

Intergroup differences in the sharing of emotive states: neural evidence of an empathy gap

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Empathy facilitates prosocial behavior and social understanding. Here, however, we suggest that the most basic mechanism of empathy—the intuitive sharing of other’s emotional and motivational states—is limited to those we like. Measuring electroencephalographic (EEG) alpha oscillations as people observed ingroup vs outgroup members, we found that participants showed similar activation patterns when feeling sad as when they observed ingroup members feeling sad. In contrast, participants did not show these same activation patterns when observing outgroup members and even less so the more they were prejudiced. These findings provide evidence from brain activity for an ingroup bias in empathy: empathy may be restricted to close others and, without active effort, may not extend to outgroups, potentially making them likely targets for prejudice and discrimination.

Keywords: empathy; prejudice; EEG; frontal asymmetries

INTRODUCTION

Prejudice is an ongoing problem in human societies, with humans committing some of the most hateful acts because of their prejudices, including acts of discrimination, segregation and even wars and genocides. At the same time, humans are truly empathic creatures: one-day old babies cry when they hear other babies cry (Sagi and Hoffman, 1970) and the recent discovery of the so called ‘mirror neuron system’ (Rizzolatti *et al.*, 1996) revealed that we intuitively ‘catch’ and ‘match’ other’s emotions and actions by mere observation. Humans, it appears, have a natural instinct to connect with others and to share their emotions.

We wonder, however: does this natural tendency to share others’ emotions occur for our social outgroups? Here, we propose that although people can easily pick up others’ emotions and thereby empathize with them, they are less likely to do so when that other belongs to an outgroup. By looking at prefrontal alpha asymmetry in response to ingroup and outgroup member’s negative emotions, this study investigates whether people resonate less with members of social outgroups than ingroups and whether this bias in empathy is intensified by increasing levels of prejudice. First, we define what we mean by empathy.

The nature of empathy

Empathy is the ability to share others’ emotions (Batson *et al.*, 1981; Preston and de Waal, 2002), or more specifically,

an affective response more appropriate to another’s situation than one’s own (Hoffman, 2000). Note though, that emotional sharing seems to be only the first step of the full blown empathic response, which requires at least minimal realization that the emotions one is feeling are caused by the other (Decety and Jackson, 2004). The initial undifferentiated vicarious experience of the other’s emotion—also called emotional contagion—nonetheless, is essential for and closely related to empathy (Singer and Lamm, 2009).

According to the perception–action model of empathy (Preston and de Waal, 2002), empathy is based on neural simulation. Merely seeing others doing something or expressing their emotions engages the same neural networks necessary for the execution of the same behavior or the experience of the same emotions in the observer. This vicarious activation of similar neural networks then elicits the associated autonomic and somatic responses, thereby allowing the observer to share the target’s motivational and emotional states (Decety and Jackson, 2004). Empathy, thus, comes to us naturally—we ‘catch’ the other’s emotions—and this vicarious experience helps us to gain an intuitive understanding of them.

Using functional magnetic resonance imaging (fMRI), a growing body of literature has now found considerable evidence for what researchers are calling ‘perception–action-coupling’ (Decety and Jackson, 2004) that, the perception of a given behavior or emotion in another individual activates one’s own neural representations of the same behavior or emotion. Such neural simulation processes have been found for a number of processes, including intentional actions (Rizzolatti *et al.*, 1996), disgust (Wicker *et al.*, 2003), touch (Keysers *et al.*, 2004), facial expressions (Carr *et al.*, 2003) and pain (Singer *et al.*, 2004). Importantly, recent evidence indicates that this perception–action-coupling is associated with empathy the more people show

Received 7 November 2010; Accepted 25 April 2011

Advance Access publication 23 June 2011

This research was supported by grants from the Canada Foundation for Innovation, the Ontario Ministry of Research and Innovation, and the Social Sciences and Humanities Research Council to Michael Inzlicht. We thank Jason Plaks, Elizabeth Page-Gould, Alexa Tullett, Sonia Kang, Jacob Hirsh, Rimma Teper, and Shona Tritt for valuable insights. We also thank Pranavi Ravichandran and Suleiman Furmli for their assistance with data collection.

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evidence of neural simulation to others' actions and emotions, the higher their levels of trait empathy (Hooker *et al.*, 2010) and the better they perform on tasks that are contingent on emotional empathy (Pineda and Hecht, 2009).

Empathy and its limits

Although perception–action-coupling and its accompanying empathic states may be unconscious, there is growing evidence that they are not automatic, subject to top–down influences. One such influence is group affiliation, with research suggesting an ‘empathy-gap’ where we are less likely to catch and match the actions and emotions of the outgroup (*vs* the ingroup). For example, people are less likely to help outgroup than ingroup members in need (Gaertner *et al.*, 1982; Saucer *et al.*, 2005; Kunstman and Plant, 2008) and less likely to value the lives of outgroup members as much as ingroup members (Pratto and Glasford, 2008).

Evidence from the social neurosciences suggests that group-affiliation similarly exerts a top–down influence on perception–action-coupling. A recent fMRI study, for example, found that people show more neural activation in pain circuits when observing the painful penetration of the face of ethnic ingroup members than of outgroup members (Xu *et al.*, 2009) and when they see people in distressing and emotionally painful situations (Mathur *et al.*, 2010). Moreover, such differences in empathy-related neural activation predict costly helping behavior (Hein *et al.*, 2010). Using transcranial magnetic stimulation (TMS), Avenanti *et al.*, (2010) found less corticospinal muscle inhibition when participants observed ethnic outgroup members receiving painful stimuli than when observing the same thing happening to ingroup members. Finally, using electroencephalographic (EEG) indices of primary motor cortex activity, Gutsell and Inzlicht (2010) found less neural simulation of action for outgroup members than ingroup members.

Rather than reflecting innate ingroup preferences, however, such ingroup biases may occur as a function of culturally learned prejudice (Chiao and Mathur, 2010). For example, people high in social dominance orientation (Pratto *et al.*, 1994; Sidanius and Pratto, 1999), a personality trait that is strongly related to higher levels of prejudice, show less activation in neural areas for pain when they see people in painful situations (Chiao *et al.*, 2009). In an intergroup context, high-prejudice people are specifically likely to show diminished perception–action-coupling to the outgroup, be that diminished motor cortex activity (Gutsell and Inzlicht, 2010) or reduced corticospinal inhibition (Avenanti *et al.*, 2010). Furthermore, the reduction in perception–action-coupling in these two studies was particularly acute for culturally disliked outgroups, so South Asians in Canada (Gutsell and Inzlicht, 2010) and Blacks in Italy (Avenanti *et al.*, 2010). Together, these studies suggest these brain effects are more a function of culture than innate preference.

The empathy gap may be part of a broader bias in perceptual processes whereby we are less receptive to outgroup members more generally including their emotions. The fMRI studies, for instance, reveal less neural activity in areas for social perception and social cognition in response to outgroups than ingroups (Harris and Fiske, 2006; Van Bavel *et al.*, 2008). Similarly, people have greater difficulty to recognize outgroup member's faces and to interpret their facial expressions and voices relative to the ingroup (Sporer, 2001; Effenbein and Ambady, 2002). There seem to be differences in not only how sensitive people are to the emotional expressions of outgroup members, but also differences in how they react to these emotions. For example, fear and happiness expressed by outgroup faces elicit the opposite emotional reaction in the observer (Weisbuch and Ambady, 2008). Moreover, people show greater amygdala response in response to fearful ingroup compared to outgroup faces (Chiao *et al.*, 2009), possibly because the amygdala is sensitive to motivational relevance (Cunningham *et al.*, 2008) and fear in ingroup members is more likely to signal danger to one's self than fear in outgroup members. Noticing the fear of someone from one's own ingroup, therefore, becomes relevant to one's own safety. The point here is that the emotions expressed by ingroups and outgroups may be perceived and reacted to differently.

The current study

All told, our social biases act as top–down influences and interfere with perception–action-coupling when it comes to outgroup members, and research on social perception suggests that other basic perception processes are equally biased against social outgroups. The suggestion, here, is that people are less able to catch and match the emotions of other people when those other people come from an outgroup. To our knowledge, no one has actually examined the sharing of emotions with the ingroup *vs* outgroup on a neural level. Previous studies have focused on basic motor and sensory processes such as motor activity or the sensation of pain (Xu *et al.*, 2009; Avenanti *et al.*, 2010; Gutsell and Inzlicht, 2010; Mathur *et al.*, 2010), but empathy also involves the sharing of basic emotional and motivational states (Levenson and Ruef, 1992; Hatfield *et al.*, 1994). It is unclear from past research, therefore, if there is an empathy gap in the actual sharing of emotions. To further investigate this specific issue, we need to measure emotional processes more directly. In the current study, we measure prefrontal alpha asymmetry as an index of emotional and motivational states (Davidson and Tomarken, 1989; Davidson, 1992; Harmon-Jones, 2003) to reveal possible ingroup biases to the extent to which people intuitively catch the emotions of other people.

We used EEG to measure the relative activation of the right and left prefrontal cortices; prefrontal cortical areas being essential for processing of reward and punishment related information (Davidson, 2004). Studies have

consistently associated activity in left prefrontal cortex with the expression and experience of approach-related motivational and affective states, such as happiness but also anger, while activation of the right prefrontal cortex has been shown to be related to the expression and experience of withdrawal-related motivational and affective states such as fear or sadness (Davidson, 1995; Harmon-Jones and Allen, 1998; Peterson *et al.*, 2008). These differences in functionality have often been measured using relative EEG activity in the alpha band (8–13 Hz) in electrodes over left and right prefrontal cortex (for a review, see Davidson, 1995). For instance, higher activation of right prefrontal cortex, as indicated by relatively lower alpha at right prefrontal electrode sites, is associated with, depression (Allen *et al.*, 1993), a general trait-like negative emotional style (Wheeler *et al.*, 1993), and with negative emotional responses to films (Davidson *et al.*, 1990). In contrast, higher activation of left prefrontal cortex is associated with approach-related positive affect (Gable and Harmon-Jones, 2008) and approach-related anger (Harmon-Jones and Sigelman, 2001). Importantly, the prefrontal cortex is involved in the experience and expression of emotions, but not in the perception of emotions (Davidson, 2004). Hence, measures of prefrontal alpha asymmetry during observation of an object other provide a measure of vicarious emotions free from confounds due to the mere perceptions of emotions.

We predict that participants will show stronger right prefrontal alpha asymmetry, indicating negative, withdrawal-related emotions while experiencing sadness and that they will show similar right prefrontal alpha asymmetry when passively observing ingroup members non-verbally expressing sadness. Reflecting an ingroup bias, we expect no such vicarious right prefrontal alpha asymmetry during the observation of outgroup members experiencing sadness. We further predict that this lack of vicarious emotion when passively observing the outgroup will be associated with participant's level of prejudice: the more prejudiced people are, the less they will catch the outgroup's emotions.

METHODS

Participants

Our original sample consisted of 30 right-handed university students. Participants were recruited from an introductory psychology course at the University of Toronto, Scarborough, and participated in the study for course credit. Two participants were excluded from our original sample due to a technical malfunction of the EEG system and another two were excluded because they self-identified as Black and mixed-race. Consequently, our final sample consisted of 26 participants, 10 males and 16 females, from various non-Black ethnic backgrounds (8 White, 6 East Asian and 12 South Asian). The participants were in the age group of 18–23 years ($M = 18.46$, $s.d. = 3.81$).

Procedure

Participants were told that the study's purpose was to investigate the neural underpinnings of emotions. Participants read and signed an informed consent sheet and were then fitted with an electrode cap for EEG recording. EEG was recorded while participants watched a set of videos. The videos showed a variety of ingroup and outgroup members expressing sadness. At the end of each video set, participants completed an emotion induction task during which they were led to feel sadness by vividly remembering past sad events in their life. To assess how individual differences in prejudice and in the ability to empathize with others are related to differences in the vicarious experience of emotional states, we then had participants complete several trait measures of prejudice and empathy.

MATERIALS

Symbolic racism scale

Participants completed the symbolic racism scale (Henry and Sears, 2002) during a mass testing session in an introductory psychology course at the beginning of the term. The symbolic racism scale is a measure of modern racism—a subtle form of racism—that obscures racist feelings with abstract values, such as justice and order.

Video manipulation

The study had a one-way within-subject design with three conditions (self-condition, ingroup condition and outgroup condition). Figure 1 graphically illustrates the design. For the purpose of our study, we defined ingroup as people who shared the participant's ethnic identity and outgroup as people who did not. Videos of ingroup and outgroup members (White, Black, South Asian and East Asian) expressing sadness served as the independent variable for the randomly presented outgroup and ingroup conditions, and this was followed by the self-condition. The videos depicted the actors sitting at a table in front of a white wall expressing sadness. In the outgroup condition, the participant saw four different actors from each ethnic outgroup. For example, a white participant would see four different black actors for 20 s each, followed by four different East Asian actors and four different South Asian actors. In the ingroup condition, participants saw four different ingroup members, each for 20 s, expressing sadness.

To control for differences besides the ethnicity of the individual actors, we asked a separate pilot sample of nine people to rate the videos. Specifically, after viewing each video, the raters used a 5-point scale to indicate the extent to which they thought the videoed individual (i) felt sad, (ii) felt positive, (iii) felt negative, (iv) experienced a strong emotion, (v) experienced an arousing emotion, (vi) was likable and (vii) was attractive. Raters further indicated (viii) the overall technical quality of the video and (ix) the amount of empathy they felt for the actor. Results revealed no significant differences between ethnic groups on

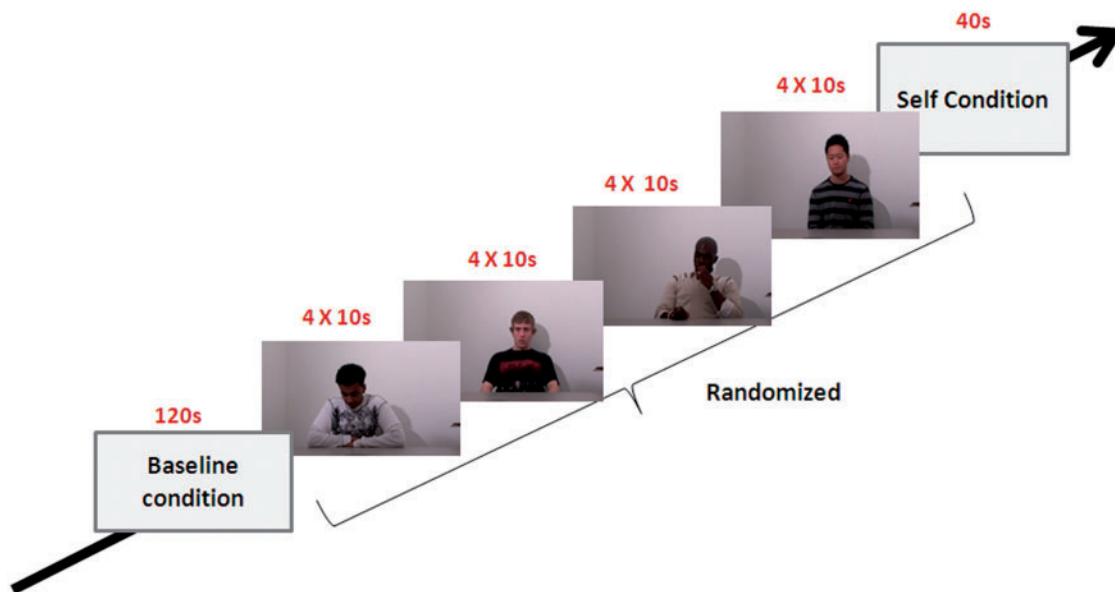


Fig. 1 Outline of experiment design.

any of these variables, all P 's > 0.16 , *ns*, suggesting that the actors from each ethnic group were viewed similarly, at least at an explicit level.

To ensure that participants attended the videos throughout the whole session, they performed a control task during the ingroup and outgroup conditions. For this task, the videos stopped between 2 and 5 times and the screen turned black for 1 s during each condition. Participants were asked to count how many times the black screen appeared and to indicate the number of such pauses at the end of the condition. Participants reported the correct number of black screens in 83% of all cases indicating that they attended the videos.

All ingroup and outgroup videos were presented in a random order, thus the ingroup condition could appear in any position in the set of videos. The actors in the videos were male students of the University of Toronto and, therefore, were approximately the same age, but not always the same sex as the participants. Each actor was displayed for 20 s. Consequently, we obtained 80 s of EEG data during the ingroup conditions and 240 s during the outgroup conditions; 80 s during each of the three different ethnic outgroups.

At the end of the video set, the participants were asked to experience the emotion of sadness themselves (self-condition). To facilitate the experience of sadness, participants completed an emotion induction exercise, which consisted of a series of instructions aimed to elicit vivid memories of past sad events. Participants saw the following instruction: 'Please think about a situation in your past, which made you feel very sad. Imagine the situation as vividly as you can'. After completion of the exercise,

participants continued experiencing the emotion for 80 s while they looked at a blank computer screen.

Empathy quotient

In order to assess the trait-like ability to empathize with others, we had participants complete the empathy quotient (Baron-Cohen and Wheelwright, 2004). The empathy quotient is a 60-item forced choice self-report scale that taps into both cognitive and emotional aspects of empathy.

Reading the mind in the eyes test

We administered a second measure related to empathy—reading the mind in the eyes test (Baron-Cohen *et al.*, 2001)—a measure of mindreading and social sensitivity. Specifically, in this test, participants are presented with a series of 25 photographs of the eye-region of different faces. For each photograph, they have to select one of four words that best describes what the person in the photograph is thinking or feeling.

EEG data acquisition and processing

To measure prefrontal alpha asymmetries, we recorded the EEG from 32 Ag/AgCl sintered electrodes embedded in a stretch-lycra cap. Recordings were collected from the 32 electrode sites according to the 10–20 system with a band pass filter at 0.1–100 Hz and a notch filter at 60 Hz. The EEG was digitized at 512 Hz using ASA acquisition hardware (Advanced Neuro Technology, Enschede, The Netherlands) with an average earlobe reference. Vertical eye movements (VEOG) were monitored using a supra- to suborbital bipolar montage and the continuous EEG recordings were corrected off-line for eye-blinks using the VEOG channel and the

Second Order Blind Identification (SOBI) procedure, which is a signal processing method for isolating and removing ocular artifacts (Tang *et al.*, 2005). During recording, the impedances were kept below 5 k Ω to ensure a clear and strong EEG signal. Continuous artefact-free epochs of 2.0 s from each interval were extracted through a Hamming window and overlapped by 75% to minimize data loss. As said above, we recorded 80 s of data for the observation of each ethnic group. To avoid habituation, however, we calculated power only for the first 10 s of each actor, resulting in 40 s of data for each ethnic group. For the same reason, we only included the first 10 s of EEG data acquired during the self-condition. Power was calculated via fast Fourier transform. Power values (in μV^2) were averaged across epochs within each interval. Total power within the alpha band (8–13 Hz), an inverse indication of cortical activity, was logarithmically transformed and asymmetry scores were calculated as right-site minus homologous left-site alpha power for lateral prefrontal sites (F8–F7), which is consistent with how prefrontal asymmetry is typically calculated (Harmon-Jones, 2006). Higher scores indicate relatively greater left- than right-cortical activation indicating more approach motivation and less sadness/withdrawal.

RESULTS

Results confirmed our hypotheses suggesting an ingroup bias in emotional sharing (Figure 2). We created index scores of relative alpha activity for each condition (log right alpha activity at F8; log left alpha activity at F7); such that more negative scores reflect greater withdrawal and negative emotionality. Participants' alpha asymmetry scores when personally experiencing sadness ($M = -0.08$, $s.d. = 0.17$) and when observing ingroup members (ideographically chosen) experiencing sadness ($M = -0.05$, $s.d. = 0.15$) did not differ from one another, $t(24) = 1.28$, $P > 0.20$. This suggests

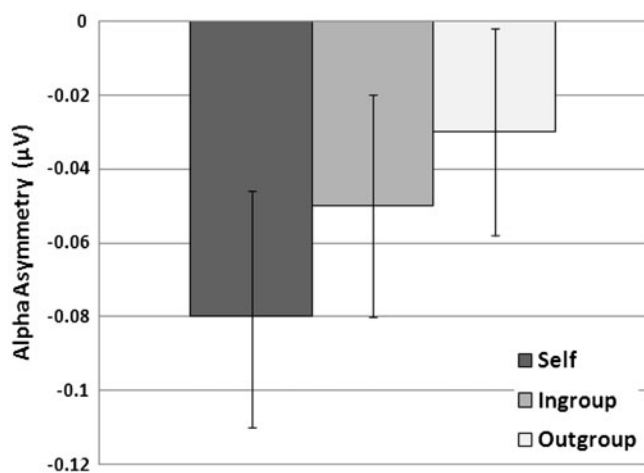


Fig. 2 Alpha asymmetry scores (log right alpha activity–log left alpha activity) during the experience and observation of sadness as a function of group membership. More negative scores indicate avoidant, negative affect.

a similarity in emotional/motivational states when personally experiencing/remembering sadness and when observing the ingroup experiencing sadness. In contrast, participants did not show such prefrontal alpha asymmetry when passively observing outgroup members: participants had significantly more alpha asymmetry when personally experiencing sadness than when observing an outgroup member experiencing sadness, ($M = -0.03$, $s.d. = 0.14$), $t(24) = 2.09$, $P < 0.05$. Although the difference in alpha asymmetry scores for the ingroup and the outgroup condition was not significant ($t(24) = -0.99$; $P = ns$, a within subject ANOVA over the three conditions (self, ingroup and outgroup) further confirmed the distinction between ingroup and outgroup. A significant linear trend indicated that alpha asymmetry was highest during personal experience of sadness, followed by the observation of the ingroup and then by the observation of the outgroup, $F(1, 23) = 4.37$, $P < 0.05$. These effects were specific to frontal sites such that alpha asymmetry scores at posterior lateral sites for all the conditions were positive (all M 's > 0.05), did not differ from one another (all P 's > 0.43), and did not show a significant linear trend $F(1, 23) = 0.64$; $P = ns$. The implication is that observing someone from one's own group who is sad elicits about the same amount of sadness as feeling sad oneself; outgroup members, in contrast, elicit significantly less sadness. These findings suggest an ingroup bias in emotional sharing.

When we break down the omnibus outgroup to specific ethnicities, we did not find any differences between subgroups. So, for example, White participants tended to have similar levels of brain activity when passively viewing Blacks, South Asians or East Asians. Once in the outgroup, in other words, participants stopped differentiating between ethnicities (Gutsell and Inzlicht, 2010).

Our second prediction regarding the role of prejudice was also supported. The results are depicted in Figure 3 and Table 1. Prejudice was marginally associated with prefrontal asymmetry scores in response to outgroup members: the higher participants scored on the modern racism scale, the higher their asymmetry score, that is the less relative right prefrontal activation they showed, $r(24) = 0.37$, $P = 0.07$. This suggests that the more prejudiced people were, the less they vicariously felt an avoidant motivational state when observing outgroup member in distress. The more prejudiced, the less they caught outgroup members' emotions.

In contrast, the correlation between prejudice and prefrontal asymmetry scores in response to ingroup members was not significant, $r(24) = 0.32$, $P = 0.12$. However, it is important to note that these two correlations are not significantly different from one another. So while prejudiced people do not vicariously share emotive states with outgroups, they may show a (nonsignificant) tendency to not share it with ingroup members either. This may suggest that biased attitudes toward outgroups may reflect egocentric

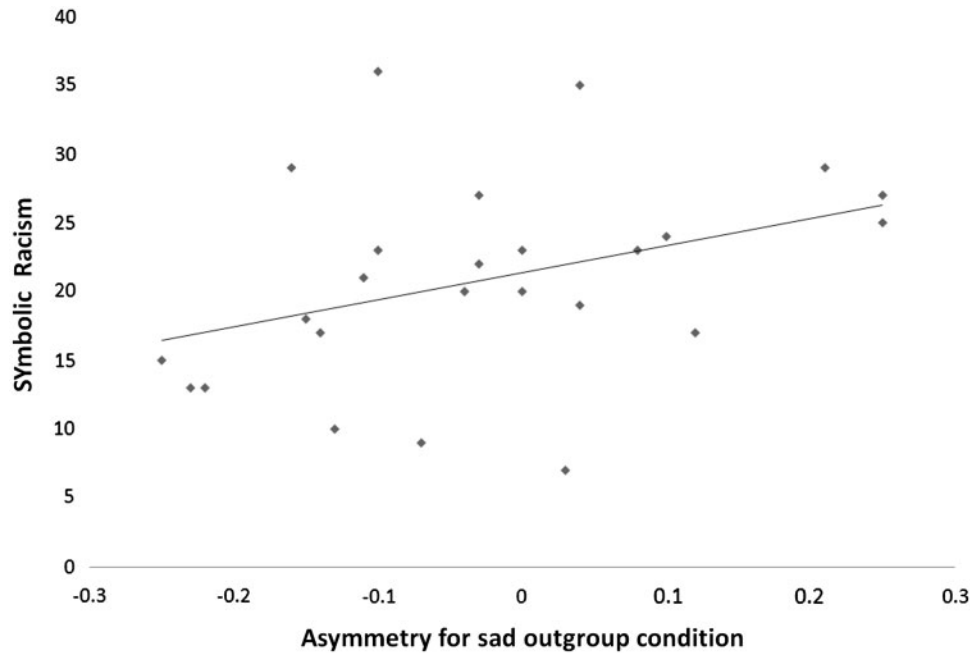


Fig. 3 Symbolic racism scores as a function of prefrontal alpha asymmetry scores in the outgroup condition.

Table 1 Correlations among asymmetry scores and individual difference measures

Alpha-asymmetry score	Symbolic racism score		Empathy quotient		Reading the mind in the eyes test score	
	R-value	P-value	R-value	P-value	R-value	P-value
Ingroup	0.32	0.12	-0.33	0.11	0.26	0.22
Outgroup	0.37	0.07	-0.27	0.20	0.35	0.10

Note: Higher alpha asymmetry denotes 'less' vicarious sharing of sadness.

biases more generally. For example, research on the prejudiced personality suggests that people who score high on prejudice are less likely to be agreeable (Graziano *et al.*, 2007a). The agreeableness is associated with prosocial behavior (Graziano *et al.*, 2007b) and empathy (Nettle, 2007). Someone who is prejudiced, therefore, may be less agreeable in general and show a lack of empathy towards others in general.

Interestingly, people's general trait-like tendency and ability to empathize with others and to read their emotions does not seem to significantly predict alpha asymmetry in response to ingroup or outgroup members. That being said, although the effects were not significant, there is a trend such that the higher people were in empathy, as assessed by the empathy quotient (Lawrence *et al.*, 2004), the higher their asymmetry scores to both ingroup and outgroup. These results suggest that trait empathy was (nonsignificantly) related to emotionally resonating with others, be they from the in or outgroup. Studies with more statistical power

would be needed to assess the robustness of these effects. Please see Table 1 for a more detailed depiction of these results.

DISCUSSION

Taken together, our research provides direct evidence that people are less likely to show prefrontal right alpha asymmetry when observing sad outgroup others. We take this as evidence that people generally do not vicariously feel the emotional and motivational states of those they categorize as outgroup members. Moreover, the extent of vicarious right alpha asymmetry in response to sad outgroup members is associated with level of prejudice. In other words, the more prejudiced people are, the less likely they will intuitively catch the emotive states of outgroup members. This bias in emotional sharing could contribute to an empathy-gap, impairing the experience of empathy for outgroups, which is a capacity that underlies and facilitates social understanding and cooperation and fosters helping, morality, altruism and justice (Batson *et al.*, 1997; Cialdini *et al.*, 1997). Thus, when people fail to share the emotional and motivational states of outgroup members they might not be as responsive to outgroup member's needs and be less likely to help or even to understand that support is needed. This could be particularly true for people high in prejudice, opening the door for discrimination.

It is important to note that our findings do not implicate any causal direction between the lack of empathy toward outgroups and prejudice. While it is possible that a lack of empathy can contribute to prejudice, it is just as likely that prejudice contributes to a lack of empathy.

Maybe both mechanisms are at work, creating a vicious cycle in which people initially empathize less with outgroups, which makes them a likely target for prejudice, which then further restricts empathy toward the disliked group. The exact nature of the relationship is difficult to determine and should be addressed by future research.

Finally, we would like to stress that, although, we suspect that the ease with which we can empathize with the ingroup may have been biologically hardwired by evolutionary pressures (Wilson and Sober, 1998), we are not suggesting that people are more or less likely to include or exclude specific ethnic groups. Indeed, the gap in perception–action–coupling may be specific to culturally disliked groups that change from one society to the next (e.g. Gutsell and Inzlicht, 2010). Instead, the specific coalitional alliances that populate our ingroup category are likely arbitrary and can in fact be changed very easily (Turner *et al.*, 1979). Recent research shows that despite a lifetime’s experience of race as a predictor of social alliance, minimal exposure to alternate coalitional possibilities is enough to deflate the tendency to categorize by race (Cosmides *et al.*, 2003; Van Bavel and Cunningham, 2009).

Hence, even if we are less likely to simulate the emotions and actions of the outgroup, these effects may be temporary and can be erased when we foster empathy toward the outgroup and better yet, include a greater number of people into our ingroup. One of the means to achieve this goal is cognitive perspective taking. Taking the perspective of an outgroup member has been shown to reduce prejudice towards the outgroup (Batson *et al.*, 1997) and this reduction is mediated by an increase in perceived self–other overlap (Galinsky and Moskowitz, 2000). By fostering a feeling of connectedness, perspective taking offers a way to overcome biases in neural simulation and thereby allows an intuitive understanding between people whether they share group membership or not.

Conflict of Interest

None declared.

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