NEUROSCIENCE OF PREJUDICE AND INTERGROUP RELATIONS

Edited by Belle Derks,
Daan Scheepers, and Naomi Ellemers

Psychology Press
Taylor & Francis Group
NEW YORK AND LONDON

15

USING EEG MU-SUPPRESSION TO EXPLORE GROUP BIASES IN MOTOR RESONANCE

Jennifer N. Gutsell and Michael Inzlicht

> The opposite of love is not hate, it is indifference.
>
> *(Elie Wiesel, n.d.)*

Humans have an incredible capacity to empathize with others, to understand their actions and intentions, and to use this information to coordinate their own behavior with the behavior of these others. When it comes to our loved ones, our family and friends, or our social in-group, we use the full extent of our empathic abilities. We automatically catch their emotions, and the meaning and intentions of their actions, which provide us with an intuitive understanding of their inner states. Thereby, we help them when they are in need, we bond with them, and we can act in unison and close cooperation. With those we hate, our adversaries or competitors, it is different. We still have a need to understand their emotions, actions, and intentions, but for more selfish reasons. Here we use our empathic abilities to anticipate our opponent's next move and to be prepared. Hence, despite our selfish reasons, we still are receptive to the inner states of our enemies. But what about those toward whom we feel nothing but indifference, the homeless person on the street, maybe the nameless service person, or simply those whom we consider part of a social out-group? Could it be that we do not intuitively catch their intentions, needs, and emotions?

We started wondering about this question not, as usually is the case, because we read an interesting article in a social psychology journal, or because we saw an inspiring talk at a social psychology conference. Instead, we came across an interesting phenomenon primarily discussed in the neurosciences—the mirroring process or motor resonance —and were intrigued by its potential implications for social psychology.

Motor resonance is a very basic and simple process: A subset of motor neurons are active not only during motor activity, but also when the perceiver remains completely still and observes someone else engaging in motor activity (Di Pellegrino, Fadiga, Fogassi, Gallese, & Rizzolatti, 1992; Rizzolatti, Fadiga, Fogassi, & Gallese, 1996). Despite its simplicity, motor resonance seems to contribute to many much more complex and important social functions. For instance, motor resonance has now been associated with better performances in tasks that require emotional empathy (Pineda & Hecht, 2009), and it is said to foster an intuitive understanding of the other's actions and emotions (Hurley, 2008; Iacoboni, 2009), potentially facilitating interpersonal coordination and cooperation (Knoblich & Sebanz, 2006).

Reading about motor resonance was fascinating and the phenomenon seemed to be incredibly relevant for social psychology; here was a mechanism that could potentially explain how and why people can so easily and effortlessly connect with each other. We noticed, however, that it was often implied that motor resonance happens relatively automatically, without much influence from top-down processes (e.g., Chong & Mattingley, 2009; Fadiga, Fogassi, Pavesi, & Rizzolatti, 1995; van Schie, Waterschoot, & Bekkering, 2008) and only a few studies have investigated the nature of top-down influences on motor resonance (e.g., Aglioti, Cesari, Romani, & Urgesi, 2008; Calvo-Merino, Glaser, Grèzes, Passingham, & Haggard, 2005; Iacoboni, 2005; Oberman, Ramachandran, & Pineda, 2008; Sartori, Cavallo, Bucchioni, & Castiello, 2011). Moreover, those that did mostly focused on relatively basic processes such as attention or situational context. At the same time, we know from research on social cognition that even very basic perceptional processes are susceptible to higher-order cognitive processes. For instance, face recognition (Bernstein, Young, & Hugenberg, 2007), the interpretation of facial expression (Elfenbein & Ambady, 2002), and memory (Rothbart, Evans, & Fulero, 1979) are all very basic processes that are still influenced by social categorization and prejudice. The same could be true for motor resonance, and finding a group bias in motor resonance could have important implications for both the literature on intergroup processes and the literature on motor resonance. If people indeed resonated less with out-group members, they would potentially have a harder time to predict their actions and intentions and to coordinate their actions with them. Moreover, to show that motor resonance is indeed influenced by social categorization and prejudice would suggest that motor resonance is susceptible to culturally learned attitudes and biases.

We were intrigued by the mirror mechanism and its potential for answering important social psychological questions, and then we came across an article by Pineda (2005) in which he discussed a method that uses electroencephalography (EEG) to investigate motor resonance. Being experienced with EEG, it was clear to us that this technique would enable us to measure motor resonance cost-efficiently and relatively conveniently. In addition, EEG is easily applicable and a relatively unobtrusive measure of brain activity so that participants would be left relatively unconstrained, allowing them to perform complex actions, and potentially even to interact with others during EEG recording.

Here we describe four studies that use EEG to investigate group biases in motor resonance. Specifically, we used EEG to measure neural activity in sensory motor areas during observation of actions performed by in-group and out-group members. We propose that, as a default, people do not resonate with ethnic out-group members, but once out-group members' behavior becomes motivationally relevant, either because group boundaries are blurred, or because the out-group member poses a threat, people become sensitive to out-group members' inner states.

Motor Resonance

A now classic effect in social psychology is that perceiving someone else's behavior increases a tendency in the perceiver to behave similarly (Chartrand & Bargh, 1999; James, 1890). This happens because actions and the mere perception or imagination of the same action share common representations (Preston & de Waal, 2002; Prinz, 1987). In the brain, this action–perception link is said to be implemented by the so-called mirror neurons, a subset of sensory motor neurons that are active during motor activity, but also when the perceiver remains completely still and sees someone else engaging in motor activity (Carr, Iacoboni, Dubeau, Mazziotta, & Lenzi, 2003; Rizzolatti & Craighero, 2004). Mirror neurons have been discovered using single-cell recordings in monkeys, but being an invasive method requiring open-brain surgery, single-cell recordings in humans are hard to get due to ethical considerations; thus far, only one study has shown mirror neurons in humans using single-cell recording (Mukamel, Ekstrom, Kaplan, Iacoboni, & Fried, 2010). Due to the lack of opportunities for single-cell recording studies in humans, mirror neuron activity is usually investigated using corresponding neural activation of sensory motor areas within an observer in response to the mere perception of motor activity in the target as a proxy. This motor resonance is considered to underlie the understanding of actions and intentions, which is in turn essential for interpersonal and social processes such as learning through observation and interpersonal coordination. For example, research shows that motor resonance goes beyond the mere mechanics of a motion, but seems to map the function and goal of the action: Mirror neurons fire, even when the "observer" can only partially see the action (Umilta et al., 2001) or not at all (Kohler et al., 2002). Moreover, motor resonance is more pronounced for goal-directed action (Cattaneo, Caruana, Jezzini, & Rizzolatti, 2009), and specific groups of mirror neurons respond to specific and unique goals of actions (Gallese, Gernsbacher, Heyes, Hickok, & Iacoboni, 2011), such as grasping to put something into a container versus grasping to bring something to one's mouth (Bonini et al., 2010).

Generally, motor resonance has been suggested to be automatic and to occur without conscious effort (Gallese, Fadiga, Fogassi, & Rizzolatti, 1996; Rizzolatti

& Craighero, 2004; Wilson & Knoblich, 2005), but this does not mean that everyone resonates with just anyone in any situation. What it probably comes down to is whether the action in question is motivationally relevant to the observer or not.

The Functional Approach to Motor Resonance

People tend to allocate their limited cognitive and perceptional resources toward others who are motivationally relevant to them (Ackerman et al., 2006). These relevant others are most often members of the social in-group. One reason for this is that from an evolutionary perspective, in-group members are more often beneficial for one's reproductive fitness. According to the concept of inclusive fitness (Hamilton, 1964, as cited in Cialdini, Brown, Lewis, Luce, & Neuberg, 1997), individuals can promote their own evolutionary success by helping others who share some of their genes (Sime, 1983). The degree of genetic overlap, however, is impossible to detect, and thus people have to use proxies of genetic overlap such as the degree of kinship, similarity, familiarity, and affiliation. In-group members are generally perceived as more similar to oneself than out-group members (Turner, Brown, & Tajfel, 1979). Moreover, in-group members are usually the ones with whom we most often interact, and if we interact with out-group members, this mostly happens on a group level rather than in one-on-one intimate interactions (Fiske, 1992). Consequently, intragroup interactions are most important to us, and since cognitive resources are limited, processing out-group members' inner states most often does not take priority (Ackerman et al., 2006).

Indeed, research in social cognition and social neuroscience has revealed several group biases in the processing of others' inner states. Research participants show less neural activity in areas for social perception and social cognition in response to out-group members (Fiske, Ames, Cikara, & Harris, Chapter 5 in this volume; Harris & Fiske, 2006; Van Bavel, Packer, & Cunningham, 2008), and they have a harder time recognizing out-group members' faces and interpreting their facial expressions (Elfenbein & Ambady, 2002; Sporer, 2001). Moreover, they react less strongly to emotions such as happiness and fear when displayed by out-group members (Weisbuch & Ambady, 2008), and they show less neural activity in the neural pain circuit when they see out-group members experiencing physical pain (Xu, Zuo, Wang, & Han, 2009), or emotionally painful situations (Mathur, Harada, Lipke, & Chiao, 2010) than when they see pain in in-group members. Taken together, these findings suggest that across perceptional domains, people are less sensitive and perceptive to the inner states of social out-group members. However, this does not necessarily mean that social perception is entirely reserved for the social in-group. When the out-group becomes motivationally relevant, it is possible that people would be as responsive to out-group members as to in-group members. For example, Ackerman et al. (2009) showed that, although usually people have problems in telling different out-group faces apart, when the faces are angry, research participants performed even better in recognizing out-group members' faces than in-group faces. Hence, when out-group members become motivationally relevant—in this case, because they potentially could pose a threat—group biases in social perception are alleviated or even reversed.

Given the role of motivational relevance and social group membership in social perception, it is likely that group biases also exist in motor resonance. Such a bias could leave people to be less responsive to the inner states of out-group members, potentially hampering cross-group interactions and cooperation. In what follows, we will describe a series of studies that investigate how group categories, prejudice, and motivational relevance influence the amount of motor resonance in response to others. In all studies reported here, we used suppression of electroencephalographic mu oscillations during the observation of actions as an index of motor resonance.

Mu-suppression as a Measure of Motor Resonance

The mu-rhythm is a well-established measure of neural activity in the sensory motor cortex (Kuhlman, 1978; Pfurtscheller & Aranibar, 1979). The alpha component of the mu-rhythm (8–12 Hz) seems to originate from the primary somatosensory cortex (Hari, 2006) and shows a synchronized activity at rest, which is desynchronized both during movement and during passive observation of movement, leading to a suppression of mu (Pineda, 2005).

During execution of movement, neurons in the premotor, motor, and sensorimotor cortices are activated. Therefore, mu-suppression while a person is moving is probably the result of motor neurons and mirror neurons. In the absence of overt movement, motor neurons should no longer be active, leaving only mirror neurons to contribute to mu-suppression (Pineda, 2005). Mu-suppression during action observation should, therefore, be exclusively attributed to the discharge of mirror neurons. Anatomically, mirror neurons located in the ventral premotor cortex could affect neurons in the primary sensorimotor cortex through existing strong connections between these two regions, resulting in mu-suppression (Pineda, 2005). Mu-suppression, thus, seems to be a good indicator of motor resonance and mirror neuron activity (Puzzo, Cooper, Cantarella, & Russo, 2011).

Studies measuring mu-suppression differ in the experimental and control conditions during which mu is measured, but they mostly follow the same general principle. At the beginning of the experimental session, researchers assess participants' baseline brain activity. For example, EEG is recorded while the participant sits completely still either looking at a blank screen or visual white noise. Following this, participants usually are shown videos of others performing a goal-directed action. These videos often only depict the hands of the other person to keep other target-related factors controlled (e.g., Oberman et al., 2008), but richer stimuli can sometimes be beneficial. For example, in our research, we usually choose to present videos depicting large parts of the body and even the face. We do this to create an experience similar to actual social interactions.

Across studies using mu-suppression, the length of the videos varies, but in general, the methods used can be split into two kinds of protocols: the long-exposure protocol and the multiple-repetitions protocol. Long-exposure protocols use longer videos, usually longer than 10 seconds, and each video is shown once or sometimes twice (e.g., Gutsell & Inzlicht, 2010; Oberman et al., 2005). In contrast, in the multiple-repetitions protocol, the videos are much shorter, usually 3 seconds or less, and the same videos are presented multiple times at each trial preceded by a fixation cross (e.g., Puzzo et al., 2011). Research shows that the multiple-repetitions protocol can elicit stronger mu-suppression for relatively minimal stimuli (e.g., a hand squeezing a ball; Puzzo et al., 2011). Nonetheless, because in our research, the stimulus videos are more complex, and because we are interested in social processes, we chose to use a long-exposure protocol in order to create a more realistic experience for the participants.

The fact that it is possible to use relatively rich stimuli depicting complex actions makes mu-suppression a flexible tool that is particularly suitable for answering social psychological questions. Moreover, this method allows participants to be relatively unrestrained by the equipment so that they themselves can move and perform actions. Both these assets could potentially enable researchers to measure motor resonance during actual interactions with real people, and when using a portable EEG system, this interaction could even take place outside the laboratory. This flexibility is certainly an advantage over more cumbersome methods such as magnetic resonance imaging (MRI) or transcranial magnetic stimulation (TMS).

Mu-suppression is usually strongest over the contralateral sensory motor areas (C3 or C4 depending on laterality), but can still be measured in the adjacent more frontal areas (FC-strip) and more posterior areas (CP-strip) (Puzzo et al., 2011). We measured mu-suppression primarily looking at C3—since right-handed participants were presented with right-hand actions.

Biased Motor Resonance

Our first study using mu-suppression to assess motor resonance in an intergroup context was aimed to test the general effect: Is there a group bias in motor resonance (Gutsell & Inzlicht, 2010). We expected that, by default, people would only show motor resonance in response to seeing members of their in-group performing an action, and not in response to the actions of out-group members. Moreover, we expected that such an in-group bias in motor resonance would be strongest for people high in prejudice. To test this prediction, we first assessed participants' level of prejudice in a mass testing session at the beginning of the academic term. Specifically, we used the Symbolic Racism 2000 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. Several weeks later, we invited participants to the laboratory one at a time and showed them videos of in-group and out-group members performing a simple action, while we measured their EEG. Specifically, we used a one-way within-subject design showing each participant videos of in-group members and out-group members. For the purpose of all the studies described here, we defined group in terms of ethnic group membership. Following the video presentation, we asked participants to perform the same action themselves.

The data obtained during the self condition confirmed that we were indeed picking up neural motor activity. When people actually performed the action, they showed a suppression of mu over electrode C3—the contralateral electrode site over motor areas— compared to mu during baseline. Interestingly, and more central to our hypotheses on motor resonance, we did also find mu-suppression when participants were sitting completely still, simply observing in-group members performing the action. These results are indicative of motor resonance in response to the in-group. Critically, the same test for mu-suppression was not significant for EEG activity during the out-group condition. Participants did not show mu-suppression for the out-group. Moreover, mu-suppression for the out-group was significantly less than mu-suppression in response to the in-group, further supporting a group bias in motor resonance. These findings suggest that people do not resonate with the actions of out-groups. We take this as evidence that people experience less vicarious action and its associated somatic and autonomic states when confronted with out-groups than with in-groups (please see Gutsell & Inzlicht, 2010, for a full description of the findings).

Although our findings suggest that people in general show this bias, not everyone seems to show it to the same degree. When we looked at the influence of prejudice, we found a positive correlation between mu-suppression for the out-group (with more negative scores indicating more suppression) and the level of prejudice reflected in a participant's score on the Symbolic Racism 2000 Scale. Thus, the more prejudiced participants were, the less mu-suppression they showed in response to out-groups. In contrast, mu-suppression for the in-group was unrelated to prejudice. The degree of bias in motor resonance is therefore influenced by how much people dislike the respective ethnic group. This is also reflected in the fact that when we break down the omnibus correlation into the specific ethnic groups, we find results that are consistent with a Canadian context: The correlation was strongest for South Asians, followed by Blacks; the correlation for East Asians, however, was not significant. Thus, motor resonance seems indeed to be limited to the in-group and more so when the perceiver is prejudiced or when the group in question is disliked.

According to social identity theory, the psychological self extends to include other people and our social in-groups so that the in-group becomes part of the self (Turner et al., 1979). Hence, if we take a functional approach to motor resonance, it makes sense that people resonate with in-group members, but not with out-group members; since in-group members are the ones people feel closest to, it is important to understand their actions and intentions. In contrast, people might not feel the same need to resonate with out-group members, especially when these groups are disliked. If a lack of closeness and liking indeed, at least partly, explains the in-group bias in motor resonance, then somehow bringing the out-group closer to the self and reducing prejudice should alleviate such biases. One way to increase closeness to social out-groups and to reduce prejudice is cognitive perspective taking.

Facilitating Cross-group Motor Resonance by Blurring Group Boundaries

Cognitive perspective taking refers to the active contemplation of others' psychological experiences; it facilitates altruistic behavior (Batson et al., 1997) and cooperation (Batson & Moran, 1999), and promotes conflict resolution (Galinsky, Maddux, Gilin, & White, 2008). In addition to these more general benefits, perspective taking can be helpful in an intergroup context (Batson et al., 1997; Dovidio et al., 2004, Galinsky & Moskowitz, 2000). For example, perspective taking improves evaluations of specific members of the out-group (Shih, Wang, Trahan Bucher, & Stotzer, 2009) and of the out-group more generally (Dovidio et al., 2004; Galinsky & Ku, 2004). Given all the benefits of perspective taking, a perspective-taking mindset could potentially be a powerful tool to decrease intergroup biases, including biases in motor resonance.

To investigate the effects of cognitive perspective taking on motor resonance in an intergroup context, we used the same design as in the first study, but this time, before participants saw the videos, they completed a mindset manipulation. Specifically, they saw a picture of a young Black university student and were asked to write a short story about a day in his life, either taking his perspective and writing in the first person, or remaining objective and writing in the third person. Following this, we had participants complete the same action video task as in the previous study while we recorded their EEG. Please see Gutsell and Inzlicht (2013) for a more detailed description of the study and findings.

The results suggest that the kind of mindset really does matter, and that a perspective-taking mindset can indeed reduce group biases in motor resonance. When in an objective mindset, participants did not show mu-suppression, either for the in-group or for the out-group. Hence, taking a step back and distancing oneself from the emotions and intentions of others can reduce motor resonance even for in-group members. Similarly, when in a perspective-taking mindset, participants showed mu-suppression in response to in-group and out-group members, reflecting a facilitating effect of a perspective-taking mindset on motor resonance in general, and motor resonance in response to out-group members in particular. Moreover, while participants in the objective mindset condition show an in-group bias in motor resonance—mu-suppression is stronger for the in-group than for the out-group, those in a perspective-taking mindset do not show such group distinction—mu-suppression for the in-group and out-group did not differ.

Taken together, the two studies described so far suggest that as a default, people tend not to resonate with the actions of out-group members. Consequently they might not intuitively grasp out-group members' actions, intentions, and inner states. Study 2 provides evidence for the utility of perspective taking as a strategy for combating this subtle consequence of racial bias. A potential mechanism for the beneficial effects of perspective taking is an increase in self–other overlap with the out-group. Taking the perspective of another person increases the link between the mental representations of the self and the mental representations of the other (Davis, Conklin, Smith, & Luce, 1996; Galinsky & Moskowitz, 2000). It leads people to ascribe more of their own traits to the other (Galinsky & Ku, 2004). Moreover, perspective taking makes people see more of the other in themselves (Ku, Wang, & Galinsky, 2010), such that the self concept extends to include the other; this is thought to assist goals related to social connection (Tiedens & Jimenez, 2003), and to increase social coordination (Galinsky et al., 2008). Through this mechanism, taking the perspective of the Black student in the story-writing task would increase a feeling of connectedness and affiliation with the student, and this affiliation goal would lead to increases in motor resonance. Thus Study 2 suggests that by blurring the boundary between the self and the out-group, people are more likely to resonate with the actions of out-group members. In a third study (Gutsell, Tullett, Inzlicht, & Plaks, 2013) we aimed to test this mechanism once more, this time looking at a more direct route to people's feelings of similarity and connectedness to out-group members— people's beliefs in genetic overlap between ethnic groups.

Despite the fact that people actually share all but a minuscule portion of their genetic information with everyone else on the planet (Feldman, Lewontin, & King, 2003), for centuries, people have been classified into different racial groups (Frederickson, 2003). How does the belief in genetic overlap between people relate to motor resonance? Do people who think that they share more of their genes with any other person tend to be more likely to resonate with the actions of those around them? Once more we used EEG mu-suppression as an indicator of motor resonance. This time, however, we used a correlational design and correlated mu-suppression scores in response to actions of ethnic in-group and out-group members with participants' scores on a self-report measure of beliefs in genetic overlap. Specifically, we asked participants: "If you were to choose two people at random from the entire world, what percentage of genetic material would they have in common? (0–100%)." This measure of genetic overlap has been shown to be correlated with the tendency to see racial groups as clear-cut categories, and when people are led to believe in a high degree of genetic overlap, they expressed less implicit racial bias (Plaks, Malahy, Sedlins, & Shoda, 2011).

The results further support the functional account of motor resonance. We found a negative correlation between beliefs in genetic overlap and mu-suppression (higher negative score indicates more suppression), such that participants of European-Canadian or East Asian-Canadian descent who believe in high genetic overlap show mu-suppression while they watch videos of ethnic in-group members, but also when they watch videos of ethnic out-group members (African-Canadian and South Asian-Canadian descent). Therefore, when people believe themselves to be more genetically related and thus closer and more connected to others in general, they are more likely to resonate with them, potentially leading to richer, more intuitive understanding of their actions and intentions.

Taken together, the findings on a perspective-taking mindset and on beliefs regarding genetic overlap suggest that creating a sense of interconnectedness or closeness can indeed positively influence motor resonance and might potentially be a good way to alleviate the in-group bias in motor resonance. Motor resonance most likely helps people to get an intuitive understanding of other's actions and intentions (Fogassi et al., 2005) and might even be involved in basic empathic processes such as emotional contagion (Pineda & Hecht, 2009). Hence, group biases in motor resonance might ultimately translate to misunderstandings and impaired social rapport, empathy, and social coordination. Perspective taking and beliefs in strong genetic overlap across groups have been shown successfully to reduce prejudice (Batson et al., 1997; Galinsky & Ku, 2004; Plaks et al., 2011), and to create a sense of connectedness to the out-group. Alleviating group biases in motor resonance might yet be another important benefit (Galinsky & Ku, 2004; Plaks et al., 2011) of these techniques.

Other techniques that reduce the psychological gap between different ethnic groups might be similarly effective in reducing group biases in motor resonance. For example, Hogeveen and Obhi (2011) found that when videos of simple hand motions were paired with words that prime an interdependent self-construal such as "social," "family," and "help" (Aron, A., Aron, E., & Smollan, 1992), participants showed an increase in motor resonance (as measured with transcranial magnetic stimulation) in the interdependent trials, as opposed to control trials. Once someone is perceived as similar, and once they are part of our inner circle of close others whose actions, intentions, and goals we care about, it seems that our neural system for action understanding becomes sensitive to out-group members.

Increasing closeness to the target, however, is not the only possible approach to make a target motivationally relevant. If we truly take a functional approach to motor resonance, it does not seem sensible to think that people only resonate with those to whom they feel close. Altruism and reciprocity are not the only reasons why we need to understand others' goals and intentions, or why others' behavior is motivationally relevant. Another reason why a behavior might be relevant is that it poses a potential threat.

Motor Resonance for Threatening Behavior

It is a well-known psychological effect that people are particularly sensitive to negative information. This negativity bias (see reviews by Cacioppo & Berntson, 1994; Peeters & Czapinski, 1990; Taylor, 1991) has been shown in various domains, such as impression formation (Skowronski & Carlston, 1989), person memory (Ybarra & Stephan, 1996), and stimulus processing. For example, people spend more time looking at negative than positive stimuli, and perceive negative stimuli to be more complex than positive stimuli (DuCette & Soucar, 1974). In an intergroup context, the negativity bias is particularly powerful when anger is concerned. For example, research has shown that angry facial expressions capture and hold our attention (Öhman, Flykt, & Esteves, 2001). The reason probably is that anger is an interpersonal emotion and poses a threat if it is directed at the observer (Ackerman et al., 2006). Threatening out-group behavior should therefore be particularly motivationally relevant for the individual, and consequently should be a likely target for motor resonance. In fact, threatening out-group behavior might even override any existing group biases in motor resonance.

In order to test this idea, we invited participants of European-Canadian and East Asian-Canadian descent to the lab and measured their EEG while they watched videos of European-Canadian or East Asian-Canadian actors respectively (in-group condition), and while they watched South Asian-Canadian and African-Canadian actors (out-group condition) (Gutsell et al., 2013). The design differed from the previous studies in that this time, actors did not only display a neutral action (moving their arm up and down with a neutral face); they also displayed a positive action (repeatedly making the "thumbs up" hand gesture with a positive facial expression) and a threatening action (repeatedly doing the "giving someone the finger" hand gesture with an angry facial expression).

Replicating Study 1, participants did not show significant mu-suppression when observing neutral actions performed by out-group members, but they did show significant mu-suppression in response to neutral in-group actions. Once again, these findings show that as a default, people have an in-group bias when it comes to motor resonance. A similar pattern was found for positive actions—participants only showed significant mu-suppression during the observation of positive actions performed by in-group members, but not during the observation of positive actions performed by out-group members. Interestingly, and as predicted, when the observed behavior was threatening, people did show significant mu-suppression in response to all targets—in-group members as well as out-group members, and the amount of mu-suppression in response to out-group members no longer differed from the amount of mu-suppression in response to the in-group. Thus, in the threat condition, participants no longer show an in-group bias in motor resonance. We resonate with threatening out-group members as much as we would usually only resonate with in-group members.

These findings are consistent with a functional perspective on person perception. No matter whether the behavior of out-group members is neutral or positive, people show an in-group bias in motor resonance. In contrast, when out-group behavior is negative and threatening, people seem to allocate cognitive resources to the threatening individual and start processing them as thoroughly as they would in-group members—the in-group bias in motor resonance disappears. Friendly out-group members might be more likable and pleasant, but as long as we do not include them in our inner circle of relevant others, we will not resonate with them. Thus, it is not so much about the valence of the behavior, but about whether or not the behavior in question has implications for one's own goals and behavior.

Added Value

A failure to resonate with out-group members' actions and intentions, and so to speak, spontaneously to "catch" the meaning of their actions and intentions can potentially have serious consequences for intergroup interactions. We presented research suggesting that, as a default, people do not resonate with ethnic out-group members. However, once an out-group member becomes motivationally relevant—either because the observer is in a perspective-taking mindset, or because the out-group member's behavior poses a potential threat—people start resonating, thereby becoming more sensitive to the inner states of out-group members.

Our findings advance current theoretical understanding of cross-group interactions, showing that one of the most basic processes underlying action perceptions is affected by group biases. Motor resonance and the sharing of somatic, autonomic, and emotional states facilitate social understanding and might foster smooth and rewarding intergroup interactions and coordination (Knoblich & Sebanz, 2006). Hence, people might not be as responsive to out-group members' needs and goals and be less likely intuitively to grasp their intentions; they might also have a harder time to synchronize their own behavior with that of out-group members and to complement it during cooperation (Sebanz, Bekkering, & Knoblich, 2006). Therefore, investigating the limits and facilitating factors of motor resonance in an intergroup context is important in order to understand the challenges of intergroup interactions. Moreover, our findings provide a possible mechanism for effective interventions to improve cross-group interactions. For example, adopting a perspective-taking mindset has been shown to be conducive to smooth and pleasant intergroup interaction experiences. The findings reported here suggest a potential mechanism: When they are in a perspective-taking mindset, people are more likely to resonate even with out-group members, which potentially could provide them with a richer, more intuitive understanding of the others' actions and intentions, leading to smoother and more positive intergroup interactions. Taken together, eventually the insights on motor resonance in an intergroup context might inform us as to how one can potentially facilitate smoother intergroup encounters, and how to create circumstances that support intergroup coordination and cooperation.

Finally, our findings contribute to the understanding of motor resonance by shedding light on the factors that facilitate and hamper it. We show that not only is motor resonance influenced by social categorization, but it can also be influenced by culturally learned prejudice and by temporarily induced mindsets. After all, motor resonance, like many other basic perception processes before, has turned out not to be as automatic as previously it was thought to be; instead, it seems to be susceptible to the multifaceted and rich world of higher-order cognitive processes that constitute human social cognition.

Strengths and Weaknesses

In the studies described here, we used EEG mu-suppression as an index for motor resonance. We chose to use EEG because it is easily applicable, and a relatively unobtrusive measure of brain activity. Participants are thus left relatively unconstrained, enabling them to perform complex actions and potentially even to interact with others during EEG recording. Moreover, because each EEG session is relatively affordable compared to other methods of neural resonance such as functional magnetic resonance imaging (fMRI), it allows for large enough samples to combine brain imaging with the use of more traditional measures used in social psychology, such as implicit reaction-time measures of prejudice, or self-report scales.

Motor resonance per definition is a phenomenon of the brain; it is the activation of the neural sensory motor system during observation of another's action. Theoretically it is linked to activity of a specific kind of neurons in these brain regions—the mirror neurons (Rizzolatti & Craighero, 2004). Therefore, in order to understand motor resonance, we need to adopt neuroscience techniques to measure brain activity. That said, motor resonance is related to at least two phenomena that can be studied using more traditional social psychological measures—automatic imitation and motor mimicry (Heyes, 2011), but the specific nature of the relationship between these phenomena is still unclear.

Automatic imitation is a type of stimulus–response compatibility effect similar to well-known effects such as the Stroop effect (Stroop, 1935). In automatic imitation paradigms (e.g., Proctor & Vu, 2006; Stürmer, Aschersleben, & Prinz, 2000), participants show response slowing when they have to perform one kind of action (e.g., opening their hand) in response to a stimulus, while a task-irrelevant and incompatible action (e.g., image of a closing hand) is presented; they respond faster when a compatible action (e.g., image of an opening hand) is presented (e.g., Brass, Bekkering, Wohlschlager, & Prinz, 2000; Heyes, Bird, Johnson, & Haggard, 2005; Stürmer et al., 2000). The task-irrelevant stimuli interfere with performing the required action, because participants co-represent the incompatible action depicted in the picture or video. Theoretically this co-representation and the resulting interference are the result of motor resonance and ultimately the mirror neuron system (Kilner, Paulignan, & Blakemore, 2003; Press, Bird, Walsh, & Heyes, 2008; Van Schie et al., 2008). Catmur, Walsh, and Heyes (2009) showed that temporally disrupting the function of relevant motor areas using TMS impaired automatic imitation, suggesting that motor resonance is indeed underlying implicit imitation. Unfortunately, other than this finding, experimental evidence is still scarce and more research is necessary.

In contrast to automatic imitation, motor mimicry can be observed in naturalistic social situations and real interactions. When we interact with others, we unconsciously mimic their postures and mannerisms (Chartrand & Bargh, 1999) and this seems to have many interpersonal benefits. For example, motor mimicry promotes liking (Chartrand & Bargh, 1999; Hove & Risen, 2009), and feelings of closeness (van Baaren, Holland, Kawakami, & van Knippenberg, 2004). Moreover, motor mimicry also seems to be influenced by group biases: Although people mimic others' expressions, gestures, and body postures, this occurs with less frequency for out-group members (Likowski, Mühlberger, Seibt, Pauli, & Weyers, 2008). This similarity in findings suggests that potentially group biases in motor resonance might translate to reduced motor mimicry, depriving intergroup interactions of the many benefits that mimicry can have on interpersonal rapport.

Intuitively it does make sense that motor mimicry depends on motor resonance, and is based on the same psychological process responsible for automatic imitation, but thus far, there is not much research integrating the three. Hence, it is still relatively unclear how motor resonance, automatic imitation, and motor mimicry are related, and specifically, whether motor resonance is the neurological process that gives rise to the two behavioral phenomena. Therefore, motor resonance is a neural process that might not always and not necessarily be expressed in reaction times or actual motor behavior, and in order to research motor resonance, one has to employ brain-imaging methods such as fMRI, TMS, or EEG. Which one of these methods is the best to use depends on the researcher's preferences, the availability of the equipment, and on the specific requirements and restrictions the specific research question poses on experimental design. Using EEG mu-suppression gave us the opportunity to have relatively large sample sizes, making between-subject designs and the use of self-report measures possible. We also appreciated that this method is relatively unobtrusive and tolerant to movement artifacts. Finally, we think that the ability to present continuous and rich stimuli opens up opportunities to create studies that more accurately simulate the experience during real-life interactions.

Ultimately, we need to link motor resonance back to behavior in actual interactions. We know that motor resonance gives rise to an intuitive understanding of another's experiences (Hurley, 2008; Iacoboni, 2009;). Motor resonance has also been associated with many other cognitive processes, such as learning and the experience of empathy (Gallese et al., 2011), but how does this translate to intergroup behavior? If we did not resonate with out-group members, would we have a harder time predicting their next move, and would we have trouble coordinating our actions with theirs? Would we be less likely to learn from their mistakes, or to help them when they are in need? Ultimately, these are the kind of questions in which we, as social psychologists, are most interested. Understanding motor resonance in an intergroup context is the first step on a journey to understand how it is expressed on a behavioral level, and how group biases in motor resonance affect intergroup experiences and interactions.

Suggestions for Further Reading

Gallese, V., Gernsbacher, M. A., Heyes, C., Hickok, G., & Iacoboni, M. (2011). Mirror neuron forum. *Perspectives on Psychological Science, 6*, 369–407.

Provides an in-depth discussion about controversial topics regarding mirror neurons. Leading experts on the subject debate the functions of mirror neurons.

Goldman, A. I. (2006). *Simulating minds: The philosophy, psychology, and neuroscience of mindreading*. Oxford, UK: Oxford University Press.

A stimulating and engaging account of how we understand others. This book provides a good overview of the philosophical debate surrounding simulation theory, and covers empirical supporting findings from developmental psychology, social psychology, and neurosciences.

Gutsell, J. N., & Inzlicht, M. (2010). Empathy constrained: Prejudice predicts reduced mental simulation of actions during observation of out-groups. *Journal of Experimental Social Psychology, 46*, 841–845.

This article describes the findings of Study 1 discussed in this chapter and provides additional information on how we measured mu-suppression.

Pineda, J. A. (2005). The functional significance of mu rhythms: Translating "seeing" and "hearing" into "doing." *Brain Research Reviews, 50*, 57–68.

Provides a discussion of the mu-rhythm and its relation to mirror neuron activity.

Puzzo, I., Cooper, N. R., Cantarella, S., & Russo, R. (2011). Measuring the effects of manipulating stimulus presentation time on sensorimotor alpha and low beta reactivity during hand movement observation. *NeuroImage, 57*, 1358–1363.

A study exploring methodological questions on how best to use EEG mu-suppression as an index of motor resonance.

Rizzolatti, G., & Craighero, L. (2004). The mirror-neuron system. *Annual Review of Neuroscience, 27*, 169–192.

Provides a detailed description of the mirror neuron system, which provides a good overview of the theory and the supporting empirical evidence.

References

Ackerman, J. M., Shapiro, J. R., Neuberg, S. L., Kenrick, D. T., Becker, D. V., Griskevicius, V. . . . Schaller, M. (2006). They all look the same to me (unless they're angry): From out-group homogeneity to out-group heterogeneity. *Psychological Science, 17*, 836–840.

Aglioti, S. M., Cesari, P., Romani, M., & Urgesi, C. (2008). Action anticipation and motor resonance in elite basketball players. *Nature Neuroscience, 11*, 1109–1116.

Aron, A., Aron, E. N., & Smollan, D. (1992). Inclusion of other in the self scale and the structure of interpersonal closeness. *Journal of Personality and Social Psychology, 63*, 596–612.

Batson, C. D., & Moran, T. (1999). Empathy-induced altruism in a prisoner's dilemma. *European Journal of Social Psychology, 29*, 909–924.

Batson, C. D., Sager, K., Garst, E., Kang, M., Rubchinsky, K., & Dawson, K. (1997). Is empathy-induced helping due to self–other merging? *Journal of Personality and Social Psychology, 73*, 495–509.

Bernstein, M. J., Young, S. G., & Hugenberg, K. (2007). The cross-category effect. *Psychological Science, 18*, 706–712.

Bonini, L., Rozzi, S., Serventi, F. U., Simone, L., Ferrari, P. F., & Fogassi, L. (2010). Ventral premotor and inferior parietal cortices make distinct contribution to action organization and intention understanding. *Cerebral Cortex, 20*, 1372–1385.

Brass, M., Bekkering, H., Wohlschlager, A., & Prinz, W. (2000). Compatibility between observed and executed finger movements: Comparing symbolic, spatial, and imitative cues. *Brain and Cognition, 44*, 124–143.

Cacioppo, J. T., & Berntson, G. G. (1994). Relationship between attitudes and evaluative space: A critical review, with emphasis on the separability of positive and negative substrates. *Psychological Bulletin, 115*, 401–423.

Calvo-Merino, B., Glaser, D. E., Grèzes, J., Passingham, R. E., & Haggard, P. (2005). Action observation and acquired motor skills: An fMRI study with expert dancers. *Cerebral Cortex, 15*, 1243–1249.

Carr, L., Iacoboni, M., Dubeau, M., Mazziotta, J. C., & Lenzi, G. L. (2003). Neural mechanisms of empathy in humans: A relay from neural systems for imitation to limbic areas. *Proceedings of the National Academy of Sciences of the United States of America, 100*, 5497–5502.

Catmur, C., Walsh, V., & Heyes, C. M. (2009). Associative sequence learning: The role of experience in the development of imitation and the mirror system. *Philosophical Transactions of the Royal Society B: Biological Sciences, 364*, 2369–2380.

Cattaneo, L., Caruana, F., Jezzini, A., & Rizzolatti, G. (2009). Representation of goal and movements without overt motor behavior in the human motor cortex: A transcranial magnetic stimulation study. *The Journal of Neuroscience, 29*, 11134–11138.

Chartrand, T. L., & Bargh, J. A. (1999). The chameleon effect: The perception–behavior link and social interaction. *Journal of Personality and Social Psychology, 76*, 893–910.

Chong, T. T., & Mattingley, J. B. (2009). Automatic and controlled processing within the mirror neuron system. In J. A. Pineda (Ed.), *Mirror neuron systems* (pp. 213–233). Totowa, NJ: Humana Press.

Cialdini, R. B., Brown, S. L., Lewis, B. P., Luce, C., & Neuberg, S. L. (1997). Reinterpreting the empathy–altruism relationship: When one into one equals oneness. *Journal of Personality and Social Psychology, 73*, 481–494.

Davis, M. H., Conklin, L., Smith, A., & Luce, C. (1996). Effect of perspective taking on the cognitive representation of persons: A merging of self and other. *Journal of Personality and Social Psychology, 70*, 713–726.

Di Pellegrino, G., Fadiga, L., Fogassi, L., Gallese, V., & Rizzolatti G. (1992). Understanding motor events: A neurophysiological study. *Experimental Brain Research, 91*, 176–180.

Dovidio, J. F., Vergert, M., Stewart, T. L., Gaertner, S. L., Johnson, J. D., Esses, V. M. et al. (2004). Perspective and prejudice: Antecedents and mediating mechanisms. *Personality and Social Psychology Bulletin, 30*(12), 1537–1549.

DuCette, J., & Soucar, E. (1974). A further reexamination of the vigilance hypothesis using random shapes as stimuli. *The Journal of Social Psychology, 92*, 109–113.

Elfenbein, H. A., & Ambady, N. (2002). Is there an in-group advantage in emotion recognition? *Psychological Bulletin, 128*, 243–249.

Fadiga, L., Fogassi, L., Pavesi, G., & Rizzolatti, G. (1995). Motor facilitation during action observation: A magnetic stimulation study. *Journal of Neurophysiology, 73*, 2608–2611.

Feldman, M. W., Lewontin, R. C., & King, M. (2003). A genetic melting-pot. *Nature, 424*, 374.

Fiske, A. P. (1992). The four elementary forms of sociality: Framework for a unified theory of social relations. *Psychological Review, 99*, 689–723.

Fogassi, L., Ferrari, P. F., Gesierich, B., Rozzi, S., Chersi, F., & Rizzolatti, G. (2005). Parietal lobe: From action organization to intention understanding. *Science, 308*, 662–667.

Frederickson, G. M. (2003). *Racism: A short history*. Princeton, NJ: Princeton University Press.

Galinsky, A. D., & Ku, G. (2004). The effects of perspective-taking on prejudice: The moderating role of self-evaluation. *Personality and Social Psychology Bulletin, 30*, 594–604.

Galinsky, A. D., Maddux, W. W., Gilin, D., & White, J. B. (2008). Why it pays to get inside the head of your opponent: The differential effects of perspective taking and empathy in negotiations. *Psychological Science, 19*, 378–384.

Galinsky, A. D., & Moskowitz, G. B. (2000). Perspective-taking: Decreasing stereotype expression, stereotype accessibility, and in-group favoritism. *Journal of Personality and Social Psychology, 78*, 708–724.

Gallese, V., Fadiga, L., Fogassi, L., & Rizzolatti, G. (1996). Action recognition in the premotor cortex. *Brain, 119*, 593–609.

Gallese, V., Gernsbacher, M. A., Heyes, C., Hickok, G., & Iacoboni, M. (2011). Mirror neuron forum. *Perspectives on Psychological Science, 6*, 369–407.

Gutsell, J. N., & Inzlicht, M. (2010). Empathy constrained: Prejudice predicts reduced mental simulation of actions during observation of outgroups. *Journal of Experimental Social Psychology, 46*, 841–845.

Gutsell, J. N., & Inzlicht, M. (2013). Perspective taking reduces group biases in neural motor resonance. Manuscript under review.

Gutsell, J. N., Tullett, A. M., Inzlicht, M., & Plaks, J. E. (2013). The effects of beliefs in genetic overlap on motor resonance. Manuscript in preparation.

Hamilton, W. D. (1964). The genetical theory of social behaviour. *Journal of Theoretical Biology*, 7, 1–52.

Hari, R., 2006. Action–perception connection and the cortical mu rhythm. *Progress in Brain Research, 159*, 253–260.

Harris, L. T., & Fiske, S. T. (2006). Dehumanizing the lowest of the low: Neuroimaging responses to extreme out-groups. *Psychological Science, 17*, 847–853.

Henry, P. J., & Sears, D. O. (2002). The Symbolic Racism 2000 Scale. *Political Psychology, 2*, 253–283.

Heyes, C. (2011). Automatic imitation. *Psychological Bulletin, 137*, 463–483.

Heyes, C., Bird, G., Johnson, H., & Haggard, P. (2005). Experience modulates automatic imitation. *Cognitive Brain Research, 22*, 233–240.

Hogeveen, J., & Obhi, S. S. (2011). Altogether now: Activating interdependent self-construal induces hypermotor resonance. *Cognitive Neuroscience, 2*, 74–82.

Hove, M. J., & Risen, J. L. (2009). It's all in the timing: Interpersonal synchrony increases affiliation. *Social Cognition, 27*, 949–961.

Hurley, S. (2008). The shared circuits model (SCM): How control, mirroring, and simulation can enable imitation, deliberation, and mindreading. *Behavioral and Brain Sciences, 31*, 1–58.

Iacoboni, M. (2005). Understanding others: Imitation, language, and empathy. In S. Hurley & N. Chater (Eds.), *Perspectives on imitation: From cognitive neuroscience to social science* (pp. 77–99). Cambridge, MA: The MIT Press.

Iacoboni, M. (2009). Imitation, empathy, and mirror neurons. *Annual Review of Psychology, 60*), 653–670. doi:10.1146/annurev.psych.60.110707.163604

James, W. (1890) *Principles of psychology*. 2 vols. NewYork: Holt.

Kilner, J. M., Paulignan, Y., & Blakemore, S. J. (2003). An interference effect of observed biological movement on action. *Current Biology, 13*, 522–525.

Kohler, E., Keysers, C., Umilta, M. A., Fogassi, L., Gallese, V., & Rizzolatti, G. (2002). Hearing sounds, understanding actions: Action representation in mirror neurons. *Science, 297*, 846–848.

Knoblich, G., & Sebanz, N. (2006). The social nature of perception and action. *Current Directions in Psychological Science, 15*, 99–104.

Ku, G., Wang, C. S., & Galinsky, A. D. (2010). Perception through a perspective-taking lens: Differential effects on judgment and behavior. *Journal of Experimental Social Psychology, 46*, 792–798.

Kuhlman, W. N. (1978). Functional topography of the human mu rhythm. *Electroencephalography and Clinical Neurophysiology, 44*, 83–93.

Likowski, K. U., Mühlberger, A., Seibt, B., Pauli, P., & Weyers, P. (2008). Modulation of facial mimicry by attitudes. *Journal of Experimental Social Psychology, 44*, 1065–1072.

Mathur, V. A., Harada, T., Lipke, T., & Chiao, J. Y. (2010). Neural basis of extraordinary empathy and altruistic motivation. *NeuroImage, 51*, 1468–1475.

Mukamel, R., Ekstrom, A. D., Kaplan, J., Iacoboni, M., & Fried, I. (2010). Single-neuron responses in humans during execution and observation of actions. *Current Biology, 20*, 750–756.

Oberman, L. M., Hubbard, E. M., McCleery, J. P., Altschuler, E. L., Ramachandran, V., & Pineda, J. A. (2005). EEG evidence for mirror neuron dysfunction in autism spectrum disorders. *Cognitive Brain Research, 24*, 190–198.

Oberman, L. M., Ramachandran, V. S., & Pineda, J. A. (2008). Modulation of mu suppression in children with autism spectrum disorders in response to familiar or unfamiliar stimuli: The mirror neuron hypothesis. *Neuropsychologia, 46*, 1558–1565.

Öhman, A., Flykt, A., & Esteves, F. (2001). Emotion drives attention: Detecting the snake in the grass. *Journal of Experimental Psychology: General, 130*, 466–478.

Peeters, G., & Czapinski, J. (1990). Positive–negative asymmetry in evaluations: The distinction between affective and informational negativity effects. In W. Stroebe & M. Hewstone (Eds), *European review of social psychology* (Vol. 1, pp. 33–60). Chichester, UK: Wiley.

Pfurtscheller, G., & Aranibar, A. (1979). Evaluation of event-related desynchronization (ERD) preceding and following voluntary self-paced movement. *Electroencephalography and Clinical Neurophysiology, 46*, 138–146.

Pineda, J. A. (2005). The functional significance of mu rhythms: Translating "seeing" and "hearing" into "doing." *Brain Research Reviews, 50*, 57–68.

Pineda, J. A., & Hecht, E. (2009). Mirroring and mu rhythm involvement in social cognition: Are there dissociable subcomponents of theory of mind? *Biological Psychology, 80*, 306–314.

Plaks, J. E., Malahy, L. W., Sedlins, M., & Shoda, Y. (2011). Folk beliefs about human genetic variation predict discrete versus continuous racial categorization and evaluative bias. *Social Psychological and Personality Science, 3*, 31–39.

Press, C., Bird, G., Walsh, E., & Heyes, C. (2008). Automatic imitation of intransitive actions. *Brain and Cognition, 67*, 44–50.

Preston, S. D., & de Waal, F. B. M. (2002). Empathy: Its ultimate and proximate bases. *Behavioral and Brain Sciences, 25*, 1–20.

Prinz, W. (1987). Ideo-motor action. In H. Heuer & A. F. Sanders (Eds.), *Perspectives on perception and action* (pp. 47–76). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Proctor, R. W., & Vu, K.-P. L. (2006). *Stimulus-response compatibility principles: Data, theory and application*. Boca Raton, FL: Taylor & Francis.

Puzzo, I., Cooper, N. R., Cantarella, S., & Russo, R. (2011). Measuring the effects of manipulating stimulus presentation time on sensorimotor alpha and low beta reactivity during hand movement observation. *NeuroImage, 57*, 1358–1363.

Rizzolatti, G., & Craighero, L. (2004). The mirror-neuron system. *Annual Review of Neuroscience, 27*, 169–192.

Rizzolatti, G., Fadiga, L., Fogassi, L., & Gallese, V. (1996). Premotor cortex and the recognition of motor actions. *Cognitive Brain Research, 3*, 131–141.

Rothbart, M., Evans, M., & Fulero, S. (1979). Recall for confirming events: Memory processes and the maintenance of social stereotypes. *Journal of Experimental Social Psychology, 15*, 343–355.

Sartori, L., Cavallo, A., Bucchioni, G., & Castiello, U. (2011). Corticospinal excitability is specifically modulated by the social dimension of observed actions. *Experimental Brain Research, 211*, 557–568.

Sebanz, N., Bekkering, H., & Knoblich, G. (2006). Joint action: Bodies and minds moving together. *Trends in Cognitive Sciences, 10*, 71–76.

Shih, M., Wang, E., Trahan Bucher, A., & Stotzer, R. (2009). Perspective taking: Reducing prejudice towards general outgroups and specific individuals. *Group Processes & Intergroup Relations, 12*, 565–577.

Sime, J. D. (1983). Affiliative behaviour during escape to building exits. *Journal of Environmental Psychology, 3*, 21–41.

Skowronski, J. J., & Carlston, D. E. (1989). Negativity and extremity biases in impression formation: A review of explanations. *Psychological Bulletin, 105*, 131–142.

Sporer, S. L. (2001). The cross-race effect: Beyond recognition of faces in the laboratory. *Psychology, Public Policy, and Law*, 7, 170–200.

Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology, 18*, 643–662.

Stürmer, B., Aschersleben, G., & Prinz, W. (2000). Correspondence effects with manual gestures and postures: A study of imitation. *Journal of Experimental Psychology: Human Perception and Performance, 26*, 1746–1759.

Taylor, S. E. (1991). Asymmetrical effects of positive and negative events: The mobilization–minimization hypothesis. *Psychological Bulletin, 110*, 67–85.

Tiedens, L. Z., & Jimenez, M. C. (2003). Assimilation for affiliation and contrast for control: Complementary self-construals. *Journal of Personality and Social Psychology, 85*, 1049–1061.

Turner, J. C., Brown, R. J., & Tajfel, H. (1979). Social comparison and group interest in ingroup favouritism. *European Journal of Social Psychology, 9*, 187–204.

Umilta, M. A., Kohler, E., Gallese, V., Fogassi, L., Fadiga, L., Keysers, C., & Rizzolatti, G. (2001). I know what you are doing. A neurophysiological study. *Neuron, 31*, 155–165.

van Baaren, R. B., Holland, R. W., Kawakami, K., & van Knippenberg, A. (2004). Mimicry and prosocial behavior. *Psychological Science, 15*, 71–74.

Van Bavel, J. J., Packer, D. J., & Cunningham, W. A. (2008). The neural substrates of in-group bias: A functional magnetic resonance imaging investigation. *Psychological Science, 19*, 1131–1139.

Van Schie, H. T., van Waterschoot, B. M., & Bekkering, H. (2008). Understanding action beyond imitation: Reversed compatibility effects of action observation in imitation and joint action. *Journal of Experimental Psychology: Human Perception and Performance, 34*, 1493–1500.

Weisbuch, M., & Ambady, N. (2008). Affective divergence: Automatic responses to others' emotions depend on group membership. *Journal of Personality and Social Psychology*, *95*, 1063–1079.

Wiesel, E. (n.d.). Quoted in *U.S. News & World Report*, October 27, 1986.

Wilson, M., & Knoblich, G. (2005). The case for motor involvement in perceiving conspecifics. *Psychological Bulletin*, *131*, 460–473.

Xu, X., Zuo, X., Wang, X., & Han, S. (2009). Do you feel my pain? Racial group membership modulates empathic neural responses. *The Journal of Neuroscience*, *29*, 8525–8529.

Ybarra, O., & Stephan, W. G. (1996). Misanthropic person memory. *Journal of Personality and Social Psychology*, *70*, 691–700.