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Flash Report

Empathy constrained: Prejudice predicts reduced mental simulation of actions during observation of outgroups

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ABSTRACT

Perception–action-coupling refers to the vicarious activation of the neural system for action during perception of action, and is considered important for forms of interpersonal sensitivity, including empathy. We hypothesize that perception–action-coupling is limited to the ingroup: neural motor networks will fire upon the perception of action, but only when the object–person belongs to the ingroup; if the object–person belongs to an outgroup these motor neurons will not fire. Using electroencephalographic oscillations as an index of perception–action-coupling, we found exactly this: participants displayed activity over motor cortex when acting and when observing ingroups act, but not when observing outgroups – an effect magnified by prejudice and for disliked groups (South-Asians, then Blacks, followed by East Asians). These findings provide evidence from brain activity for yet another detrimental aspect of prejudice: a spontaneous and implicit simulation of others' action states may be limited to close others and, without active effort, may not be available for outgroups.

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Introduction

People are sensitive to others who fall within a closed circle defined by their social relations; and members of our social outgroups are excluded from this circle (Turner, Brown, & Tajfel, 1979). When people connect with others, they resonate with them by adopting their postures, intonations, and facial expressions, but also their motivational states and emotions. Such perception–action-coupling (Decety & Jackson, 2004) is implemented by brain mechanisms that allow observers to mirror the actions and emotions of those they observe, thereby synchronizing the inner states of both individuals. We suggest that this perception–action link is bound to the ingroup, thus making it difficult to respond to the feelings, intentions, and needs of those categorized as members of an outgroup. Measuring the neural processes underlying perception–action-coupling, this study directly investigates how the basic building blocks of empathy are affected by group membership and social biases. Specifically, we propose that people are less likely to mentally simulate the simple actions of others when those others belong to a disliked outgroup. We also propose that this reduced mental simulation will be exacerbated for those who are high in prejudice.

Perception–action-coupling and the mirror-neuron-system

According to the perception–action-model of empathy (Preston & de Waal, 2002), perception–action-coupling is the mechanism through which people understand others' actions, intentions, and emotions. When someone (the subject) observes another (the object), the object's body actions and facial expressions activate the subject's neural networks for the same actions and expressions (Dimberg, Thunberg, & Elmehed, 2000). Simulating others' actions and expressions elicits the associated autonomic and somatic responses, thereby increasing social sensitivity (Decety & Jackson, 2004). Hence, by adopting the object's outer states, the subject experiences these states firsthand and thereby lays the foundation for empathy and social understanding.

The idea that shared neural networks are the basis for interpersonal sensitivity has found much support in the social neurosciences. Research using functional magnetic resonance imaging and electroencephalography (EEG) has identified shared neural networks for the perception and experience of disgust (Wicker et al., 2003), pain (Singer et al., 2004), touch (Keysers et al., 2004) and facial expressions (Carr, Iacoboni, Dubeau, Mazziotta, & Lenzi, 2003). The system of neurons building these shared networks are often referred to as the “mirror-neuron-system” (Rizzolatti & Craighero, 2004). Perception–action-coupling, thus, is essential for a number of forms of interpersonal sensitivity, including emotional contagion, empathy, theory of mind (Singer et al., 2006; Vignemont & Singer, 2006) and action and intention

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understanding (e.g. Iacoboni et al., 2005; Oberman, Pineda, & Ramachandran, 2006).

Bounded interpersonal sensitivity

Perception–action-coupling, however, seems to be subject to social factors. When observing others in pain, people show activity in brain areas associated with the experience of pain only for others they like and not for those they dislike (Singer et al., 2006). Similarly, participants show diminished neural activation of pain circuits when observing ethnic outgroup members in pain relative to ingroup members (Xu, Zuo, Wang, & Han, 2009).

These biases, however, might be a manifestation of a more basic and general bias: perception–action-coupling for gross motor responses – the physiological process thought to be at the core of interpersonal sensitivity – might be impaired in response to disliked outgroups. Such a fundamental bias, would not only make it difficult to empathize with outgroup members' suffering, but also to understand their actions and intentions, potentially hampering smooth intergroup interactions and communication.

Behavioral research supports the idea of action–perception-coupling being bound to the ingroup. Although people mimic others' expressions, gestures, and body postures, this occurs with less frequency for outgroup members (Likowski, Mühlberger, Seibt, Pauli, & Weyers, 2008). These findings suggest that the link between actions and perceptions is weaker when it comes to outgroups, but falls short of showing how exactly this occurs. We aim to fill this gap by taking a direct look at perception–action-coupling, online, while people passively observe the actions of ingroup and outgroup members. By measuring neural activity during observation and action, we aim to measure potential group biases in perception–action-coupling – a precursor of empathy unobservable in overt behavior.

Research on prejudice has shown that our social attitudes bias how we perceive and process others. For example, we have a harder time to recognize outgroup members' faces (Sporer, 2001) and to interpret their facial expressions (Elfenbein & Ambady, 2002); outgroups are also less likely to activate neural areas for social cognition (Harris & Fiske, 2006) and social perception (Van Bavel, Packer, & Cunningham, 2008). Given these biases in social perception and processing it follows that we would be less sensitive to the actions, intentions, and thoughts of outgroup members—something that should be reflected in the neural networks that implement perception–action-coupling. It also follows that the more we dislike outgroups—the more prejudiced we are—the less we will show neural evidence of simulation.

Overview

We used EEG recordings to compare brain activity during the experience and observation of actions, and used suppression of EEG oscillations in the 8–13 Hz mu frequency at scalp locations over primary motor cortex as our main dependent measure. Mu suppression is a commonly used measure of motor cortex activity (Kuhlman, 1978; Pfurtscheller & Aranibar, 1979) and has recently been used to index activity in the mirror-neuron-system by looking at motor cortex activity during observation of action (Marshall, Bouquet, Shipley, & Young, 2009; Oberman et al., 2005; Perry & Bentin, 2009). When mu power decreases during observation of an object other, the subject's motor neurons are active and the subject is presumed to be simulating the object's action. We predict that participants will show less mu suppression in response to outgroup members than to ingroup members and that this difference in vicarious mu suppression will be stronger with increasing prejudice. Sociological research (Kalin & Berry, 1996) indicates that Canadians of South-Asian descent belong to the least valued ethnic

groups in Canada. Thus, while we expect less perception–action-coupling for the average of all outgroups, we predict the least perception–action-coupling when observing South-Asians, followed by Blacks, and then by East Asians, who are generally not disliked in a Canadian context.

Methods

Subjects and design

We originally sampled 37 White participants, but excluded seven because some were left handed ($n = 3$), self identified as non-White ($n = 2$), because of system malfunction ($n = 1$), or incomplete data ($n = 1$). Our final sample thus included 30 White, right-handed University of Toronto Scarborough students (13 female; $M_{\text{age}} = 18.46$, $SD = 3.81$), who participated for course credit. Participants completed three conditions in a one-way within subject design: ingroup, outgroup and self condition. We defined ingroup as people who share the participant's ethnic identity (Caucasian), and outgroup as people who did not (African–Canadian, East Asian, South-Asian).

Procedure

Upon arrival in the lab, participants provided informed consent and were then fitted with an electrode cap for EEG recording. We recorded 120 s of baseline EEG activity over motor areas while participants were sitting still looking at a white screen. EEG was then recorded while participants passively watched a set of videos. The videos showed a variety of ingroup and outgroup members performing a simple action. After watching the videos, participants were asked to perform the action themselves.

Material

Symbolic racism scale

During a mass testing session in an introductory psychology course, participants completed the symbolic racism scale (Henry & Sears, 2002) – a measure of modern racism, indicative of a subtle form of racism that obscures racist feelings with abstract values, such as justice and order.

Video-set manipulation

Participants saw videos depicting members of different ethnic groups (Caucasian, East Asian, South-Asian, and African–Canadian) performing an action. The videos showed university-aged male actors sitting at a table in front of a white wall with a glass of water in front of them. Displaying a neutral face, the actors repeatedly reached for the glass, picked it up, took a small sip of water, and then put the glass back in its place. In the ingroup condition, participants saw three different Caucasian actors, each performing the action for 10 s. In the outgroup condition, the participants saw three different actors of each ethnic outgroup perform the action for 10 s.

To control for other differences in the videos, we presented screen-shots of each of our videos to a different sample of 33 introductory psychology students (25 female) and asked them about their impressions. Specifically, we asked participants to rate the screen-shots in terms of video quality (ingroup: $M = 2.52$, $SD = .61$; outgroup: $M = 2.49$, $SD = .54$), attractiveness (ingroup: $M = 1.68$, $SD = .57$; outgroup: $M = 1.70$, $SD = .65$), likability (ingroup: $M = 2.11$, $SD = .68$; outgroup: $M = 2.20$, $SD = .68$), and racial group typicality (ingroup: $M = 2.52$, $SD = .61$; outgroup: $M = 2.49$, $SD = .54$) on a 5-point Likert scale. Results revealed no significant differences across any of these variables, all $ps > .21$, ns .

Fig. 1 shows a graphic depiction of the experimental design. In total, we obtained 30 s of EEG data during the ingroup condition and 90 s during the outgroup condition with 30 s blocks for each of the three different ethnic outgroups. The blocks of the four different ethnic groups were presented in random order and the order of individual actors within each block was also randomized. Thus each ethnic group and each actor within each ethnic group was presented in a random order. Near the end of the session, participants performed the same action themselves for 30 s.

Electrophysiological recording and processing

To measure mu rhythm, we recorded the EEG from 32 Ag/AgCl sintered electrodes embedded in a stretch-lycra cap. Recordings were collected 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 sub-orbital 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, Liu, & Sutherland, 2005). During recording, the impedances were kept below 5 K Ω . Continuous artefact-free epochs of 2.048 s from each interval were extracted through a Hamming window and overlapped by 75% to minimize data loss. We performed fast Fourier transformation and calculated power in the 8–13 Hz band for 10 s for each ethnic group and 10 s for self-action. We averaged the spectral data over the three outgroups and then created mu suppression index scores for each condition by calculating the log ratio of mu power during that condition over mu power during baseline. We did this for all electrodes. However, because all participants performed the action with their dominant right hand we performed statistical analysis only for electrode C3 located over the contra lateral, left primary motor area. More negative scores indicate a stronger suppression of the mu rhythm and, hence, more cortical activity.

Results

We created log-ratio scores (log mu power during action/log mu power during baseline) for all conditions. As expected, the self-action log-ratio scores ($M = -.33$, $SD = .40$) were significantly different from zero, $t(29) = -4.44$, $p < .01$, indicating that participants showed mu suppression and suggesting an increase in motor cortex activity during motor action compared to the motionless baseline condition.

Fig. 2 illustrates that the data confirmed our hypotheses. Participants showed increased mu suppression when passively observing ingroup members ($M = -.06$, $SD = .13$). Although these log-ratio scores were significantly different from self-action, $t(29) = -3.97$, $p < .01$, critically, the increase was significantly different from zero, $t(29) = -2.40$, $p < .03$. This suggests that there was motor cortex activity when participants passively observed ingroup members. Importantly, participants showed no activity over motor areas when they observed outgroup members ($M = -.01$, $SD = .13$), $t(29) = -.03$, $p = .77$, a level of activity that was significantly lower than while observing ingroup members, $t(29) = 2.12$, $p < .05$. These findings suggest that participants did not mentally simulate the actions of outgroup members. A within subject ANOVA over the three conditions (self, ingroup and outgroup) revealed a significant linear trend, $F(1, 29) = 9.47$, $p < .01$, indicating the most mu suppression during the self condition, followed by the ingroup, and finally the outgroup condition. This linear trend, however, was subsumed under a significant quadratic trend, $F(1, 29) = 17.91$, $p < .01$, reflecting much stronger mu suppression during action than during observation of action.

Subsequent analysis revealed a marginal difference between the three different outgroups, $F(2, 28) = 3.05$, $p = .06$, such that participants showed more mu suppression for East Asians ($M = -.04$, $SD = .15$), followed by Blacks ($M = -.03$, $SD = .15$), and then South-Asians ($M = .02$, $SD = .16$). Importantly, participants did not show significant mu suppression when observing any of the outgroups (all $ps > .14$), thus justifying our a priori decision to average across groups. However, the marginal difference between them suggests different levels of perception–action–coupling for each group.

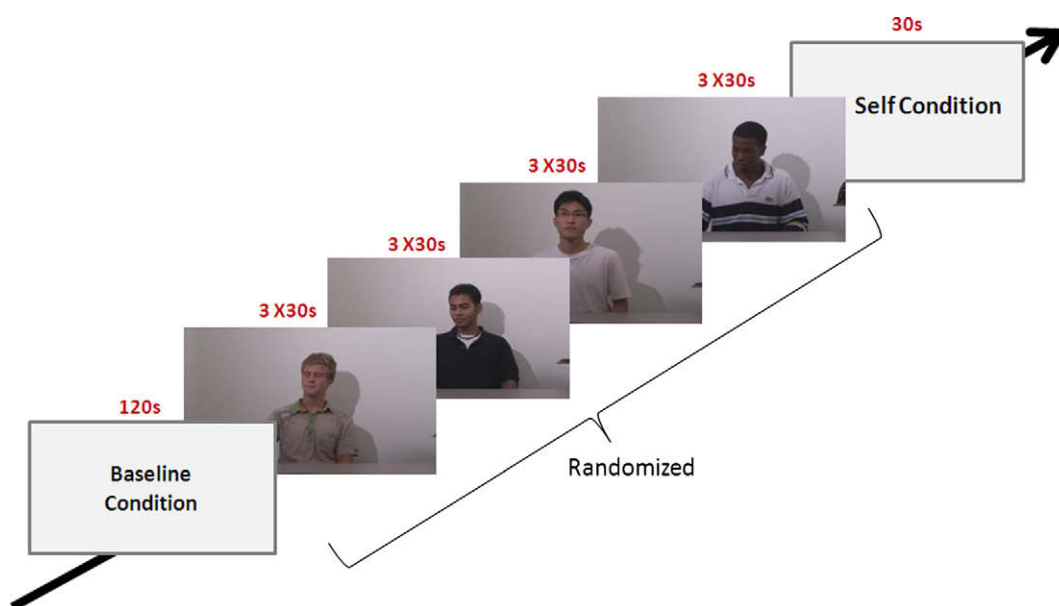


Fig. 1. Outline of experiment design: first participants completed a 120 s baseline measure. Following, participants completed three conditions: outgroup, ingroup and self condition. In the ingroup condition, participants saw three 10-s videos of people who shared the participant's ethnic identity (Caucasian). In the outgroup condition they saw three 10-s videos of each ethnic outgroup (African–Canadian, East Asian and South-Asian). The ingroup and outgroup condition appeared in randomized order and were followed by the self condition during which participants performed a simple action for 30 s.

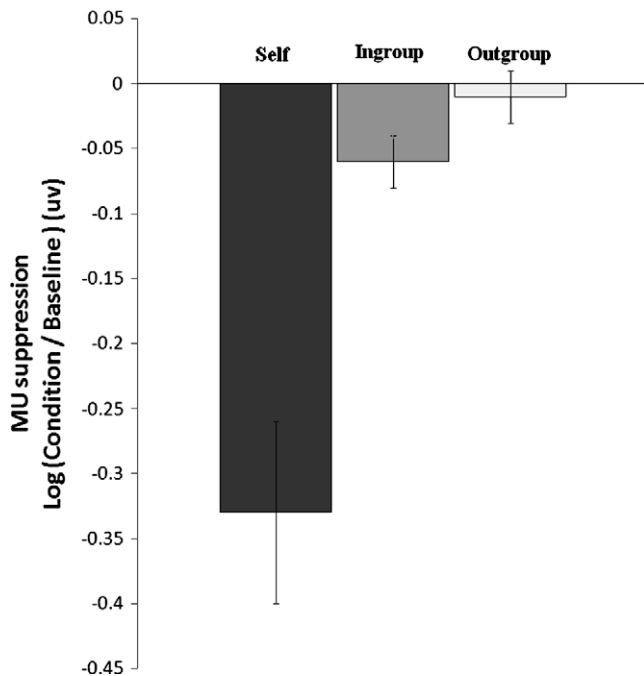


Fig. 2. EEG mu suppression at left central scalp location (C3) during action and during the observation of ingroup and outgroup members. Error bars represent ± 1 standard error. Negative numbers denote more mu suppression (i.e. more neural activity) at C3.

Interestingly the degree of mirroring neatly reflects the distinct Canadian context, where South-Asians' tend to have lower status than Blacks, and where East Asians are seen as a model minority (Kalin & Berry, 1996).

Additional analyses confirmed that prejudice was inversely correlated with activity at scalp locations over motor cortex in response to outgroup members. The more prejudiced participants were, the less mu suppression they showed in response to outgroups,¹ $r(28) = .52, p < .01$ (see Fig. 3). In contrast, we found no such correlation for the ingroup condition $r(28) = .18, p = .36$, two correlations that are significantly different from one another, $Z = 1.83, p < .035$ (one tailed). When we breakdown the omnibus outgroup correlation into the specific racial outgroups, we find results that are consistent with a Canadian context: the correlation was strongest for South-Asians, $r(28) = .56, p < .01$, and followed by Blacks, $r(28) = .36, p = .05$; the correlation for East Asians, however, fell below traditional levels of significance, $r(28) = .30, p = .11$. Since mu activity is inversely related to motor cortex activity, these findings suggest that the more participants are prejudiced, the less their motor cortex fires in response to the passive viewing of outgroup members' actions—an effect that is magnified for disliked outgroups (South-Asians, then Blacks, followed by East Asians).

Discussion

Our research suggests that people do not mentally simulate the actions of outgroups. That is, those neural networks underlying the simulation of actions and intentions—most likely part of the “mirror-neuron-system”—are less responsive to outgroup members than to ingroup members. We take this as evidence that people experience less vicarious action and their associated somatic and

¹ Note that mu suppression is coded such that negative values indicate more suppression (i.e. more motor-cortex activity). A negative association between mu suppression and prejudice, therefore, appears like a positively valued correlation.

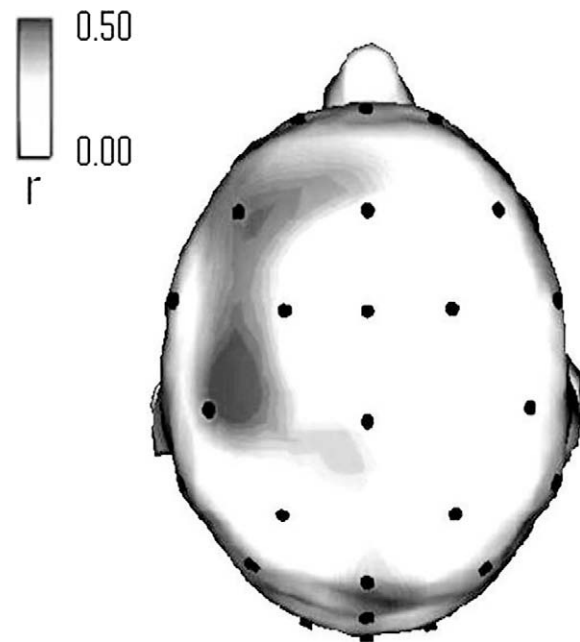


Fig. 3. Scalp topography of the correlations between mu suppression for outgroups and prejudice. Darker grey indicates scalp locations for which mu suppression is positively correlated with symbolic racism scores. Due to the inverse relationship of mu suppression and motor activity, this depiction indicates that less motor activity in left parietal areas is associated with higher levels of prejudice.

autonomic states when confronted with outgroups than with ingroups. Especially, prejudiced people fail to mentally simulate outgroup members' actions and this failure to simulate is particularly pronounced for disliked outgroups. Here is evidence that people—but especially people high in prejudice—do not intuitively grasp outgroup members intentions and actions. We interpret this correlation with caution, however. While a natural deficit in outgroup-action simulation can contribute to prejudice, it is also likely that prejudiced people do not simulate outgroup members because of their biases and dislikes. Specifically, prejudice might bias attention against outgroups thereby impairing perception-action-coupling.

Indeed, perception-action-coupling is malleable, and often shaped by selective attention (Bach, Peatfield, & Tipper, 2007; Chong, Williams, Cunnington, & Mattingley, 2008) and motivation (Cheng, Meltzoff, & Decety, 2007), thus selective attention and motivation could potentially be the component processes via which prejudice contributes to lower perception-action-coupling for the outgroup. Research is not conclusive, but does suggest that this is a distinct possibility. For example, selective attention and motivation seems to favor ingroup members such that ingroups are processed in greater depth than outgroup members, with evidence indicating greater activity in the amygdala, fusiform gyri, and orbitofrontal cortex (Golby, Gabrieli, Chiao, & Eberhardt, 2001; Van Bavel et al., 2008). Similarly, selective attention and motivation might filter for the actions of ingroup members. The right temporoparietal junction (TPJ), for example, is a brain structure involved in both attention and mind-inference (Decety & Lamm, 2007), and has been found to limit attention to the most behaviorally relevant of actions (Kerr, 2008). Does ingroup action elicit more perception-action-coupling through a filtering process implemented by the right TPJ? Does this imply that when outgroup actions are more behaviorally relevant, such as during times of fear and threat (e.g. Schaller, Park, & Faulkner, 2003), outgroup action will elicit more perception-action-coupling? These questions await future investigations.

A deficit in the spontaneous “catching” of outgroup members’ actions and intentions can have serious consequences for intergroup interactions. Perception–action-coupling, and the sharing of somatic, autonomic, and emotional states, facilitate social understanding and foster helping, morality, altruism, and justice (Batson et al., 1997; Cialdini, Brown, Lewis, Luce, & Neuberg, 1997). Thus, people might not be as responsive to outgroup member’s needs and feelings and be less likely to understand their intentions; they might also be less likely to help and effectively communicate with them.

On the positive side, even if we do not intuitively grasp outgroup members’ inner states; there may be ways to compensate. Cognitive perspective taking, for example, can increase interpersonal sensitivity and understanding, thereby reducing prejudice (Galinsky & Moskowitz, 2000) and increasing helping (Batson, Chang, & Orr, 2002). In addition, it fosters self-other merging – a process during which the cognitive representations of the perspective-taker and target increasingly overlap (Galinsky, Ku, & Wang, 2005). This overlap, is cognitive in nature, but also translates to an embodiment of the other person; for example, perspective taking not only leads people to include stereotypes of the other into the self, but also to act stereotypically (Galinsky, Wang, & Ku, 2008; Wheeler, Blair, Jarvis, & Petty, 2001). Therefore, even if taking another’s perspective is an effortful form of interpersonal sensitivity, over time it can change the way people perceive and help people overcome their biases.

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