Underwood B J. Attributes of memory. *Psychol. Rev.* 76:559-73, 1969.

The article proposes that a memory is a collection of attributes. These serve to discriminate one memory from another and to act as retrieval mechanisms. The attributes identified are temporal frequency, modality, orthographic, associative nonverbal, and associative verbal. [The *Science Citation Index*® *(SCI*®) and the *Social Sciences Citation Index*™ *(SSCI*™*)* indicate that this paper was cited a total of 141 times in the period 1969-1976.]

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"What is the basic constituent of a memory? What is lost when we say that we have (alas) forgotten? Almost from the beginning of recorded thought, answers to such questions revolved around the concept of an association. Associations between words and between ideas were generally held to be the heart of a memory for an event. My paper, which described a memory as a collection of attributes (a collection of different types of information), represented a clear departure from the classical position. Associations were not abandoned; rather, they became only one of several types of information which were said to be constituents of memories. The theoretical problem was to describe the role played by each attribute in memory functioning.

"In the early 1960s I had come to realize that the human memory system was very sensitive to repeated events. Specifically, it appeared that quite unintentionally the system 'counted' repeated events, and if we interrogated the system the frequency information would be made manifest. Thus, when we asked college students to estimate the relative frequency with which various words appear in printed discourse, we found their judgments to be quite valid. Such information could not be classed as associative information except in a rather trivial sense. Each word in our vocabulary has frequency information associated with it, but this was not like the classical idea of associations between words or between ideas. Repetition may strengthen associations between words, but frequency per se has a representation in memory that is independent of the strength of the association.

"It did not seem to me that nature would provide us with such a remarkable counting mechanism without this mechanism having a role in memory functioning. We then offered a theory about the role played by frequency discrimination in recognition tests of memory. Having broken the associative rampart with this one concept, it seemed probable to me that other concepts could be found to join frequency in the assault. My article represents a summary of such concepts. These concepts or attributes were educed from a wide variety of studies, most of which had been published by other investigators. That this paper has been cited frequently probably stems from the fact that most investigators in the area were already thinking about memories in terms of multiple types of information. My paper simply identified a greater number of different types than had previously been identified."