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Race Categorization Modulates Holistic Face Encoding

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Abstract

Recent studies have shown that same-race (SR) faces are processed more holistically than other-race (OR) faces, a difference that may underlie the greater difficulty at recognizing OR than SR faces (the "other-race effect"). This article provides original evidence suggesting that the holistic processing of faces may be sensitive to the observers' racial categorization of the face. In Experiment 1, Caucasian participants performed a face-composite task with Caucasian faces, Asian faces, and racially ambiguous morphed face stimuli. Identical morphed face stimuli were processed more holistically when categorized as SR than as OR faces. Experiment 2 further suggests that this finding was not underlain by strategic or training effects. Overall, these results support the view that one's categorization of a face as belonging to the same or another race plays a critical role in the holistic processing of this face.

Keywords: Face recognition; Other-race effect; Holistic processing; Race categorization

1. Introduction

It has long been known that faces from a different race are more difficult to distinguish and recognize than our own-race faces. This phenomenon, called the "other-race effect" (ORE) in the face processing literature (for a meta-analysis, see Meissner & Brigham, 2001), has been demonstrated both in experimental tasks (see Meissner & Brigham, 2001) and in real-life experiences (e.g., Behrman & Davey, 2001; Brigham, Wasserman, & Meissner, 1999; Valentine, Pickering, & Darling, 2003). Researchers generally admit that the ORE is due to a lack of visual experience at processing faces presenting phenotypical features that are different from those of the faces one is used to seeing in everyday life (see Le, Farkas, Ngim, Levin, & Forrest, 2002). However, there is little agreement about how our differential

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experience with other-race (OR) and same-race (SR) faces underlies the ORE (e.g. Slone, Brigham, & Meissner, 2000). Some authors have argued that our perceptual system is *unable* to generalize its expertise to OR faces (e.g., Goldstein & Chance, 1980). Consequently, SR and OR faces would have a differential representation in the face processing system (e.g., Valentine, 1991). Others have proposed a more sociocognitive account of the ORE: Once categorized as belonging to another race ("It's an Asian"), an OR face would be processed less efficiently than a SR face (e.g., Hugenberg, Miller, & Claypool, 2006; Levin, 1996, 2000; MacLin & Malpass, 2003).

Three recent studies have supported the view of a differential representation for SR and OR faces, showing that facial features of OR faces are less strongly integrated into a global (so-called "holistic") representation than facial features of SR faces (Michel, Caldara, & Rossion, 2006; Michel, Rossion, Han, Chung, & Caldara, 2006; Tanaka, Kiefer, & Bukach, 2004). In the most recent experiment of Michel, Rossion, et al. (2006), facial features integration in SR versus OR faces was compared using a "face composite paradigm" (Young, Hellawell, & Hay, 1987). In this paradigm, participants tend to perceive identical top halves of two face stimuli as being different when they are aligned with different bottom halves (Fig. 1A). This visual illusion disappears when the two face halves are laterally offset, or when faces are

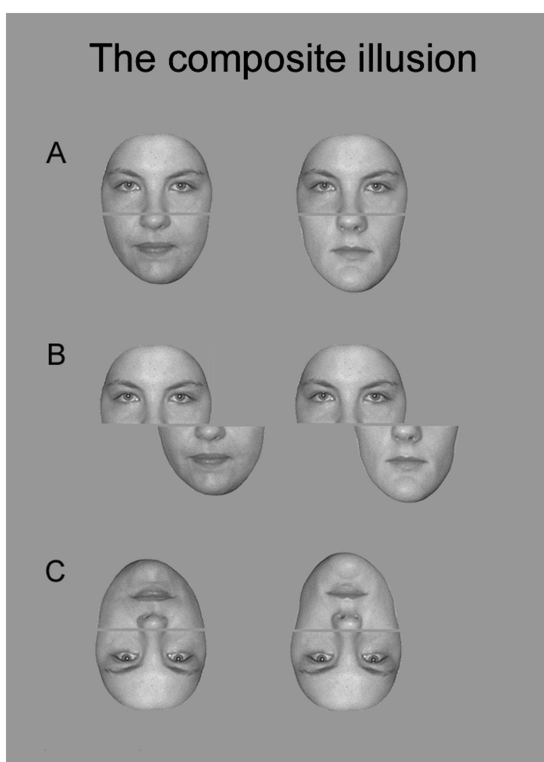

Fig. 1. Illustration of the "face-composite illusion." *Note:* Identical top halves of two face stimuli tend to be perceived as being different when they are aligned with different bottom halves (A). This visual illusion disappears when the two face halves are laterally offset (B) or when the faces are presented upside down (C).

presented upside down (e.g., Young et al., 1987; Fig. 1B and 1C). The "face-composite effect" (i.e., the advantage of the misaligned over the aligned displays) is generally considered as the most compelling evidence that facial features are integrated into a holistic representation (see Maurer, Le Grand, & Mondloch, 2002, for a review).

For both Asian and Caucasian populations, Michel, Rossion, et al. (2006) found that the face-composite effect was stronger for SR than OR faces, suggesting that the ORE may be related to a reduced holistic encoding of OR faces.

However, the differential holistic processing applied to SR and OR faces could be partly explained under the sociocognitive theoretical framework. At the core of the sociocognitive account of the ORE is the hypothesis that OR faces are differentially (and less efficiently) processed than SR faces because they are categorized as belonging to another race (Hugenberg et al., 2006; Levin, 1996, 2000; MacLin & Malpass, 2003). According to this view, the differential amount of holistic encoding observed for SR versus OR faces should also, at least partly, depend on the observer's perception of the face as being of his or her own race or of a different race—that is, a Caucasian observer confronted with a given face stimulus should handle it more or less holistically, depending on whether the face stimulus is perceived as being Caucasian or Asian, respectively.

This hypothesis was tested in the present study using a set of morphed face stimuli between Asian and Caucasian face photographs. These morphed face stimuli had been equally often categorized as "Asian" and as "Caucasian" by Caucasian participants in a preliminary race classification experiment. In the experiment proper, these stimuli were presented, without participant's knowledge, within blocks containing a majority of either Asian or Caucasian faces (different groups of Caucasian participants). Participants were told that they would have to perform a task on either Caucasian (first group) or Asian (second group) faces. The face-composite effect was used to measure holistic processing of Caucasian (SR), Asian (OR), and morphed faces. We expected a larger face-composite effect for SR than for OR faces, replicating our previous observations (Michel, Rossion, et al., 2006). Most important, we expected a larger face-composite effect for *identical* morphed face stimuli when these faces were considered as Caucasian than when they were considered as Asian.

2. Experiment 1

2.1. Method

2.1.1. Participants

Fifty staff and students from the University of Louvain, Belgium, randomly divided in two groups of 25 took part in the experiment voluntarily or for course credit (first group: 19 women, mean age = 23.32 years, range = 18–38 years; second group: 16 women, mean age = 24 years, range = 18–32 years). None of them had any significant experience with OR faces (as assessed by a questionnaire, see the Procedure section), and all had normal or corrected-to-normal vision. Contrary to our previous studies, there was no need to test Asian participants here because the critical comparison concerned identical morphed face stimuli, inserted in a majority of either SR (Caucasian) or OR (Asian) faces.

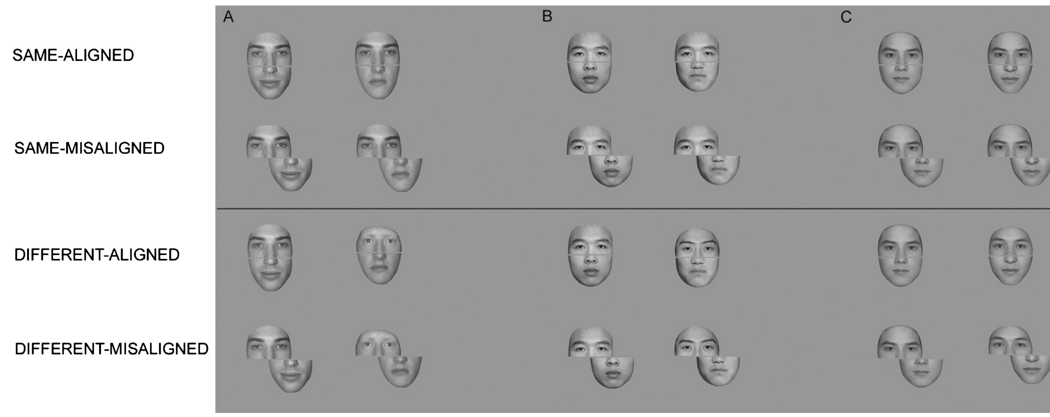

Fig. 2. Examples of Caucasian (A), Asian (B), and morphed (C) faces used in the composite experiment. *Note:* Aligned and misaligned original composite faces were presented in pairs with a new composite face (same format: aligned or misaligned) having either the same top part and a different bottom part (same-aligned and same-misaligned pairs) or both different top and bottom parts (different-aligned and different-misaligned pairs).

2.1.2. Stimuli

2.1.2.1. Asian and Caucasian stimuli: The original sample was composed of 40 Asian (China, Beijing area) and 40 Caucasian (Belgium) hairless full-front greyscale faces, unfamiliar to the participants, posing with a neutral expression (visual angle ~4,56° × 3,42°). Each face stimulus was divided into a top and a bottom segments by slicing it off in the middle of the nose. A misaligned version of the face was created by placing the bottom part next to the extreme left side of the top part (Fig. 2). These faces were considered as the original composite faces. New composite faces were then created by recombining the top and bottom halves of different individuals. Stimuli were dispatched in pairs in four conditions: (a) the same-aligned condition, (b) the same-misaligned condition, (c) the different-aligned condition, and (d) the different-misaligned condition. In the same conditions (same-aligned; same-misaligned), an original composite face was paired with a new composite face having the same top part but a different bottom part (same gender). In the different conditions (different-aligned; different-misaligned), an original composite face was paired with a new composite face having *both* the top and the bottom parts different. The bottom part of the four composite faces associated with an original composite face was identical (Fig. 2).

2.1.2.2. Morphed face stimuli: In a preliminary experiment, 34 Caucasian participants were presented with 220 greyscale Asian–Caucasian morphed face stimuli (2 times each for a total of 440 face stimuli) for a race categorization task. These stimuli were generated with morphing software (Morph™), allowing the creation of 11 blended face stimuli (from 0:100 to 100:0 for Asian:Caucasian proportions, respectively) for each of 20 Asian–Caucasian continua (Fig. 3, top panel). The participants had to decide within a maximum of 3,000 msec for each face (presentation time: 200 msec, random order) if it was Asian or Caucasian. In each continuum, the face that was equally often categorized

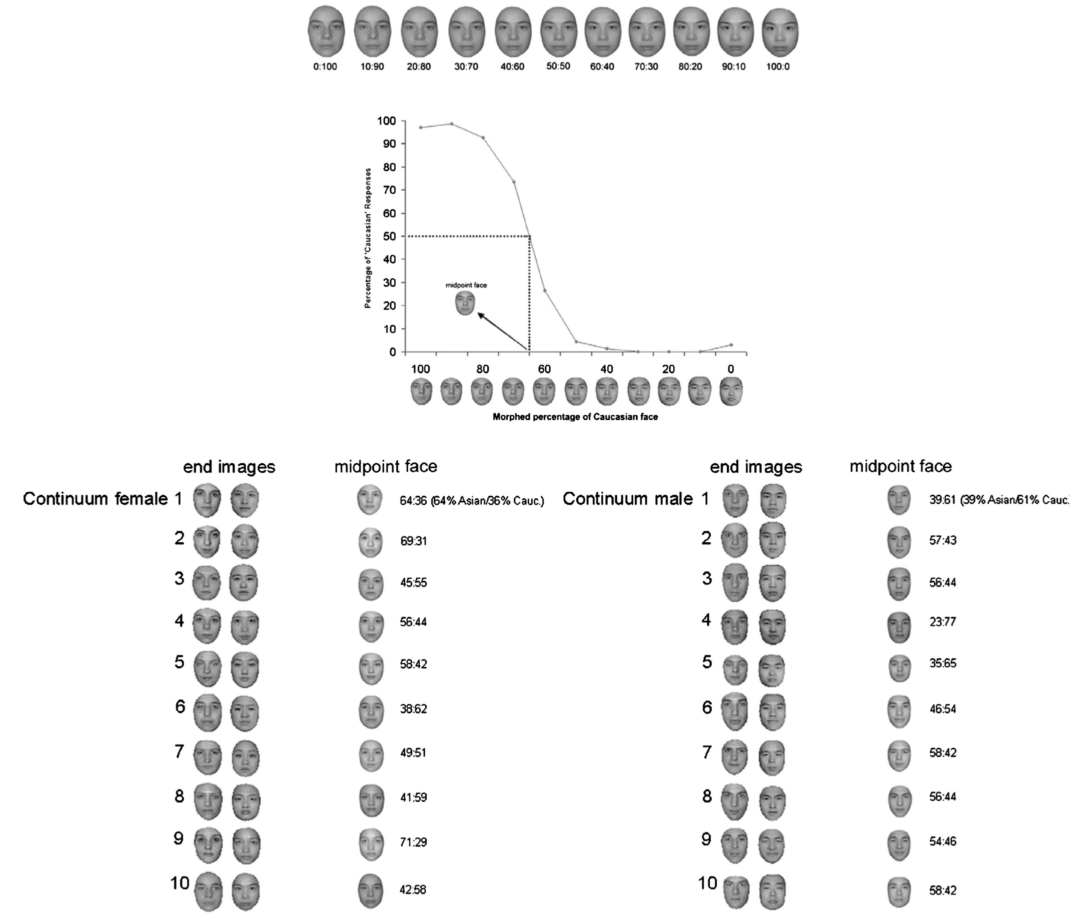

Fig. 3. Top: Examples of stimuli used in the preliminary race categorization experiment. The first number refers to the proportion of the Asian face, blended with a proportion of the Caucasian face (second number). Middle: An example of the midpoint face (i.e., the face that was equally often [50%] categorized as an Asian and as a Caucasian face) for one Asian–Caucasian continuum in the preliminary race categorization experiment. Here, the midpoint face is the 35:65 (i.e., the morphed face including 35% of the original Asian face and 65% of the original Caucasian face). Bottom: The 20 morphed faces (one half women) that have been brought out of the preliminary race categorization experiment to be used in the composite experiment. Each morphed face is defined by a proportion of the Asian (first number) and of the Caucasian (second number) original faces (end images) that have been used to generate the linear continuum of blended images.

as Asian and as Caucasian was identified (midpoint face: Fig. 3, middle panel). The 20 Asian–Caucasian midpoint faces extracted from this preliminary experiment (Fig. 3, bottom panel) were used as base images of morphed face stimuli in the face-composite experiment.

Aligned and misaligned composite-face stimuli were constructed as to be associated with these morphed base images in the same way than for Asian and Caucasian faces (Fig. 2). Stimuli were displayed using E-Prime 1.1, against a neutral grey background.

2.1.3. Procedure

Participants were tested individually, at a distance of 100 cm from the computer screen. They were randomly assigned to one of two groups, both instructed to perform a "same–different" delayed matching task. Participants belonging to the first group ($n = 25$) were told that they were going to be presented with a series of Caucasian faces. Each trial started with a fixation cross (300 msec), followed after a 200 msec blank screen by a target face appearing for 600 msec. The target face was either an original Caucasian face stimulus (66% of trials) or a morphed face stimulus (33%), presented either in an aligned or in a misaligned format. Following a 300 msec blank screen, a second face was presented in the same format than the target face (aligned or misaligned) for a maximum of 1,000 msec, having either the same top part or a different top part than the target face (Fig. 2). The bottom parts were always different between the two faces of a pair. Participants were instructed to decide as accurately and as fast as possible whether the top part of the second stimulus was the same or different than the top part of the target (left or right keys, counterbalanced across participants), ignoring the bottom parts.

After eight practice trials, participants performed two experimental blocks. Each block comprised 60 trials with Caucasian faces and 30 trials with morphed faces, presented randomly (inter-stimuli interval: 1 sec). Among Caucasian trials, 40 required a "same" decision (half aligned), and the remaining 20 required a "different" decision (half aligned). The same response bias, introduced because "same" trials only were of interest to measure the face-composite effect (e.g., Le Grand, Mondloch, Maurer, & Brent, 2004), was applied to the morphed trials with 20 "same" trials and 10 "different" trials (half aligned). As a result, the whole experiment included 80 "same" and 40 "different" trials with Caucasian faces, added to 40 "same" and 20 "different" trials with morphed faces.

Participants in the second group ($n = 25$) performed the same delayed matching task with two blocks including 60 trials with Asian faces and 30 trials with morphed faces, presented in a random order. As opposed to the first group, these participants were told that they were going to be presented with a series of Asian faces. Thus, more important, both groups of participants were naive regarding the inclusion of morphed faces in the experiment. Crucially, the trials with morphed faces included in Caucasian (first group of participants) and in Asian (second group) blocks were strictly identical.

At the end of the experiment, participants filled out a questionnaire about their experience with OR faces.

2.2. Results

2.2.1. Accuracy

Accuracy rates on same trials were submitted to a $2 \times 2 \times 2$ analysis of variance (ANOVA) with *type of stimulus* (original vs. morphed) and *alignment* (aligned vs. misaligned) as within-subjects factors and *group of subjects* (Asian vs. Caucasian faces presented) as a between-subjects factor. Results (Figs. 4 and 5) showed more accurate responses on misaligned than aligned trials, $F(1, 48) = 32.6$, $p < .001$; revealing the face-composite effect.[1] The interaction between *alignment* and *type of stimulus* was significant, the face-composite effect (i.e., the difference between misaligned and aligned same trials) being lower for morphed faces as

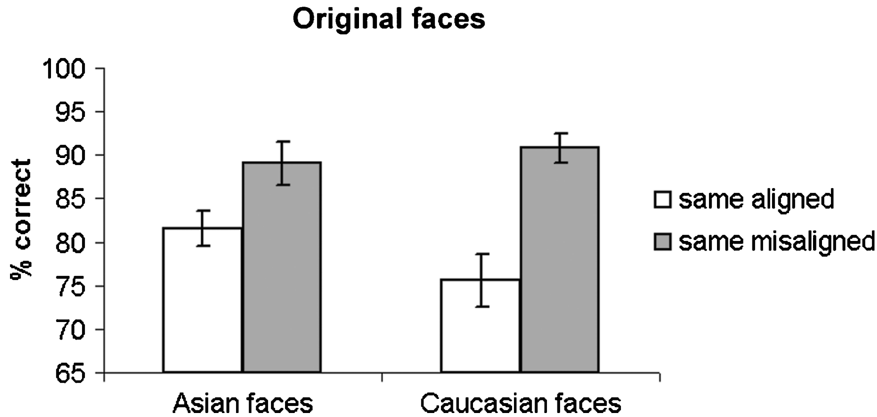

Fig. 4. Accuracy for "same" trials in the composite task of Experiment 1 for Asian and Caucasian (original) faces in Caucasian participants. The composite effect (larger for Caucasian faces) is assessed by the difference between the misaligned and the aligned condition. Errors bars represent standard errors of the mean.

compared to original faces (Figs. 4 and 5). Most interesting to note is that there was a significant interaction between *alignment* and *group of subjects*, $F(1, 48) = 5.0$, $p < .05$; this was not further moderated by *type of stimulus*, as revealed by the nonsignificant three-way interaction, $F(1, 48) < 1$. Consistent with previous findings, a larger composite effect was obtained on Caucasian than on Asian faces, $t(48)_{\text{one-tailed}} = 1.89$, $p < .05$ (Fig. 4). More important and for the purpose of this research, a larger composite effect was found on the exact same morphed faces when these were inserted in a Caucasian relative to an Asian block of faces, $t(48)_{\text{one-tailed}} = 1.77$, $p < .05$ (Fig. 5).

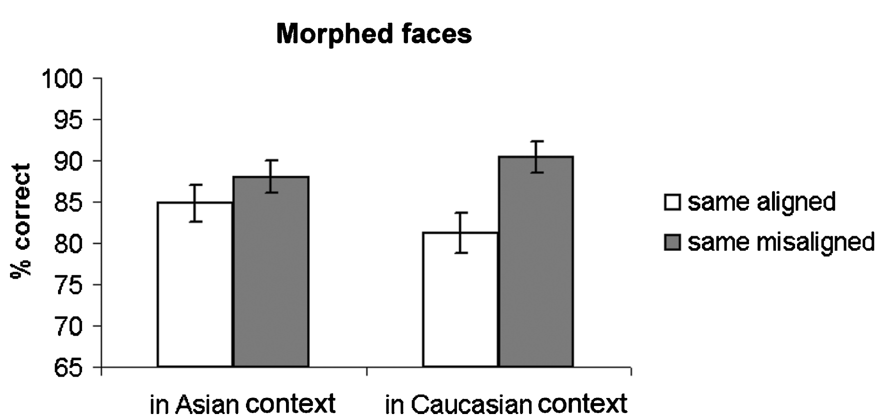

Fig. 5. Accuracy for "same" trials in the composite task of Experiment 1 for identical morphed faces presented among a majority of either Asian faces (Asian context) or Caucasian faces (Caucasian context). The composite effect (larger in the Caucasian context) is assessed by the difference between the misaligned and the aligned condition. Errors bars represent standard errors of the mean.

2.2.2. *Response times (RTs)*

A $2 \times 2 \times 2$ ANOVA was conducted on correct RTs with *type of stimulus* (original vs. morphed) and *alignment* (aligned vs. misaligned) as within-subjects factors and *group of subjects* (Asian vs. Caucasian faces presented) as a between-subjects factor. There was a significant main effect of *alignment,* $F(1, 48) = 115.81$, $p < .001$; with faster responses on misaligned ($M = 568$ msec) than aligned ($M = 621$ msec; the face-composite effect) trials. There was a significant interaction between *type of stimulus* and *group,* $F(1, 48) = 4.78$, $p < .05$; with faster responses on original ($M = 589$ msec) than morphed ($M = 599$ msec) faces in Asian blocks but faster responses on morphed ($M = 591$ msec) than original ($M = 598$ msec) faces in Caucasian blocks. All other effects were not significant.

2.3. *Discussion*

The results of Experiment 1 indicate that *identical* face stimuli are processed more or less holistically, depending on people's racial categorization of these faces. This finding supports the sociocognitive account of the ORE, according to which OR faces would be differentially encoded because they are considered as belonging to a different race category (Hugenberg et al., 2006; Levin, 1996, 2000; MacLin & Malpass, 2003). However, due to the blocked presentation of Asian versus Caucasian face stimuli, some may argue that a "strategic effect" underlied our finding—that is, in the context of faces that are difficult to process holistically (i.e., Asian faces), participants might have simply given up trying processing holistically the racially ambiguous faces. Perhaps even more relevant, it may be argued that the racially ambiguous faces benefited from a "training effect" when they were embedded in faces that were processed holistically (i.e., Caucasian faces). If these strategic or training effects were underlying the effect obtained in Experiment 1, then one would also expect a less holistic processing for a minority of unambiguous Asian faces embedded in Asian than in Caucasian faces. These alternative strategic and training accounts were addressed in Experiment 2.

3. Experiment 2

3.1. *Method*

3.1.1. *Participants*

Thirty-two Caucasian students participated in the experiment for cash or course credit. They were randomly divided in two groups of 16. The data from two participants of the second group were discarded because these participants were of Creole origin, leaving 16 participants in Group 1 (5 women, mean age = 22.62 years, range = 19 – 26 years) and 14 participants in Group 2 (10 women, mean age = 21.64 years, range = 18–29 years). None of them had any significant experience with OR faces, and all had normal or corrected-to-normal vision.

3.1.2. Stimuli

We used all the Asian composite face stimuli used in Experiment 1 and the Caucasian composite face stimuli associated with 26 (among 40) Caucasian base images.

3.1.3. Procedure

Holistic processing of faces was examined as in Experiment 1, with the following modifications. Participants in Group 1 were presented with two experimental blocks comprising 39 trials with Caucasian faces and 21 trials with unambiguous Asian faces. Among Caucasian trials, 26 required a "same" decision (13 of which were aligned), and 13 required a "different" decision (7 of which were aligned). Among Asian trials, 14 required a "same" decision (7 of which were aligned), and 7 required a "different" decision (3 of which were aligned). As a result, the whole experiment included 52 "same" and 26 "different" Caucasian trials and 28 "same" and 14 "different" Asian trials. Participants in Group 2 performed two blocks including exclusively Asian trials, among which the 21 Asian trials that were presented as a minority among Caucasian trials in the first group of participants. No participant received instructions regarding the race of the faces.

3.2. Results

3.2.1. Accuracy

The comparison of interest concerned the minority of Asian trials inserted in Caucasian versus Asian context. Accuracy rates on these (same) trials were submitted to a 2×2 ANOVA with *alignment* (aligned vs. misaligned) as a within-subjects factor and *context* (Asian vs. Caucasian blocks) as a between-subjects factor. We found a significant main effect of *alignment,* $F(1, 28) = 8.53$, $p < .01$; with more accurate responses on misaligned ($M = 87.62\%$) than aligned ($M = 80.63\%$) trials. More important, this face-composite effect was not modulated by *context*, as revealed by a nonsignificant interaction between the two factors, $F(1, 28) < 1$. The main effect of *context* was not significant, $F(1, 28) < 1$. Complementary analyses also confirmed that the face-composite effect was larger for Caucasian ($M = 75.65\%$ and 89.9% for aligned and misaligned conditions, respectively) than Asian faces ($M = 82.44\%$ and 88.39%) for the participants who were exposed to faces of both races (i.e., Group 1; interaction between *alignment* and *race of face* in this group of participants: $F[1, 15] = 4.55$, $p = .05$). Thus, and unsupportive of the strategic or training hypotheses, although this group of participants may have benefited from the holistic processing of the Caucasian faces and apply it to the Asian faces, they simply did not.

3.2.2. RTs

Again, the comparison of interest concerned the minority of Asian trials inserted in Caucasian versus Asian context. RTs on these (same) trials were submitted to a 2×2 ANOVA with *alignment* (aligned vs. misaligned) as a within-subjects factor and *context* (Asian vs. Caucasian blocks) as a between-subjects factor. We found a significant main effect of *alignment,* $F(1, 28) = 8.54$, $p < .01$; with faster responses on misaligned ($M = 581$ msec) than on aligned ($M = 613$ msec) trials. It is interesting to note that we also found a significant interaction between *alignment* and *context,* $F(1, 28) = 5.28$, $p < .05$; with a larger composite effect obtained on the Asian faces when embedded in an Asian ($M = 634$ msec and 574 msec for "aligned" and "misaligned" conditions, respectively) than in a Caucasian ($M = 594$ msec and 587 msec) context. This effect is clearly at odds with the strategic or training hypotheses. Complementary analyses also confirmed that the face-composite effect was larger for Caucasian ($M = 622$ msec and 576 msec for aligned and misaligned conditions, respectively) than Asian ($M = 594$ msec and 587 msec) faces for the participants who were exposed to faces of both races (i.e., Group 1; interaction between *alignment* and *race of face* in this group of participants: $F[1, 15] = 8.47$, $p < .05$). Thus, and again unsupportive of the strategic or training hypotheses, although this group of participants may have benefited from the holistic processing of the Caucasian faces and apply it to the Asian faces, they actually displayed less holistic processing of the Asian faces than participants who were presented with these faces in an Asian context (i.e., Group 2).

3.3. Discussion

According to the alternative strategic or training hypotheses, a larger face-composite effect was to be obtained for the minority of unambiguous Asian faces embedded in Caucasian relative to Asian faces. The results of Experiment 2 did not provide support for this hypothesis. If anything, a more holistic processing of Asian faces was obtained when these faces were inserted in an Asian than in a Caucasian context. This suggests that what is important for applying holistic processes to a face stimulus is not the process that has been at work all along the block of trials (as suggested by the alternative hypothesis), but instead the perceived race of the incoming face stimulus.

4. General discussion

Consistent with Michel, Rossion, et al. (2006), we replicated the stronger composite effect for SR relative to OR faces. Most critically, our results also provide original evidence that *identical* face stimuli are processed more or less holistically, depending on people's categorization of these faces as belonging to the same or another race.

These findings support a sociocognitive account of the ORE, according to which OR faces would be differentially encoded once they are considered as belonging to a different race category (Hugenberg et al., 2006; Levin, 1996, 2000; MacLin & Malpass, 2003).

This sociocognitive view has been indirectly supported by empirical studies showing that the propensity to code category membership on OR faces appears to be related to the magnitude of the ORE in face recognition (Levin, 2000). More recently, this view has been supported by results obtained with racially ambiguous face stimuli, as used in this study (MacLin & Malpass, 2003). It was found that participants were better at discriminating racially ambiguous faces perceived as SR faces, as compared to the same face stimuli categorized as OR faces. However, our findings differ from previous evidence in several ways. First, the face stimuli used in MacLin and Malpass study were schematic faces, which were considered as being of different "races" by having different haircut (African vs. Hispanic type). In contrast, the morphed face stimuli in this study were photographs that were exactly identical in the different conditions. These findings thus reveal that, all other factors being equal, the degree of holistic processing applied to a face stimulus can be strongly modulated by its perceived race identity. Second, and most important, whereas this previous study showed a difference of processing efficiency for faces considered as SR as compared to OR faces (i.e., a less efficient processing for the latter), here we show a difference in the *nature* of the processing applied to identical face stimuli considered as SR versus OR faces—that is, faces are processed more or less holistically depending on whether they are considered as being of the same or a different race. These results are in line with data collected by Holguin, McQuiston, MacLin, & Malpass (2000), which suggested a differential perception of ambiguous face stimuli depending on their believed race membership. However, in the latter study, the dependent measure was the participants' ratings about physical characteristics of the faces (e.g. nose width, mouth width, etc.), which were shown to vary depending on the believed race membership. Whereas these rating measures could reflect the outcome of post-perceptual (i.e., decisional) processes, these data are collected during an illusion that is thought to take place at perceptual face processing stages (see Goffaux & Rossion, 2006; Schiltz & Rossion, 2006). Thus, our results provide some clues about the possible mechanisms underlying a sociocognitive account of the ORE: When a face is categorized as belonging to another race, holistic encoding is reduced. As a result, individual faces of another race may be remembered and discriminated from each other less efficiently than SR faces.

As in previous studies (e.g., MacLin & Malpass, 2003), in Experiment 1 we used racially ambiguous face stimuli. One can reasonably assume that these stimuli were considered by participants as Asian or Caucasian faces, depending on the context. For instance, it has been recently demonstrated that racially ambiguous faces could be perceived as belonging to either one or the other race depending on participants' expectations following the prior presentation of a "Black" or "White" label (Eberhardt, Dasgupta, & Banaszynski, 2003). Yet, our main demonstration was made on faces that share roughly one half of the morphological features of OR faces, not *veridical* SR and OR faces. In principle, an even more provocative demonstration would be to show that veridical OR faces are processed more or less holistically depending on their race categorization. However, this would require to be able to manipulate the race categorization of veridical faces, something unlikely to achieve through instructions (i.e., it is unlikely that instructions could lead participants to categorize veridical OR faces as SR faces). Veridical (unambiguous) Asian faces have been used in Experiment 2 for another purpose (i.e., to test the alternative strategic or training hypotheses). If these Asian face stimuli were unlikely to be *perceived* as Caucasian, they were still probably *expected to be* Caucasians when presented in a Caucasian context (Group 1). Because these unambiguous faces were not handled more holistically when expected to be Caucasian than when expected to be Asian in Experiment 2, it would seem that merely expecting a face stimulus to be a SR face is not sufficient to process it more holistically.

Thus, the findings obtained in these two studies appear to qualify the sociocognitive account of the differential holistic processing for SR versus OR faces: Holistic face processing is modulated by the race categorization of the incoming face stimulus, which is more or less flexible depending on the more or less clear-cut morphological properties of the face. The influence of the race categorization on the face holistic processing is thus of most critical relevance for naturally ambiguous faces that do not fit neatly into one race category or another. Note that due to the increasing frequency of interracial marriages, the latter type of faces with mixed racial heritage are in ever-increasing numbers and might become the "new faces of the millennium" (Fulbeck, 2006, p.17).

It is interesting to note that the face-composite effect was smaller for the racially ambiguous faces than for the original (non-ambiguous) photographs (Figs. 4 and 5). A possible explanation for this observation is that two morphed faces combined together to create composite faces were less likely to differ than two original faces. More precisely, identical top halves of two face stimuli tend to be perceived as being different when they are aligned with different bottom halves (the face-composite illusion). Thus, presumably, the more different the bottom halves, the larger the face-composite illusion. Yet, the morphing procedure tends to attenuate the individual properties of the two faces being morphed, resulting in a more "averaged" face. Consequently, bottom halves pertaining to two different morphed faces are probably more similar on average than two bottom halves pertaining to different original (non-morphed) faces, thus possibly reducing the face-composite illusion.

Although our results support a sociocognitive account of the ORE, one should remain cautious to avoid an improper generalization of our findings. As indicated earlier, previous findings suggested that classifying an OR face along its race dimension decreases one's chance of recognizing it subsequently (MacLin & Malpass, 2003). Yet, these previous findings do not show that *all* the differences classically observed between people's performance at recognizing SR versus OR faces can be attributed to such a sociocognitive interference. Revealing the sociocognitive nature of one aspect by which SR and OR face processing precisely differ (i.e., holistic processing), these findings offer a qualifying view of the sociocognitive hypothesis. Once categorized as belonging to another race, a face is handled less holistically by the perceptual system than a SR face, a phenomenon that could partly explain the ORE (Michel, Caldara, & Rossion, 2006; Michel, Rossion, et al., 2006; Tanaka et al., 2004). However, the visual system has presumably been tuned to extract diagnostic features for discriminating faces we have experience with (i.e., SR faces; Valentine, 1991), and these diagnostic features probably differ from one race to another (e.g., Ellis, Deregowski, & Shepherd, 1975; Shepherd, 1981). Consequently, OR faces are encoded in memory according to visual cues/dimensions which do not provide a good base for discrimination (Valentine, 1991; see also Furl, Phillips, & O'Toole, 2002; O'Toole, Deffenbacher, Abdi, & Bartlett, 1991). Overruling the ORE would thus probably require both visual expertise and the proper sociocognitive representations to be at work.

In summary, our study confirmed that the features of OR faces are less strongly integrated into a holistic representation than the features of SR faces (Michel, Caldara, & Rossion, 2006; Michel, Rossion, et al., 2006; Tanaka et al., 2004) and, most important, that this differential holistic processing is modulated by the race categorization of the face.

Notes

1. Note that the participants were equally accurate on same-race (SR) and other-race (OR) misaligned trials, for both "same" trials (90.78% and 89.06% for SR and OR faces, respectively; $t[48] = .57$, *ns*) and "different" trials (85.6% and 82.6%; $t[48] = .94$, *ns*).

This was true for original Asian and Caucasian faces and for morphed faces presented in Asian and Caucasian blocks as well (88% and 90.4% for "same" trials in Asian and Caucasian blocks, $t[48] = .88$, *ns*; and 73.2 and 66% for "different" trials in Asian and Caucasian blocks, $t[48] = 1.39$, *ns*). Consequently, the smaller composite effect observed for OR faces cannot be interpreted as a consequence of a generally bad performance for OR (aligned and misaligned) faces.

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