Cognitive Neuroscience of Memory

Within the last two decades, the field of cognitive neuroscience has begun to thrive with technological advances that non-invasively measure human brain activity. This is the first book to provide a comprehensive and up-to-date treatment on the cognitive neuroscience of memory. Topics include cognitive neuroscience techniques and human brain mechanisms underlying long-term memory success, long-term memory failure, working memory, implicit memory, and memory and disease. *Cognitive Neuroscience of Memory* highlights both spatial and temporal aspects of the functioning human brain during memory. Each chapter is written in an accessible style and includes background information and many figures. In his analysis, Scott Slotnick questions popular views, rather than simply assuming they are correct. In this way, science is depicted as open to question, evolving, and exciting.

Scott D. Slotnick is an Associate Professor of Psychology at Boston College, Editor-in-Chief of the journal *Cognitive Neuroscience*, and author of the book *Controversies in Cognitive Neuroscience*. He employs multiple cognitive neuroscience techniques to investigate the brain mechanisms underlying memory including functional magnetic resonance imaging (fMRI), electroencephalography (EEG), and transcranial magnetic stimulation (TMS).

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This book is dedicated to my incredible daughter Sonya, for dominating my hippocampal sharp-wave ripples these past twelve years

As regards the question . . . what memory or remembering is . . . it is the state of a presentation, related as a likeness to that of which it is a presentation; and as to the question of which of the faculties within us memory is a function . . . it is a function of the primary faculty of sense-perception, i.e. of that faculty whereby we perceive time.

(Aristotle, [350 BCE] 1941, p. 611)

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Preface

The human brain and memory are two of the most complex and fascinating systems in existence. Within the last two decades, the cognitive neuroscience of memory has begun to thrive with the advent of techniques that can non-invasively measure human brain activity with high spatial resolution and high temporal resolution.

This is the first book to provide a comprehensive treatment of the cognitive neuroscience of memory. It is related to three classes of other books. First, textbooks on cognitive psychology or cognition provide broad overviews of the cognitive psychology of memory and therefore only consider a small fraction of the work on the cognitive neuroscience of memory. Second, textbooks on cognitive neuroscience provide broad overviews of the entire field and also consider only a small fraction of the work on memory. Third, more specialized books on memory focus on the cognitive psychology, the behavioral neuroscience, or the computational modeling of memory rather than the cognitive neuroscience of memory.

This book highlights temporal processing in the brain. Cognitive neuroscientists predominantly use functional magnetic resonance imaging (fMRI) to identify the brain regions associated with a cognitive process. Although fMRI has excellent spatial resolution, this method provides little if any information about the time at which brain regions are active or the way in which different brain regions interact. By emphasizing both spatial and temporal aspects of brain processing, this book provides a complete overview of the cognitive neuroscience of memory and aims to guide the future of memory research.

Each chapter is written in an accessible style and includes background information and many figures. Debated topics are discussed throughout the text. The most popular view is routinely questioned rather than simply assumed to be correct, as is done in the vast majority of textbooks. In this way, science is depicted as open to question, evolving, and exciting.

The audience for this book is educated lay people interested in the cognitive neuroscience of memory and undergraduate students, graduate students, and scientists who are interested in a comprehensive up-to-date treatment of this topic. Each chapter includes learning objectives, an introduction, sections on key topics, a summary, review questions, and

recommended scientific articles. At a college or university, this book could serve as a supplemental textbook in lower-level courses (for instructors who desire a comprehensive treatment on this topic) or as a main text in an intermediate-level undergraduate course, an advanced-level undergraduate course, or a graduate seminar (with instructor lectures, student presentations, and discussions of the recommended scientific articles).

Many individuals significantly improved the quality of this book. First and foremost, I thank Matthew Bennet, my editor. Without his vision, guidance, and support, this book would not exist. I am grateful to Jessica Karanian, Brittany Jeye, and two anonymous reviewers for providing invaluable comments and suggestions on the entire book. I thank Elizabeth Chua for her expert comments on the transcranial direct current stimulation section (and for providing a photograph illustrating this technique) and Lauren Moo for her insightful comments on the explicit memory and disease chapter. Finally, I thank Jacqueline French for her skilled copy editing and appreciate all of the professionals at Cambridge University Press, including Valerie Appleby, Brianda Reyes, Srilakshmi Gobidass, and Maree Williams-Smith, who made the production of this book a smooth process.