Research Article

"We All Look the Same to Me"

Positive Emotions Eliminate the Own-Race Bias in Face Recognition

Kareem J. Johnson and Barbara L. Fredrickson

University of Michigan

ABSTRACT—***Extrapolating from the broaden-and-build theory, we hypothesized that positive emotion may reduce the own-race bias in facial recognition. In Experiments 1 and 2, Caucasian participants (N = 89) viewed Black and White faces for a recognition task. They viewed videos eliciting joy, fear, or neutrality before the learning (Experiment 1) or testing (Experiment 2) stages of the task. Results reliably supported the hypothesis. Relative to fear or a neutral state, joy experienced before either stage improved recognition of Black faces and significantly reduced the own-race bias. Discussion centers on possible mechanisms for this reduction of the own-race bias, including improvements in holistic processing and promotion of a common in-group identity due to positive emotions.***

When people describe individuals of a different race, it is not uncommon to hear them exclaim, "They all look the same to me!" This colloquial phrase describes one of the more reliable empirical findings in face recognition: the own-race bias (ORB). Generally, people are less able to recognize and distinguish between people of a different race than to recognize and distinguish between people of their own race (Meissner & Brigham, 2001; Slone, Brigham, & Meissner, 2000). This recognition bias is prevalent among all racial groups (Ng & Lindsay, 1994; Teitelbaum & Geiselman, 1997), but some evidence suggests the effect is most pronounced for Caucasians viewing members of racial minority groups (Meissner & Brigham, 2001). The prevalence of the bias has significant practical and societal costs. For instance, the ORB makes cross-racial eyewitness identifications highly unreliable and has dire consequences for the criminal-justice system (Doyle, 2001; Kassin, Ellsworth, & Smith, 1989).

The cognitive and social factors responsible for the ORB remain unclear (Slone et al., 2000). Theories proposing that the degree of interracial contact should be negatively associated with level of ORB have been only weakly supported (Chiroro & Valentine, 1996). A meta-analysis of 30 years of research has shown that interracial contact accounts for only about 2% of the variance in ORB across samples (Meissner & Brigham, 2001). Although negative racial attitudes are correlated with limited interracial contact, no relationship has been found between the ORB and racial attitudes, whether explicit or implicit (Ferguson, Rhodes, & Lee, 2001).

Recently, researchers have suggested that the ORB results from differences in the perception of own-race and cross-race faces (Rhodes, Brake, Tan, & Taylor, 1989; Tanaka, Kiefer, & Bukach, 2004). Generally, faces are recognized holistically; that is, a face is seen as a collective whole instead of a collection of parts (Tanaka & Farah, 1993; Maurer, Le Grand, & Mondloch, 2002). A classic demonstration of holistic face processing is the *inversion effect*, in which turning a face upside down, and thereby changing its spatial configuration, dramatically impairs recognition of the face; in contrast, inversion has little impact on object recognition (Farah, Wilson, Drain, & Tanaka, 1998).

Some evidence suggests that one reason for the ORB may be that cross-race faces are perceived less holistically than own-race faces (Rhodes et al., 1989; Tanaka et al., 2004). In essence, cross-race faces may be perceived more like objects. Tanaka and his colleagues (2004) recently found that people rely on more holistic information for recognizing own-race faces than for recognizing cross-race faces. In addition, the inversion effect is more disruptive to recognizing own-race faces than recognizing cross-race faces (Rhodes et al., 1989). Facial recognition has been localized to an area of the brain dubbed the fusiform face area (FFA; Tong, Nakayama, Moscovitch, Weinrib, & Kanwisher, 2000).[1] However, the FFA is less active in response to

Address correspondence to Kareem J. Johnson, Department of Psychology, Temple University, 564 Weiss Hall, 1701 North 13th St., Philadelphia, PA 19122; e-mail: kareem.johnson@temple.edu.

[1]Activation of the FFA is not restricted to faces and has been found for other complex stimuli when the perceiver has developed a form of perceptual expertise (Gauthier & Logothetis, 2000). For example, dog experts perceive different dog breeds holistically, whereas novices do not.

cross-race faces than own-race faces (Golby, Gabrieli, Chiao, & Eberhardt, 2001), which again suggests that cross-race faces are perceived less holistically than own-race faces.

An additional explanation for the ORB is that when viewing cross-race faces, people focus more on cues of racial category than on cues of individual identity (Levin, 2000; Maclin & Malpass, 2003). Race is perhaps the most salient social category. Montepare and Opeyo (2002) demonstrated that racial differences are detected faster than other social differences, such as gender, age, or emotional expression. Evoked-response potentials are about 50% faster responding to racial differences than gender differences (Ito & Urland, 2003). People are also significantly faster at racially categorizing cross-race faces than own-race faces (Levin, 1996). Levin (2000) showed that an enhanced ability to categorize cross-race faces by race is correlated with an impaired ability to recognize cross-race faces; this finding suggests that the ORB occurs because encoding information about racial category interferes with encoding individuating information.

The role of racial categorization is also highlighted by Maclin and Malpass (2003), who argued that the mere act of categorizing a face by race alters how individual facial features are represented in memory. For example, after categorizing a face as "African American," one may remember the skin tone as darker than it actually was and facial features as more like a prototypical racial exemplar than they were. Maclin and Malpass concluded that the altered perception of cross-race faces due to the categorization process may underlie the ORB.

Even though the underlying mechanisms remain unclear, the ORB has proven to be a very robust psychological phenomenon, both prevalent and persistent (Meissner & Brigham, 2001). One study did show that hours of intensive training could reduce the magnitude of the ORB, but the effect was short-lived, and 1 week later there was no difference between trained and untrained participants (Lavrakas, Buri, & Mayzner, 1976). A new perspective on emotions, however, led us to test whether experienced positive emotions can reduce the ORB.

The benefits of positive emotions extend beyond the good feelings associated with them. Fredrickson's (2001) broaden-and-build theory states that positive emotions are evolved adaptations that in the moment broaden a person's "thought-action" repertoire and over time build that person's enduring personal resources. Positive emotions may have long-term survival benefits by making people more open-minded and flexible, and ultimately better able to see and take advantage of more opportunities in the environment.

One aspect of the broaden-and-build theory, the *broaden hypothesis*, predicts that positive emotions widen the scope of attention and literally enhance an individual's ability to see the "big picture" (Fredrickson & Branigan, 2005). Several studies have demonstrated that positive emotions facilitate holistic attentional processes (Basso, Schefft, Ris, & Dember, 1996; Derryberry & Tucker, 1994). Studies investigating global versus local attentional processes have found that individuals with negative emotional traits, like anxiety, focus more on local elements, whereas individuals with positive emotional traits, like optimism, focus more on global elements (Basso et al., 1996).

When positive or negative feedback is used to induce mood during global-local tasks, failure feedback produces a local bias, whereas success feedback produces a global bias (Derryberry & Tucker, 1994). We have additional evidence linking positive emotions to more holistic perceptions. In one experiment, we showed that induced positive emotions produced global biases on a global-local choice task (Fredrickson & Branigan, 2005). Recently, we found that the frequency of Duchenne smiles was positively correlated with faster reaction times to global relative to local targets (Johnson, Waugh, Wager, & Fredrickson, 2004). Because one explanation for the ORB is weaker holistic encoding of cross-race faces than own-race faces (Rhodes et al., 1989), we propose that positive emotion may reduce the ORB by facilitating holistic perceptions.

An additional prediction of the broaden-and-build theory is that positive emotions help to build social resources, perhaps by diminishing the salience of group differences. Positive affect is known to produce more inclusive categorization strategies, which increase perceived similarities between social groups (Isen, Niedenthal, & Cantor, 1992). Dovidio, Isen, and their colleagues have found that induced positive affect promotes the use of more inclusive social categories and more superordinate group representations, making participants more likely to view each of their groups as part of one larger, all-encompassing group (Dovidio, Gaertner, Isen, & Lowrance, 1995). Positive affect fosters a common in-group identity in which individuals are more willing to see "them" as "us" (Dovidio, Isen, Guerra, Gaertner, & Rust, 1998). However, we do not know whether these more inclusive social categorizations also extend to racial perceptions. An intriguing possibility is that by promoting a common in-group identity, positive emotions could reduce the ORB by reducing the salience of racial differences.

Possible mechanisms aside, the present experiments were designed to test the initial hypothesis that positive emotions, relative to negative emotions or neutral states, reduce the ORB in facial recognition. Because recognition tasks require at least two stages, an encoding (learning) stage and a later recognition (testing) stage, we conducted a pair of experiments to examine the influence of emotions on encoding (Experiment 1) and recognizing (Experiment 2) pictures of Black and White people of both genders. Brief video segments were used to induce joy, fear, or a neutral state. Procedures for Experiments 1 and 2 were identical except for the timing of the emotion induction. In Experiment 1, we induced joy, fear, or neutrality prior to face encoding, whereas in Experiment 2, we induced these same states prior to the recognition test. We restricted our analyses to participants identifying themselves as Caucasian.

METHOD

Participants

A total of 89 Caucasian students at the University of Michigan (40 males, 49 females) participated in the experiments in exchange for course credit. The same group of participants constituted the neutral group in the two experiments.

Stimuli

Fifty-six yearbook-style gray-scale images of Black and White college-aged individuals were used as visual stimuli. The images were evenly divided by race and gender. All stimuli were frontal images of faces with a neutral emotional expression, so that false recognition of smiling faces would be avoided (Baudouin, Gilibert, Sansone, & Tiberghien, 2000).

Four short videos were used to induce joy, fear, or neutrality. "Comedy" (4 min 54 s), a clip of a stand-up comedian, was used to induce joy. "Horror" (4 min 50 s), a clip from a horror movie, was used to induce fear. Two videos were used to induce neutral states. The first, "Neutral 1" (3 min 45 s), presented a series of pictures of common everyday objects, and the second, "Neutral 2" (5 min 3 s), featured footage from an instructional video of a box being made in a woodshop. All people portrayed in the videos were Caucasian. For Experiment 1, participants were randomly assigned to view the "Comedy" ($n = 19$), "Horror" ($n = 19$), or "Neutral 1" video as their first induction, and all participants viewed the "Neutral 2" video as their second induction. The participants ($n = 22$) who viewed the two neutral videos also served as the neutral group for Experiment 2; for the other conditions (Experiment 2), participants viewed the "Neutral 1" video as their first induction, but were randomly assigned to the "Comedy" ($n = 14$) or "Horror" ($n = 15$) video as the second induction.

Emotion-Induction Manipulation Checks

Two self-report measures were used to assess the effectiveness of the emotion inductions. Immediately after both the learning and testing phases of the recognition task, participants indicated their emotion at the moment by marking an affect grid. The affect grid (Russell, Weiss, & Mendelsohn, 1989) represents subjective experience as a nine-by-nine matrix varying along two dimensions, valence and arousal. For example, positive valence and high arousal indicate a feeling of joy. After completing the affect grid, participants completed a retrospective emotion report (adapted from Ekman, Friesen, & Ancoli, 1980). They were asked to indicate the degree to which they had felt (on a scale from 0 to 8) each of seven different emotions (amusement, anger, anxiety, fear, happiness, joy, and sadness) during the videos.

Procedure

Each experimental session consisted of four stages: first emotion-induction video, learning phase of the recognition task, second emotion-induction video, and testing phase of the recognition task. Video inductions were presented on a television monitor.

During the learning phase of the face recognition task, participants viewed 28 faces presented in a random order. The faces were presented for 500 ms each, with a 2,000-ms delay between images. During the testing phase, participants were presented with 56 faces in a random order. Half of these faces were the same 28 shown during the learning phase, and the rest were foils—images not previously viewed. Images used for both learning and testing were evenly divided by race and gender. Each image remained on screen until a response had been made. Participants indicated whether they had seen each face previously by pressing a labeled "yes" or "no" key on a stimulus response box; responses were made with the first two fingers of the dominant hand.

RESULTS

Manipulation Checks

As shown in Table 1, each emotion-induction video was very effective at producing the desired emotional response.[2] Participants viewing the comedian reported significantly higher levels of positive emotions, such as joy and amusement, than did participants viewing the other videos. Likewise, the horror clip resulted in significantly higher reports of negative emotions, such as fear and anxiety, than did the other videos. A few significant gender differences in reported emotion emerged, with males reporting higher levels of joy in response to the male comedian ($M = 5.7$ for males vs. $M = 4.5$ for females), $t(31) = 2.3$, $p < .05$, and females reporting higher levels of fear, anxiety, and anger in response to the horror clip: fear—$M = 6.0$ for females versus $M = 3.3$ for males, $t(32) = 4.8$, $p < .001$; anxiety—$M = 5.5$ for females versus $M = 3.7$ for males, $t(32) = 2.9$, $p < .03$; anger—$M = 1.4$ for females versus $M = 0.0$ for males, $t(32) = 2.6$, $p < .02$.

Both neutral videos were effectively neutral. The means across all seven emotion-report items were less than 2 (on a scale from 0 to 8), and the modal response for each item was zero with one exception. There were no significant gender differences for either neutral induction video.

The effectiveness of the emotion inductions was also supported by reported valence and arousal on the affect grids completed immediately after the learning and testing phases. The "Comedy" video resulted in higher reports of positive valence in comparison with the "Horror" and neutral videos, and the "Horror" video resulted in higher reports of negative valence and arousal than the "Comedy" or neutral videos. Across all conditions, males reported significantly more positive valence after the learning and testing phases of the recognition task than

[2]Emotion reports did not differ as a function of whether the video was the first or second induction, so analyses for each video were collapsed across experiments.

TABLE 1
Self-Reported Emotion by Video Induction

	Video							
	Joy (n = 33)		Fear (n = 34)		Neutral 1 (n = 51)		Neutral 2 (n = 60)	
Measure	Mean	Mode	Mean	Mode	Mean	Mode	Mean	Mode
Emotion reports								
Amusement	5.8 (1.6)$_a$	6	2.7 (2.3)$_b$	0	1.6 (1.6)$_c$	1	1.6 (1.6)$_c$	0
Anger	0.2 (0.5)$_a$	0	1.0 (1.5)$_b$	0	0.4 (1.0)$_a$	0	0.3 (0.9)$_a$	0
Anxiety	0.9 (1.5)$_a$	0	4.9 (2.2)$_b$	6	1.5 (2.0)$_c$	0	0.7 (1.4)$_a$	0
Fear	0.1 (0.4)$_a$	0	5.2 (2.3)$_b$	6	0.3 (0.8)$_a$	0	0.3 (1.0)$_a$	0
Happiness	5.3 (1.8)$_a$	6	0.9 (1.3)$_b$	0	1.5 (1.7)$_c$	0	1.1 (1.2)$_b$	0
Joy	5.0 (1.8)$_a$	6	0.7 (1.2)$_b$	0	1.1 (1.3)$_b$	0	0.7 (1.2)$_b$	0
Sadness	0.3 (0.9)$_a$	0	1.0 (1.7)$_b$	0	0.3 (0.7)$_a$	0	0.3 (1.0)$_a$	0
Affect grids								
Valence	1.5 (1.7)$_a$	2	−1.1 (1.9)$_b$	−2	0.3 (1.7)$_c$	1	0.6 (1.5)$_c$	0
Arousal	0.4 (1.7)$_a$	2	1.3 (1.7)$_b$	2	−0.7 (1.6)$_c$	−2	−0.9 (1.7)$_c$	−2

Note. Emotions were reported on a scale from 0 (*no emotion*) to 8 (*a great deal of emotion*). The table reports averages for each video, regardless of whether the video was viewed as the first or second induction. Standard deviations are reported in parentheses. Within a row, values with different subscripts differ at $p < .05$ (Fisher's LSD).

did females: learning—$M = 1.1$ for males versus $M = 0.25$ for females, $F(1, 86) = 12.0, p < .001$; testing—$M = 0.85$ for males versus $M = -0.04$ for females, $F(1, 86) = 5.6, p < .02$.

Measures of Facial Recognition Performance

We used a signal detection measure of discriminability (d') to determine performance on the facial recognition task. The d' statistic, often described as discriminability or sensitivity, is a composite measure incorporating hit rate and false alarm information. One advantage of this statistic is that the value is independent of an observer's threshold for making a response (Wickens, 2002). Our measure of the ORB is the difference score obtained by subtracting discriminability (d') of Black faces from discriminability of White faces for each participant; higher scores indicate higher levels of the ORB.

Effects of Emotion Inductions Prior to Encoding and Recognition

For each experiment, we conducted a 3 (emotion induction: joy, neutrality, or fear) × 2 (race of face: White or Black) mixed-factors analysis of variance (ANOVA). Both ANOVAs revealed a significant main effect for the race of the facial stimuli: Experiment 1—$F(2, 60) = 5.31, p < .03, \eta^2 = .09$; Experiment 2—$F(2, 47) = 8.55, p < .005, \eta^2 = .18$. The main effect for race of face replicated the ORB, with recognition performance higher for White faces ($M = 1.36$) than Black faces ($M = 1.07$).[3]

A priori pair-wise comparisons of ORB d' difference scores by emotion condition revealed that a joy induction before either encoding or recognition resulted in lower levels of ORB relative to a fear induction: Experiment 1—$t(37) = 1.76$, $p < .09$, $\eta^2 = .08$; Experiment 2—$t(26) = 2.11$, $p < .05$, $\eta^2 = .15$. A joy induction also resulted in lower levels of ORB relative to a neutral induction: Experiment 1—$t(39) = 2.05, p < .05, \eta^2 = .10$; Experiment 2—$t(33) = 1.79, p < .09$, $\eta^2 = .09$.

To determine the magnitude of the ORB within each emotion condition, we applied paired-sample t tests separately by emotion condition. There was a recognition difference between Black and White faces for participants in the neutral condition, $t(21) = 2.38, p < .05$, and the fear conditions, Experiment 1—$t(19) = 1.97, p < .08$; Experiment 2—$t(14) = 2.98, p < .01$). In contrast, there was no recognition difference for participants in the joy conditions: Experiment 1—$t(18) = 0.47$, n.s.; Experiment 2—$t(12) = 0.30$, n.s.

Considering White and Black faces independently, a set of one-way ANOVAs demonstrated that the elimination of the ORB in the joy conditions was due to improved recognition of Black faces in those conditions. Emotion inductions did not alter recognition performance for White faces (all Fs < 1), but there was a significant effect of the inductions on recognition of Black faces: Experiment 1—$F(2, 60) = 4.00$, $p < .03$, $\eta^2 = .12$; Experiment 2—$F(2, 49) = 3.54$, $p < .05$, $\eta^2 = .13$. Planned comparisons revealed that the joy induction resulted in higher discriminability of Black faces compared with the neutral induction: Experiment 1—$t(39) = 2.53$, $p < .03$, $\eta^2 = .12$; Experiment 2—$t(33) = 2.23, p < .05, \eta^2 = .13$. The joy induction also resulted in higher discriminability of Black faces compared with the fear induction: Experiment 1—$t(37) = 2.53$, $p < .02$,

[3]Across all conditions, there was a main effect of gender of face, $F(1, 83) = 13.5$, $p < .001$, as well as an interaction of gender of face and race of face, $F(1, 83) = 18.6$, $p < .001$, with White female faces being recognized best. However, gender of face did not interact with emotion condition or participant's gender.

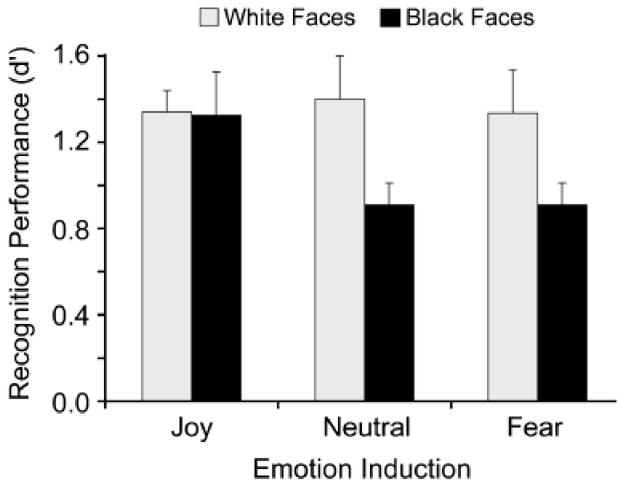

Fig. 1. Recognition performance (discriminability) for own-race (White) and other-race (Black) faces as a function of emotion induction. Data are averaged across Experiments 1 and 2. Error bars represent standard errors.

$\eta^2 = .15$; Experiment 2—$t(26) = 2.52$, $p < .02$, $\eta^2 = .20$. Because the results of Experiments 1 and 2 were very similar, Figure 1 depicts recognition performance averaged from both experiments.

Across both experiments, improved recognition of Black faces in the joy conditions was due to significantly higher hit rates relative to the fear conditions, $t(86) = 3.48$, $p < .001$, $\eta^2 = .12$, and the neutral condition, $t(86) = 3.18$, $p < .002$, $\eta^2 = .11$. There were no differences in false alarms across conditions (all ts < 0.5, n.s.).

Additional evidence for the role of emotions in the ORB comes from the correlations between self-reported emotions and recognition of White and Black faces.[4] As shown in Table 2, higher levels of self-reported positive emotions predicted better recognition of Black faces and lower levels of the ORB.

DISCUSSION

The results of Experiments 1 and 2 provide clear support for the hypothesis that positive emotions can reduce the ORB. In Experiment 1, we found that inducing a positive emotion before faces were learned improved our Caucasian participants' recognition of Black faces, and effectively eliminated differences in recognition of Black and White faces. Experiment 2 showed this same effect when emotions were induced prior to testing; relative to negative emotion or a neutral state, induced positive emotion improved recognition of Black faces and eliminated the ORB in facial recognition.

[4]The correlational analysis included self-reported emotion in response to one video for each subject: the comedian and horror clips in the joy and fear conditions, respectively, and the first neutral video shown in the neutral condition.

TABLE 2
Correlations Between Self-Reported Emotion and Recognition Performance

Emotion report	White faces	Black faces	Own-race bias
Amusement	−.09	.28**	−.27**
Anger	.01	−.07	.05
Anxiety	−.01	−.21*	.14
Fear	.08	−.15	.17
Happiness	−.10	.31**	−.30**
Joy	.08	.32**	−.30**
Sadness	.02	−.11	.09

*$p < .05$. **$p < .01$.

Taken together, Experiments 1 and 2 establish that positive emotions can reduce and even eliminate the ORB. Even so, the present experiments do not directly address the mechanism (or mechanisms) through which this elimination occurs. Drawing from the broaden-and-build theory (Fredrickson, 2001), we have proposed two separate but not mutually exclusive possibilities. The broadening effect of positive emotions may boost recognition of cross-race faces by promoting more holistic perceptual processes (Basso et al., 1996; Fredrickson & Branigan, 2005). It is also possible that positive emotions, by promoting more inclusive social categorizations (Dovidio et al., 1998; Isen et al., 1992), decrease the salience of racial categories. That is, positive emotions may facilitate more accurate memories of cross-race faces by reducing memory distortions due to categorizing the faces by race (Maclin & Malpass, 2003).

Induced positive emotion significantly improved recognition of other-race faces, but had no appreciable effect on recognition of own-race faces. We suspect that this lack of an effect for own-race faces is due to a ceiling effect. If own-race faces are already processed holistically, the boost in holistic processing arising from a positive emotion may not alter performance for own-race faces. Additionally, if White faces are already seen as in-group members, no improvement in own-race recognition would be expected from using more inclusive social categorizations. It is also interesting to note that the improvements in recognition were equivalent for Black male and Black female faces, which suggests that the more inclusive racial categorizations were not bounded by the gender of the target.

Whereas previous research showed that training could reduce the ORB temporarily (Lavrakas et al., 1976), we have shown that induced positive emotion can do the same. We cannot yet generalize our findings to all positive emotions because our positive emotion induction focused on joy and humor. It remains an empirical question whether a positive emotion like contentment would produce a similar reduction in the ORB, or whether laughter is responsible for eliminating the ORB.

Originally, we expected that emotions would most likely influence the ORB by changing how cross-race faces were encoded. If participants could encode cross-race faces more holistically or without categorizing the faces by race, they would have a more accurate visual memory of the faces (Maclin & Malpass, 2003; Tanaka et al., 2004). However, Experiment 2 showed improved recognition of cross-race faces even when the positive emotion was induced after the faces were encoded. It is not clear how positive emotions can improve recognition after faces have already been learned. We suspect that improved holistic processing and decreased racial categorization of the test faces allow for more accurate comparisons with faces in memory.

We have proposed two possible mechanisms for how positive emotions may eliminate the ORB; however, other possibilities exist. For instance, in a recent neuroimaging study, Caucasian participants exhibited higher levels of amygdala activation upon subliminal presentation of Black faces relative to White faces. The greater activation of the amygdala in response to Black faces predicted lower activation in the FFA for Black faces relative to White faces and more pro-White/anti-Black bias on the Implicit Association Test (Cunningham et al., 2004). Positive emotions could reduce the ORB by altering amygdala activation, possibly allowing greater activation of the FFA in response to cross-race faces. Indeed, this type of modulated neural activation could underlie changes in holistic processing or racial categorization.

The finding that positive emotion can eliminate the ORB suggests one way that positive emotion may help build social resources. Positive emotions, by eliminating the ORB, may alter the way people interact with one another. Functionally, positive emotions might build resources by producing a state of "social broadening" during which the distinctions and typical boundaries between social groups become less salient within social interactions. This contention is supported by experiments showing that inducing positive affect fosters a common in-group identity and reduces intergroup bias (Dovidio et al., 1995). Recent work by Waugh and Fredrickson (2004) showed that induced positive emotion increased self-expansion, the incorporation of another person into one's self-concept (Aron, Aron, Tudor, & Nelson, 1991). Subsequently, Waugh and Fredrickson found that positive emotions in the weeks before starting freshman year predicted a greater degree of self-expansion between new college roommates, which in turn predicted a closer relationship between the roommates a month later.

For now, our research reliably demonstrates a new finding: Positive emotion eliminates the highly robust ORB in face recognition. The practical applications of this finding could include developing methods to improve eyewitness testimony, or designing interventions to reduce racial biases in the workplace. It remains for future studies to address underlying mechanisms, but we hope the current studies represent the beginning of a line of research that may ultimately facilitate more harmonious social relations by showing that positive emotions can erase some effects of race.

Acknowledgments—This research was supported by grants from the National Institute of Mental Health (MH53971 and MH59615) and by an award from the American Psychological Association (2000 Templeton Positive Psychology Prize) to Barbara L. Fredrickson, as well as by National Institute of Mental Health Training Grant MH15801 awarded to Kareem J. Johnson. We thank Christian Waugh, Phoebe Ellsworth, Denise Sekaquaptewa, Oscar Ybarra, and Stephanie Brown for comments on earlier versions of this article.

REFERENCES

Aron, A., Aron, E.N., Tudor, M., & Nelson, G. (1991). Close relationships as including the other in the self. *Journal of Personality and Social Psychology*, *60*, 241–253.

Basso, M.R., Schefft, B.K., Ris, M.D., & Dember, W.N. (1996). Mood and global-local visual processing. *Journal of the International Neuropsychological Society*, *2*, 249–255.

Baudouin, J., Gilibert, D., Sansone, S., & Tiberghien, G. (2000). When the smile is a cue to familiarity. *Memory*, *8*, 285–292.

Chiroro, J., & Valentine, T. (1996). An investigation of the contact hypothesis of the own-race bias in face recognition. *Quarterly Journal of Experimental Psychology*, *48A*, 879–894.

Cunningham, W.A., Johnson, M.K., Raye, C.L., Gatenby, J.C., Gore, J.C., & Banaji, M.R. (2004). Separable neural components in the processing of Black and White faces. *Psychological Science*, *15*, 806–813.

Derryberry, D., & Tucker, D.M. (1994). Motivating the focus of attention. In P.M. Niedenthal & S. Kitayama (Eds.), *The heart's eye: Emotional influences in perception and attention* (pp. 167–196). San Diego, CA: Academic Press.

Dovidio, J.F., Gaertner, S.L., Isen, A.M., & Lowrance, R. (1995). Group representation and intergroup bias: Positive affect, similarity, and group size. *Personality and Social Psychology Bulletin*, *21*, 856–865.

Dovidio, J.F., Isen, A.M., Guerra, P., Gaertner, S.L., & Rust, M. (1998). Positive affect, cognition, and the reduction of intergroup bias. In C. Sedikides (Ed.), *Intergroup cognition and intergroup behavior* (pp. 337–366). Mahwah, NJ: Erlbaum.

Doyle, J. (2001). Discounting the error costs: Cross-racial false alarms in the culture of contemporary criminal justice. *Psychology, Public Policy, and Law*, *7*, 253–262.

Ekman, P., Friesen, W.V., & Ancoli, S. (1980). Facial signs of emotional experience. *Journal of Personality and Social Psychology*, *39*, 1124–1134.

Farah, M., Wilson, K., Drain, M., & Tanaka, J. (1998). What is "special" about face perception? *Psychological Review*, *105*, 482–498.

Ferguson, D.P., Rhodes, G., & Lee, K. (2001). 'They all look alike to me': Prejudice and cross-race face recognition. *British Journal of Psychology*, *92*, 567–577.

Fredrickson, B.L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American Psychologist*, *56*, 218–226.

Fredrickson, B.L., & Branigan, C. (2005). Positive emotions broaden the scope of attention and thought-action repertoires. *Cognition and Emotion*, *19*, 313–332.

Gauthier, I., & Logothetis, N.K. (2000). Is face recognition not so unique after all? *Cognitive Neuropsychology*, *17*, 125–142.

Golby, A.J., Gabrieli, J.D., Chiao, J.Y., & Eberhardt, J.L. (2001). Differential responses in the fusiform region to same-race and other-race faces. *Nature Neuroscience*, *4*, 845–850.

Isen, A.M., Niedenthal, P., & Cantor, N. (1992). The influence of positive affect on social categorization. *Motivation and Emotion*, *16*, 65–78.

Ito, T.A., & Urland, G.R. (2003). Race and gender on the brain: Electrocortical measures of attention to the race and gender of multiply categorizable individuals. *Journal of Personality and Social Psychology*, *4*, 616–626.

Johnson, K.J., Waugh, C.E., Wager, T.D., & Fredrickson, B.L. (2004). *Smile to see the forest: Expressed positive emotions increase attentional flexibility and broaden attentional scope*. Manuscript submitted for publication.

Kassin, S., Ellsworth, P., & Smith, V. (1989). The "general acceptance" of psychological research on eyewitness testimony: A survey of the experts. *American Psychologist*, *44*, 1089–1098.

Lavrakas, P.J., Buri, J.R., & Mayzner, M.S. (1976). A perspective on the recognition of other race faces. *Perception & Psychophysics*, *20*, 475–481.

Levin, D.T. (1996). Classifying faces by race: The structure of face categories. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *22*, 1364–1382.

Levin, D.T. (2000). Race as a visual feature: Using visual search and perceptual discrimination tasks to understand face categories and the cross-race recognition deficit. *Journal of Experimental Psychology: General*, *129*, 559–574.

Maclin, O.H., & Malpass, R.S. (2003). The ambiguous-race face illusion. *Perception*, *32*, 249–252.

Maurer, D., Le Grand, R., & Mondloch, C. (2002). The many faces of configural processing. *Trends in Cognitive Sciences*, *6*, 255–260.

Meissner, C., & Brigham, J. (2001). Thirty years of investigating the own-race bias in memory for faces. *Psychology, Public Policy, and Law*, *7*, 3–35.

Montepare, J.M., & Opeyo, A. (2002). The relative salience of physiognomic cues in differentiating faces: A methodological tool. *Journal of Nonverbal Behavior*, *26*, 43–59.

Ng, W., & Lindsay, R. (1994). Cross-face recognition: Failure of the contact hypothesis. *Journal of Cross-Cultural Psychology*, *25*, 217–232.

Rhodes, G., Brake, S., Tan, S., & Taylor, K. (1989). Expertise and configural coding in face recognition. *British Journal of Psychology*, *80*, 313–331.

Russell, J.A., Weiss, A., & Mendelsohn, G.A. (1989). The affect grid: A single-item scale of pleasure and arousal. *Journal of Personality and Social Psychology*, *57*, 493–502.

Slone, A., Brigham, J., & Meissner, C. (2000). Social and cognitive factors affecting the own-race bias in Whites. *Basic and Applied Social Psychology*, *22*, 71–84.

Tanaka, J., & Farah, M. (1993). Parts and wholes in face recognition. *Quarterly Journal of Experimental Psychology*, *85*, 397–405.

Tanaka, J., Kiefer, M., & Bukach, C.M. (2004). A holistic account of the own-race effect in face recognition: Evidence from a cross-cultural study. *Cognition*, *93*, B1–B9.

Teitelbaum, S., & Geiselman, R.E. (1997). Observer mood and cross-racial recognition of faces. *Journal of Cross-Cultural Psychology*, *28*, 93–106.

Tong, F., Nakayama, K., Moscovitch, M., Weinrib, O., & Kanwisher, N. (2000). Response properties of the human fusiform face area. *Cognitive Neuropsychology*, *17*, 257–279.

Waugh, C.E., & Fredrickson, B.L. (2004). *Feeling good and feeling close*. Manuscript submitted for publication.

Wickens, T.D. (2002). *Elementary signal detection theory*. New York: Oxford University Press.

(Received 9/3/04; Revision accepted 11/3/04; Final materials received 12/13/04)