

## Introduction

### Behavioral Approaches to the Study of Human Learning and Memory

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The systematic investigation of the ability of humans to learn and remember information had its beginning near the end of the nineteenth century. Numerous influential scholars and developments during that period strongly impacted the nascent field, and it has now matured into several major research communities that each bring a different focus and methodology to the study of learning and memory. Arguably, the most prominent publication of this era was Hermann Ebbinghaus's *Über das Gedächtnis* (Ebbinghaus, 1885), but several important short notes reporting experiments similar to Ebbinghaus's were reported by the physicist Francis Nipher in the preceding decade (Nipher, 1876, 1878). These three publications reported systematic treatments of learning, remembering, and forgetting that employed quite modern techniques, such as the use of careful stimulus control, quantitative treatment of data, and multiple measures of retention. In that same period, both Sergei Korsakoff and Theodore Ribot published monographs that analyzed memory-impaired populations and provided sophisticated treatments of memory function (Korsakoff, 1887; Ribot, 1881). Shortly thereafter, Edward Thorndike published some of the first work using animal subjects to study learning and memory (Thorndike, 1898). Earlier in that decade, Thorndike's mentor, William James, published the authoritative two-volume set *Principles of Psychology* (James, 1890), which provided a comprehensive and scholarly treatment of many topics in learning and memory.

Despite this common ancestry, current treatments of human learning and memory are so varied that a volume such as this one is necessary merely to track parallels and divergences among subject populations and among methodological approaches. The purpose of this section is to review

some of the current topics that arise in the experimental treatment of memory in nonpathological adults. This work thus follows most directly from the tradition established by Ebbinghaus and Nipher, and is characterized by three interrelated principles that can be directly traced to those origins and that are distinct from the traditions established by the other great scholars of that early time.

### **1. Experimentation**

The principal tool for investigating learning and memory in normal humans is the experiment. Here the emphasis is on the rigid definition of the term, which fundamentally implies random assignment as a core principle. This may not seem like a particularly distinctive standard for research, but it is on this principle that this research diverges from the human neuropsychological research that has lesion studies as its basic currency. Animal research and human neuroimaging serve as bridges between lesion studies in humans (which are nonexperimental but are revealing of brain function) and experimental cognitive psychology (which is rigorously experimental but mostly uninformative about the underlying neuroanatomy and neurobiology of cognition).

### **2. Quantitative standards**

Today, behavioral research on learning and memory is one of the most quantitatively and analytically advanced areas of psychology. At least in part, this is the heritage of Ebbinghaus and Nipher, who were pioneers in their quantitative sophistication. Both were acutely aware of measurement error and variability, and developed techniques to reduce such error (by using repeated measures) and to evaluate results with an eye toward the magnitude of such error. Both pioneered a model-based approach to experimental analysis of psychological data; Nipher, for example, evaluated memory across different serial positions of digit strings by comparison with proportions predicted by a binomial distribution null hypothesis.

### **3. Abstractness**

The final legacy attributable to Ebbinghaus and Nipher was the use of abstract stimuli. Of all the aspects listed here, this one is the most questionable, and the one that has undergone the most scrutiny over the history

of the field. The advantages of such stimuli were well articulated by Ebbinghaus, who used consonant–vowel–consonant trigrams as stimuli:

*The nonsense material . . . offers many advantages, in part because of this very lack of meaning. First of all, it is simple and relatively homogeneous. In the case of the material nearest at hand, namely poetry or prose, the content is now narrative in style, now descriptive, or now reflective; it contains now a phrase that is pathetic, now one that is humorous; its metaphors are sometimes beautiful, sometimes harsh; its rhythm is sometimes smooth and sometimes rough. There is thus brought into play a multiplicity of influences which change without regularity and are therefore disturbing.*

(Ebbinghaus, 1964, p. 23)

By using such stimuli, Ebbinghaus hoped to reduce the problems of memory to a more tractable set, one that minimized the influence of stimulus factors. As can be seen in the contributions to this section, this approach is still the predominant one in the field. However, arguments have been made that such contrived stimuli impede a full understanding of the capacities of memory (e.g., Neisser, 1976).

And so this is the stage in which the chapters of this section are players. The predominately experimental, quantitative, abstract approach will be evident throughout; remembering the advantages and also the limitations of such aspects is crucial to gaining a better understanding of what behavioral studies have to offer to the larger picture of learning and memory that this book provides.

The chapter by Hulbert and Anderson outlines evidence that inhibition can be actively and strategically used to support memory function and increase cognitive efficiency. Because memory inhibition is a central player at the interface of cognitive psychology and clinical psychology—in which inhibition is presumed to underlie important putative clinical phenomena such as repression—well-controlled experimental studies have had a profound influence on both low-level cognitive characterizations of memory and higher-level clinical and social depictions of memory.

Neath and Surprenant critically consider a distinction popularized by William James between short-term and long-term memory. The larger debate that this chapter prominently features is how data are used to support or reject distinctions between multiple memory systems. This is a point of contention between lesion studies, for which double dissociations are the signature datum, and perspectives such as the one embodied in this chapter, in which quantitative process models are used to interpret patterns across experiments.

The chapter by Evans and Federmeier provides an excellent example of how Korsakoff's legacy can be profitably merged with the tradition of

Ebbinghaus. They review the current state of knowledge on hemispheric specialization of mnemonic functions, with an eye toward characterizing the complementary roles the cerebral hemispheres have evolved. Warren, Miller, and Heller consider the role of lateralized function further by examining how emotion can promote or disrupt memory. In doing so, they provide linkage to clinical characterizations by considering how psychopathy—particularly, depression and anxiety—influences memory function.

The final chapter by Simon reviews how the scheduling of learning events can have dramatic effects on consequent memory for the involved materials. Implementing learning regimens that accord with the well-known effects of spacing and intermixing of materials thus has the potential to improve learning in education and training settings.

Each chapter in this section provides an example of how modern memory research has benefited from connections to neuroscience, computer science, education, and other areas. Fundamentally, this is the lesson of this book: understanding learning and memory in any useful way requires investigation and consideration from multiple levels of analysis. To the degree that we create an environment within which researchers from different traditions can communicate effectively, we will have done ourselves, and the field, a good turn.

## References

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