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Judgments of associative memory ☆

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Abstract

Judgments of associative memory (JAM) were indexed by ratings given to pairs of cue and response words. The normed probabilities, *p*(response|cue), were obtained from free association norms. The ratings were linearly related to the probabilities. The JAM functions were characterized by high intercepts (~50 on a 100 point scale) and shallow slopes (<0.5). The JAM function generalized across materials and method of rating. The function was not affected by expectancies or semantic similarity. Attempts to alter the function by making alternative responses more available were unsuccessful. A computer simulation model (MINERVA 2) exhibited the linear JAM function and successfully accounted for more complex phenomena (like the joint influence of forward and backward associative strengths on ratings). The shallow JAM slope appears to result from a fundamental lack of discrimination among associative strengths. The high intercept appears to result partly from an independent post-mnemonic source of bias producing over-estimation of association.

Keywords: Memory; Memory judgments; Association; Associative memory; Metacognition; MINERVA

☆ Experiments 1 and 2 were presented at the October 2003 meeting of ARMADILLO in College Station, TX. All the experiments and a preliminary version of the computational model were summarized in a poster presented at the meeting of the Psychonomic Society, Minneapolis, November 19, 2004. The version of the model described in this paper was presented at the meeting of the Society for Computers in Psychology, Toronto, November 10, 2005. For their assistance with the data collection, I thank Nicole Holstrom, Michael Mebane, and Amber Thompson. I am deeply indebted to Randy Engle, Ruth Maki, Cathy McEvoy, and Doug Nelson for their stimulating thoughts about "JAM" and its interpretation. Thanks also to Doug Nelson for sharing the rating data depicted in Fig. 9 and to Asher Koriat for permission to preview the results reported in Koriat, Fiedler, and Bjork (2006).
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1. Introduction

The structure of associative memory is a topic of long-standing theoretical and empirical interest in psychology (Deese, 1965; Esper, 1973). The associative links between words are presumed to arise from our experience with the co-occurrences of those words in written and spoken language (e.g., Spence & Owens, 1990). Typically, the links have been assessed by use of the method of free association. In free association tests, people are instructed to respond to a stimulus word ("cue") with the first response word that comes to mind. A frequency distribution accumulated over a large number of participants is the basis for computing the probability that a response word occurs given a cue. These probabilities are then interpreted as the strengths of the associations between a cue and its response words. The most current and most ambitious such undertaking is the set of free association norms compiled over many years by Nelson, McEvoy, and Schreiber (2004).

Another technique for assessing word associations involves presenting both cue and response words and asking for an associative judgment (Garskof & Forrester, 1966; Haagen, 1949; Kamman, 1968; Koriat et al., 2006; Nelson, Dyrdal, & Goodmon, 2005). Garskof and Forrester (1966), for example, asked their participants to "imagine a group of 100 students and to try to estimate how many students would say the second word as their first association to the first word" (p. 503).

The relationship between free association and associative judgments is not clear. On the face of it, the two methods should be measuring the same thing—associative strength. However, judgments of probability and frequency tend to be victimized by judgmental biases such as the availability heuristic (Tversky & Kahneman, 1973). So judgments of associative strength may produce different answers than those found with the method of free association. One study reporting such judgments was the particular motivation for the research to be reported here. Koriat (1981) provided some casual observations, in his Discussion section, of an associative judgment study. He presented pairs of words that varied considerably in normed associative strength and asked "people" to guess the probability that the second word would be the response to the first word in free association norms. Koriat observed that "Most people who were asked to guess these probabilities underestimated greatly the differences among the pairs" (Koriat, 1981, p. 597).

Koriat's brief report does not illuminate exactly how the reduced discrimination of associative strengths comes about. Three possibilities are exposed in Fig. 1. Associative judgments are represented on the vertical axis and plotted against normed strengths represented on the horizontal axis. The 45° line, with a zero intercept and unit slope, is what would be expected if observers were perfectly calibrated. Reduced discriminability would be reflected in functions with lesser slopes. The three functions depicted in Fig. 1 all have shallow slopes, but the reduced discriminability occurs for different reasons. The topmost function arises from severe overestimation of the associative strengths of weakly associated pairs. The middle function arises from overestimating strengths of weak pairs and underestimating strengths of strong pairs (regression to the mean). The bottom function arises from underestimating strengths of strongly associated pairs. The answer to the question of which of these functions might have been operating in Koriat's study is speculative. There is a tendency toward overestimation in other domains of human judgments (Dunning, Johnson, Ehrlinger, & Kruger, 2003; Levin, Momen, Drivdahl, & Simons, 2000), but there are instances of regression toward the mean in frequency judgments