

This Week's Citation Classic

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Craik F I M & Lockhart R S. Levels of processing: a framework for memory research. *J. Verb. Learn. Verb. Behav.* 11:671-84, 1972.
[University of Toronto, Toronto, Ontario, Canada]

The authors suggest that human memory be viewed as the record of mental operations carried out primarily for the purposes of perception and comprehension. The operations are performed at various levels of processing, where 'deeper' levels involve greater semantic analysis and are associated with longer-lasting memory traces. [*The Science Citation Index*[®] (*SCI*[®]) and the *Social Sciences Citation Index*[™] (*SSCI*[™]) indicate that this paper has been cited over 590 times since 1972.]

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"In the 1960s, human memory was thought about principally in terms of stores that were characterized as holding different kinds of information for various lengths of time. The generally accepted model was one in which the sense organs fed information into associated sensory memory stores. The information was then transferred to a limited-capacity short-term memory and finally into a permanent long-term memory. Researchers were concerned with such problems as the capacity of the various stores, their coding characteristics, and the mechanism of information transfer between the stores.

"Robert Lockhart and I had both been involved with these types of questions in Sydney and London respectively, but since coming to Toronto we had both developed serious reservations about the continuing usefulness of the stores metaphor.

Presumably, different experimental techniques should yield the same values of capacity, decay rate, and so on, but they did not; perhaps the data could be reinterpreted within a rather different conceptual framework. Lockhart and I found that we held very similar views on one such alternative framework in which discrete stores were replaced by a continuum of processing varying from shallow sensory analyses to deeper, semantic analyses. We postulated that memory was the record of the operations carried out during perception and comprehension, and that deeper levels of processing were associated with longer-lasting memory traces.

"At that time our colleague, Endel Tulving, was editor of the *Journal of Verbal Learning and Verbal Behavior* and he asked us to write up the ideas for the last issue under his editorship, December 1972. So Lockhart and I worked on the article in the early summer of that year, by turns being praised, threatened, and cajoled by Tulving in order to meet his publication deadline! In fact Endel Tulving gave us a great deal of help during the writing and editing process and it is pleasant to be able to record our appreciation of his efforts.

"It seems likely that the article has attracted some attention because memory researchers were unhappy with the notion of memory stores and were looking for a more process-oriented account of remembering and forgetting. The ideas that Lockhart and I put forward were very much in the air at the time, to the extent that quite a few people told us later that they were just about to write a similar article. Indeed, one person—Laird Cermak—had already set down a parallel set of ideas in his textbook on memory.¹ More recently, the levels of processing viewpoint has come in for a good deal of criticism on the grounds of its lack of predictive power. Over the next few years it will be interesting to see whether the Craik and Lockhart framework can nevertheless lead to a fuller understanding of memory processes."

1. Cermak L S. *Human memory: research and theory*. New York: Ronald Press, 1972. 294 p.