

## **Race, Behavior, and the Brain: The Role of Neuroimaging in Understanding Complex Social Behaviors**

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*Recent advances in brain imaging techniques have allowed us to explore the neural basis of complex human behaviors with more precision than was previously possible. As we begin to uncover the neural systems of behaviors that are socially and culturally important, we need to be clear about how to integrate this new approach with our psychological understanding of these behaviors. This article reviews findings about the neural systems involved in processing race group information, in particular the recognition of same-race versus other-race faces and the explicit and implicit evaluation of race groups. Combining the psychological and neural approaches can advance our understanding of these complex human behaviors more rapidly and with more clarity than could be achieved with either approach alone. However, it is inappropriate to assume that the results of neuroimaging studies of a given behavior are more informative than the results of psychological studies of that behavior.*

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**KEY WORDS:** race, brain imaging, bias

Over the past decade, we have seen unprecedented advances in our understanding of the human brain. Perhaps most exciting has been research with functional neuroimaging that allows us a window into the brain activity underlying complex human behaviors. Using neuroimaging techniques, recent studies have begun to explore the brain systems involved in behaviors we consider to be defining as individuals, such as moral reasoning (e.g., Greene, Sommerville, Nystrom, Darley, & Cohen, 2001), social cooperation (Rilling et al., 2002), violent tendencies (Davidson, Putnam, & Larson, 2000), responses to race groups (e.g., Phelps

et al., 2000), and love (e.g., Bartels & Zeki, 2000). This is certainly good news. From a scientific perspective, these research tools provide additional avenues to help us understand these complicated and important behaviors. However, it remains unknown whether this knowledge has any significance beyond furthering basic behavioral and neural science.

The implications are clear. As we begin to uncover the neural basis of behaviors that are relevant to our social and political lives, could we use brain science to guide social and political choices? In this article we argue that at this time the answer is “no.” There is a disturbing trend developing in the interpretation of brain imaging research in the general public, as well as among some scientists. This trend is rooted in the assumption that a biological understanding of a behavior is more informative or reliable than a psychological understanding of a behavior. Although brain science can inform our understanding of complex human behaviors, it cannot help us predict human behavior with any more certainty than can be derived from examining behavior itself. To explore this topic, we review what has been learned about the neural basis of social group processing, in particular social groups defined by race.

### Same-Race Versus Other-Race Face Recognition

Two main findings have emerged concerning our understanding of the neural processing of race group information. The first is related to our ability to recognize faces from our own and other race groups. Psychological research has shown that, in general, we are likely to recognize faces of our own race more quickly and accurately than faces of another race (Brigham & Barkowitz, 1978; Brigham & Malpass, 1986; Chance & Goldstein, 1996; Malpass & Kravitz, 1969). This is called the *same-race advantage*. One possible reason for the same-race advantage is the *contact hypothesis*, which attributes this enhanced recognition to greater experience with faces of our own race. This hypothesis is supported by studies showing that the same-race advantage is greater for white than for black Americans. It is proposed that because black Americans are a minority in the United States, they are more likely to have contact with other race groups than white Americans, who are in the majority (Brigham & Malpass, 1986; Carroo, 1986; Fallshore & Schooler, 1995; Malpass & Kravitz, 1969). Another way of phrasing the contact hypothesis is that face recognition is a skill that is learned over many years of practice in social situations. White Americans may have less experience with other races, resulting in a greater differentiation and enhanced memory for same-race versus other-race faces.

Neuroimaging data and studies in patients with specific brain injuries have identified an area in the brain that specializes in face recognition (Haxby et al., 1994; Kanwisher, McDermott, & Chun, 1997; Puce, Allison, Gore, & McCarthy, 1995). This region, the fusiform gyrus, is in the ventral occipitotemporal cortex and is commonly called the fusiform face area (FFA). In an effort to determine

whether the same-race advantage can be detected in this brain region, Golby, Gabrieli, Chiao, and Eberhardt (2001) used functional magnetic resonance imaging (fMRI). Ten black and 10 white American subjects were shown pictures of unfamiliar black and white faces, along with pictures of objects (antique radios). The subjects were asked to remember these stimuli, and their memory was later tested. This memory test yielded a same-race advantage, consistent with previous studies. Both black and white subjects were better at recognizing same-race faces, but this was a significant effect only for the white subjects who demonstrated a relatively larger same-race advantage.

The imaging data from this study showed that there was greater activation of the FFA when subjects viewed same-race versus other-race faces. This difference was apparent in both the black and white subjects, primarily in the right fusiform gyrus. Previous studies have found the FFA to be primarily localized in the right hemisphere (e.g., Kanwisher, 2000). Golby et al. (2001) also conducted a correlation across subjects in which they compared the magnitude of the FFA response to same-race versus other-race faces with the relative memory advantage for same-race faces. They found that superior memory for same-race versus other-race faces was significantly correlated with greater activation of the left fusiform gyrus as well as the right hippocampal and parahippocampal gyri, regions known to be important for memory in general (Cohen & Eichenbaum, 1993). They proposed that face processing is asymmetric, with the left hemisphere mediating categorical visual processes (i.e., black vs. white) and the right hemisphere mediating processes involved in individuating faces within a category.

Golby et al. (2001) suggested that the differences in FFA recruitment for same-race versus other-race faces could be due to long-term differences in experience with members of these race groups, which is similar to the contact hypothesis mentioned earlier. Previous research has suggested that the FFA may mediate experience-dependent visual categorization, not only for faces but also for other sets of objects with which one may acquire expertise, such as birds, cars, etc. (Gauthier, Skudlarski, Gore, & Anderson, 2000). In addition, Golby et al. suggested that the recruitment of the FFA during the viewing of same-race versus other-race faces is related not only to long-term experience with members of the same race, but also to attentional processes that emphasize classifying other-race faces with the use of race-specific information (categorical, left hemisphere) rather than individuating information (right hemisphere).

This study is intriguing in that it links what was previously known about the neural basis of face recognition with the recognition of race group information. This link can help us begin to understand how faces of different races are represented in the brain; in addition, these results are consistent with one possible hypothesis as to why there is a same-race advantage for face recognition. This study advances our understanding of the role of the FFA and extends it to the processing of race group information. However, these results do not teach us anything about the behavior of recognizing same-race versus other-race faces that we

did not know previously from behavioral work. We already knew that this advantage exists, is stronger in white than in black Americans, and varies across individuals. Knowing how this behavior is represented in the brain does not change these facts.

Although the study by Golby et al. is an important first step, some aspects of the role of the FFA in the same-race advantage remain unresolved. For instance, the role of the left fusiform gyrus in the recognition of faces is not clear. Most previous studies examining the FFA have reported a right hemisphere advantage. Moreover, the Golby et al. data do not entirely support the link between the same-race advantage and the FFA response. In this study, the white American subjects showed a greater same-race advantage, consistent with previous results. However, the black American subjects showed a more consistent FFA response to same-race versus other-race faces. About 75% of white subjects showed greater FFA activation to same-race faces in comparison to all of the black subjects, including those black subjects who did not show any race-related recognition bias. These questions point to potential problems in determining the precise link between the FFA and the same race advantage that will need to be addressed in future studies.

### **Direct and Indirect Measures of Race Evaluation**

The second main finding that has emerged from research on the neural basis of social group processing concerns biases in the evaluation of individuals on the basis of race group membership. These studies have focused on a brain region called the amygdala. The amygdala is a small almond-shaped structure in the medial temporal lobe that has been shown to be important for emotional learning and memory and for some aspects of emotional evaluation (e.g., LeDoux, 1996). Specifically, the amygdala has been shown to be important for the expression of a learned evaluation when it is assessed indirectly, such as through a physiological response. The amygdala does not seem to be important when this same evaluation is expressed explicitly or directly. For example, fear conditioning is a paradigm by which a neutral stimulus, such as a blue square, comes to acquire aversive properties by repeatedly being paired with an aversive event, such as a mild shock to the wrist. After a few pairings of square and shock, normal subjects are able to explicitly report that the blue square predicts a shock, and they demonstrate a physiological fear response (e.g., increased sweating) to the blue square presented alone. Patients with amygdala damage also explicitly report that the blue square predicts a shock; however, they fail to show any indirect, physiological indication of this learned fear response (Bechara et al., 1995; LaBar, LeDoux, Spencer, & Phelps, 1995). This preferential involvement of the amygdala in the indirect (implicit) expression of an evaluation, but not direct evaluation, has also been shown with other types of emotional stimuli and measures of evaluation (Funayama, Grillon, Davis, & Phelps, 2001).

The evaluation of social groups defined by race is a topic of undeniable importance that has been studied by social psychologists for decades. One finding that has emerged from this literature is that there has been a consistent decrease over the years in the explicit report of negative attitudes toward black Americans expressed by white Americans (Biernat & Crandall, 1999; Schuman, Steeh, & Bobo, 1997). Although it was not uncommon for white Americans to express negative attitudes toward black Americans 40 years ago, recent studies have found that white Americans' explicit attitudes are significantly less biased today. However, there is robust evidence that when attitudes are assessed indirectly or implicitly, most white Americans demonstrate a negative bias toward black Americans (Banaji, 2001; Bargh & Chen, 1997; Devine, 1989; Fazio, Jackson, Dunton, & Williams, 1995; Fiske, 1998; Nosek, Banaji, & Greenwald, 2002). There are a few possible reasons for this observed dissociation between an implicit negative bias and an explicit unbiased report. One is that this negative implicit bias is consistent with a biased explicit attitude, but subjects are simply reluctant to admit a biased attitude. However, it is also possible that even those subjects who consciously believe that there is no reason for a biased attitude are influenced by cultural stereotypes and limited experiences, in such a way that biases are expressed on implicit tests that are not amenable to conscious control and mediation. This notion of unintentional and unconscious bias was recently expressed in the Study on the Status of Women Faculty in Science at MIT, in which the dean of science, when acknowledging a pattern of sex discrimination, indicated that "it was usually totally unconscious and unknowing" (Birgeneau, 1999).

In an effort to determine whether the dissociation in the neural systems underlying implicit and explicit assessments of evaluation could be linked to the dissociation observed among white Americans in explicit and implicit measures of race bias, my lab, in collaboration with Banaji and colleagues (Phelps et al., 2000), used fMRI to examine the relationship between activation of the amygdala and behavioral measures of race bias. During brain imaging, white American subjects were shown pictures of unfamiliar black and white male faces. They were simply asked to indicate when a face was repeated. After imaging, subjects were given a standard explicit assessment of race attitudes (the Modern Racism Scale or MRS; McConahay, 1986) and two indirect assessments of race bias. The first indirect test measured startle potentiation while viewing the same faces. Startle is a reflex that is potentiated in the presence of stimuli considered to be negative (Grillon, Ameli, Woods, Merikangus, & Davis, 1991; Lang, Bradley, & Cuthbert, 1990); the difference in the magnitude of the startle reflex in the presence of the black versus white faces served as the indirect measure of bias. The second indirect measure of bias was the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998). In this study, the IAT involved the presentation of a series of trials on which a black or white unfamiliar face was presented; subjects were asked to classify these faces according to race as quickly as possible. Interspersed

among the face trials were trials in which a word was presented and subjects were asked to classify this word as representing something “good” (e.g., joy, love, peace) or “bad” (e.g., cancer, bomb, devil), again as quickly as possible. On half of the trials, the subjects pressed one key to indicate a “good” word or a black face and another key for a “bad” word or a white face. For the other half of the trials, these pairings were reversed. Reaction time differences in the black + good/white + bad pairing versus the black + bad/white + good pairing provided an indirect assessment of social group evaluation.

The behavioral results from this study (Phelps et al., 2000) mirrored those of previous studies (see Banaji, 2001). The white American subjects showed a relatively pro-black bias as measured by the explicit test, the MRS, while at the same time they exhibited an anti-black bias as measured indirectly by the IAT. On the startle potentiation test, they showed a nonsignificant trend toward greater startle while viewing black versus white unfamiliar faces. The imaging results did not yield a main effect for race. Although the majority of these subjects showed greater amygdala activation to the black faces than to the white faces, this effect was not observed in all of the subjects. When the variability in amygdala activation to black versus white faces across subjects was correlated with the variability in the behavioral measures, an interesting pattern emerged: Those subjects who showed greater negative bias on the indirect measures of race evaluation (IAT and startle) also showed greater amygdala activation to the black faces than to the white faces. This correlation between the indirect measures of bias and amygdala activation was not observed when the amygdala response was compared to the MRS, the explicit test of race attitudes. In other words, the amygdala response was predictive of race bias evaluation when this bias was measured indirectly, but not by explicit report.

This study is the first to link what is known about the neural systems of emotional learning and evaluation to the evaluation of social groups. It is important because it relates social evaluations to the ordinary mechanisms of everyday emotional learning and memory. Also, by showing a brain region whose activation response is correlated with indirect but not direct measures of evaluation, this study supports the idea proposed by social psychologists that attitudes toward social groups can be expressed both directly and indirectly and that these two means of expression may represent different underlying processes. However, like the study with face recognition mentioned earlier, it is unclear what we have learned about the behavior of race bias that we did not know before identifying these neural mechanisms. It may be appealing to extrapolate from these neuroimaging results that such measurements may be able to detect biases that individuals are unwilling to admit, but as this study indicates, behavioral tests are already able to detect such biases. Indeed, the only avenue we have to understand the behavioral significance of this or any other brain activation result is by linking it to behaviors we have defined. In addition, there are several other factors to consider when interpreting these results.

First, how general are these results? The subjects in the study by Phelps et al. (2000) were white Americans. Would members of other race groups perform similarly? Overall, black Americans show more variability than white Americans on measures of indirect race bias, with some showing a pro-black bias and others showing no bias or a pro-white bias (Nosek et al., 2002). If amygdala activation to same-race versus other-race faces predicts a negative bias on indirect measures of race evaluation, we might expect a less consistent amygdala response to same-race versus other-race faces in black American subjects. However, a study by Hart et al. (2000) assessed amygdala activation to black versus white faces in both black and white American subjects and observed greater amygdala activation to other-race faces than to same-race faces in both groups. In this study, the activation response was not linked to behavioral measures of race evaluation, making it difficult to know whether this link between implicit race bias and amygdala activation extends to black American subjects.

Second, does this effect extend to other stimuli that vary by race? Both the Hart et al. (2000) and Phelps et al. (2000) studies presented photographs of unfamiliar black and white male faces. A previous study (DuBois et al., 1999) reported that the amygdala shows increased activation to unfamiliar versus familiar neutral faces. Could it be that the amygdala response to same-race versus other-race faces is driven by greater familiarity with one's own race group? How might the responses observed in these studies be changed by familiarity? In an effort to address this question, Phelps et al. (2000) conducted a second study in which the faces presented belonged to familiar black and white male individuals. In this study, the white American subjects did not show any consistent evidence of stronger amygdala activation to the black versus white faces. The indirect startle test also failed to show any differentiation between race groups. Although the IAT, in which subjects are asked to classify these faces by race, did show a negative bias toward black faces, performance on this task was not correlated with an amygdala response. This second study suggests that this amygdala response can be modified by experience and familiarity.

Finally, what does an "activation" response measured with fMRI tell us about the precise role of the amygdala in this study? Brain activation is usually measured in response to a mental challenge created by the experimenter. In the Phelps et al. study, pictures of faces were presented during brain imaging and subjects were asked to respond to the identity of the individual faces, but clearly subjects also coded race group information from these stimuli. The result was a relationship observed between the differential amygdala response to the race groups and indirect measures of race bias. This relationship or correlation between the brain response and the behavioral measures does not tell us how or if the amygdala is involved in generating these behaviors; it indicates simply that there is some relationship. An activation response does not inform us as to what, exactly, a brain region does in the generation of a behavior. To determine the precise role of a given brain region in a task, we must use other techniques.



In an effort to determine whether the amygdala plays a critical role in the indirect evaluation of race groups, our lab tested a patient with bilateral damage to the amygdala (Phelps, Cannistraci, & Cunningham, 2003). This white American patient was given the same explicit measure of race bias mentioned earlier (MRS) along with the IAT to assess indirect race bias. Her performance was similar to the normal white American control subjects and consistent with previous results. This patient and the control subjects demonstrated a dissociation between the explicit measure of race attitude, on which they showed a pro-black bias, and the IAT, on which they showed a negative, anti-black bias. In other words, damage to the amygdala did not eliminate the indirect expression of race bias. These results suggest that even though the amygdala may play some role in the learning or expression of indirect race bias, the amygdala is not critical for the expression of this behavior, at least as measured by the IAT.

As is clear from the Phelps et al. (2000) and Hart et al. (2000) studies, as well as the Golby et al. (2001) study mentioned earlier, we can begin to use brain imaging to help inform our understanding of social group evaluation and of race bias in particular. However, it is inappropriate to assume that these techniques yield results that are more informative about the behavior of race bias than studying the behavior itself. Instead, combining the psychological and neural approaches is the best way to advance our understanding of these complex human behaviors more rapidly and with more clarity than could be achieved using either approach in isolation.

## Conclusions

In this brief review, we have tried to highlight how neural science can contribute to psychological science. Studies examining how the brain processes race information have provided support for psychological theories concerning the same-race advantage for recognition and the dissociation between direct and indirect measures of race group evaluation. As these studies indicate, a good understanding of the potential contributions of brain imaging can help us discover the structure and organization of a behavior. However, a poor understanding can lead us to conclusions that are inappropriate and possibly hurtful. As we develop techniques that allow us to investigate the biological basis of complex behavior, we need to be clear about what it means to say that a behavior is “in the brain.”

Showing a behavior “in the brain” does not indicate that it is innate, “hard-wired,” or unchangeable. Every experience leads to an alteration in the brain. Some of these alterations may be long-lasting and result in learning or memory. For example, the second study by Phelps et al. (2000) showed that the amygdala response to same-race versus other-race faces can be altered by familiarity and learning. Although it is often exciting to demonstrate a neural basis for a given behavior, it should not be surprising to show that *any* behavior has an identifiable neural substrate. To take a simple example, imagine that a week ago you visited



a new restaurant and enjoyed it. This experience resulted in a favorable opinion of this restaurant. Is this preference in your brain? Of course it is; there is a neural signature underlying this preference. If the next visit to this restaurant is a disappointment, you may change your opinion and your neural representation of this restaurant will change accordingly. This rather trivial example makes an important point. We all change, learn, and grow over time. It is easy to recognize the dynamic nature of behavior. Most of us also recognize the interdependence of behavior and the brain. We all have heard of or know someone who has suffered a brain injury resulting in a change in behavior. However, it is somehow more difficult to make the additional connection and recognize the dynamic nature of the brain. Changes in behavior correspond with changes in brain activity and structure. Discovering the representation of a behavior in the brain does not discount the influence of learning in generating, maintaining, or changing this behavior.

Showing a behavior “in the brain” does not say something more important or fundamental about who we are than our behavior. Functional neuroimaging techniques pick up on signals indicating brain activity. These signals, by themselves, do not specify a behavior. Only by linking these brain signals with behavior do they have psychological meaning. For example, recent research has shown different brain activity patterns during reading in individuals with dyslexia (e.g. Habib, 2000). Discovering the brain activity related to this disorder does not change the defining characteristic of dyslexia, which is difficulty reading. We would not label someone “dyslexic” solely on the basis of his or her brain activity pattern; likewise, we should not label someone “racist” because of the pattern of his or her brain response. Assessing brain activity may aid our understanding of a behavior, but the psychological meaning of these brain signals comes from their link to behavior. Discovering the brain activation pattern linked to a behavior does not change the importance of that behavior. It is also unlikely to tell us something about ourselves that we could not conclude from the behavior itself.

Over the past decade, we have become accustomed to seeing pictures of the human brain that are colored like junior high school geography maps, indicating where certain behaviors occur. These colored brain maps are a necessary oversimplification in our initial efforts to describe the representation of behavior in the brain, but they can be misleading. There is not a one-to-one correspondence between a behavior and a brain structure. Most behaviors recruit a network of brain regions, and a given brain region may be important for a number of behaviors. It is a mistake to assume any single brain region “does” a given behavior, just as it is a mistake to assume that activity in a given brain region predicts a single behavior.

Despite these misconceptions, these maps of brain activation patterns are compelling demonstrations of our newfound ability to investigate the biology of human behavior. For neuroscientists, it is an exciting time to try to unravel the complex circuits that tie together the brain and behavior. However, we need to be

reasonable in our interpretation of this research and use it to enhance, not subtract from, other means of investigation. These advances in neuroscience should not negate nor substitute for advances in the psychological understanding of behavior.

### ACKNOWLEDGMENTS

This work was supported by the James S. McDonnell Foundation 21st Century Scientist Award. Correspondence concerning this article should be sent to Elizabeth A. Phelps, Department of Psychology, New York University, 6 Washington Place, 8th floor, New York, NY 10003. E-mail: liz.phelps@nyu.edu

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