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# The Social Neuroscience of Empathy

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**E**mpathy is a complex psychological response in which observation, memory, knowledge, and reasoning are combined to yield insights into the thoughts and feelings of others (Ickes, 1997). There is broad agreement about two primary components of empathy: (1) an affective response to another person, which may (but not always) entail sharing that person's emotional state; and (2) a cognitive capacity to take the other person's perspective (e.g., Batson, 1991; Hodges & Wegner, 1997). Definitional variations on these general statements abound. However, virtually all empathy researchers agree that empathy requires making a link between the self and other, but without confusing the self and other. With this point in mind, our goal in this chapter is to bridge social psychological studies of empathy with findings from neuroscience in order to identify the fundamental neural mechanisms that could serve as the basis for empathy.

Our task is not to identify a single neural/cognitive module for empathy; no such simple module exists. A behavior as complex as empathy involves parallel and distributed processing in a number of dissociable mechanisms that are underpinned by distinct neural systems. We propose that empathy first relies on a system of shared neural representations that establishes the connection between the self and the target of empathy, but this shared representation network also necessitates regulatory mechanisms for distinguishing between the self and other.

## SHARED REPRESENTATIONS BETWEEN SELF AND OTHER

At the core of our theoretical framework is the notion of *shared representations* between the self and other, which has been proposed as a possible neurophysiological basis for social cognition (Decety & Sommerville, 2003). Shared representations rely on the common neural coding associated with the *perception* and *performance* of actions. Perception of a given behavior in another individual automatically activates one's own representations of that behavior (Knoblich & Flach, 2003). However, the activation of that behavior is generally inhibited or occurs at a sub-threshold level. In neuroscience, evidence for shared representations ranges from electrophysiological recordings in monkeys to neuroimaging experiments in humans. These studies consistently demonstrate that similar brain areas (in the frontal and parietal cortices) are activated during imagining one's own action, imagining another's action, and observation of another's action (Jackson & Decety, 2004).

The shared representations model may also be applied to the processing of emotions, which are a key component of empathy. For instance, viewing facial expressions triggers expressions on one's own face, even in the absence of conscious recognition of the stimulus (Dimberg, Thunberg, & Elmehed, 2000). Further support for the role of shared representations in emotion processes is provided by reports of paired deficits of emotion production and emotion recognition. Damage within the right somatosensory related cortices (including the insula and anterior supramarginal gyrus) impairs people's ability to express emotions and judge the emotional states when viewing facial expressions (Adolphs, Damasio, Tramel, Cooper, & Damasio, 2000).

Moreover, there are several dramatic single case studies in favor of the idea that the same neural systems are involved both in the recognition and in the expression of a specific emotion. Lesions of the amygdala may cause paired deficits in both the recognition of fear in facial expressions as well as in the phenomenological experience of fear (Adolphs, Tranel, Damasio, & Damasio, 1995). There is also evidence of paired deficits in recognizing and experiencing disgust after lesion of the left insula (Calder, Keane, Manes, Antoun, & Young, 2000). Consistent with this finding, it was demonstrated that the same regions of the insula and cingulate cortex are activated whether participants inhale odorants that produce disgust or watch video clips showing facial expressions of disgust (Wicker et al. (2003).

## SHARED REPRESENTATIONS, THE EGOCENTRIC BIAS
## AND SOCIAL PROJECTION

Many social and developmental psychologists have documented that the default mode for understanding others is biased toward relying on one's own self-perspective. We see others through our own embodied cognition, and use our own knowledge (including beliefs and attitudes) as the primary basis for understanding others. Stated in other words, people are fundamentally ego-

centric and have difficulty getting beyond their own perspective when anticipating what others are thinking or feeling (Royzman, Cassidy, & Baron, 2003). For instance, we are inclined to impute our own knowledge to others, and overestimate what they know (Keysar, Lin, & Barr, 2003). In addition, recent research indicates that people's predictions of how other people will feel in situations that arouse drive states (such as thirst) are based largely on their predictions of how they themselves would feel, which in turn are based on their own current drive states (Van Boven & Loewenstein, 2003).

This projective tendency, which stems from the shared representations, is very parsimonious and frequently useful in understanding and predicting the behaviors of others. Yet it is far from perfect, as individual differences in people's thoughts and emotions abound. Errors in taking the perspective of others stem from the inability to suppress the self-perspective (Hodges & Wegner, 1997) and many costly social misunderstandings are rooted in people's failure to recognize the degree to which their perception of a situation may differ from those of others.

## ADOPTING THE SUBJECTIVE PERSPECTIVE OF THE OTHER

Fortunately, human empathic abilities are more sophisticated than simply yoking of perceptions of the self and other. Furthermore, confusion of the self and other is generally not considered a hallmark of empathy (Batson et al., 1991; Ickes, 1997). The shared representations mechanism just described lends credence to the idea that the same neural representational form is used in coding embedded intentional actions, whether they involve the self as an agent or another agent. Yet, although the self and other may be similar, we are able to understand that they are separate. Perspective-taking allows us to adjust for differences in the way other individuals may, literally and figuratively, see the world. Significantly, perspective-taking also plays a critical role in triggering empathy (Batson, 1991).

An essential aspect of empathy is to recognize the other person as like the self, while maintaining a clear separation between self and other. When adopting the perspective of another individual, an adjustment must be performed on shared representations. This ability to adjust further suggests that there is an important role for regulatory mechanisms in the neural machinery of empathy that maintain this distinction. We argue that empathy requires some form of executive inhibition (i.e., the deliberate suppression of cognitions or responses to achieve an internally represented goal). The contributions of the prefrontal cortex play an essential role in this regulation process.

A series of neuroimaging studies of healthy volunteers has investigated the neural underpinning of perspective-taking in three different modalities (i.e., motoric, conceptual, and emotional) of self–other representations. Participants were scanned while asked to imagine either himself or herself or another person performing a familiar action (Ruby & Decety, 2001), to judge the truthfulness of sentences (Ruby & Decety, 2003), to identify what emotion would be

elicited by a real life situation (Ruby & Decety, 2004), and to imagine painful situations (Jackson, Meltzoff, Brunet, & Decety, 2005). One of the most striking findings of these studies was the systematic involvement of two prefrontal cortex sub-areas (namely the frontopolar cortex and medial prefrontal cortex) when the participants adopted another person's perspective. Frontal damage in similar regions may result in impaired perspective-taking ability and a lack of cognitive flexibility. Interestingly, Anderson and colleagues (Anderson, Bechara, Damasio, Tranel, & Damasio, 1999) reported the cases of two patients with early damage to the anterior prefrontal cortex (encompassing the frontopolar cortex) who, when tested on moral dilemmas, exhibited an excessively egocentric perspective. We believe this inhibitory component is required to regulate the prepotent self-perspective (and disengage it in favor of another's perspective). This view is compatible with the role of the prefrontal cortex in top-down control of behavior. It is also congruent with Batson's (1991) empathy–altruism model, which postulates that concern for another person in distress is the more reliable predictor of the distressed person receiving help, rather than experiencing another person's distress as one's own.

## SELF AND OTHER AWARENESS

In our view, self–other awareness is a vital component of human empathy. Indeed, it has been argued that self-awareness may have evolved for the specific purpose of allowing us to understand our own and others' behavior. This may help explain why humans are able to "feel for" and act on behalf of other people whose experiences differ greatly from their own. Behavior that constitutes rudimentary "empathy" in other species consists mainly of fixed action patterns that are engaged only for those recognized as kin. Self-reflexive capability may be a crucial difference between humans and other animals (Povinelli, 2001).

It is unlikely that self-awareness relies on one specific brain area; rather, it probably arises from the interaction of processes distributed in the brain. Regions of the right hemisphere, especially the prefrontal cortex and the inferior parietal lobule, play a prominent role. Notably, two recent fMRI studies have demonstrated a specific increased hemodynamic activity in the right medial prefrontal cortex and anterior cingulate during tasks that involved self-reflection (Gusnard et al., 2001; Johnson et al., 2002).

Clinical neuropsychological observations also support an important role of the right prefrontal cortex in self awareness. For instance, Keenan and his group (Keenan, Nelson, O'Connor, & Pascual-Leone, 2001) demonstrated that patients were temporarily desensitized in recognizing their own faces when their right hemispheres were anaesthetized as part of a diagnostic procedure. Right ventromedial prefrontal cortex damage can also be associated with impairments in autobiographical memory and self-evaluation. Interestingly, patients with lesions of this latter region exhibit empathy deficits (Shamay-Tsoory, Tomer, Berger, & Aharon-Peretz 2003).

Recent research indicates that the right inferior parietal cortex in conjunction with prefrontal cortex may be critical in distinguishing the self from the other, and is therefore important in modulating shared representations. The inferior parietal cortex is a heteromodal association area, and is well-situated to receive input from the lateral and posterior thalamus and prefrontal cortex, as well as from visual, auditory, somaesthetic, and limbic areas that plays a critical role in the sense of self-agency  in distinguishing the perspective of the self from the other. Notably, when participants are asked to adopt another person's perspective to evaluate their beliefs or imagine their feelings or their pain, the right parietal cortex is also chiefly involved which is consistent with its role in self–other distinction required in our model of empathy (see Decety & Jackson, 2004).

## CONCLUSIONS

Empathy denotes, at a phenomenological level of description, a sense of similarity between the feelings we experience and those expressed by others, without losing sight of whose feelings belong to whom. In this chapter, we have proposed a model of empathy that is grounded in shared representations between self and others, which produce a "self-bias" in the way we think and feel about others. By bridging social psychology and cognitive neuroscience, we have demonstrated how such a model, with its roots in social psychology, provides important guidelines for investigating the neural processes underlying empathy. For example, just as social psychologists have identified how multiple social stimuli may trigger empathy (e.g., the target person's emotion, kinship with the target, attempts to take the target's perspective), we suggest that within our model, there is no specific cortical site for shared representations. Instead, the neural substrate of shared representations is widely distributed and the patterns of activation (and also presumably deactivation) vary according to the processing domain, specific emotional responses, and stored information.

Furthermore, the bridge linking social psychology and neural explanations of empathy goes both ways. We have demonstrated how recent cognitive neuroscience findings have provided complementary and corroborating evidence of empathy mechanisms first proposed by behavioral scientists. Social psychologists (and philosophers before them) have distinguished empathy as more complex than mere projection and thus, the shared representations that form the basis of our model must be regulated and adjusted. Evidence of this adjustment is found in neural activity in the prefrontal cortex as well as in the neural structures involved in emotional regulation (anterior cingulate, orbitofrontal, and ventromedial prefrontal cortex). In addition, activity in the right hemisphere plays a predominant role in the way that the self is both connected to and distinguished from the other.

Further benefits of bridging the two disciplines may be accrued in future studies of empathy. For example, neural imaging studies of patient populations may provide a better understanding of, and possible treatments for,

forms of psychopathology that are characterized by empathy deficits (e.g., autism and schizophrenia). Identifying how empathy behaviorally resembles other mental processes that link the self and other (e.g., social comparison) may suggest roles for additional neural structures in empathy. In a parallel manner, examining how the neural "signature" of empathy differs from that of other self–other processes may help us to further refine our definition of empathy. As our brief treatment here has demonstrated, neither the concept of empathy nor the mechanisms behind it are simple and thus, these investigations will not be easy. However, they will almost certainly be worth the effort in terms of understanding the uniquely human experience of empathy.

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