

Wickelgren W A. Distinctive features and errors in short-term memory for English consonants. *J. Acoust. Soc. Amer.* 39:388-98, 1966.

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Intrusion errors in short-term recall of lists of 23 English consonants share distinctive features (voicing, nasality, openness of the vocal tract, and place of articulation) with the correct consonant. Sequential memory span uses an auditory, articulatory, or abstract phonetic code, at least in part. [The *Science Citation Index®* (SCI®) and the *Social Sciences Citation Index®* (SSCI®) indicate that this paper has been cited in over 160 publications.]

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September 21, 1986

Studies by R. Conrad, George Sperling, and me had found evidence that verbal short-term memory for lists of word-size units (typically letter names or nonsense syllables) was often coded in some phonetic modality of the mind. Recall errors were similar to the correct item, having common segments (phonemes or allophones). The cited article pushed this analysis to a lower level by showing that errors in short-term recall of single consonant segments were similar to the correct consonant by having common distinctive features.

I compared three feature systems on their accuracy in predicting these errors, one using many binary-valued dimensions devised by Morris Halle for linguistic data,¹ one with fewer multiple-valued dimensions devised by George Miller and P. Nicely for errors in auditory perception of consonants,² and a system I devised that was a modification of the Miller-Nicely system. Since it was optimized for the data, the one I devised worked best,

followed by Miller-Nicely, with Halle's system a distant third.

One reason for citing this article was that one could be sure that memory-error data result only from mental coding, while auditory-recognition data also reflect the physical stimulus and background noise. This study was relevant to the hypothesis that verbal short-term memory was coded at a lower, more structural, level of the mind, while verbal long-term memory was coded in semantic memory. It is still not decided whether short- and long-term memory are distinct types of traces, but it should always have been clear that there are long-lasting phonetic memories (for example, the phonetic components of familiar words) and probably short-lasting semantic memories. A summary of this area can be found in my *Learning and Memory* text.³

This is a useful paper, but none of my best theoretical ideas are in it. When I was "making it" as a new assistant professor at MIT, I knew that it was wise to do experiments in active areas. This was one of those studies. During the seven years it took to become a full professor, I had an explicit policy of devoting half of my time to research to make me famous and half of my time to really creative research. There was only a little overlap. My judgment on such matters was nearly flawless. Because I never fooled myself that what brought the quickest rewards was the most innovative, I quickly shifted more of my effort to more important problems after I became a professor (with the predictable consequence that I became less famous).

The most important result of working in this area was to give me the necessary background to generate the really important idea of context-sensitive coding, for example, that a word like "struck" can be coded as an unordered set of overlapping phoneme triples, #st, str, tru, ruk, uk#.4,5 Context-sensitive coding of ordered sets, hierarchies, and other relations, in terms of unordered sets, is the most important mechanism by which human minds code sequences and patterns.

1. Halle M. On the bases of phonology (Fodor J A & Katz J J, eds) *The structure of language*.

Englewood Cliffs, NJ: Prentice-Hall, 1964. p. 324-33

2. Miller G A & Nicely P E. An analysis of perceptual confusions among some English consonants.

J. Acoust. Soc. Amer. 27:338-52, 1955 (Cited 285 times)

3. Wickelgren W A. *Learning and memory*. Englewood Cliffs, NJ: Prentice-Hall, 1977. 448 p

4. ———. Context-sensitive coding, associative memory, and serial order in (speech) behavior.

Psychol. Rev. 76:1-15, 1969. (Cited 60 times)

5. ———. *Cognitive psychology*. Englewood Cliffs, NJ: Prentice-Hall, 1979. 436 p.