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FlashReport

Looking the other way: The role of gaze direction in the cross-race memory effect

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ABSTRACT

One of the most replicable findings reported in the social psychological literature is the cross-race memory effect. We argue this effect derives from higher-order interactions among social cues that determine the perceived relevance of a face to an observer. The current research tested this hypothesis by examining the combined influences of eye gaze direction and race on face memory. The physical subtlety of eye gaze belies its powerful influence on social perception, and in this case helps specify the relevance of same-versus other-race faces. We found that only in faces making direct eye contact—not those displaying averted eye gaze—was the cross-race memory effect evident. Likewise, only in same-race faces did direct relative to averted-gaze enhance face memory. These findings have implications for our general understanding of the combinatorial nature of social perception and help clarify the underlying cause of the cross-race memory effect.

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Introduction

The proportionally large size of the human brain is sometimes explained as a consequence of social memory requirements (e.g., Dunbar, 1992, 1995, 1998). To keep track of relatively large social networks, people possess an extraordinary ability to remember faces. By the same token, social memory cannot be entirely indiscriminate; for example, it is more important to remember the identity of a spouse than a cashier. Generally, people should better remember those whose actions are likely to be relevant to their own wellbeing (Maner et al., 2003; Mealey, Daoood, & Krage, 1996; Oda, 1997; Rodin, 1987). Such a functional account has been invoked to explain several biases in face memory, including those favoring same-race faces (e.g., Shriver, Young, Hugenberg, Bernstein, & Lanter, 2008). Indeed, the cross-race effect (CRE) in memory is well chronicled (cf. Meissner & Brigham, 2001) and is often cited to explain alarming racial inequities in faulty eyewitness testimony (Innocence Project, 2007).

If the CRE stems from the perceived relevance of ingroup faces, non-race facial cues that influence perceived relevance, such as eye contact, should impact the presence or absence of the CRE. Extending the functional approach in this way assumes that the combined processing of social cues is adaptive, facilitating the detection of self-relevant information signaled by the face (Adams, Franklin, Stevenson, & Nelson, in press). Facial cues can

signal sexual opportunities (Rule & Ambady, 2008), shared social categories (Rule, Ambady, Adams, & Macrae, 2007), potential health of shared offspring (Maner, Gailliot, & DeWall, 2007), possibility for affiliation (Mason, Tatkov, & Macrae, 2005), the presence of environmental danger and its source (Adams & Kleck, 2005), and so on. Same-race, attractive, angry, and direct-gaze faces can all be considered relevant to the self. The perceived relevance of these cues in combination, however, will vary across individuals. For example, should we expect an attractive woman with direct gaze to be perceived similarly by both heterosexual men and women? Research suggests not (Mason et al., 2005). Similarly, fearful relative to happy faces only seem to elicit negative affect when displayed by someone of the same race as the perceiver (Weisbuch & Ambady, 2008). In other words, evaluations of faces appear to derive from the integrated meaning of the face and its relational value to the perceiver rather than to particular cues in isolation. Here we examine the influence on memory of two facial cues that have independently received extensive empirical attention: race and eye gaze.

Cross-race memory

Over one hundred studies spanning four decades document a surprisingly replicable out-group homogeneity effect in face memory, the so-called “cross-race” effect (CRE). In a recent meta-analytic review, it was reported that the probability of accurate cross-race identification was less than half that of same-race identification (Meissner & Brigham, 2001). An enduring explanation for this effect is that of perceptual expertise, which has been demon-

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strated in some studies by showing that increased contact with other racial groups is related to decreased CRE (e.g., Chiroro & Valentine, 1995; Cross, Cross, & Daly, 1971; Feinman & Entwisle, 1976; Hancock & Rhodes, 2008; Sangrigoli, Pallier, Argenti, Venturi, & de Schonen, 2005; Valentine & Endo, 1992). In their review, however, Meissner and Brigham (2001) found that the variance accounted for by interpersonal contact in the CRE was virtually negligible.

MacLin and Malpass (2001, 2003) offered an alternative mechanism linking cross-race memory to social categorization. They found that *identical* racially ambiguous faces were differentially encoded and remembered based on perceived racial categories determined by the application of race prototypical hairstyles. More recent studies have revealed comparable effects, whereby participants exhibit diminished memory for own-race faces believed to belong to salient outgroups (i.e., University affiliation; Bernstein, Young, & Hugenberg, 2007; sexual orientation; Rule et al., 2007; class; Shriver et al., 2008), and improved memory for out-group faces with increased motivation to individuate these faces (Hugenberg, Miller, & Claypool, 2007; Pauker et al., 2009). Such findings point to the powerful role of perceived social relevance in the CRE.

Eye contact and social perception

Of the many facial cues that signal social relevance, none may be more powerful than eye gaze. Direct-gaze signals an increased likelihood for social engagement (Cary, 1978; Ellsworth & Ross, 1975; Grumet, 1999), captures attention (see Frischn, Bayliss, & Tipper, 2007 for review), is associated with greater galvanic skin response (Nichols & Champness, 1971), greater EEG arousal (Gale, Kingsley, Brookes, & Smith, 1978; Gale, Lucas, Nissim, & Harpham, 1972; Gale, Spratt, Chapman, & Smallbone, 1975), increased heart rate (Kleinke & Pohlen, 1971), and increased amygdala responsivity in the perceiver (Kawashima et al., 1999). Humans are sensitive to eye gaze from birth (Faroni, Csibra, Simion, & Johnson, 2002) and cross-species evidence reveals this sensitivity is not unique to humans (Emery, 2000) suggesting that it may be innately prepared.

It is perhaps not surprising then that faces with direct gaze are found more easily in an array (Von Grünau & Anston, 1995), are more quickly categorized by perceivers (Macrae, Hood, Milne, Rowe, & Mason, 2002), are more likely to elicit affiliative feelings (Mason et al., 2005), and, critically, are better remembered than faces exhibiting averted gaze (Hood, Macrae, Cole-Davies, & Dias, 2003; Mason, Hood, & Macrae, 2004; Smith, Hood, & Hector, 2006). The direct-gaze bias in face memory is apparent in both children and adults, and exerts its influence at both the encoding and retrieval phase of face memory (Hood et al., 2003). In short, perceivers are extremely sensitive to direct gaze as a signal of social relevance.

The current work

In every study on the CRE that we could locate, stimulus faces were displayed with direct gaze. Given the functional approach detailed here, we expect that only when paired with direct gaze will the CRE be apparent. In the current study, White participants studied Black and White faces displaying either direct or averted gaze. If faces are prioritized for memory based on independent influences of social cues, we would expect to find only main effects, the CRE and direct-gaze memory biases previously reported in the literature. However, if faces are prioritized for memory on the basis of integrated social relevance, as predicted here, such main effects should be qualified by an interaction.

Method

Participants

Sixty-five White undergraduates were recruited in exchange for partial course credit or payment; six expressed suspicion during debriefing concerning the gaze direction manipulation and thus were dropped from the analysis, leaving a total of 59 participants (40 female, 19 male).

Facial stimuli

Neutral displays of 40 White and 40 Black males were obtained from the NIMSTIM face set (Tottenham et al., *in press*), the Montreal Set of Facial Displays of Emotion (Beaupré & Hess, 2005), and a set developed by Chiao and Ambady (2001). Gaze direction was manipulated using Adobe Photoshop®, resulting in 80 laterally averted-gaze and 80 direct-gaze images. Images were grayscale, presented against a gray background, cropped to display head and hair only, and presented in a uniform size of 3.5 × 4.9 in.

Procedure

Participants were seated approximately 24 in. from a computer monitor and presented with facial images using Superlab®—their task was simply to remember each face presented. Participants were randomly assigned to see direct-gaze ($n = 27$) or averted-gaze ($n = 32$) faces. In the learning phase, participants viewed 20 Black faces and 20 White faces for 3.2-s each. Each trial began with a 790-ms fixation point that was immediately replaced by a 10-ms blank screen preceding stimulus onset. Upon completion of the learning phase, participants were given a distracter task (word search) for 5 min. Participants were then presented with the same 40 faces randomly intermixed with 40 new foil faces (faces used as targets and foils were counterbalanced across participants). Participants were instructed to indicate as quickly and accurately as possible whether or not they had seen each face before, after which the next stimulus face was presented.

Results

Data transformation

We used a signal detection measure of sensitivity (d') as our index of recognition performance. Hits and false alarms from the face recognition task were combined into d' scores, where d' is equivalent to z -score for hits minus z -score for false-alarms. In cases where the proportion of hits or false alarms equals zero or one, d' cannot be calculated due to an inability to calculate a z -score for these values. Thus, we calculated corrected proportions based on the number of signal or noise trials ($n = 40$; Stanislaw & Todorov, 1999). When the proportion of hits or false alarms equaled zero, the value was recoded as $0.5/n$, and when the proportion of hits or false alarms equaled one, the value was recoded as $1 - (0.5/n)$. Finally, we calculated a measure of each participant's response bias criterion (c ; Macmillan & Creelman, 1990). For the ideal observer $c = 0$; when the observer adopts a more liberal strategy c is negative, and when the observer adopts a more conservative strategy c is positive.

Preliminary analyses revealed no reliable main effects or interactions as a function of participant gender, so analyses were collapsed across this variable.

d' Scores were then used to compute a 2 (target race: Black or White) × 2 (eye-gaze: direct or averted) mixed-model ANOVA. From this, a main effect of race was found, thereby replicating

Table 1
Mean recognition memory, hit rates, false alarm rates, and criterion scores, for White and Black faces as a function of averted- and direct-gaze.

	Averted-gaze		Direct-gaze	
	White faces	Black faces	White faces	Black faces
d' (recognition memory)	1.27 (.561)	1.11 (.479)	1.7 (.62)	1.22 (.642)
Hit rate	0.638 (.151)	0.698 (.150)	0.651 (.152)	0.648 (.179)
False alarm rate	0.213 (.112)	0.309 (.126)	0.136 (.131)	0.246 (.145)
c (response bias criterion)	0.246 (.360)	−0.02 (.353)	0.421 (.453)	0.160 (.448)

Note: Larger d' indicates greater recognition performance. $c < 0$ indicates a more liberal criterion, $c > 0$ indicates a more conservative criterion (Macmillan and Creelman, 1990). Standard deviations appear in parentheses.

the CRE: same-race faces were better remembered than other-race faces, $F(1, 57) = 18.69$, $p < .0001$, partial $\eta^2 = .25$. A main effect of gaze was also found, thereby replicating the previously reported gaze effect: direct-gaze faces were better remembered than averted, $F(1, 57) = 4.33$, $p = .042$, partial $\eta^2 = .07$. Critically, these effects were qualified by the interaction of interest, $F(1, 57) = 4.79$, $p = .033$, partial $\eta^2 = .08$.

In order to examine the nature of this target race by eye-gaze interaction more closely, direct contrasts were computed. These revealed that direct-gaze/own-race faces were remembered significantly better than all other conditions including: (1) direct-gaze/other-race faces, $t(26) = 4.39$, $p < .0002$, $d = 1.72$; (2) averted-gaze/own-race faces, $t(57) = 2.81$, $p < .01$, $d = .74$; and (3) averted-gaze/other-race faces, $t(57) = 4.12$, $p < 0.0005$, $d = 1.09$. No other comparisons for recognition accuracy yielded significant results. In addition, main effects were found for both false alarm rates and response bias (c) including for target race ($F_s(1, 57) > 19.35$, $p_s < .0001$, partial $\eta^2_s > .25$) and eye-gaze ($F_s(1, 57) > 4.20$, $p_s < .05$, partial $\eta^2_s > .06$), such that participants displayed more false alarms and more liberal criterions (tended to say yes more) to both averted- versus direct-gaze faces and to Black versus White faces (see Table 1 for d' , hits, false alarms, and c means).

Discussion

As previously documented, the current study revealed main effects of both gaze and race on recognition accuracy in face memory. Critically, these effects were qualified by the predicted interactive influence of race and gaze. Same-race faces were better remembered than other-race faces, but only when exhibiting direct eye gaze. Likewise, direct-gaze faces were better remembered than averted, but only when displayed on same-race faces. Thus, low-level perceptual expertise in face processing and exogenously mediated visual attention (i.e., direct-gaze attention capture; Senju & Hasagawa, 2005, and averted-gaze attention shift; Driver et al., 1999) are insufficient to explain these results. The current findings suggest that the meaning of facial cues are integrated or bound with respect to their adaptive relevance. This insight is consistent with the ecological approach to visual and social perception (Gibson, 1979; see also Zebrowitz, 2006).

It is also important to note that we utilized photographs of faces in this study, which can introduce qualities such as lighting and perspective factors that do not directly represent live faces and can contribute to picture-matching strategies in memory. Although picture-matching can influence memory independent of face processing per se, such influences are necessarily unrelated to those of social cues signaled by the face, as examined here. Moreover, neither picture presentation (pictures versus live faces) nor similarity of pictures at learning versus test phase (identical versus different) has been previously found to moderate cross-race discrimination accuracy (Meissner & Brigham, 2001). Given that we presented the same pictures during learning and testing, however, does limit the conclusions we can draw regarding the influ-

ence of social cues at encoding versus retrieval. Our hypotheses, however, were not contingent on stages of processing, and thus such important questions await future research efforts.

Two previous studies examined the combined influences of race and gaze (Richeson, Todd, Trawalter, & Baird, 2008; Trawalter, Todd, Baird, & Richeson, 2008). These studies found that for White participants, Black relative to White faces generated more amygdala responsivity and selectively captured attention to a greater degree. Like the current study, however, this effect was only evident for faces coupled with direct relative to averted gaze. They argued that direct gaze compounded the threatening approach-oriented signal value of Black faces, and that the perceived threat was more clearly directed at the observer (see also Adams & Kleck, 2003, 2005 for similar rationale)—this explanation is quite consistent with the current functional approach outlined here. Also related is research demonstrating that White participants' memory for Black versus White faces increases when coupled with angry versus neutral displays, an effect that was argued to be due as well to the functional value of perceiving compound threat cues (Ackerman et al., 2006; but see Corneille, Hugenberg, & Potter, 2007).

Perhaps the most striking finding of the current work is that such a subtle cue—irises shifted only millimeters to the left or right—was enough to eliminate the otherwise robust and highly replicable CRE in memory. It is plausible that early categorization of a face gates the perceptual processes devoted to it, thereby resulting in direct-gaze facilitating an exclusive process of individuation for own-race faces. This finding is consistent with recent work on race perception (e.g., MacLin & MacLin, in press) suggesting that early racial categorization of faces influences not just the level of processing but the type of processing engaged. Also consistent with this view is evidence that activation in the fusiform gyrus—critical for face processing—is not only greater when viewing direct versus averted-gaze faces, but also differentially coupled with activation in other brain regions (George, Driver, & Dolan, 2001). When viewing direct-gaze faces, fusiform activation was found to be correlated with amygdala responses, reflecting stimulus salience; however, when viewing averted-gaze faces, it was correlated with activity in the intraparietal sulcus, essential for gaze following. Future research efforts are obviously necessary to understand the exact nature of these mechanisms. It is clear from the current work, however, that only by examining such cues in combination will the cross-race and direct-gaze memory biases be fully understood. As such, the current work provides a new context for evaluating previously reported cross-race and direct-gaze memory biases, and offers a framework for future investigation that will likely illuminate more general processes by which perceivers bind adaptive meaning across facial cues.

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