

11 Race and Emotion: Insights from a Social Neuroscience Perspective

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Successful human social interaction relies on each individual's ability to understand other people's intentions, beliefs, and desires (Baron-Cohen, 1988). An important building block for understanding others' mental states is being able to recognize how they feel. We can infer this in many ways, for example, from a person's tone of voice or social context. Another important way is through deciphering facial expressions. Endowed with a flexible, sophisticated set of facial muscles, human and nonhuman primates use these expressions as a primary means of communicating emotions (Darwin, 1872).

Although the ability to express and recognize emotions is to a large extent universally shared across human and nonhuman primates, social experience, and in particular racial or cultural experience, moderates how well an individual recognizes these emotions in others. For example, emotional expressions expressed by members of a different species or racial group are often inaccurately recognized (Elfenbein & Ambady, 2002a). Cultural differences in display rules indicating when it is appropriate to communicate certain kinds of emotions are another example of how social experience can shape the ability to recognize emotions. Differences in the capacity to recognize emotions accurately may explain social misunderstandings and communication difficulties that can arise during interracial interactions.

The Origins of Emotion Recognition

Recognizing and expressing emotions through the face is a robust and innate human ability. From the beginning of life, infants show proclivity to express facial emotions, imitate the facial movements of others (Oster & Ekman, 1978; Meltzoff & Moore, 1983), and discriminate between positive and negative expressions (Nelson, Morse, & Leavitt, 1979). By age five years children learn to make finer-grained distinctions among facial expressions and recognize them beyond the positive-negative dimension

(Widen & Russell, 2003). Even children who are blind and deaf and have no visual or auditory notion of what it is like to communicate an emotion create spontaneous facial expressions that greatly resemble those displayed by normal children (Eibl-Eibesfeldt, 1970). Their ability to generate emotional expressions recognizable by others is compelling evidence of an innate mechanism for communicating emotions through the face. Darwin (1872) first noted over 100 years ago that humans share distinct facial morphology and expressions with nonhuman primates. For example, rhesus macaques display facial threat by widening their eyes and mouth in a fashion very similar to a human expression of fear (Knapp & Hall, 1997). Finally, people from various cultures are able to recognize emotional expressions such as happiness, fear, anger, sadness, disgust, and surprise at above-chance levels of accuracy (Ekman, 1992, 1994; Izard, 1994).

The potent ability to recognize emotions expressed by the face is supported by a complex but relatively discrete network of bodily systems including brain regions within and connected to the limbic system. Numerous brain imaging and patient studies show that the amygdala plays a role in the perception, detection, and subsequent recognition of fearful facial expressions (Phan et al., 2002; Adolphs, 2002). Studies using neuroimaging and tensor magnetic stimuli provide converging evidence that medial frontal gyri are critically involved in recognizing angry expressions (Phan et al., 2002; Harmer et al., 2001). Other imaging studies suggest that the basal ganglia is engaged during recognition of happy expressions and other pleasant visual stimuli (Phan et al., 2002).

How do these brain regions interact during emotion recognition? Evaluation of emotional content in faces is a rapid process that occurs very early in the perceptual processing stream. Affective evaluation of faces along positive and negative dimensions occurs as early as 160 msec after stimulus presentation (Pizzagalli et al., 2002). Perceiving fearful facial expressions, in particular, modulates neural responses in frontocentral regions even earlier, at approximately 120 msec (Eimer & Holmes, 2002). Thus, it appears that the neural processes associated with emotion recognition occur early.

In summary, substantial evidence indicates that the human capacity to express and recognize emotions through the face has evolutionary roots, is shared across human cultures, and has dedicated neural machinery.

Emotion Recognition and the Role of Social Experience

In addition to emotion recognition through facial expressions, social experience influences this process. The face conveys a multitude of social information, not only about

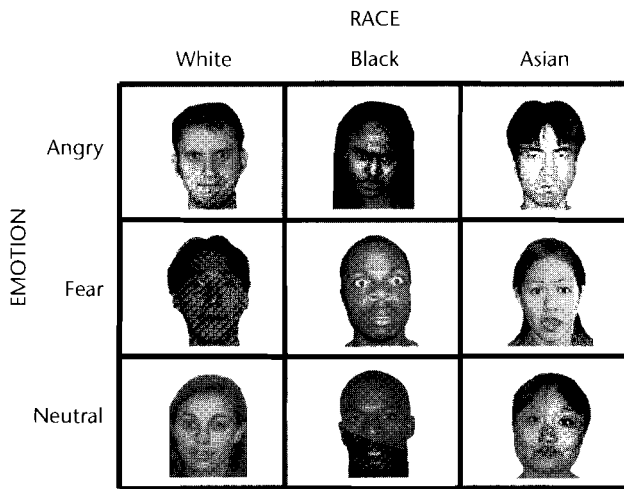


Figure 11.1

Sample stimuli of different racial emotional expressions in functional magnetic resonance imaging and event-related potential experiments on emotion recognition.

internal attributes such as how someone feels, but also external features (age, gender, race) that shape a person's identity by influencing how one sees oneself and how others construe one (Fiske & Neuberg, 1990). Indeed, behavioral findings suggest that such social attributes as race and cultural group membership can influence emotion recognition.

For instance, people can recognize emotions in faces from all cultures at striking levels of accuracy (Ekman, 1992). However, they recognize emotions most accurately in members of the same cultural group relative to other cultural groups (Elfenbein & Ambady, 2002b; figure 11.1). Several factors are thought to moderate this recognition advantage, including differences in attitude toward one's own cultural group relative to other groups, and quantity and quality of familiarity with other cultures¹ (Elfenbein & Ambady, 2002a). Moreover, cultural standards for when it is appropriate to convey a particular emotion can influence when and how much an emotion is publicly expressed, which may in turn affect the internal experience of that emotion (Ekman & Friesen, 1969; Hochschild, 1979).

Race and the Brain

The investigation of neural and behavioral responses to in-group and out-group stimuli has to date focused exclusively on reactions to neutral faces of different races,

to imagined partners of a different race within a neutral context, or to race-specific words (Hart et al., 2000; Golby et al., 2001; Phelps et al., 2000; Richeson et al., 2003). However, given the impact of emotion on social perception and interaction (Hess, Barry, & Kleck, 2000; Keltner, Ellsworth, & Edwards, 1993; Vrana & Rollock, 1998, 2002), and the particularly rapid, possibly unconscious, processing of negative expressions (Fox et al., 2000; Dimberg & Oehman, 1996; White, 1996), both the racial and emotional salience of a target face are likely to affect neural and behavioral responses.

Despite substantial evidence for the impact of emotional states on prejudiced attitudes and stereotypical judgments (Jackson et al., 2001; Asuncion & Mackie, 1996; Bodenhausen, Kramer, & Susser, 1994; Bodenhausen, Sheppard, & Kramer, 1994; Lambert et al., 1997), and evidence that physiological reactivity of perceivers during social interaction varies according to both racial and emotional contexts (Vrana & Rollock, 1998, 2002), scant attention has been given to the emotion expressed by targets of such judgment (Vaes et al., 2003). Indeed, little previous work to our knowledge has examined perceivers' responses to in-group and out-group members expressing different emotions (Hugenberg & Bodenhausen, 2003). This is a surprising oversight given considerable evidence indicating rapid and efficient processing of facial expressions, particularly negative expressions (Dimberg & Oehman, 1996; Fox et al., 2000; White, 1996).

We conducted functional magnetic resonance imaging (fMRI) and event-related brain potential² (ERP) studies in our laboratory that emphasize not only the impact of race on emotional processing, but also the influence of emotional expression on evaluation of in-group and out-group members. Our data underscore both the importance of emotional expression on how a target is appraised and also the utility of using converging measures to clarify social phenomena and processes that contribute to social behavior.

Does Race Affect Brain Processes during Emotion Recognition?

To examine how racial group membership affects brain processes during emotion recognition, Chiao and colleagues (2004) conducted an event-related fMRI in eight Caucasian participants (4 men) while they explicitly identified fear, anger, and neutral expressions in faces of Caucasian, Asian-American, and African-American men and women. Participants were shown each facial expression for 750msec and responded within 2500msec, pressing an appropriate button to indicate which emotion the face was expressing. We predicted that participants would recognize all expressions but that they would be most accurate at recognizing those in faces of their own race.

Consistent with previous behavioral work, all emotional expressions were recognized at better-than-chance accuracy levels; however, Caucasian participants recognized neutral faces better than fearful and angry faces. They were also best at recognizing emotions in Caucasian and Asian-American faces relative to African-American faces, specifically, fear and anger.

Neuroimaging results³ revealed greater amygdala activity in response to Caucasian and Asian-American faces showing fear relative to African-American faces. Caucasian expressions of anger elicited increased signal change in medial frontal cortex relative to Asian-American and African-American anger. These findings suggest that neural regions specifically involved in recognizing fear and anger show differences in signal change depending on the race of the person expressing the emotion.

Chiao, Lowenthal, and Ambady (unpublished data) examined when neural processes involved in emotion recognition are influenced by racial group membership. The vertex positive potential (VPP) of ERPs was used to study fourteen Caucasian participants while they viewed expressions and judged whether or not each face was angry, fearful, or neutral. We hypothesized that race of the facial target would influence basic structural face processing approximately 170 msec after stimulus onset and this would be observable in the amplitude of the VPP, an ERP that is critical to face processing (Bentin et al., 1996; Jeffreys, 1989, 1996). Moreover, we predicted that the emotional expression being processed would affect the extent to which race influenced neural processing. To investigate this hypothesis, participants were asked to self-report their overall exposure to Caucasians, Asian-Americans, and African-Americans on a Likert scale of 1 to 7; they reported most exposure to Caucasians and least to African-Americans. Participants detected angry expressions most accurately in African-American and Caucasian faces relative to Asian-American faces, but they recognized fear most accurately in Caucasian faces relative to African-American and Asian-American faces. Finally, neutral expressions were recognized equally well across the three racial groups.

The VPP amplitude was sensitive to both race and emotion of the face. It was greatest for all African-American faces, regardless of the emotion being expressed. Furthermore, angry expressions yielded the most positive amplitude for African-American and Asian-American faces relative to Caucasian faces. For fear expressions, African-American faces yielded the greatest positive amplitude in the VPP relative to Caucasian and Asian-American faces. For anger expressions, African-American and Asian-American faces yielded greater amplitude relative to Caucasian faces. For neutral faces, VPP amplitude was similar across all different race faces.

Taken together, these neuroimaging and ERP data suggest that race affects brain processes involved in recognizing of fear and anger. First, regions important in the

successful recognition of fear and anger show modulation of signal change based on the race of the expressor. Second, behavioral and neural evidence suggests that not all outgroup faces are processed alike. The amygdala and VPP respond differently to African-American fear faces relative to Caucasian and Asian-American fear faces. However, Asian-American and African-American anger faces are processed more similarly relative to Caucasian anger faces.

Differences in behavioral and neural responses to out-group faces may be a result of several factors. Caucasians and Asian-Americans may have greater exposure to each other, thus leading to better recognition of emotions expressed by those groups relative to African-Americans (Elfenbein & Ambady, 2002a). Furthermore, social groups often vary in social status relative to each other. This observation was first made in reference to the power differentials witnessed between the sexes; however, social psychologists and sociologists have also applied this subordination hypothesis to racial groups as they vary not only in socioeconomic status but also their historical progressions, which influence the degree to which these minority out-groups are stigmatized by the majority. Of importance, neuroimaging and ERP evidence shows that differences seen at the group level are also detectable at the neural level within individuals. It has yet to be determined definitively whether these neural differences in processing of emotion expressed by individuals of different races arise from variations in racial exposure or social status, or additional factors.

Together, our data are among the first to indicate that the emotional expression of a racially salient target influences processing of different out-group members at not only the behavioral but also the physiological level. As we describe below, using neuroscience techniques to investigate the influence of race and emotion on the processing of one another may also illuminate such costly social phenomena as prejudice. Specifically, theories of prejudice emphasize that a combination of factors that make up a stereotype may in turn influence behavior toward out-group members (Fiske et al., 2002; Fiske, 1998). That is, the degree to which prejudiced behavior is manifested may depend on not just group membership of the target (out-group African-American) but also the extent to which the target possesses other qualities (warmth or competence; Fiske et al., 2002). Given that facial expressions are processed differently depending on the valence of the expression, that prejudiced behavior is influenced by the particular composition of qualities portrayed by an out-group target, and that emotion clearly influences social behavior, an investigation of the interactions among race, emotion, and prejudice is warranted.

ERP Differentiation to In-Group and Out-Group Facial Expressions: Insights for Understanding Prejudice

Intriguing work on the neural responses to outgroup faces evaluated correlations with implicit measures of prejudice on passive viewing tasks of neutral faces (Phelps et al., 2000; Richeson, et al., 2003). A series of studies from our laboratory examined cortical and behavioral responses of high- and low-prejudiced individuals to in-group and out-group emotional stimuli. In contrast with previous investigations that used passive viewing tasks to examine neural responses to out-group stimuli, we employed an active evaluation task in which participants were asked to make a socially relevant judgment (do I want to work with this person?) regarding in-group and out-group members (Chiu, Ambady, & Deldin, 2004).

Both behavioral responses and the contingent negative variation (CNV) component of the ERP were measured in high- and low-prejudiced individuals (selected on the basis of their responses on the modern racism scale; McConahay, Hardee, & Batts, 1981) who were asked to make evaluative judgments of emotionally and racially salient facial stimuli (figure 11.2). The CNV is typically elicited by a warning

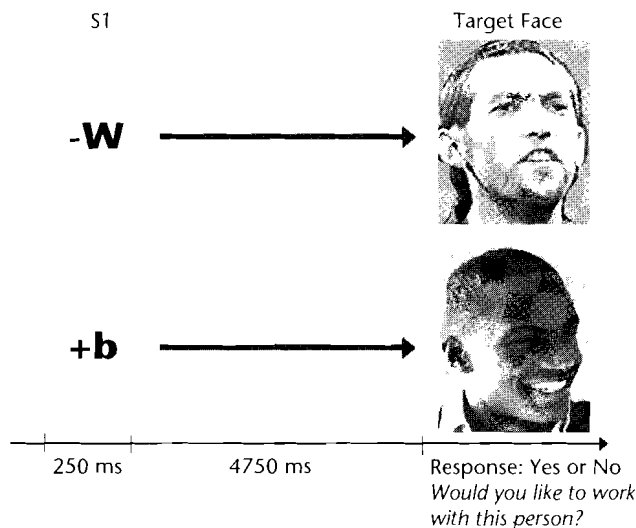


Figure 11.2

Schematic representation of CNV task. Each trial consisted of a warning stimulus ($-w$, $+w$, $-b$, $+b$, r) presented for 250 msec followed 4750 msec later by a corresponding target face (happy white, angry white, etc.). Participants were asked to respond yes or no according to their preference for working with the individual.

stimulus that requires anticipation of a target stimulus (Walter et al., 1964; Picton & Hillyard, 1988). The early component of the CNV is thought to index initial attention to information carried by the warning stimulus, the expected degree of expenditure of cognitive effort to respond to the target stimulus, and the degree of motivation to respond to the target stimulus (Low & McSherry, 1968; Forth & Hare, 1989; Hamon & Seri, 1987). Moreover, the presence of the early CNV is generally thought to be a cortical reflection of controlled, rather than automatic, psychological processes in response to an S1 that requires anticipation of a subsequent S2 (Picton & Hillyard, 1988; Shiffrin & Schneider, 1977). Several groups demonstrated the sensitivity of the CNV to the anticipation of affective stimuli and successfully used the CNV to identify individual and group differences in distinct components of information processing that reflect the subjective significance of anticipated stimuli (Rockstroh et al., 1979; Klorman & Ryan, 1980; Yee & Miller, 1988; Regan & Howard, 1995).

Our behavioral and ERP data indicate not only that high- and low-prejudiced individuals are differently influenced by the affective relevance of in-group and out-group members, but also that the affective nature of target stimuli may be especially salient for low-prejudiced individuals (figure 11.3). Specifically, low-prejudiced individuals showed an increased CNV not only to angry out-group stimuli, but also in anticipation of angry faces more generally, compared with happy faces. Longer behavioral response latencies of the low-prejudiced group in evaluating angry black targets further indicate this enhanced processing. Together, these data support, and extend to include emotion, theories of prejudice proposing that these individuals monitor automatic

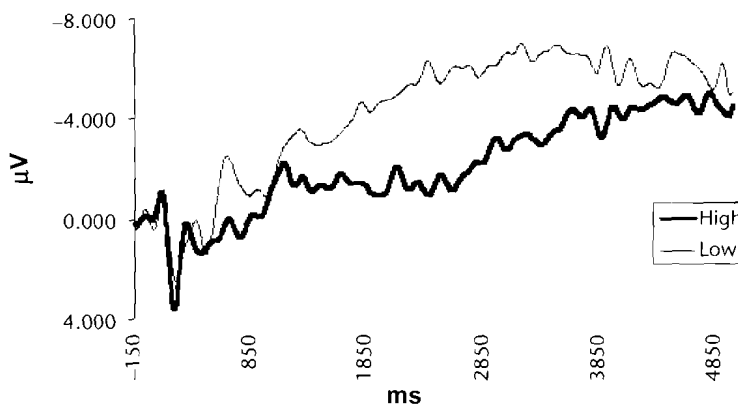


Figure 11.3

Contingent negative variation amplitude at site Cz of high- and low-prejudiced individuals to S1, indicating the subsequent presentation of an angry black American face (S1 = "–b").

reactions to negative stereotypes elicited by out-group stimuli (Bodenhausen & Macrae, 1998; Devine, 1989; Monteith, Devine, & Zuwerink, 1993; Plant & Devine, 1998).

In comparison, the high-prejudiced group showed decreased CNV in anticipation of angry black targets compared with all other targets, supporting theories that individuals high in explicit prejudice may be characterized by a decreased tendency, or motivation, to monitor automatic prejudiced responses to negative stereotypes (Bodenhausen & Macrae, 1998; Monteith et al., 1993; Plant & Devine, 1998). The shorter behavioral response latencies of the high-prejudiced group to angry black targets further reflects absence of effortful suppression of prejudiced behavior. In further comparison, the high-prejudiced group showed an enhanced CNV in anticipation of happy white targets; this suggests a greater recruitment of cognitive resources to respond to happy white stimuli, and is consistent with theories proposing that prejudiced individuals may expend extra effort to make individuating responses when required to evaluate in-group stimuli, and that less effort in individuating out-group members may contribute to the expression of prejudice (Brewer, 1999; Miller & Brewer, 1986). Indeed, high-prejudiced individuals showed enhanced CNV in anticipation of a specific nonthreatening in-group stimulus (happy white), but not a more general response to happy faces.

Our data augment the small but growing literature investigating neural concomitants of race perception and race bias. In the one fMRI study (Phelps et al., 2000) that employed measures of both implicit and explicit race bias, positive correlations between amygdala activity and race bias were found only on implicit (implicit association test; startle potentiation) and not explicit measures of race evaluation (modern racism scale, MRS). In contrast, in our work (Chiu et al., 2004), CNV amplitudes distinguished participants with high and low scores on an explicit measure of racial bias (MRS) such that low-, compared with high-prejudiced individuals showed greater cortical activity to angry black targets. At first glance, these data may seem at odds with those of Phelps et al. However, most of their participants scored below 2 on the MRS, suggesting that their participants may be comparable with our low-prejudice group. Indeed, within this group, the data show greatest cortical resources to angry black stimuli, compared with all other targets.

A study investigating possible mechanisms by which race bias may be suppressed provides further evidence for the role of controlled processing in prejudice (Richeson et al., 2003). Briefly, participants with high scores on the implicit association test of racial bias had greater activity in brain regions associated with cognitive control when viewing out-group faces. The authors noted that this pattern of results was

counterintuitive, and suggested that it may not be race bias per se that correlates with activity in brain regions associated with cognitive control, but rather greater concern with exhibiting overt signs of prejudice that is subsequently reflected in the recruitment of cognitive control in order to suppress prejudicial behavior (Richeson et al., 2003; Richeson & Shelton 2003; see also Gehring, Karpinski, & Hilton, 2003). Such an interpretation indicates that these individuals may score low on explicit measures of prejudice and, as proposed by current perspectives on prejudice, may be more motivated to control prejudiced reactions to negative stereotypes, devote more cognitive resources to monitoring their behavior toward out-group members (Blascovich et al., 1997; Devine, 1989; Devine et al., 1991; Fazio et al., 1995), and thus show greatest activity in brain regions associated with cognitive control, as reported by Richeson et al. Clearly, it would be of theoretical interest to explicate further the nature of prejudice by examining whether individuals who score high on explicit measures of racial prejudice show differentiable subcortical activation to in-group and out-group emotional faces, and also to investigate the relationship between implicit and explicit measures of race evaluation and cortical processes.

It is further notable that in our sample the high- and low-prejudiced groups exhibited no differences in behavioral or physiological responses to the evaluation of happy out-group stimuli (Hugenberg & Bodenhausen, 2003, did not specifically investigate participants' identification of happy expressions). Indeed, the differences between these groups were enhanced or attenuated by simply varying the anticipated and actual valence of facial expression from angry to happy. The pattern of null group differences to happy out-group stimuli, in conjunction with the robust between-group differences to angry out-group stimuli, is striking and suggests at least that prejudice and stereotyping are not unitary phenomena and may be malleable. It should be emphasized, however, that no analyses within race or emotion alone yielded significant between-group effects; thus, both race and emotion, and likely an interaction between them, appear critical in influencing behavioral, attitudinal, and physiological responses toward in-group and out-group members.

Preliminary data from two other ERP studies from our laboratory supplement these findings. First, high- and low-prejudiced individuals appear to engage different neural resources and cognitive processes when confronted with racial stereotypes and violation of these race-based expectancies. Briefly, we measured N400 and late positive components (LPCs) of the ERP as high- and low-prejudiced individuals viewed sentences that confirmed or violated racial stereotype-based expectancies ("Jamaal's favorite sport is lacrosse," versus "Jamaal's favorite sport is basketball"). The N400 is typically enhanced in response to the presentation of context incongruent words relative to

context congruent words, and is thus thought to index both lexical and conceptual-level information processing (Halgren, 1990; Kutas & Van Petten, 1994; Osterhout & Holcomb, 1995; Rugg, 1990). In sentence-comprehension paradigms, the component temporally after the N400, variously termed the LPC, P600, or syntactic positive shift, is not only sensitive to syntactic violations, but also reflects subjective probability and the ease with which new information is integrated into one's representation of the environment (as part of the P300 family; Donchin, 1981; Donchin & Coles, 1988; Coulson, King, & Kutas, 1998; Gunter, Stowe, & Mulder, 1997). Our data indicate that out-group stereotypes may be equally represented in the cognitive representations of high- and low-prejudiced individuals, and, for all participants, more salient than in-group stereotypes (greater N400 to violation of out-group versus in-group expectancies; lack of between-prejudice differences). Notably, although the representation of in-group and out-group stereotypes, respectively, may be equivalent between high- and low-prejudiced individuals, the cognitive processes involved in resolving these stereotypes appear to be quite different. Specifically, low-prejudiced individuals exhibited enhanced LPC to violations of out-group race-based expectancies, whereas high-prejudiced individuals exhibited enhanced LPC to violations of in-group expectancies (Chiu et al., unpublished observations).

In another investigation of the influence of race and emotion on the processing of each, we examined the cognitive processes and temporal resolution of cortical physiology as high- and low-prejudiced individuals viewed images of in-group and out-group emotional faces. Preliminary analyses indicate that racial and emotional differentiation occur as early as 120msec after stimulus presentation (as evidenced by more positive voltages for out-group relative to in-group faces, and delayed latencies to angry faces compared with happy faces), and effects of target gender are seen even earlier (~80msec; female targets elicited more negative voltage than male targets). Of importance, interaction effects including race, emotion, and level of prejudice are evident at all stages of processing, beginning as early as 80msec after stimulus presentation. Although data analyses from this study are still under way, preliminary findings unambiguously highlight the mutual and respective influence of race and emotion on person perception and social behavior (Chiu et al., unpublished observations).

Conclusion

Studies in our laboratory emphasize not only the impact of emotion on the perception of members of in-groups and out-groups but also, we believe, the utility of

converging measures to clarify the impact of race and emotion on social behavior. Indeed, self-report measures are vulnerable to selective distortion by self-presentational and experimenter biases, especially with regard to socially questionable phenomena such as prejudice. A neuroscience approach to understanding social phenomena allowed progress relatively unhindered by such biases. Nevertheless, we concur with others (Cacioppo et al., 2003) who caution against the use of brain imaging tools simply to show that there are biological concomitants of social phenomena; indeed, that changes in social behavior correspond with physiological differences is expected. Instead, we draw on the long tradition of using ERPs as quantifiable measures of the temporal manifestation of cortical resources and specific cognitive processes that may not be readily accessible by isolated use of traditional behavioral and self-report measures. We believe that these may provide both converging evidence for existing theories of social behavior and also supply fuel for new conceptualizations. For example, our data suggesting that high- and low-prejudiced individuals do not differ at the N400 component but do differ at the LPC in response to violations of racial expectancies, provide evidence not only that race-based information may trigger a societally constrained conceptual representation of race, but also that the manifestation of prejudice depends how individuals process this information. Moreover, the specificity of our between-group findings to the early, but not the late, component of the CNV provides intriguing insight about when and how in the processing of social information high- and low-prejudiced individuals may begin to diverge. That is, substantial evidence indicates that the late CNV is the sum of motor (response preparation) and nonmotor (cognitive anticipation of a task-relevant stimulus) components (Damen & Brunia, 1994; van Boxtel & Brunia, 1994). Thus, given that the early CNV is thought to reflect sustained processing that extends to the late CNV and also the greater early CNV in the low-prejudiced group, a relatively smaller contribution of motoric preparation to the late CNV in anticipation of angry black targets is evidenced in this group compared with the high-prejudiced group.

The brain's functional anatomy places important constraints on psychological theories of racial and emotional processing, and their relationship in social behavior. Thus, a social neuroscience approach integrating the spatial resolution of fMRI with the temporal resolution of ERPs along with traditional behavioral and self-report measures not only facilitates a comprehensive description of the functional anatomy of racial and emotional processing, but also encourages development of more comprehensive theoretical models of prejudice and other social phenomena, uses current knowledge of brain function to test hypotheses about the processes underlying social phenomena that may not otherwise not be assessed, and allows an assessment of

independent and interactive contributions of emotional, race, and cognitive factors to social discrimination. Our series of studies emphasizes not only the impact of emotion on the perception of members of in-groups and out-groups but also, we believe, the utility of converging measures to clarify the impact of race and emotion on social behavior.

The main purpose of this work is to show that facial expressions of emotion affect both neural and behavioral responses to in-group and out-group faces, and that a social neuroscience approach is of utility for understanding factors that contribute to social behavior. Indeed, findings from our laboratory are among the first to indicate that the emotional expression of a racially salient target influences processing of in-group and out-group members at not only the behavioral, but also the physiological level, and the first to show neural differentiation between individuals who score high and low on explicit measures of racial prejudice. Together, these data underscore both the importance of emotional expression on how social targets are appraised and also the utility of using converging measures to clarify processes that may contribute to social behavior. These investigations are, however, a first step toward understanding the respective contributions of racially and emotionally salient features of individuals to how we perceive and interact with each other.

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Notes

1. As indexed by geographical distance and self-report.
2. An extensive and rapidly growing literature in cognitive psychophysiology suggests that event-related brain potentials (ERPs), voltage changes time-locked to stimulus presentation, may be a particularly useful tool for exploring the cognitive and emotional processes that may be associated with social behavior. The amplitude and latency of these voltages changes are thought to reflect the cognitive processing associated with the presentation, or pending presentation, of discrete events. Relative immunity to demand characteristics renders ERPs of particular utility for exploring phenomena, such as prejudice, that in purely behavioral paradigms may be especially sensitive to experimenter effects and self-presentation biases. Moreover, since ERPs are considered the gold standard among noninvasive imaging methods for measuring the temporal resolution of the physiological manifestation of psychological processes (Fabiani, Gratton, & Coles, 2000), the temporal pattern of social impression formation and reaction can be examined.

3. Whole-brain analyses were conducted using a general linear model in SPM'99. All contrast analyses were conducted at the $p < 0.001$ level corrected. Due to the limited number of incorrect trials per given condition, all events were included in the contrast analyses regardless of whether or not the event response was correct.

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