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Book review

The Oxford Handbook of Memory **Endel Tulving and Fergus Craik, Oxford University Press, 2000**

The Oxford Handbook of Memory, edited by Endel Tulving and Fergus Craik, is an exiting and up-to-date work on the scientific research of memory. This 700 page *Handbook* contains 39 chapters by as many different head authors, most of them acclaimed experts in their field (e.g., John Anderson, Gordon Bower, Roger Ratcliff & Gail McKoon, Douglas Hintzman).

Each chapter is concise and easily accessible to the novice reader. This makes the *Handbook* suitable for use in advanced undergraduate and perhaps even graduate courses on human memory. One of the most salient aspects of the Handbook is its broad scope. The book starts off with several general and historical chapters (''study of memory'') after which it deals with ''memory in the laboratory'' (subsections: acts of memory, contents of memory, reflections in memory and awareness in memory), ''memory in life'' (subsections: memory in development, memory in use and memory in decline) and, finally, ''organization of memory'' (subsections: neural substrates of memory and theories of memory). It should be noted however that despite the *Handbook*'s broad scope, semantic memory tasks such as lexical decision are hardly discussed at all. On a more mundane point, the *Handbook* looks very attractive from outside. It is a hard cover book that will probably last a lifetime.

As stated in the preface, the editors set out to ''summarize the current state of the science of memory'' (p. vi), and I believe they have achieved their goal. This leaves, of course, the question ''So what *is* the current state of the science of memory?'' Here, I will focus on four defining characteristics that the science of memory and the *Handbook* have in common. First, *fashion* has a considerable impact on memory research. For instance, a hot topic in memory research today is the false memory phenomenon. This somewhat surreal term often simply denotes that after subjects have studied a list of related exemplar words (e.g., LETTERS, READ, HARD COVER) subjects tend to classify the never-seen prototype word (e.g., BOOK) as old on a subsequent recognition test. The fact that people can remember events that did not occur is of importance for the evaluation of eyewitness testimonies and claims of child abuse. Another hot topic in memory research concerns the role of consciousness. Previous exposure to a stimulus can affect its later processing, even if subjects are completely unaware of the earlier presentation. This has been labeled implicit memory, to be contrasted with conscious or explicit memory. The *Handbook* is fashionable in that it pays a lot of attention to these recent trends in memory research.

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Second, there is a lack of interest for *computational* memory models. Computational memory models try to explain how information is represented and processed. Of the 39 chapters, only three are explicitly concerned with computational modeling (i.e., chapters by Anderson & Schooler, Ratcliff & McKoon and McClelland). In the *Handbook*, Ratcliff and McKoon note that "The study of models of memory often seems like a backwater in the overall study of memory." (Ratcliff & McKoon, p. 571). Thus, both the *Handbook* and the science of memory pay little attention to computational models. To illustrate this point still further, the SAM model (Raaijmakers & Shiffrin, 1981), widely held to be one of the most complete models for recall and recognition, is referred to only four times throughout the entire book, of which three times in the Ratcliff and McKoon chapter. This number of references is the same as for "mediodorsal nucleus", and even less than for "perirhinal cortex"! These neurological terms bring us to the next issue.

Third, there is a growing emphasis on research methods and models that relate memory performance directly to *brain structures* and/or activation patterns of the brain. A substantial portion of the Handbook is dedicated to relatively recent advances in the neuroscience of human memory. One can perhaps argue that neuroscientists operate at a different level of description than traditional memory psychologists. For instance, it is probably not feasible for neuroscience to study the neural substrate of the list-strength effect. As an aside, I should mention an interesting line of research that provides an excellent example of how traditional memory research and cognitive neuroscience might go hand in hand. In the study of unconsciously processed semantic primes (e.g., the prime DOCTOR influences identification of the related target NURSE), an psychophysiological study (Dehaene et al., 1998) has shown that even for subliminally presented primes a covert motor response is initiated. This is strong evidence for a response competition account of priming. Regardless of the level of description however, any scientific model needs to be testable and falsifiable in order to merit attention. A theory should go beyond a mere description of the data and make new and testable predictions. I feel that this latter issue, the need to go beyond description and move to prediction, is a somewhat underestimated concern in much neuropsychological research.

Fourth, there is a fascination to create a taxonomy of multiple human *memory systems*, often based on diametrically opposed concepts. As was already noted by Newell (1973) in his famous paper "You can't play 20 questions with nature and win", psychologists tend to think in opposing concepts. Memory research for instance features episodic versus semantic memory, explicit versus implicit memory, procedural versus declarative memory, short-term versus long-term memory, and perceptual versus conceptual memory, to name but a few. Each of these different types of memories can be ascribed to a different mechanism in the brain. Based on double dissociations and evidence from amnesic patients it is argued throughout almost the entire the *Handbook* that there are multiple independent memory systems originating in different structures of the brain. However, the issue of a unitary memory versus multiple memory systems is part of an ongoing and as yet undecided debate. In order to claim that separate memory systems exist, one first needs to clearly state what it means for a system to be independent of another system.

Schacter tries to deal with this concern in one of the chapters of the *Handbook*. In this chapter, Schacter also discusses a PET study (Martin, Wiggs, Ungerleider, & Hexby, 1996) showing that naming pictures of animals is accompanied by a different pattern of brain activity than naming pictures of tools. Should we infer from this that there are separate memory systems, one for animals and one for tools? Schacter discusses an alternative explanation, namely that the processes involved in naming animals versus naming tools are different. For instance, it is argued that the pictures of animals were less discriminable than those of tools, and that tools are encoded more in terms of their function. This example is meant to illustrate that distinct patterns of activation do not necessarily indicate distinct memory systems. The crucial question is, "Does the multiple memory systems approach explain findings that a unitary memory system approach cannot handle?" Occam's razor certainly places the burden of proof with the proponents of the multiple memory approach. And even if neuropsychology would succeed in teasing apart every single form of memory and ascribe it to a given neural substrate, I cannot help but wonder what we will have learned except for facts like "brain system X is involved in process Y".

Some readers might enthusiastically support the current trends in memory research mentioned above, whereas others may find them depressing. Regardless of the interpretation of the prevailing trends in memory research, I believe the *Handbook* provides a fascinating overview of the field as it currently stands. The chapters are well written and provide food for thought even if one does not agree with the general philosophy that lies behind them.

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