

## REFLECTIONS ON SOCIAL NEUROSCIENCE

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Social Neuroscience is a useful tool for elucidating both the psychological and neural mechanisms underlying social behavior. The promise of new theoretical insights was one of the most exciting potential benefits of integrating social and biological approaches. Now that social neuroscience research has progressed, evidence of this promise can now be seen. This review highlights some of the ways in which social neuroscience has benefited our understanding of social processes, while also noting considerations for improving the field's impact.

The field of social neuroscience has seen tremendous growth in the past decade. What started as research done by a few pioneers has blossomed into a robust sub-discipline whose research is routinely reported within major social psychology journals and conferences. There is also sufficient research to support several social neuroscience specialty journals and conferences. In light of this growth, *Social Cognition's* questions of whether, when, and how social neuroscience contributes to advances in social psychology theory presents a timely opportunity to reflect on how the field has grown and where it is headed.

One of the original arguments in favor of integrating social psychology with more biological approaches was that new insights would result. In what is believed to be the first published reference to *social neuroscience*, Cacioppo and Bersohn (1992) argued that “analyses of a phenomenon at one level of organization can inform, refine, or constrain inferences based on observations at another level of analysis and, therefore, can foster comprehensive accounts and general theories of complex psychological phenomena” (p. 1021). The promise of using new techniques to leverage theoretical advances is heady stuff, so it is reasonable to start our analysis of social neuroscience by asking to what extent this has occurred.

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## BENEFITS OF AN INTEGRATIVE PERSPECTIVE

At the most basic level, the benefits of social neuroscience can be evaluated in terms of advances in our theoretical understanding of social behavior, and a reasonable heuristic for advance is when our models are able to explain more and more varied empirical outcomes.

Social neuroscience facilitates this in part through the introduction of new measures that expand our hypothesis testing beyond observable behavior to include the neural and physiological bases of these behaviors. But the benefits are not limited to having new measures at our disposal. Social neuroscience also encourages the incorporation of new theoretical perspectives from other subdisciplines of behavioral science, increasing the likelihood that relevant models are brought to bear in understanding social phenomena. This influx of both new tools and new models can be quite generative, suggesting unique and beneficial ways to probe social behavior. Lastly, social neuroscience allows theories to be evaluated in terms of biological plausibility, so that proposed mechanisms are evaluated against what is known about brain structure and function.

Social neuroscience research on face perception provides an example of how incorporating new methods and findings from divergent perspectives has expanded theoretical models. Although clearly a social phenomenon, a good deal of research examining face perception was traditionally done outside of social psychology.<sup>1</sup> The unfortunate result was that research on a critical aspect of social perception was not well integrated with more general models of social perception. Operating at the interface of social psychological and cognitive neuroscience perspectives, it was natural for social neuroscience research to more explicitly consider the cognitive neuroscience research on face perception, which in turn drew from the larger cognitive science research on face perception. The result is research that very explicitly melds social psychological models of person perception, cognitive science models of face perception, and cognitive neuroscience research on the neural aspects of face perception (e.g., Golby, Gabrieli, Chiao, & Eberhardt, 2001; Ito & Bartholow, 2009; Ito & Urland, 2003, 2005; Todorov, Said, Engell, & Oosterhof, 2008).

Research done in this vein is producing more comprehensive models of how and when different types of social information are processed from faces. Initial models of face perception were primarily concerned with how unique identity is determined (Bruce & Young, 1986; Burton, Bruce, & Hancock, 1999), and studies of the neural basis of face perception tended to reflect this emphasis (e.g., Bentin & Deouell, 2000; Eimer, 2000; Kanwisher, McDermott, & Chun, 1997; Puce, Truett, Gore, & McCarthy, 1995). The more explicit integration of social psychology into this research has rapidly expanded neuroscience investigations to other social cues readily extracted from faces that impact social interactions, including social category membership, emotional expression, attractiveness, and information supporting trait inferences (e.g., Cloutier, Heatherton, Whalen, & Kelley, 2008; Golby et al., 2001; Kubota & Ito, 2007; Ito & Urland, 2003; Said, Moore, Engell, Todorov, & Haxby, 2010). One theoretical impact of this integration has been to question prior

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1. This is not to say that social psychological research never studies faces. However, this research often sought to understand a general social process (e.g., social categorization) and not face perception per se (but see research done by Zebrowitz for a notable exception of social psychological research concerned with aspects of face perception, e.g., Zebrowitz, 1996).

assumptions that structural face encoding is a separate stage that precedes and is independent of the processing of social cues such as group membership and emotional expression (Bruce & Young, 1986). Research now shows that social category and expression can modulate neural responses to faces more quickly than previously thought (Ito & Urland, 2003, 2005; Kubota & Ito, 2007), and in particular, that structural face encoding can be modulated by social cues such as race (Golby et al., 2001; Herrmann et al., 2007; Ito & Urland, 2005; Stahl et al., 2008; Walker et al., 2008; for a review, see Ito & Bartholow, 2009). In this particular example, behavioral measures were not sufficient for detecting sensitivity to social cues during structural face encoding. Unique information was obtained with the addition of the neural measures.

There are also several examples in this domain where the neuroscience investigations converge with existing behavioral results. ERP studies on social categorization, for instance, demonstrate that social category information is extracted automatically within the first several hundred milliseconds of perception (Ito & Urland, 2003, 2005), supporting assumptions that social categorization occurs automatically (Brewer, 1988; Fiske & Neuberg, 1990). Similarly, fMRI studies of spontaneous trait inferences suggest a general valence dimension underlying many different kinds of social judgments (Todorov, Baron, & Oosterhof, 2008; Todorov & Engell, 2008), in line with similar conclusions based on behavioral observations (Rosenberg, Nelson, & Vivekananthan, 1968). Although our theoretical models may remain relatively unchanged following the addition of the neural data, this can be thought of as an advance in our understanding because the models have been demonstrated to account for new and different kinds of data.

Providing information on the neural structures involved in different social judgments can also make social neuroscience useful for identifying similarities among heretofore conceptually distinct processes, leading to consideration of how seemingly separate phenomena may actually derive from a common mechanism.<sup>2</sup> Take recent work examining the functional role of the medial prefrontal cortex (MPFC). MPFC activity has been associated with thinking about the self (e.g., D'Argembeau et al., 2007; Kelley et al., 2002), considering the psychological attributes of others (e.g., Mitchell, Cloutier, Bonaji, & Macrae, 2006; Mitchell, Banaji, & Macrae, 2005), and experiencing emotional and evaluative states (e.g., Ochsner et al., 2004; Zysset, Haber, Ferstl, & von Cramon, 2002). Work initially proceeded in these domains more independently, but researchers have begun to consider whether involvement of the same brain area in seemingly distinct processes reflects involvement of a common process. Amodio and Frith (2006) suggested that the disparate tasks associated with MPFC activity all involve making inferences about psychological states, of both the self and others, or representing the value of possible actions and

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2. Interpreting overlapping brain activation as indicating that two different psychological operations share a common neural mechanism requires caution. Activations located to the same area at spatial resolutions currently available may in fact reflect activation of nearby but non-overlapping regions. It is also possible that the areas being imaged are involved in a particular process, but perform some relatively more secondary computation relative to another area that was not imaged. While it is important to keep these considerations in mind when interpreting the meaning of overlapping brain activation associated with different psychological phenomena [see Cacioppo et al. (2003) and Cacioppo & Tassinari (1990) for discussions of several relevant inferential issues], it is not unreasonable to use the common findings for hypothesis generation purposes, as in the present examples.

outcomes (with the former associated with anterior rostral MPFC and the latter with both posterior rostral MPFC and orbitofrontal cortex). Mitchell (2009) has suggested that what unites the aspects of social cognition associated with MPFC activity is processing of probabilistic and subjective states—what he calls fuzzy mental estimates—as opposed to veridical representations of the external world. He goes on to argue that the disparate phenomena that have traditionally fallen under the rubric of social psychology can in fact be understood as involving these kinds of internally generated mental judgments. These are new perspectives that require further empirical testing. Nevertheless, they are provocative ideas with implications for social psychology. Consider the issue of whether the self is quantitatively versus qualitatively distinct. This has been largely addressed in the context of memory (i.e., the memory advantage for self-referential material) (e.g., Greenwald & Banaji, 1989; Kelley et al., 2002; Klein & Kihlstrom 1986; Maki & McCaul, 1985), but there are many other aspects of self. This research on the MPFC suggests that similarity in self/other processing may also extend to making inferences about transient states and traits.

## CAVEATS

The preceding is not meant to be exhaustive, but merely to provide concrete illustrations of the way in which a social neuroscience perspective can contribute to theoretical progress. Integrative accounts can certainly emerge from other perspectives, but the point is that adopting an outlook that explicitly orients one toward integration is going to more readily foster these kinds of comprehensive accounts. A social neuroscience perspective has the added benefit of not only illuminating an underlying psychological phenomenon, but also providing direct information about functional brain organization. Moreover, with the increasing integration of neuroscience into other areas of psychology (e.g., cognitive, developmental, and clinical), social neuroscience can also facilitate direct connections between social psychology and these other subdisciplines, as well as disciplines outside of psychology (e.g., genetics, psychiatry).

At the same time, arguing for the benefits of social neuroscience should not be interpreted to mean that all advances in social psychology will come from social neuroscience. The processes of interest to social psychologists are too broad to be sufficiently understood with a single perspective; social neuroscience is simply another tool at our disposal for probing complex phenomena. Moreover, in stating the benefits of social neuroscience, it is important to note that there is nothing inherent about measuring the brain that necessarily confers greater inferential power. While it can be easy to assume that brain measures are somehow more powerful than behavioral measures, any such dichotomy is false. Social neuroscience is exciting because it can offer new insights into the mechanisms that underlie behavior, but having access to that information does not provide fundamentally more important data than the behavior itself. In fact, showing the involvement of a brain area is just the beginning. We ultimately need to know what functional role each area plays, and this is not a trivial issue. Because many different psychological operations could map onto the same brain area, we must be cautious in interpret-

ing covariation between a psychological state and a particular pattern of neural activity as signaling the discovery of the neural substrate that underlies that psychological process (see Cacioppo et al. 2003 and Cacioppo & Tassinary, 1990), for discussions of several relevant inferential issues).

## PUTTING THE "SOCIAL" IN NEUROSCIENCE

While the general approach of social neuroscience is bearing fruit, we can do more to nurture its development. One of social neuroscience's great strengths is in examining the mechanisms of social behavior, but designing studies to isolate proposed mechanisms can come at the cost of external realism (cf. Cialdini, 2009). As the field moves forward, one important consideration will be in how to make our neuroscience even more social. By that I mean how to measure with neuroscience methods the full range of processes that occur in a social context. This will be challenging, because human social activity—with its face-to-face interactions and high degree of dynamism—is extremely messy from an experimental perspective. Balancing this messiness with experimental control can be challenging when only behavioral measurements are involved; adding neuroscience measures increases the challenge (e.g., because the measures are particularly sensitive to artifact caused by movement or are done in a way in which other people cannot physically be present). It is possible, though. The effects of physical contact on neural responses have been investigated by having participants undergoing fMRI scanning hold hands with someone outside the scanner (Coan, Schaefer, & Davidson, 2006), and games such as the prisoner's dilemma and the ultimatum game have been used to study neural and physiological responses to cooperation and competition (Decety, Jackson, Sommerville, Chaminade, & Meltzoff, 2004; Rilling, Sanfey, Aronson, Nystrom, & Cohen, 2004; Sanfey, Rilling, Aronson, Nystrom, & Cohen, 2003; van't Wout, Kahn, Sanfey, & Aleman, 2006). Methodological advances and increased creativity may eventually allow for even greater flexibility in the implementation of neuroscience measures during procedures that engage social processes as fully as possible. It can also be useful to run behavioral studies in parallel with neuroscience ones, adding measures to the behavioral version that would be difficult to obtain in the neuroscience version. Inferences can then be made from the two versions together, providing more information than either alone (see Wheeler & Fiske, 2005, for an example).

*Bidirectional Integration.* The meaning of brain activation depends on the goal state of the individual. As a consequence, another form of putting the social in neuroscience is to expand the role that social psychological theory plays in the interpretation of neuroscience data generally, even for investigations that may not be explicitly framed around social processes. Our current understanding of amygdala activation illustrates the benefits of integrating social psychological perspectives into neuroscience. Initial studies consistently found that amygdala activity increased following exposure to negative as compared to neutral and positive stimuli (e.g., Lane et al., 1997; Morris et al., 1996; Whalen et al., 1998; for reviews, see Phan, Wager, Taylor, & Liberzon, 2002; Zald, 2003). Studies then emerged showing sensitiv-

ity to positive stimuli as well, with greater amygdala activity to positive relative to neutral stimuli (Canli, Sivers, Whitfield, Gotlib, & Gabrieli, 2002; Hamann & Mao, 2002; Said, Baron, & Todorov, 2009; Zald, 2003). More recently, sensitivity to intensity has been observed (Cunningham, Raye, & Johnson, 2004). Finally, amygdala activity can differ depending on the personal relevance of a stimulus, as shown by greater amygdala activity to ingroup members in a minimal group situation (Van Bavel, Packer, Cunningham, 2008). These many patterns of amygdala sensitivity could seem disordered or outright contradictory. However, they begin to cohere when considering that valence, intensity, and ingroup membership all affect motivational relevance, leading to the argument that the amygdala responds flexibly to motivationally important cues (Cunningham, Van Bavel, & Johnsen, 2008; Sander, Grafman, & Zalla, 2003; Vuilleumier, 2005).

As a field used to dealing with the impact of subjective construals on behavior, seeing the interplay between the person and situation on brain responses should come relatively easily to social psychologists, but this perspective is not as familiar to all neuroscientists. Making social psychological perspectives more widely known, though, is hampered by the need to cross disciplinary boundaries. Social psychologists are influenced by the same disciplinary partisanship that other researchers are, so we tend to publish within a limited number of journals and present our research at a small number of conferences. New social neuroscience journals and conferences may help in this regard as these tend to be read and attended by researchers who are interested broadly in social phenomena, regardless of the area of their original training. We can also be mindful of the way we reward work in our field so that we are not overly critical and unsupportive of researchers who work at the interface of multiple disciplines and consequently choose to present their research in venues that differ from the norm.

## FINAL THOUGHTS

Social and biological approaches have historically been cast as antagonistic. Ultimately, though, our sociality and biology do not exist in isolation. Social behavior is the result of biological processes, and biological processes are in turn shaped by social perceptions. With this recognition comes the natural conclusion that explicitly studying the neural and biological basis of social behavior (and of the social bases of neural and biological processes) will be informative. This paper has highlighted some examples of progress made using this approach, while arguing for an even greater infusion of social psychological perspectives into explorations of the neural bases of behavior. In fact, it may be appropriate to view social neuroscience as a particularly natural nexus for integration. Social psychologists are already versed in understanding the impact of subjective states on behavior, making us well-suited to understand their impact on the brain.



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