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Edited by John Hart , Michael A. Kraut
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Neural Basis of Semantic Memory

The advent of modern investigative techniques to explore brain function has led to major advances in understanding the neural organization and mechanisms associated with semantic memory. This book presents current theories by leading experts in the field on how the human nervous system stores and recalls memory of objects, actions, words and events. Chapters range from models of a specific domain or memory system (e.g. lexical–semantic, sensorimotor, emotion) to multiple modality accounts; from encompassing memory representations, to processing modules, to network structures, focusing on studies of both normal individuals and those with brain disease.

Recent advances in neuro-exploratory techniques allow for investigation of semantic memory mechanisms noninvasively in both normal healthy individuals and patients with diffuse or focal brain damage. This has resulted in a significant increase in findings relevant to the localization and mechanistic function of brain regions engaged in semantic memory, leading to the neural models included here.

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Preface

As investigative techniques have advanced, there has also been a significant increase in information regarding the storage and access of semantic memory in the human brain. The initial investigations in this area were limited to lesion studies focusing on delineating the organization of the lexical–semantic system for categories of objects and entities. With the advent of modern neuroimaging and brain activation studies, investigations of semantic processing in normal, healthy individuals have resulted in the shaping of the functional–anatomic architecture of semantic memory for entities (e.g. object, animals, and actions) in the human brain. These advances have led to the maturation of the basic knowledge base to the point that a work dedicated to the neural organization of semantic memory was indicated.

Just as in any emerging field, there has been less agreement in some domains than in others, as is evidenced in this book by several alternative accounts for the same general neural instantiation for a specific aspect of semantic memory. It is our belief that we will continue to balance multiple accounts of neural mechanisms and localizations associated with semantic memory, even with refinement in experimental tools. The reasons for this may relate to difficulties inherent in establishing functional–anatomic consistencies in general for semantic memory, aside from broad regions associated with common semantic functions. These reasons include, but are not limited to, individual variations of the anatomic substrates that encode semantic memories, different and ever-changing life experiences (affecting salience for example), the likely existence of multiple neural mechanisms to perform certain semantic functions, variability in the extent of semantic memory recall engaged depending on the task to be performed, and likely a select set of semantic memory instantiations that are common to all humans.

The focus of this book is on current theories of components of semantic memory that also encompass the neural elements associated with these components. Other than a concentration on the memory of single entities

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(objects, animal, actions, etc.), the chapters range from being specific to a domain and/or memory system (e.g. lexical–semantic, sensorimotor, multiple modalities, etc.) or amodal; cover memory representations, processing, both, and/or parallel network structures; general storage principles of knowledge; and/or focused on studies of normal, healthy individuals as well as those with brain disease. The neural specification ranges from anatomic localizations, physiological accounts, mechanistic explanations, and in some instances extend to providing insights into pathophysiological disruptions of semantic memory.

The following chapters elucidate the leading theories of neural organization of semantic memory, with each extending from the unique approaches of the investigators. Investigators have focused on (i) performing extensive studies on patients with lesions and utilizing the inferences from their performance to inform models of neural function, (ii) insights from electrophysiological measurements of semantic operations, (iii) applying theoretical models to understanding the formal thought disorder in schizophrenia, (iv) the long-running debate in semantic memory over the representations of nouns and verbs and their semantic memory conceptual counterparts of objects and actions, (v) uncovering the essential role of subcortical nuclei in semantic memory, which had been obscure before the advent of current neuroinvestigative techniques, and (vi) overarching models of semantic memory stemming from a variety of investigative perspectives. As those of us investigating semantic memory have gleaned so much from these approaches, we are confident the readers of this book will, too.

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