# SOCIAL NEUROSCIENCE

## Biological Approaches to Social Psychology

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# A BRIEF OVERVIEW OF SOCIAL NEUROSCIENCE

## Biological Perspectives on Social Psychology

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Near the end of the 20th Century, psychological scientists began to delve deeper into biological processes that may cause and be consequences of psychological processes. With this growing interest, research considering the biological processes involved in cognitive and affective processes grew, and these subfields were termed cognitive neuroscience and affective neuroscience. During this same period of time, social psychologists coined the term "social neuroscience" to unite and draw attention to research aimed at understanding biological aspects of social psychological processes and behaviors. Several theoretical, methodological, and empirical breakthroughs in social neuroscience have occurred since these early days. Indeed, empirical journals devoted to social neuroscience have blossomed (e.g., *Social Cognitive and Affective Neuroscience*, *Social Neuroscience*), and several books reviewed the early research in this field (Cacioppo et al., 2002; Harmon-Jones & Winkielman, 2007). This increase in interest in social neuroscience is revealed in a search for citations using the term social neuroscience as a topic. It shows that in the late 1990s, fewer than 50 publications and 500 citations per year occurred; whereas in 2014, there were more than 400 publications and 14,000 citations (Web of Science, 28 July 2015; http://wokinfo.com/).

This volume aims to provide a source of recent interesting, programmatic lines of research. In this introductory chapter, we define social neuroscience, briefly review its historical roots, and explain some of its benefits to social psychology. Finally, we preview the chapters in this volume.

### Definition

Biological approaches to social psychological processes and behavior have been named in several ways and hence defined in several ways as well. For example,

these approaches have been referred to as social psychophysiology, social neuropsychology, social cognitive neuroscience, social emotive neuroscience, and social cognitive and affective neuroscience. We prefer to use what we believe is the most commonly used name: *social neuroscience*. We also prefer to consider the biological approaches to social psychological processes in a rather broad way. Thus, we believe that social neuroscience, as a field, examines how nervous (central and peripheral), endocrine, and immune systems are involved in social psychological processes. Social neuroscience is an integrative and comprehensive field that seeks to understand mechanisms underlying and consequences of social psychological processes by combining biological and social approaches.

## Historical Roots

Historically, interest in the role of biological responses involved in social psychological processes can be seen in several places. For instance, the idea that biological responses could be used as a way of measuring social psychological processes that could not be easily measured by self-reports or overt behavior can be traced back to the 3rd Century BC. The Greek physician Erasistratus measured the heartbeat of a young man in the presence of his attractive stepmother to conclude that love, and not a physical illness, caused the young man's malady (Mesulam & Perry, 1972).

In the middle of the 20th Century, social psychological researchers used biological measures to measure unreportable psychological states. During this period of time in the United States, social norms prohibiting the public expression of racial prejudice began to emerge. Social psychological researchers interested in studying racially prejudiced attitudes took advantage of biological measures to circumvent individuals' concerns over expressing racial prejudice that might prevent researchers from accurately measuring self-reported racial attitudes. This early research revealed that White Americans had greater skin conductance responses (indicative of greater sympathetic nervous system activity) in response to Blacks compared to Whites (e.g., Rankin & Campbell, 1955; Vidulich & Krevanick, 1966). Also during this same period of time, researchers started using psychophysiological measures to investigate processes that might be unconscious and thus too subtle to assess with other methods (Lazarus & McCleary, 1951). To this day, interest continues in using the methods of social neuroscience to measure psychological processes that might not be assessed with other methods for reasons of social desirability or unawareness.

In addition to these historical interests in social neuroscience, researchers have examined how the brain is involved in social psychological processes and behaviors. The earliest attempts to link social psychology to brain processes occurred as a result of observations of how social psychological processes

changed drastically following injuries to the brain. For example, Phineas Gage showed dramatic changes in his personality and social behavior following a railroad accident that sent a spike through his ventromedial prefrontal cortex (Damasio, H., Grabowski, Frank, Galaburda, & Damasio, A. R., 1994; Harlow, 1868). Another early example is research on what was referred to as Klüver–Bucy syndrome. In the 1930s, Klüver and Bucy (1939) found that removal of the temporal lobes in rhesus monkeys caused reductions in emotional expressions and altered sexual behavior, among other behavioral changes (see also Brown & Schäfer, 1888). Similar emotional effects as a result of lesions to these brain regions in humans were later observed (Terzian & Ore, 1955)

In the 1980s and 1990s, several papers and books discussed the idea of a "social brain" and how certain brain functions are important for social psychological processes and social behaviors (e.g., Brothers, 1997; Gazzaniga, 1985). Also in the early 1990s, several social psychologists discussed the importance of combining psychological and biological approaches to gain a better understanding of social behavior (e.g., Cacioppo & Berntson, 1992; Klein & Kihlstrom, 1998). These early considerations of the "social brain" inspired researchers from various subfields to begin to use neuroscience approaches to gain insights into social psychological questions and assist in solving theoretical controversies (Adolphs, 1999, 2003; Blascovich, 2000; Ochsner & Lieberman, 2001; Winkielman, Berntson, & Cacioppo, 2001).

## Benefits of Social Neuroscience

Social neuroscience can benefit social psychology in several ways (see also Amodio & Harmon-Jones, 2012; Harmon-Jones & Devine, 2003). Often observers assume that the primary purpose of social neuroscience is to map social psychological processes onto certain brain structures or other biological responses. This type of research can help to establish ideas about the psychological functions of particular brain structures if multiple studies using conceptually similar manipulations are used. This establishment is important for understanding biological structures and responses involved in psychological disorders and may lead to effective treatments using neuroscience methods. In addition, knowing the psychological functions of specific structures can assist in neurosurgery, so that important psychological functions are not inadvertently harmed with the removal of nearby seizure-producing structures, for example.

This "mapping" type of research does indeed exist, but it is not the primary purpose of social neuroscience. The mapping of psychological processes to brain regions or other biological responses can be useful because it can serve as a starting point for theory-testing experiments. However, the mapping of psychological processes is potentially problematic. For most psychological processes that are of interest to social psychologists, it is very difficult to

establish that one particular neural structure, or even network of structures, is involved with one particular social psychological process or behavior (Cacioppo et al., 2003; Willingham & Dunn, 2003). That is, one-to-one mapping between psychological function and brain areas is very rare. Instead, many neural structures and networks are involved in many social psychological processes, and most social psychological processes are implemented in many neural structures and networks. Consequently, in the "mapping game," more and more psychological functions are ultimately assigned to a particular structure (e.g., the anterior cingulate cortex is involved in physical pain, social rejection, cognitive conflict, etc.), thus providing little benefit for research that tests psychological processes. However, this mapping function of neuroscientific research is only one of the functions of a neuroscience approach to social psychology. Below we consider several other benefits of a social neuroscience perspective.

First, social neuroscience research and theory can assist in addressing theoretical debates in mainstream social psychology. In cognitive psychology, several theoretical debates were informed by neuroscientific studies (e.g., debates about the nature of imagery, structure of memory, early versus late attentional selection). The same is true in social psychology. For example, in Chapter 6 of this volume, Inzlicht, Berkman, and Elkins-Brown discuss research using social neuroscience methods that has helped to arbitrate between competing accounts of the nature of self-control.

Second, methods used in social neuroscience provide a means of measuring brain/body activity unobtrusively and directly. Consequently, these methods provide information that is impossible to gather using other commonly used techniques. Measures of reaction times, self-reports, and overt behaviors are often inaccurate measures of psychological states, and they are thus often subject to alternative theoretical explanations. As discussed in Chapter 10 of this volume by Page-Gould and Danyluck, this use of neuroscience measures is particularly prevalent in research on prejudice because of various biases that may prevent individuals from reporting accurately.

Third, the neuroscientific study of social psychological processes and behaviors can inform research and theory in neuroscience more broadly, by illustrating the importance of social psychological variables in brain and body processes. For example, as reviewed in Chapter 11 of this volume by Moieni and Eisenberger, research on the experience of social rejection has revealed that the neural circuitry underlying social pain overlaps considerably with the neural circuitry underlying the experience of physical pain.

To summarize, social neuroscience integrates the theory and methods of neuroscience with those of mainstream social psychology to develop novel hypotheses. These hypotheses are then tested using a multitude of methods, including the typical measures used in social psychology as well as the measures of neuroscience. The best social neuroscience research does more than simply

use neuroscience methods to measure existing social psychological constructs: It incorporates ideas from other fields to achieve a better understanding of issues in social psychology, or in neuroscience more generally. Ideally, both social psychology and neuroscience benefit more broadly as a result of this integration of fields.

## Goals and Organization of the Book

In designing this volume, we hoped to capture the excitement of social neuroscience and accomplish two primary goals. First, we wanted to provide overviews of programmatic research in social neuroscience that addresses some of the primary processes of interest to social psychologists. Second, we wanted to showcase the theoretical and methodological diversity and depth of current research in social neuroscience. Thus, we have included chapters from researchers who represent a wide variety of theoretical approaches, including social, cognitive, clinical, personality, and evolutionary perspectives. We have also included chapters from researchers who use a wide variety of social neuroscience methods. These methods include:

1 electrophysiological methods such as electroencephalograms and event-related potentials;
2 hemodynamic measures, which measure changes in blood flow associated with changes in neural activity, such as functional magnetic resonance imaging;
3 non-invasive electrical stimulations to the brain that induce "virtual lesions" or temporary changes in neural activity, such as transcranial direct current stimulation and repetitive transcranial magnetic stimulation;
4 measurements and manipulations of hormones such as cortisol, testosterone, and oxytocin;
5 measurements of facial muscle responses using electromyography; and
6 measurements of sympathetic and parasympathetic nervous system responses using skin conductance responses and various indices of cardiovascular functioning.

## Overview of the Chapters

Next, we provide a brief overview of the exciting information covered in each chapter in this volume. In Chapter 2, entitled "Perceiving Persons: Social Cognitive Neuroscience Approaches," Curtis Von Gunten, Bruce Bartholow, and Hannah Volpert review recent social neuroscience research on person perception. They discuss how social neuroscience methods provide ways of accurately and directly measuring neural responses associated with psychological processes by circumventing socially desirable responses. In addition, they

discuss how some neuroscience measures can be used to separate the timing and contribution of underlying cognitive processes that influence more overt responses. Throughout these discussions, they emphasize the need for theory-derived research questions to guide which methods are used.

In Chapter 3, entitled "Persuasion Neuroscience: New Potential to Test Dual-process Theories," Stephanie Vezich, Emily Falk, and Matthew Lieberman review neuroimaging research designed to unpack the multiple processes involved in persuasion, from message presentation to encoding to evaluation. The use of neuroimaging methods during individuals' processing of persuasive messages has revealed that activity in certain brain regions, particularly the medial prefrontal cortex, predicts behavioral changes weeks after message presentation, and also in individuals who themselves were not exposed to the message. These results are discussed in the context of mainstream social psychological theories of persuasion, ranging from dual-process models to more recent single-process models.

In Chapter 4, entitled "Mentalizing," Joseph Moran and Jason Mitchell review neuroscience research that has revealed how the brain accomplishes mentalizing, or the process of understanding others' mental states and forming impressions of others. When individuals mentalize, a network of regions is activated. This network includes the medial prefrontal cortex, temporoparietal junction, and medial parietal cortex. Interestingly, this same network overlaps with the brain default network, which is a set of regions that is involved in non-social task demands. Together, these bodies of information suggest that some of the brain default mental activities involve inferring the intentions and mental states of other individuals.

In Chapter 5, entitled "Three Questions about the Neural Basis of Self," Jennifer Beer examines the neural basis of the self, defined as self-reflection or a person's capability and awareness of simultaneously playing the role of a perceiver and the object of that perception. The chapter details how specific brain regions underlie various aspects of self-processing, including enhanced encoding of the self, motivated self-evaluations, and self-enhancement. The chapter also suggests, however, that such brain involvement is not specific to self-processes and instead might reflect more basic cognitive functions related to reward, certainty, and abstraction.

In Chapter 6, entitled "The Neuroscience of 'Ego Depletion': How the Brain Can Help us Understand why Self-control Seems Limited," Michael Inzlicht, Elliot Berkman, and Nathaniel Elkins-Brown ask how examining the brain can inform recent debates about the nature of so-called ego depletion, which is a phenomenon akin to mental fatigue and is associated with reductions in self-control. Although the dominant account of self-control likens it to a limited resource that becomes depleted over time, the chapter details the shortcomings of such an account, while suggesting an alternative that likens self-control to a choice people make. Critically, the authors provide support

for the latter by discussing recent neuroscience findings that liken self-control to a valuation process that changes dynamically over time.

In Chapter 7, entitled "Existential Neuroscience: A Review and Outlook for the Case of Death Awareness," Markus Quirin and Johannes Klackl discuss the area of existential neuroscience, which examines how research on the brain aids in a better understanding of how existential threat influences human motivation and behavior. The chapter reviews studies on the neural mechanisms underlying mortality awareness, including how mortality awareness shapes our neural responses to culture, affiliative targets, and in-group members, responses which have been put forward to serve defense functions.

In Chapter 8, entitled "Oxytocin Conditions Human Group Psychology," Carsten De Dreu provides a wide-ranging discussion of the roots of human cooperation, examining the neuroendocrine basis of group psychology and a specific examination of the peptide hormone, oxytocin. Although oxytocin is sometimes referred to as the "love drug," this chapter provides a more nuanced perspective, suggesting that oxytocin modulates three critical aspects of human group psychology: in-group favoritism or in-group love; tendencies to protect the in-group against outside threat; and compliance and adherence to group norms. The chapter also covers the basic methods used to study oxytocin, including some of their weaknesses.

In Chapter 9, entitled "Sex, Love, Temptation: Human Mating Motives and the Hormones that Underlie them," Jon Maner and Tania Reynolds integrate theories of social psychology and evolutionary biology to propose a model that has tested the adaptive motivations involved in various types of relationships, ranging from early romantic attractions to long-term romantic partnerships. Motivations to mate cause individuals to seek novel sexual mating opportunities, whereas motivations to maintain a relationship cause individuals to protect the relationships they already have. This program of research has also shed light on the role of various endocrine systems in these two broad classes of relationship motivations.

In Chapter 10, entitled "The Biological Perspective on Intergroup Relations," Elizabeth Page-Gould and Chad Danyluck review research on the neuroscience of intergroup relations, covering the topics of prejudice, discrimination, bias, intergroup contact and interaction, as well as stigma. The chapter highlights how measurement of psychophysiological and biological outputs supports the idea that we pay more attention to and empathize with in-group members more than out-group members, but the capacity exists to process any social stimulus with equivalent depth and empathic concern, if sufficiently motivated.

In Chapter 11, entitled "Neural Correlates of Social Pain," Mona Moieni and Naomi Eisenberger review evidence accrued since the mid-2000s which has revealed that the neural substrates involved in processing physical and social pain (i.e., rejection) overlap substantially. This neural substrate involves the

dorsal anterior cingulate cortex and anterior insula. This program of research has illustrated how the integration of neuroscience with social psychology benefits both parent disciplines by inspiring new research on the effects of social pain on physical pain and vice versa.

In Chapter 12, entitled "A Review of Social Neuroscience Research on Anger and Aggression," Douglas Angus, Dennis Schutter, David Terburg, Jack van Honk, and Eddie Harmon-Jones review neuroscience evidence suggesting that social aggression is caused by hormonally driven imbalances within and between subcortical and cortical levels of the brain. Greater testosterone levels relative to cortisol levels predispose individuals toward approach motivation, in which they respond to potential threats with aggression. This same imbalance reduces subcortical–cortical coupling, which results in a decrease of the top-down control that may inhibit aggression. The frontal cortex also shows imbalances: The left frontal cortex is associated with approach motivation and anger, whereas the right frontal cortex is associated with avoidance motivation and anxiety (Harmon-Jones, 2003; van Honk, Harmon-Jones, Morgan, & Schutter, 2010).

In Chapter 13, entitled "Cultural Neuroscience: Bridging Cultural and Biological Sciences," Joan Chiao and Katherine Blizinsky introduce cultural neuroscience, which is defined as the research field that investigates how cultural and genetic factors shape the human brain and behavior. This chapter provides an overview of theory and methods in cultural neuroscience as well as a review of empirical advances in the emerging field. Notably, the authors discuss how findings in cultural neuroscience can inform the gap in population health disparities.

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