face in the synchronous condition (item 8), $t(58) = 2.88$, $p < .01$, and that the cotton bud stroking their own face and the cotton bud stroking the onscreen face were the same (items 9 and 10), both $ts(58) \geq 2.52$, $ps < .05$. However, despite the clear convergence in *felt* resemblance between observers' own and the onscreen face, they did not report that these faces *actually* began to resemble each other (items 4 and 6), both $ts(58) \leq 1.89$, $ps > .07$. In addition, observers also did not report that the experience of their own face was less vivid than normal (item 7), $t(58) = 1.93$, $p = .07$. Finally, the overall enfacement effect, by combining scores for all items, was stronger in the synchronous (M = 33.6, SD = 11.9) than the asynchronous condition (M = 23.2, SD = 9.0), $t(58) = 3.81$, $p < .01$.

Racial prejudice measures

The scores for the single category IAT were analysed according to Karpinski and Steinman (2006). This adapted D score for the single category IAT is calculated by subtracting the average response times when other-race faces shared the same key with negative words from the average response times when other-race faces shared the same key with positive words (for further details, see Karpinski & Steinman, 2006). Thus, a positive score reflects a positive attitude toward other-race people. Individual scores in the single category IAT are presented in Figure 7. As can be seen in the figure, these scores were overall similar for the synchronous (pre-test M = -.06, SD = .18; post-test M = -.01, SD = .14) and the asynchronous conditions (pre-test M = -.04, SD = .18; post-test M = -.02, SD = .11). This was confirmed by a 2 x 2 ANOVA with the within-subjects factor time (pre-test vs. post-test) and the between-subject factor condition (synchronous vs. asynchronous). This showed neither a main effect of time, $F(1,58) = 1.50$, $p = .24$, $\eta^2_p = .02$, or condition, $F(1,58) = 0.02$, $p = .85$, $\eta^2_p < .01$, and no interaction between factors, $F(1,58) = 0.19$, $p = .59$, $\eta^2_p < .01$.To explore whether racial prejudice was modulated by observers' feelings of ownership over the onscreen face, Pearson correlations were also conducted between the total enfacement score and the post-test IAT score. This correlation was not significant, $r(58) = .17$, $p = .18$.

Discussion

This experiment explored whether SMS with an other-race face modulates racial prejudice by comparing synchronous and asynchronous stimulation of observers' faces. Before and after the stimulation, observers performed the single-category IAT to provide an implicit measure of their attitudes toward other-race faces. As in previous experiments, observers reported a stronger subjective enfacement illusion in the synchronous condition. In contrast to Experiments 1 and 2, which compared synchronous stimulation with a neutral condition, in which no stroking was administered to the onscreen face or the observers, this effect was now found by comparing synchronous with temporally asynchronous stimulation. This effect was such that observers were more likely to report that the onscreen face was, in fact, their own. Despite this clear multisensory stimulation effect, an effect of SMS on racial prejudice was not found. This replicates the findings of Experiments 1 and 2.

General discussion

This study investigated whether multisensory stimulation with an other-race face produces an enfacement effect that can reduce racial prejudice. In Experiment 1, Caucasian participants were exposed to synchronous stimulation, whereby their own face was stroked in synchrony with an observed black face. This was compared with a neutral condition, in which no tactile stimulation was delivered. Racial prejudice was measured implicitly, with the name-race IAT (e.g., Hall et al., 2009), and explicitly, with the subtle prejudice questionnaire (Lepore & Brown, 1997). After synchronous stimulation, observers were more likely to feel that the onscreen face 'was' their own face and 'belonged' to them. This effect was consistently found, across seven of the eight items on the enfacement questionnaire. However, this change in the onscreen face ownership experience was not accompanied by a modulation of racial prejudice, both on the implicit and explicit measures.

Further experiments explored whether the stimulation paradigm and the racial prejudice measures can be modified to improve the sensitivity of this approach. In Experiment 2 the name-face IAT of Experiment 1 was replaced with a face-race version (Dasgupta et al., 2000), which removes possible familiarity confounds. For example, the name-race IAT cannot measure racial prejudice if observers cannot attribute ethnic origin accurately to the name stimuli (see van Ravenzwaaij et al., 2011). Despite this change, Experiment 2 replicated the main findings. Thus, observers exhibited a clear enfacement effect after synchronous stimulation with the onscreen face, but this did not affect implicit or explicit racial prejudice. Finally, Experiment 3 also compared synchronous and asynchronous stimulation and employed a single category IAT to provide a more specific measure of racial prejudice attitudes against another ethnic group (see Karpinski & Steinman, 2006). Once again, observers were more likely to feel that the other-race onscreen face was their own after synchronous stimulation, but this did not reduce racial prejudice.

These findings converge with previous research by showing that it is possible to embody physical features of an other-race hand (Maister et al., 2013a) or face (Fini et al., 2013; Bufalari et al., 2014). In contrast to previous work, however, a positive effect of SMS of the face on prejudice reduction was not found. For example, a recent study has shown that after the enfacement of an other-race face, an increased visual remapping of touch effect (i.e., the tactile sensitivity caused by watching another person being touched) for the other-race face is found up to the level normally associated with an own-race person (Fini et al., 2013). This could suggest a reduction of racial prejudice after the SMS of the face. However, as the visual remapping of touch effect was measured exclusively for the enfaced face, it is also possible that this effect reflects an increase of positive attitudes toward the enfaced face, but not more generally toward its race. This explanation would be consistent with the finding that SMS produces positive affective reactions toward enfaced faces (e.g., Paladino et al., 2010).

The finding that SMS of the face does not reduce racial prejudice might also appear to contradict studies that have observed such effects after the embodiment of other-race avatars and hands (Farmer et al., 2012; Maister et al., 2013a; Peck et al., 2013). However, these studies observed reductions in racial prejudice independent of whether synchronous or asynchronous stimulation was delivered. This indicates that it might have been the general feeling of ownership, and not synchronous stimulation, that produced the reduction of racial prejudice in previous work.

The current results clearly differ from other procedures that rely on a similar mechanism of differences reduction for prejudice reduction (for a review, see Gaertner & Dovidio, 2000), such as intergroup contact, shared attribute generation (Hall et a., 2009) and behavioural mimicry (e.g., Inzlicht et al., 2012; Tuner & Crisp, 2010). Therefore, the question arises of why SMS is unable to modulate racial prejudice, when other methods of differences reduction do. A possible explanation might lie in the repetition of the IAT and the questionnaire for measuring racial prejudice, which might have reduced the sensitivity of our paradigm. However, this seems unlikely considering that a reduction of racial prejudice has been observed for the rubber hand illusion with such repetitions (Maister et al., 2013a; for similar results, see Peck et al., 2013). Moreover, our current findings persist when the results are analysed for the first experimental block only, which avoids repetition of the tests (see Results of Experiment 1 and 2).

Another possibility is that observers' prejudice was already low (i.e., at floor level) at the start of the current experiments and therefore could not be susceptible to the current manipulation. Across the three experiments, observers' scores fell just above the midpoint of the IAT scale (e.g., at ~ 0.4 in Experiment 1, with the scale ranging from -2 to +2). Thus, these scores rule out a floor (or ceiling) effect and indicate some prejudice toward the other race. Previous studies have successfully modulated racial prejudice on the IAT with other manipulations despite reporting similar baseline scores (see, e.g., Hall et al., 2009; Maister et al., 2013a; Peck et al., 2013). This indicates also that we did not fail to obtain an enfacement modulation because observers' racial prejudice was too low.

Alternatively, it might be possible that SMS of the face can affect self-recognition (Tsakiris, 2008; Sforza et al., 2010; Tajadura-Jiménez et al., 2012a) and social cognition processes (Paladino et al., 2010), but the involved mechanism cannot modulate racial prejudice. For example, such differences could be found if observers can integrate the onscreen face into their own perspective during enfacement, but, conversely, are unable to adopt the model's perspective (see Petkova et al., 2011). In other words, observers might tend to perceive the onscreen face as more similar to their own after enfacement, but not vice versa (Tajadura-Jiménez et al., 2012a, 2012b). Thus, modulation of racial prejudice might not have occurred in the current experiments because observers perceived the other-race faces as more similar to their-own race, instead of perceiving themselves as more similar to the other race. The responses of the enfacement questionnaire cannot distinguish these possibilities (see items 6 and 7 in Table 2), but embodiment studies with hands (Longo et al., 2008) and faces support this idea (Tajadura-Jiménez et al., 2012a, 2012b).

This own-perspective bias appears to be a critical difference between embodiment and other manipulations which decrease racial prejudice, such as behavioural mimicry (Inzlicht et al., 2012), shared attribute generation (Hall et al., 2009), or intergroup contact (Turner & Crisp, 2010). In these procedures, observers must take the model's perspective and should therefore "look" more like the model. In the case of behavioural mimicry, for example, observers have to copy a model's action. The current findings therefore suggest that such perspective-taking might be an important factor for prejudice reduction.

Finally, although SMS of the face or hand does not modulate racial prejudice, there is evidence that a general ownership feeling over (embodied) other-race stimuli relates to observers' prejudice. This effect has been demonstrated in Caucasian observers who, independent of the administered type of multi-sensory stimulation, exhibit less prejudice if they also report a strong sense of ownership over black hands (Farmer et al., 2012; Maister et al., 2013a; Peck et al., 2013). While this indicates that the strength of feeling of ownership over other-race stimuli might be another important factor for prejudice reduction, the current experiments did not show a link between such feelings over an enfaced black *face* and racial prejudice. This raises the questions of why embodiment of other-race hands modulates racial prejudice but of faces does not.

Faces are particularly distinctive physical features and are important not only for recognizing others but also for self-recognition. Moreover, whereas several neuropsychological studies have reported denial of ownership over body parts such as hands or feet in brain-damaged patients (see, e.g., Berlucchi & Aglioti, 1997; Giummarra, Gibson, Georgiou-Karistianis, & Bradshaw, 2008), deficits in self-recognition of faces appear to be less frequent and are, in most of the cases, transient (see Brédart & Young, 2004). This raises the possibility that other peoples' faces are more difficult to embody than other body parts, such as hands. In line with this reasoning, phenomenological evidence suggests that the enfacement illusion is less vivid than both the rubber hand and full-body illusions (Botvinick & Cohen, 1998; Lenggenhager et al., 2007; Sforza et al., 2010; Tsakiris & Haggard, 2005).

From a cognitive perspective, these differences between findings could indicate that different body illusions reflect different aspects of self-identity. For example, psychometric studies have found a *self-identification* component in the rubber illusion and the enfacement illusion (see Longo, Schüür, Kammers, Tsakiris, & Haggard, 2008; Tajadura-Jiménez et al., 2012b). However, this component seems to differ in its statistical weight and structure in both illusions. In the case of the rubber hand illusion, this component is constituted of the subcomponents ownership (i.e., the feeling that the rubber hand was part of the body), location (i.e., the feeling that the rubber hand was in the same place as the own hand), and agency (i.e., the feeling of being able to move the rubber hand; see Longo et al., 2008), and accounts for 26% of the total variance in the data. In the case of the enfacement illusion, on the other hand, no subcomponents for self-identification were found (Tajadura-Jiménez et al., 2012b), but this component itself accounted for the 44% of the total variance. It has been proposed that this reflects the different importance that faces and hands have for self-identity, which appears to be stronger for faces (see Tajadura-Jiménez et al., 2012b). If faces are more strongly tied to an observer's own identity than other body parts, then this might be part of the explanation of why general feelings of ownership over an other-race hand or body can modulate racial prejudice (independent of whether synchronous or asynchronous stimulation is applied, as in Farmer et al., 2012; Maister et al., 2013a; Peck et al., 2013), but over an other-race face cannot (as in the current experiments).

In conclusion, our results converge with previous reports that SMS does not modulate racial prejudice. In contrast to other procedures that can decrease racial prejudice, such as intergroup contact and behavioural mimicry, the absence of a similar effect in an enfacement paradigm might have occurred because observers perceive the embodied other-race faces as more similar to themselves than vice versa. Such egocentric perspective-taking might reflect the importance of faces for self-identity.

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TABLE 1. The Subtle Prejudice Questionnaire

Subtle prejudice questionnaire items
1. It makes sense for minority groups to live in their own neighbourhood because they share more and get along better than when mixing with whites.
2. I consider our society to be unfair to black people.
3. It should be easier to acquire British citizenship.
4. The number of black members of parliament is too low and political parties should take active steps to increase it.
5. Minority groups are more likely to make progress in future by being patient and not pushing so hard for change.
6. Given the present high level of unemployment, foreigners should go back to their countries.
7. The right of the immigrants should be restricted (1), left as they are (4), extended (7).
8. If many black persons moved to my neighbourhood in a short period of time, thus changing its ethnic composition, it would not bother me.
9. If people move to another country, they should be allowed to maintain their own traditions.
10. Once minority groups start getting jobs because of their colour, the result is bound to be fewer jobs for whites.
11. Those immigrants who do not have immigration documents should be sent back to their countries.
12. Some black people living here who receive support from the state could get along without it if they tried.
13. Suppose that a child of yours had a child with a person of very different colour and physical characteristics than your own. If your grandchildren did not physically resemble the people on your side of the family, you would be very bothered (1), not bothered at all (7).
14. It is unfair to the people of one country if the immigrants take jobs and resources.
15. I would not be concerned if most of my peers at the university were black.

TABLE 2. The Enfacement Questionnaire

Enfacement Item
1. I felt like the other's face was my face.
2. It seemed like the other's face belonged to me.
3. It seemed like I was looking at my own mirror reflection.
4. It seemed like my own face began to resemble the other person's face.
5. It seemed like my own face was out of my control.
6. It seemed like the other's face began to resemble my own face.
7. It seemed like the experience of my face was less vivid than normal.
8. I felt that I was imitating the other person.
9. The touch I felt was caused by the cotton bud touching the other's face.
10. The touch I saw on the other's face was caused by the cotton bud touching my own face

FIGURE 1. Example video stills from the synchronous/asynchronous condition (left panel) and the neutral condition (right panel).

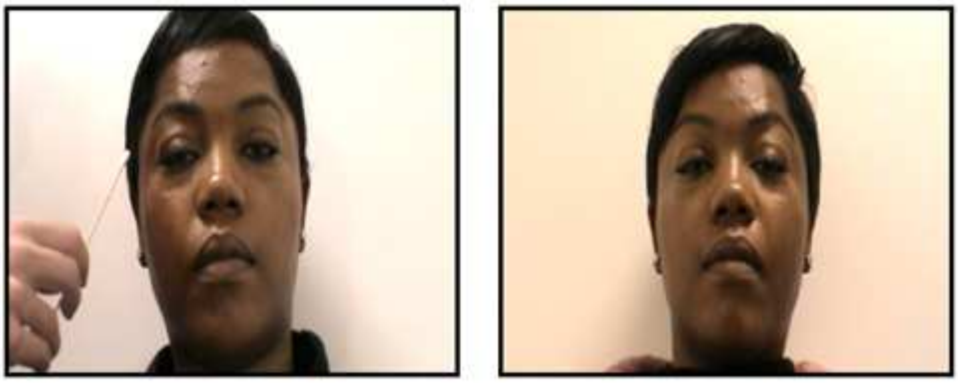

FIGURE 2. Mean Likert responses to each enfacement item for the synchronous and the neutral condition in Experiment 1. Note: * $p < .05$; ** $p < .01$; *** $p < .001$.

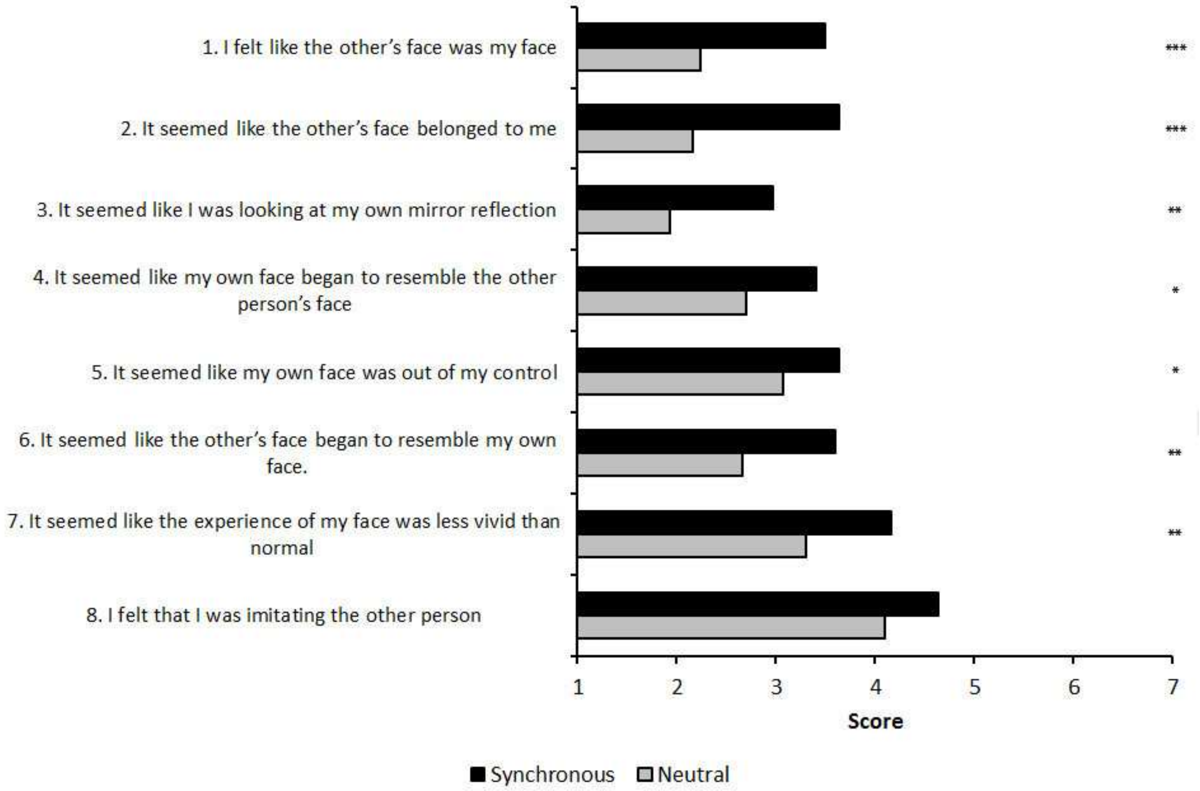

FIGURE 3. Individual performance in the name-race IAT for the synchronous and neutral condition in Experiment 1.

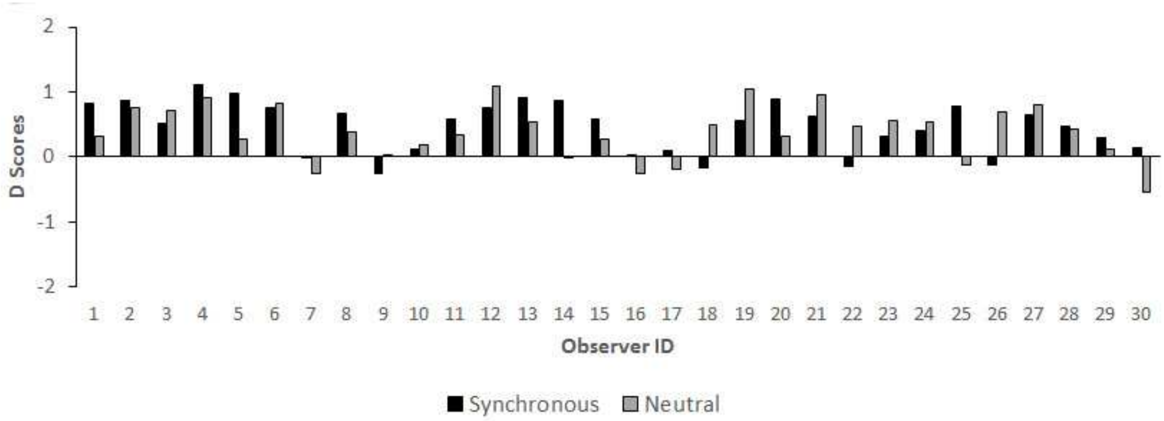

FIGURE 4. Mean Likert responses to each enfacement item for the synchronous and the neutral condition in Experiment 2. Note: * $p < .05$; ** $p < .01$; *** $p < .001$.

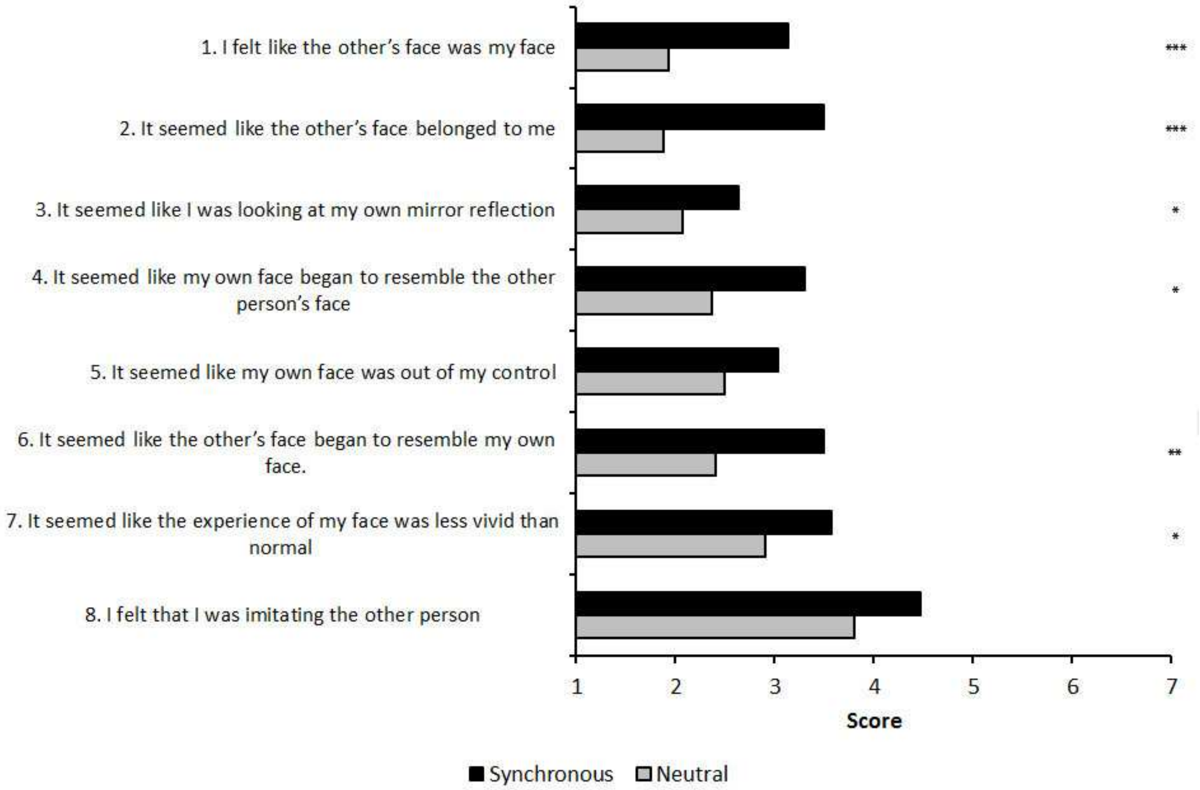

FIGURE 5. Individual performance in the face-race IAT for the synchronous and neutral condition in Experiment 2.

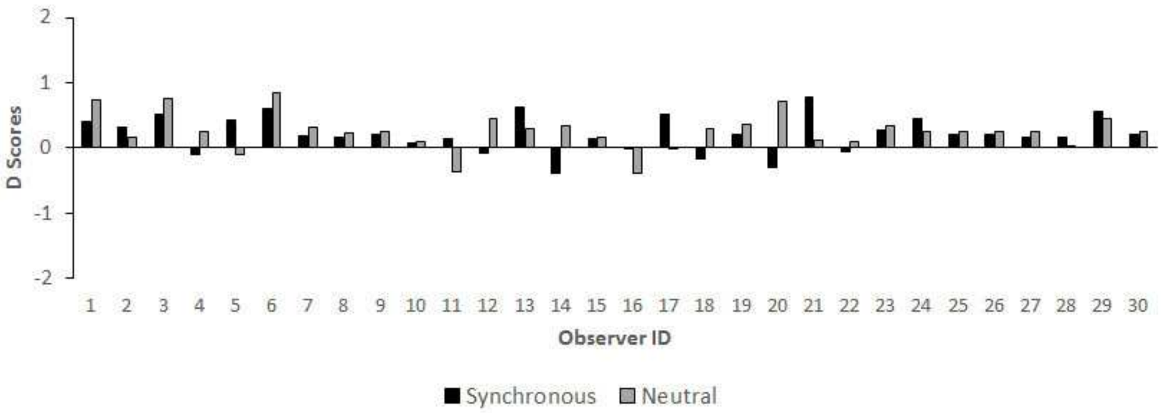

FIGURE 6. Mean Likert responses to each enfacement item for the synchronous and the asynchronous condition in Experiment 3. Note: * $p < .05$; ** $p < .01$; *** $p <.001$.

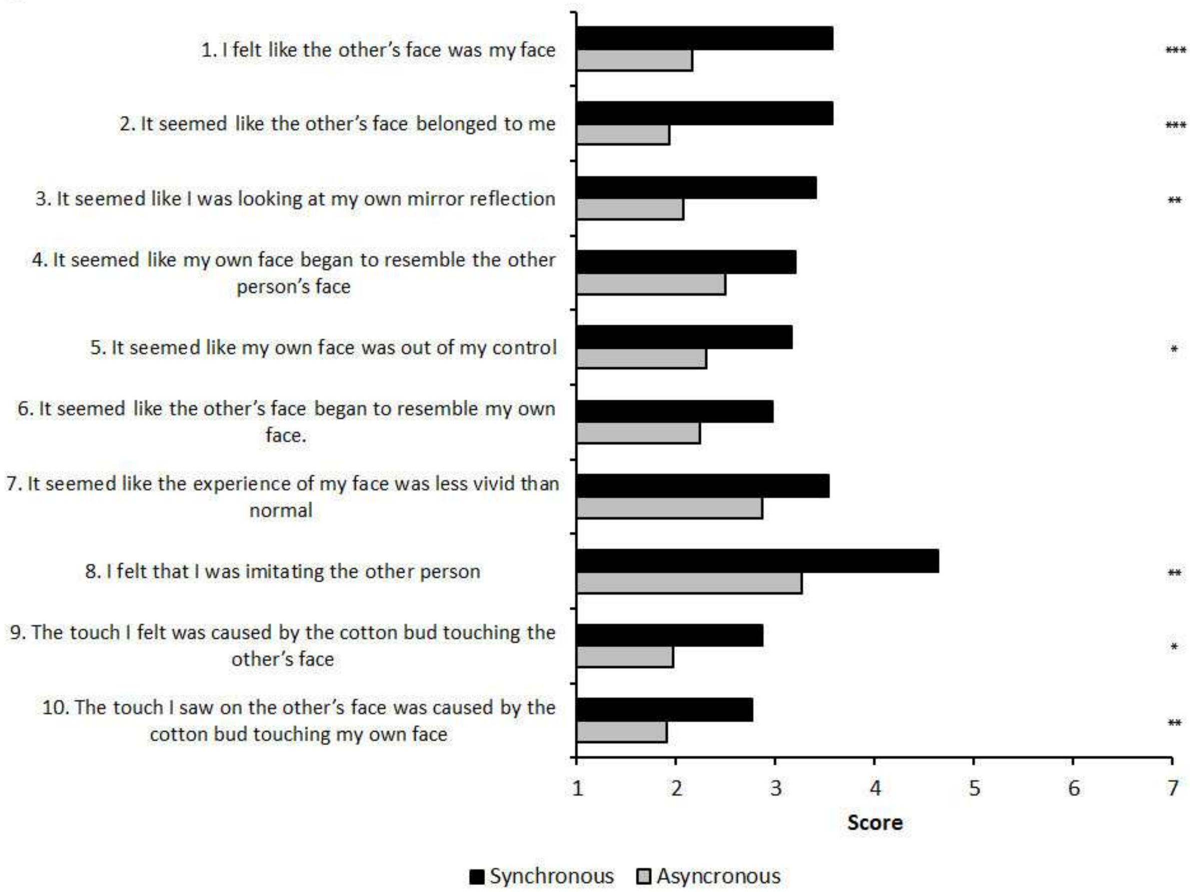

FIGURE 7. Individual performance for the pre- and post-test IAT of the synchronous and asynchronous conditions in Experiment 3.