Denotative-generality, imagery, and meaningfulness in paired-associate learning of nouns¹

Allan Paivio and Margaret Olver
UNIVERSITY OF WESTERN ONTARIO

Abstract

Paired-associate learning of lists composed of "specific" and "general" nouns as both stimuli and responses was facilitated by stimulus but not response specificity. Specific nouns were rated superior to general nouns in their capacity to evoke sensory images, and stimulus imagery correlated positively with number of associates correctly recalled. Meaningfulness was insignificantly related to specificity and learning. The findings are discussed in terms of the theory that imagery can mediate verbal associations.

Problem

Variation in word abstractness was previously found to have a strong influence on paired-associate (PA) learning (Paivio, in press), recall of associates being particularly facilitated with concrete nouns as stimuli. The effects were predicted from the hypothesis that verbal associations can be mediated by stimulus-aroused sensory images, and the assumption (supported by rating data) that concrete nouns evoke such imagery more readily than abstract nouns (Paivio, 1963; cf. Miller, Galanter, & Pribram, 1960, pp. 134-138). In further support of the hypothesis, imagery scores of stimulus items correlated highly (positively) with recall scores, whereas response imagery did so less strongly. However, an unequivocal interpretation of the results was difficult since concrete nouns also exceeded abstract nouns in associative meaningfulness (M), and imagery and M correlated about equally with learning.

The above experiment involved concrete terms (e.g., tree) having relatively specific objective referents and highly abstract terms (e.g., idea) which do not. In the present experiment, all test items were "concrete" but varied in generality. On the assumption that specificity-generality is part of the broader continuum of abstractness, we predicted that the relatively general nouns would fall short of the specific concrete nouns but exceed the previously-used abstract nouns in imagery, and that the effect of variation in generality on PA learning would therefore be similar to that of abstractness, although weaker. Thus, recall should be directly related to specificity, this effect being greater on the stimulus side of pairs where the image-evoking capacity of the term can be effective. The most crucial implication of this prediction was that specific-general pairs should be learned more easily than general-specific pairs. The role of M was also investigated further.

Method

Thirty-two "general" and 32 "specific" nouns with frequencies of 40 or more per million (Thorndike &

Lorge, 1944) were selected by matching a relatively general word (e.g., furniture) with a more specific example of its referent class (e.g., table). PAs were constructed by randomly pairing the specific and general members of one class of nouns with the two members of another to generate four PAs relatively free of a systematic pre-experimental association. Thus, from the words furniture-table and money-dollar resulted the PAs furniture-money, furniture-dollar, table-money, and table-dollar, representing the combinations general-general (GG), general-specific (GS), specific-general (SG), and specific-specific (SS), respectively. Sixty-four PAs thus developed were randomly assigned to four lists of 16 pairs each, so that each list included four pairs from each of the above combinations but not both the specific and general members of any one class. Four additional lists were obtained by reversing the above pairs.

The PA procedure involved four alternating learning trials (presentation of pairs) and recall trials (presentation of stimuli only) on a memory drum. A 2-sec. exposure of each pair or stimulus item and a 2-sec. interitem interval was used on both learning and recall trials. Ten sec. were allowed between a learning and recall trial, and 30 sec. between a recall trial and the next learning trial. The ordinal position of items was varied on each trial. Ss were 80 university undergraduates, ten (5 males and 5 females) being assigned to each list.

A separate group of 20 Ss rated the words on imagery (cf. Paivio, in press). Presented in booklets, each word was accompanied by a five-point scale representing different degrees of "ease of imagery" (a crude measure of the latency of a sensory image). Data on M were obtained from four additional groups of 17-22 Ss each, following Noble's (1952) procedure. Each group gave written associations for 60 sec. to a different set of 16 words.

Results and Discussion

To determine the overall effects of specificity on learning, the data of the 8 groups was pooled. Table 1 shows the mean total number of correct response over the four trials for each stimulus-response combination. In support of prediction, an analysis of variance for correlated data revealed a highly significant main effect of stimulus specificity ($F_{1, 79} = 60.11$; $P < .001$), but not of response specificity ($F_{1, 79} = 2.52$). The interaction of stimulus and response specificity was also significant ($F_{1, 79} = 7.56$; $P < .01$), indicating an effect of variation in generality of responses when stimuli are

Table 1. Mean Total Number of Correct Responses Over Four Trials as a Function of Stimulus and Response Generality (N = 80)

Stimuli	Responses			
	Specific		General	
	Mean	SD	Mean	SD
Specific	11.1	3.0	10.2	3.5
General	8.5	3.2	8.6	3.3

specific but not when they are general. Comparisons of means by correlated *t* tests indicated that all differences except that between GS and GG pairs were highly significant, the superiority of SG over GS pairs ($t = 4.91$; $df = 79$; $P < .001$) being particularly crucial support for the imagery hypothesis. As expected, the above effects were somewhat weaker than those obtained in the earlier, abstractness study (Paivio, in press), notably in that the mean recall scores of GS and GG pairs are greater than the means of 7.36 and 6.05 for the analogous abstract-concrete and abstract-abstract pairs. Generally, however, the effects of abstractness and generality are highly similar, a particularly noteworthy finding inasmuch as the earlier study involved aural rather than visual presentation of material.

The overall mean imagery scores, based on the ratings of 20 Ss, were 4.58 for the 32 specific nouns and 3.92 for the 32 general nouns, a highly significant difference in the predicted direction ($t = 5.74$; $df = 62$; $P < .001$). The former compares favorably with the mean of 4.70 previously obtained for concrete nouns but, as expected, the mean imagery of general nouns exceeds the mean of 2.90 for abstract nouns. The mean *M* scores of 12.11 for specific and 11.60 for general nouns do not differ significantly.

A mean recall score, based on the total number of correct recalls by all Ss learning a given item, was determined for each item as stimulus and (separately) as response, and product-moment correlations were computed between these learning scores and imagery and *M* scores of the 64 items. The correlation with learning was significant in the case of stimulus ($r = .34$; $P < .01$)

but not response ($r = .09$) imagery. The correlations of .22 and $-.16$ for stimulus and response *M* were not significant. To permit comparisons with imagery and *M*, point biserial correlations were also computed between learning scores and word specificity. Stimulus specificity correlated .51 ($P < .001$), and response specificity, .02, with recall. The relative contribution of stimulus imagery, *M*, and specificity to PA performance were also analyzed by means of partial correlations. With *M* held constant, the correlation between imagery and recall is .28 ($P < .025$), conversely, with imagery constant, *M* correlated only .09 with recall. These findings are significant in ruling out *M* as the effective variable, a conclusion that could not be unequivocally supported in the earlier experiment (Paivio, in press). It should also be noted, however, that with specificity held constant, stimulus imagery correlates only .06 with recall, but with imagery constant, stimulus specificity and recall correlate .41 ($P < .005$). Thus, imagery as defined here, only partially explains the effectiveness of specificity as a stimulus variable. The ratings obviously constitute a crude measure of imagery, however, and a more sensitive index of this variable may be necessary to clarify its role as an associative aid. In addition, alternative hypotheses (cf. Paivio, in press) must be investigated.

References

- MILLER, G. A., GALANTER, E., & PRIBRAM, K. H. Plans and the structure of behavior. New York: Holt, 1960.
- NOBLE, C. E. An analysis of meaning. *Psychol. Rev.*, 1952, 59, 421-430.
- PAIVIO, A. Learning of adjective-noun paired-associates as a function of adjective-noun word order and noun abstractness. *Canad. J. Psychol.*, 1963, 17, 370-379.
- PAIVIO, A. Abstractness, imagery, and meaningfulness in paired-associate learning. *J. verb. Learn. verb. Beh.*, in press.
- THORNDIKE, E. L., & LORGE, I. The teacher's word book of 30,000 words. New York: Bureau of Publications, Teachers Coll., 1944.

Note

1. This research was partially supported by Grant APA-87 from the National Research Council, Canada, and a grant from the University of Western Ontario Research Fund.