Advances in neuroimaging methods and techniques and interest in understanding the neural bases of psychological phenomena are rapidly changing how the capacity for self-control is being addressed. An approach dubbed Social Cognitive and Affective Neuroscience (SCAN) integrates research across multiple levels of analysis, leading to important findings that link the basic social, cognitive, and affective processes underlying self-control to their neural substrates. This chapter illustrates how a SCAN approach can be useful for addressing questions including the problem of how to enable researchers from different areas with different types of expertise and interests in self-control to communicate with one another and most effectively use each other’s (sometimes highly technical) theories and methods. Towards this end, we begin by describing the basic goals of SCAN and some of the key challenges facing researchers who adopt this approach. We then describe how this approach is currently being used to build an integrative understanding of the processes underlying a particular type of self-control process that involves actively reinterpreting the meaning of an emotionally evocative stimulus to meet and/or modulate one’s feelings. We conclude by discussing important future research directions in this area.
Brain imaging has become widely applied to the study of aging because of substantial advances in technology and the diffusion of this technology throughout the world of human neuroscience. These advances together with better clinical characterization and more sophisticated molecular approaches now permit us to better understand relationships between brain aging and brain disease. In this setting, the concept of “normal aging” may become better defined by our ability to clearly characterize chemistry, anatomy, and physiology of the aging brain using multimodal approaches. Future directions for this cognitive neuroscience of aging will be the detection of presymptomatic forms of age-related disease, understanding how different diseases interact in normal older people, and the definition of age-related processes that are independent of disease and that affect specific cognitive, anatomic, and neurochemical systems.

This book explores whether the mental order corresponds to the order of structures, events, and processes in one part of the neural order, namely, the cerebral cortex. For clarity and simplicity, this means the search for a spatial and temporal order in the cerebral cortex that matches the cognitive order in every respect. A change or difference in the cortical order corresponds to a change or difference in the mental order. The principal aim of this book is to map cognitive networks onto cortical networks. It has implications for cognitive neuroscience, neurophysiology, neurobiology, neuroimaging, neurology, neurosurgery, psychiatry, cognitive psychology, and linguistics. The book will also interest students in all the disciplines of neuroscience and can be used as a text or collateral reading in courses on systems neuroscience, behavioral neuroscience, cognitive science, network modeling, physiological psychology, and linguistics.
Facts, fictions and the future of neuroethics
Michael S. Gazzaniga

This chapter argues that cognitive neuroscience has three main issues with respect to the current field of neuroethics. First, cognitive neuroscience can help with some current ethical dilemmas such as whether the embryo has the moral status of a human being. Secondly, there are important ethical areas to which neuroscientists are being asked to contribute when, in fact, they should not be. For instance, neuroscience has nothing to say about concepts such as free will and personal responsibility, and it probably also has nothing to say about such things as antisocial thoughts. Finally, cognitive neuroscience is building an understanding of how brain research will instruct us on ideas like universal morals possessed by all members of our species. This fundamental development will find cognitive neuroscience becoming central to the modern world's view of ethical universals.

From genome to brainome: charting the lessons learned
Ronald M. Green

This chapter explores converging and diverging issues between genetic and neuroimaging science research and clinical applications. It shows how genetics is intensely communal and familial, while the study of the central nervous system is more focused on the individual. Nonetheless, we learn how the ‘therapeutic gap’ gene hype, and the risk of scientific over-promising from both can lead to advances that may make situations worse before they make them better.
Michael S. Gazzaniga
Larry R. Squire

in The History of Neuroscience in Autobiography: Volume 7

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Michael S. Gazzaniga carried out original studies of human brain laterality and function in split-brain patients, work that has rich implications for consciousness, free will, and the self. He introduced the term cognitive neuroscience, helped develop the discipline, and founded the discipline’s flagship journal. More recently, he has effectively written several books for a broad audience about brain and mind, showing generations of readers the human face of science.

Simultaneous EEG and fMRI
Markus Ullsperger and Stefan Debener (eds)

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Systemic interactions in brain networks have been successfully studied in vivo using non-invasive methods such as electroencephalography (EEG) and functional magnetic resonance imaging (fMRI), for many years. The rate-limiting step, however, is that each method can only map selective aspects of brain function, while missing other key aspects. Furthermore, the inferences on neuronal processes and information flow are often rather indirect. By simultaneously combining both methods, the researcher is better able to make optimal use of their specific advantages while compensating for their disadvantages. In recent years, research has shifted and expanded, from demonstrating technical feasibility, to methodological issues of artifact control, new ways of analyzing and integrating data, and to applications for scientific and clinical questions. Combined EEG and fMRI methods now cover everything from physiological questions on the bases of the two recorded signals, to more specific questions on the mechanisms of certain cognitive and pathological functions like epileptic brain activity. Simultaneous EEG and fMRI provides the interested researcher with the tools to establish a simultaneous EEG-fMRI laboratory, as well as for those scientists who are interested in integrating electrophysiological and hemodynamic data. As evidenced by the diversity of topics presented, this is a dynamically developing field in which several
approaches are being tested, validated, and compared. Chapters are dedicated to the physiological bases of the measured signals, technical setup, sources of artifacts and data de-noising, various approaches of data analysis and fusion, as well as applications. In addition, open questions and directions for future research are outlined.

Cognitive Neuroscience, Development, and Psychopathology
Jacob A. Burack, James T. Enns, and Nathan A. Fox (eds)

The premise of this volume is that the disciplines of cognitive neuroscience, development, and psychopathology are complementary in the study of human perception and attention. Although each discipline emerges from a decidedly different and sometimes even incompatible worldview, together they lead to better science. Development is the study of the myriad of changes that occur over the lifetime of an individual, with the focus on uncovering universal categories and structure in that change. In contrast to this emphasis on universals, the study of psychopathology is premised entirely on the observation of differences between individuals, as researchers of psychopathology try to make sense of a vast array of debilitating conditions, histories, and experiences that lead to specific and usually deleterious outcomes among specific individuals, groups, or populations. The study of cognitive neuroscience offers researchers a wide variety of tools with which to examine specific cognitive functions and behaviors, with a focus on the mechanisms internal to the brain, which underlie functional and behavioral outcomes, especially specific and fine-grained analyses of the neural underpinning of behavior. With the integration of these three areas of scholarship, the emphasis in this volume is on the functional role that neural-based behavior plays in the larger social-emotional-intellectual world and how these neural processes develop over time among typically developing children and adults as well as those with anxiety, depression, autism, dyslexia, and childhood experiences of abuse and neglect.
Commentary: Neuroscience frontiers of cognitive aging: Approaches to cognitive neuroscience of aging

Roberto Cabeza

in New Frontiers in Cognitive Aging

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This chapter describes three methodological approaches of cognitive neuroscience of aging, and for each one, it underscores some interesting findings and notes some current issues. These are the neuropsychological approach, correlational approach, and activation imaging approach. The neuropsychological approach compares cognitive changes in healthy aging and in patients with brain damage due to trauma, stroke, or degenerative disorders. The correlational approach associates cognitive measures to neural measures that were independently obtained. The activation imaging approach measures brain activity in young and older adults during cognitive performance.

Learning and Memory: Donald Hebb, Brenda Milner, and H. M.

Gordon M. Shepherd

in Creating Modern Neuroscience: The Revolutionary 1950s

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Item type: chapter

This chapter details studies on learning and memory by Donald Hebb and Brenda Milner. The leading hypothesis for the neural basis of learning and memory is due to Donald Hebb, as presented in a textbook in 1949; the activity-dependent Hebb synapse remains the focus of much current research. Research in the 1950s extended cortical studies to the limbic lobe, reporting the first evidence for neural mechanisms in the amygdala and other subcortical structures related to emotional behavior. A new chapter in studies of the brain opened with surgical operations for the relief of epilepsy, which showed the critical role of the hippocampus in memory. Bilateral removal of the hippocampus for relief of chronic debilitating epilepsy rendered a patient, H. M., unable to form new memories. A series of studies of H. M., beginning in 1957 and lasting for half a century, by Brenda Milner, delineated the role of the hippocampus in the formation of memories, and launched the new field of cognitive neuroscience.
Some Growing Tips
C. J. Brainerd and V. F. Reyna

in The Science of False Memory

This chapter considers what the near future of the science of false memory may hold by exploring some emerging areas of experimentation. It focuses on three specific areas: mathematical models of false memory, aging effects, and cognitive neuroscience.

Neuroscience and the Design of Educational Places
John Paul Eberhard

This chapter is centered on a discussion of the architecture of schools, including three examples of existing schools. It includes a discussion of how cognitive neuroscience is helping to understand the experiences of children in classroom settings. An important portion of this chapter is devoted to descriptions of potential hypotheses (with background introductions) related to children in classrooms.

Shared affective motion experience (SAME) and creative, interactive music therapy
Istvan Molnar-Szakacs, Vanya Green Assuied, and Katie Overy

One of the most exciting recent developments to emerge from cognitive neuroscience, with the potential to impact significantly both on our understanding of music and of the therapeutic uses of music, is the discovery of the so-called human mirror neuron system (MNS). In
essence, the MNS allows us to understand and predict the behaviour of others, by engaging the neural regions required to produce such behaviour ourselves. A working model has recently been developed of the potential role of the MNS in emotional, embodied responses to music, called Shared Affective Motion Experience (SAME). According to the SAME model, musical sound is perceived not only in terms of the auditory signal, but also in terms of the intentional sequences of expressive motor acts behind the signal. Thus, even a simple musical listening experience carries within it the presence of human action and human agency, and can facilitate feelings of empathy and social bonding. This chapter elaborates upon and extends the argument in relation to creative, interactive music-therapy. It suggests that the situation of shared music-making is a sophisticated example of the potential of music to express emotion and stimulate empathetic understanding.

How Has Cognitive Neuroscience Contributed to Social Psychological Theory?
Adrianna C. Jenkins and Jason P. Mitchell

in Social Neuroscience: Toward Understanding the Underpinnings of the Social Mind
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Item type: chapter

Even the most casual follower of developments within social psychology is unlikely to have missed the recent surge of studies adapting the methods of cognitive neuroscience to questions about the nature of human social cognition. With this surge of neuroimaging studies have come novel theoretical contributions to social psychological theory. This chapter reviews three such contributions. The first has been the somewhat unexpected observation that social cognition consistently elicits a distinct pattern of brain activity that distinguishes it from non-social cognition, strongly suggesting that the mental operations giving rise to human social abilities do not simply “piggyback” on general-purpose cognitive processes but instead rely on a set of processes specialized for social thought. Second, recent neuro-imaging work has revitalized a question that, although of central importance to social cognition, has been relatively understudied by social psychologists—namely, what are the mechanisms that allow one person to successfully infer the mental states (thoughts, feelings, motivations) of others? Third, perhaps the most unique contribution made to social psychology by the use of neuroimaging has been the observation that brain regions subserving social cognition appear to have a special status in the brain.
Introduction
William R. Uttal

in Mind and Brain: A Critical Appraisal of Cognitive Neuroscience

This book examines the role played by brain imaging in cognitive neuroscience by exploring published studies and related literature that compare brain images to cognitive processes. It also discusses whether brain imaging and other recording techniques have any role in providing a solution to the question of how the brain makes the mind. The book discusses two ontological postulates exerting influence on the development of the theory regarding the relationship between the mind and the brain, and emphasizes that no concrete solution to the mind–brain problem is provided by macroscopic brain imaging or any other electrical recording activity. It reports the implications of the ontological postulates for philosophy and neuroscience, and also discusses how these postulates affect the course of scientific psychology. Some conceptual and technical issues such as the attractiveness of brain images, the problem of interpreting and defining the mental process, the paucity of quantification, and indirectness as a measurement of brain activity are also discussed.

Why Methods Matter in the Study of the Biological Basis of the Mind: A Behavioral Neurologist’s Perspective
Mark D’Esposito

in The Cognitive Neuroscience of Mind: A Tribute to Michael S. Gazzaniga

The chapter focuses on the relationship between the brain and behavior, and discusses both how methods play an important role in cognitive neuroscience, as well as the contributions made by Michael Gazzaniga in the field of cognitive neuroscience. Gazzaniga, who is considered to be the greatest ambassador of cognitive neuroscience, launched the Journal of Cognitive Neuroscience and created the Cognitive Neuroscience Society for better understanding and development in the discipline of cognitive neuroscience. Lesion studies and functional magnetic resonance imaging (fMRI) are two important methods, and the author
discusses their significance in studying the relationship between the human brain and behavior.

**Social Neuroscience**  
Alexander Todorov, Susan Fiske, and Deborah Prentice (eds)

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Item type: book

The field of social cognitive neuroscience has been at the forefront of study for many psychologists over the past decade or so. Much of the spur for this new field has come from the development of functional neuro-imaging techniques, making possible unobtrusive measurement of brain activation over time. Now we are able to ask such questions as: are there regions of the brain in the inferior temporal cortex dedicated to face processing? There are many other such intractable questions that we can ask now that we could not even imagine asking thirty years ago. This book is interested in questions such as: How do we understand and represent other people? How do we represent social groups? How do we regulate our emotions and offer socially undesirable responses? This book is divided into four sections. The first deals with understanding and representing other people. The second deals with representing social groups. The third section deals with the interplay of cognition and emotion in social regulation. The final section considers a range of questions that have emerged in the context of social neuroscience research.

**COGNITIVE NEUROSCIENCE, DEVELOPMENT, AND PSYCHOPATHOLOGY**  
James T. Enns and Jacob A. Burack

in Cognitive Neuroscience, Development, and Psychopathology: Typical and Atypical Developmental Trajectories of Attention

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Item type: chapter

How do scientists of human behavior from three different perspectives approach the comparison of two highly publicized athletes of the 2008 Olympics: Shaun Johnson, a female American gymnast who is 5 feet tall, and Yao Ming, a male Chinese basketball player who is 7-foot-6? A typical developmentalist might well focus on the similarities in their physical and neural development, which is at one level of description
the same, despite vast differences in gender, ethnicity, and physique. A psychopathologist would, on the other hand, ask what is unique about each of these individuals that sets them apart from one another and the rest of the population. Finally, a cognitive neuroscientist might construct fine-grained cognitive tasks that probe how their different physiques and physiologies are manifest at the level of detailed neurology and behavioral analyses. This work follows each of these three perspectives as they explore the topics of anxiety, depression, autism, dyslexia, and infants at risk.

Molecular Mechanisms of Memory Consolidation
Kevin M. Hellman and Ted Abel

in Sleep and Brain Plasticity
Published in print: 2003 Published Online: September 2009
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Item type: chapter

This chapter describes how neuromodulators and electrophysiological phenomena in the hippocampus during NREM and REM sleep affect intracellular signaling pathways that are known to mediate memory consolidation. The hippocampus appears to be a locus for consolidation during sleep, because it is required for the consolidation of spatial learning and contextual fear conditioning and these tasks require sleep for consolidation. During this period of sleep, replay of activity occurs in the hippocampus in oscillations that have the ability to alter synaptic plasticity, perhaps via molecular cascades involved in LTP.

You, Me, and My Brain
Jamil Zaki and Kevin Ochsner

in Social Neuroscience: Toward Understanding the Underpinnings of the Social Mind
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Item type: chapter

How do we reconcile our tendencies to think of others as being similar to us with the importance and ease of seeing ourselves as different from others? This chapter adopts a social cognitive neuroscience (SCN) approach to address this issue, using information about the brain to constrain thinking about the psychological processes involved in perceiving people. It reviews neuroimaging research on self-perception,
emotion, and social cognition with an eye toward understanding the person perception processes that lead to our dual tendencies to see others as both like and not like ourselves. It reviews neuroimaging research on self-perception, emotion, and social cognition with an eye toward understanding the person perception processes that lead to our dual tendencies to see others as both like and not like ourselves. It differentiates between two modes of processing information about people—one that is a quick, direct, and bottom-up and another that is deliberative, reflective, and top-down. The chapter then examines whether self and other overlap may depend critically on which mode of processing perceivers are engaging.