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Dynamic neural mechanisms underlie race disparities in social cognition

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ABSTRACT

Race disparities in behavior may emerge in several ways, some of which may be independent of implicit bias. To mitigate the pernicious effects of different race disparities for racial minorities, we must understand whether they are rooted in perceptual, affective, or cognitive processing with regard to race perception. We used fMRI to disentangle dynamic neural mechanisms predictive of two separable race disparities that can be obtained from a trustworthiness ratings task. Increased coupling between regions involved in perceptual and affective processing when viewing Black versus White faces predicted less later racial trust disparity, which was related to implicit bias. In contrast, increased functional coupling between regions involved in controlled processing predicted less later disparity in the differentiation of Black versus White faces with regard to perceived trust, which was unrelated to bias. These findings reveal that distinct neural signatures underlie separable race disparities in social cognition that may or may not be related to implicit bias.

Race disparities are wide-ranging in behavior, from less perceived trust in Black versus White faces (Stanley et al., 2011), lower ratings on job performance for Black versus White managers (Greenhaus et al., 1990), and broad deficits in recognizing other- versus same-race faces (Meissner and Brigham, 2001). Although cultural associations of Black males with aggression (Dovidio et al., 1996) may potentially underlie these tensions by perpetuating implicit bias toward minorities (e.g., McConnell and Leibold, 2001), other work suggests that race disparities emerge in several ways, some of which may be relatively independent of implicit bias. Disentangling the mechanisms underlying race disparities that are and are not related to implicit bias is critical to develop strategies that most effectively mitigate their consequences.

A wealth of social psychological research has demonstrated the pernicious effects of implicit bias on behavior (Gawronski et al., 2003). For instance, individuals with higher versus lower levels of implicit bias (as measured through subtle measures of prejudice) evaluate Black faces as less trustworthy than White (Stanley et al., 2011), discriminate more against Black proposers in economic games (Kubota et al., 2013; Stanley et al., 2011), have tenser intergroup interactions (McConnell and Leibold, 2001), and have more stereotyped mental representations of outgroup members (Dotsch et al., 2008). In contrast, implicit bias does not predict own-race effects in memory for faces (e.g., Slone et al., 2000), while the while the ability to distinguish (i.e., differentiate) other-race faces from one another does predict these effects (Goldstein and Chance, 1985; Hills and Lewis, 2006). For example, given a majority of Black professional basketball players, White fans better recognize Black faces than do White novices because they can better differentiate between them (Li et al., 1998). Even though differentiation itself may be separable from bias (Ferguson et al., 2001), less differentiation of outgroup versus ingroup members has downstream consequences on behavior. Indeed, individuals who do not differentiate other-race faces as well as others do not recognize them as well as ingroup members (Goldstein and Chance, 1985) and stereotype them more (Linville and Fischer, 1998).

However, it is unclear whether distinct components of race perception underlie race disparities due to bias or differentiation. To distinguish mechanisms for these disparities, our study dissociated bias-related disparities from disparities relatively independent from bias based on performance in a single task. The benefit to using the same task to disentangle neural mechanisms for these race disparities is that it controls for differences due to task. When White individuals view Black and White faces, they engage multiple processes reflected in neural activity (Amodio, 2014). For instance, they differentiate faces (Linville et al., 1989) as well as evaluate them (Stanley et al., 2012). In the case of the former, these processes emerge from perceiving race, but are not necessarily influenced by bias (Meissner and Brigham, 2001), whereas bias does influence evaluative judgments (Stanley et al., 2011). Because neuroimaging has importantly localized brain regions contributing to perceptual, affective, and cognitive components of race perception and how implicit bias impacts those regions' engagement (for reviews, see Amodio, 2014; Kubota et al., 2012), it allows us to disentangle how neural activity contributes to later behavioral race disparities. This is a critical consideration because understanding how different race disparities arise provides a basis to develop interventions that reduce them.

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Perceiving race engages affective processing regions, including the amygdala and orbitofrontal cortex (OFC). Imaging work on implicit bias has also found amygdala and OFC activity correspondence to ingroup favoritism (Beer et al., 2008), suggesting these regions' responses to race may underlie individual differences in bias-related race disparities. The amygdala has been implicated widely in emotional face processing (Vuilleumier et al., 2001), with activity toward Black versus White individuals reflecting threat (Chekroud et al., 2014). Amygdala response to Black over White faces increases with more implicit bias (Phelps et al., 2000), suggesting greater responses to Black versus White faces may underlie exacerbation of later bias-related race disparities.

OFC activity also contributes to affective face processing (Vuilleumier et al., 2001), particularly in cues that guide approachability judgments related to trust (Willis et al., 2010). OFC activation reflects affect-based judgments with regard to race in that it decodes representations of Black and White faces during friendship evaluation (Gilbert et al., 2012), and potentially may represent racial groups during evaluation better than the amygdala (Amodio, 2014). Although less studied in race perception than other regions, research suggests a strong role of OFC in group preferences that reflect the representation of value (Kringelbach and Rolls, 2004) such that stronger OFC responses to ingroup versus outgroup members predict biases in liking of these individuals (Van Bavel et al., 2008). This positive outcome from stronger OFC response allows for the possibility that stronger OFC response to Black versus White faces may underlie attenuation of bias-related evaluative race disparities later.

Implicit bias also alters perceptual processing of other- versus same-race faces. Most studies on this topic have focused on the fusiform gyrus, a region widely implicated in face processing (Kanwisher et al., 1997), and for which viewing own- versus other-race faces enhances its response (Golby et al., 2001). Critically, White individuals with higher levels of bias have increased fusiform activity in response to White as compared to Black faces, whereas lower bias individuals do not exhibit a difference (Brosch et al., 2012). However, the fusiform gyrus has also been implicated in non-bias-related behaviors associated with race. For instance, activity in this region contributions to own-race memory biases driven by differentiation, such that lower activity toward outgroup versus ingroup members may reflect perceptual homogeneity and failures to encode outgroup members at an individual level (Golby et al., 2001). These findings suggest that enhanced fusiform activity to Black over White faces may underlie the later attenuation of bias-related and bias-independent race disparities. However, even though the fusiform may engage regardless of implicit bias, the connectivity of the fusiform to different regions involved in affective or cognitive processing may differ in predicting race disparities related to bias versus not.

Simple race perception tasks also elicit activity from regions implicated in cognitive control, and specifically lateral prefrontal cortex (Amodio, 2014). Although many past neuroimaging tasks were not designed to assess control (e.g., Cunningham et al., 2004), past work has identified a link between dorsolateral prefrontal cortex (dlPFC) activity and controlling race-related stereotypes (Amodio, 2010). Prior work shows that differentiation requires motivation and cognitive effort (Hills and Lewis, 2006), suggesting that increased dlPFC activity toward Black versus White faces may underlie later attenuation of race disparities in differentiating faces that are relatively independent from bias. Indeed, individuals engage prefrontal regions when processing faces they are more likely to differentiate (Feng et al., 2011). Prefrontal engagement has also been implicated in regulating prejudiced responses (Amodio, 2014). For instance, control regions are more active in individuals with high versus low implicit bias when they evaluate Black versus White faces (Richeson et al., 2003). More activation among higher bias individuals suggests they may need more control to inhibit their bias (Devine, 1989) and comply with egalitarian social norms (Richeson et al., 2003).

Overall, these findings suggest that bias impacts regions involved in affective processing during race perception. While bias may also influence activity in perceptual and cognitive processing regions during race perception, perceptual and cognitive associations with bias may be influenced by connectivity to affective processing regions while perceiving race. These findings also suggest that the contributions of these components of race perception to later race disparities may depend on the disparity being assessed. To this end, we disentangled neural mechanisms predictive of different race disparities by connecting neural activity in a simple race perception task to two separable aspects of a later trustworthiness ratings task: evaluative racial trust disparity (i.e., perceiving less trust in Black versus White faces) and racial differentiation disparity (i.e., differentiating Black less than White faces). Differing from paradigms tracking activity during online evaluations, we assessed whether variations in neural response while perceiving race support later behavioral disparities within the same individuals. We assessed trustworthiness because perceivers automatically extract information from faces regarding their trustworthiness (e.g., Meconi et al., 2014; Todorov, 2008), suggesting reliability between brain activity when perceiving faces and later evaluations. These evaluations occur in the absence of cognitive control (e.g., Rule et al., 2013; Todorov, 2008), drawing on perceptual and affective processes (e.g., Winston et al., 2002). Connecting to race biases, trustworthiness evaluations draw from approach responses (Todorov, 2008) much like evaluative associations with race that are distinct from stereotype-based biases (Amodio and Devine, 2006). At the same time, people make distinctions between faces by way of their scale use when making a series of trustworthiness evaluations (Linville et al., 1989). Differentiating faces requires motivation and cognitive effort (Hills and Lewis, 2006), suggesting differentiation draws more on control than automatic evaluations.

In sum, we predicted that more fusiform and OFC activity toward Black versus White faces would correspond with less racial trust disparity in later evaluations. Further, we expected that greater connectivity between these regions would correspond with less racial trust disparity, reflecting bias-related behavior as dynamically driven by perceptual and affective processes. In contrast, given the association between amygdala response to Black versus White faces and threat (Chekroud et al., 2014), we expected greater amygdala activity toward Black versus White faces to underlie more racial trust disparity later. In contrast, we anticipated more fusiform or lateral prefrontal activity toward Black versus White faces to correspond with less later racial differentiation disparity given perceptual and cognitive contributions to differentiation. We also expected that more connectivity between regions reflecting these processes would correspond with less racial differentiation disparity.

Methods

Participants

Thirty right-handed White adults with no history of neurological problems (18–29 years, 17 female; $M_{age} = 21.27, SD = 2.38$) recruited from Indiana University participated and provided informed consent. This sample size was derived on the basis of past neuroimaging studies on race perception (for a review of these studies, see Amodio, 2014). The Indiana University IRB approved this study. Participation was completed over a pre-testing day and a separate scanning day.

Procedure

Pre-testing

Participants completed an extensive fMRI screening and measures relevant to the present task and others in the laboratory. The behavioral measures completed in the lab included the Implicit Association Test (IAT) for race (Greenwald and Banaji, 1995; Greenwald et al., 2003) –