Introduction

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In the previous edition of this book, Joseph LeDoux (2000) noted that the study of emotion, though long neglected, had become one of the major growth areas in cognitive neuroscience. Indeed, as demonstrated by the six superb chapters on emotion in the 2nd edition, the rediscovery of the “hot” aspects of cognition, along with the corresponding demonstration that animal models of emotion applied well to the human brain, placed research examining the neural basis of emotions at the absolute forefront of cognitive neuroscience. The neuroscientific study of emotion has continued to flourish, and in doing so it has led scientists to recognize that other hot aspects of cognition are equally due for attention, namely, the social aspects of cognition. In addition to foundational chapters on emotion, this section expands in this new edition to include the social brain.

The interdisciplinary field of cognitive neuroscience has provided ample evidence of the benefits of examining psychological constructs across multiple levels of analysis, from the molecular to the cultural. The nine chapters in this section cross many levels, from the role of gene expression in learning and memory to brain regions that subserve sensitivity to societal norms and embarrassment. Cacioppo and Berntson detail many of the advantages of multilevel analyses and trace the history of these efforts in social and affective neuroscience. Of course, a multilevel approach works only if people consider interactions across levels, such as how basic affective processes influence cognition and how cognitive processes modulate affect. This approach is evident at least in some degree in each chapter in this section, even as the primary focus tends to be at adjoining levels of analysis. What is clear is that research using multiple approaches is moving the field toward the ultimate goal of developing
coherent models of how the brain makes emotion and performs its social function.

One overriding theme in the previous edition was the role of the amygdala in emotional processes. There was a remarkable convergence of evidence highlighting the important role of the amygdala across animal species and paradigms. The importance of the amygdala continues to hold center stage in the neuroscience of emotion, as is evident in many of the present chapters. Schafe and LeDoux review the importance of the amygdala in fear. Rapid advances in neuroscience methods over the past 5 years have provided researchers with the opportunity to study the biochemical and molecular mechanisms that underlie learning and memory. For instance, research has demonstrated an important role of gene expression in long-term potentiation, which is perhaps the most likely candidate for the physiological basis of fear conditioning. Schafe and LeDoux also review research on the fascinating phenomenon of reconsolidation, in which recalled fear memories can be disrupted by processes similar to those active during consolidation of new memories. In the next chapter, Phelps describes imaging and patient studies demonstrating the crucial role of the amygdala in human emotion and cognition. Her research investigates the role of the amygdala in affective learning and attention/perception. She also describes recent research on the cognitive and social basis of fear learning, such as learning through instruction and observation. The chapter by Adolphs reviews research showing that damage to the amygdala can impair the processing of social cues of emotion.

Of course, the amygdala is not the only brain structure that is important for emotion. The hippocampus plays an important role both in contextual fear conditioning and in the memory of emotional events. Sapolsky addresses how stress affects memory processes as a function of the type of stress and type of memory. Although some degree of stress facilitates emotional memories, chronic and severe stress can have devastating consequences, especially for hippocampus-dependent memory and cognition. At the same time, severe stress can lead to enhanced consolidation of amygdala-dependent memories. Understanding how specific forms of stress can have an impact on different brain structures and cognitive processes is important for understanding the effects of traumatic experiences on psychological processes. In their chapter, Breiter and Gasic propose an information backbone consisting of many brain regions, especially in the mesolimbic dopamine pathway, that is responsible for processing reward and aversive input. The existence of this integrated system is supported by recent imaging and neurophysiological studies. This system might have important implications for understanding and classifying various psychiatric disorders based on deficits in processing reward and aversive inputs.

Three of the chapters focus on the role of the prefrontal cortex in social cognition and social emotions. Since the last edition an entirely new field has emerged, which some have called the social brain sciences. This new field encompasses research using the approaches of evolutionary psychology, social cognition, and especially neuroscience (e.g., patient studies, brain imaging) to study social behavior. As previously noted by Adolphs (2003), the social brain sciences represent a sometimes uneasy alliance between evolutionary psychology and social cognition. The successful marriage of these two areas is due to their adopting the methods of neuroscience and largely restricting the domain of empirical study to emotional aspects of cognition. Thinking about other people entails emotional responses that thinking about vegetables, say, does not. The social and emotional aspects of the brain are inexorably linked, with the adaptive significance of emotions being closely linked to their social value, and nearly all social interaction produces affective responses.

Of course, interest in understanding the neural basis of social behavior is not new. Since the time of Phineas Gage, it has been known that damage to certain brain regions (e.g., the medial prefrontal cortex) interferes with social and emotional competence while not affecting cognitive competence in other domains. Indeed, Cacioppo and Berntson's chapter traces much of this history. More recently there has been growing interest among social psychologists and cognitive neuroscientists in using brain imaging to study social cognition. This research has identified a number of brain regions that appear to subserve highly specialized social capacities, such as recognition of faces and emotional expressions, theory of mind, social emotions such as empathy, judging trustworthiness and attractiveness, cooperation, and so forth. The gist of these studies is that "people" are given privileged status by the brain as it processes objects in the environment (see Mitchell, Heatherton, and Macrae, 2002).

The social brain sciences approach is providing new insights into long-standing questions regarding social behavior. For example, Macrae, Heatherton, and Kelley describe research demonstrating how brain imaging was able to resolve a long-standing debate in social psychology regarding the processes responsible for the self-referential enhancement effect in memory. The special role of self is also evident in Klein's chapter, in which he examines how people store information about themselves. He concludes that there is a subsystem of semantic memory that is dedicated to storing personality trait information in summary form, and that this system is not dependent on episodic memory (as revealed by studies of amnesic patients). As Klein notes, the advent of neuroscience has allowed researchers to examine vexing questions about the self that were first raised, but not answered, by William James.
It is clear from recent research that many aspects of social behavior rely on specialized regions of the prefrontal cortex. For instance, Macrae, Heatherton, and Kelley discuss the importance of the medial prefrontal cortex for many aspects of social cognition, such as theory of mind. In their chapter, Beer, Shimamura, and Knight review various executive functions of prefrontal cortex, such as how dorsolateral regions are involved in control over attention. They also discuss the important role of the prefrontal cortex, especially orbitofrontal cortex, in the integration of emotion and cognition. Their studies of patients with prefrontal brain injury document impairments in the social domain, such as understanding how other people interpret their behavior, a capacity that requires theory of mind. The social brain sciences are in their infancy, with scholars from widely diverse areas (e.g., social psychology, neuroscience, philosophy, anthropology) working together and across levels of analysis to understand fundamental questions about human social nature. At the same time, there has been rapid progress in identifying the neural basis of many social behaviors. Many of the chapters in this section reflect this new field and describe some of the exciting new discoveries about human social behavior.

The chapters in this section make it clear that the study of emotion continues to be a strong growth area in cognitive neuroscience. Moreover, it has expanded to include the closely connected social brain. As an organ that has evolved to solve adaptive problems, the brain relies on emotional processes to solve challenges to successful adaptation. For humans, many of the most pernicious adaptive problems involve other humans, such as selecting mates, cooperating in hunting and gathering, forming alliances, competing over scarce resources, and even warring with neighboring groups. Interacting with other humans produces emotion, and these emotions serve as guidelines for successful group living. For example, behaviors such as lying, cheating, or stealing are discouraged by social norms in all societies because they decrease survival and reproduction for other group members. They also elicit vigorous emotional responses, knowing whether to trust somebody requires intact emotional processing systems, as is made clear by Adolphs’s chapter. Hence, any true understanding of human nature will require a full consideration of both the emotional and the social brain. We expect that research on this topic will continue to be on the cutting edge of cognitive neuroscience in the next decade.

REFERENCES

