Pictures versus words as stimuli and responses in paired-associate learning[1]

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Pictures and concrete nouns served as stimulus and response members of paired-associate (PA) lists, in a factorial design. PA learning was better with pictures than with nouns as stimuli, the effect being greater when nouns served as responses. No main effect was obtained on the response side, but an interaction indicated differential effects of response mode, depending on whether the stimuli were pictures or nouns. The results generally parallel those previously obtained with nouns varying in concreteness or imagery and further support the "conceptual peg" hypothesis.

A facilitating effect of noun concreteness or "imagery" is consistently greater on the stimulus than on the response side in PA learning (e.g., Paivio, 1965; Paivio & Olver, 1964; Paivio, Yuille, & Smythe, in press; Yarmey & Paivio, 1965). This effect was predicted from the hypothesis that stimulus items can function as "conceptual pegs" for their associates, the efficiency of the pegs depending on their capacity to arouse sensory images which could mediate response recall. Imagery was defined in the above studies in terms of Ss' ratings of the ease with which nouns elicit images. However, since objects or pictures arouse concrete images directly, according to the hypothesis they should surpass even high imagery nouns as effective stimuli. Epstein, Rock, & Zuckerman (1960) did find PA learning of pictures to be easier than the learning of concrete nouns, but they did not vary pictures and nouns independently on the stimulus and response sides of pairs. Wimer & Lambert (1959) found that object-nonsense syllable pairs were easier to learn than noun-nonsense syllable pairs, indicating a facilitating effect of stimulus concreteness. They did not investigate the relative effects of objects and nouns on the response side, however, and the S-R comparison is crucial to the conceptual peg hypothesis. In the present study, pictures of objects and their concrete noun labels were varied on the stimulus and response sides of PA lists in a factorial design, i.e., the lists included picture-picture (P-P), picture-noun (P-N), noun-picture (N-P), and noun-noun (N-N) pairs. From the conceptual peg hypothesis, it was predicted that "picturedness" would facilitate learning more on the stimulus than on the response side of pairs.

Method

The PA list consisted of 20 pairs, five of each S-R combination, i.e., P-P, P-N, N-P, and N-N. The items were selected from a larger pool on the basis of the criterion that their pictorial representation can be unambiguously and readily named, so that pictures could appropriately serve as responses in the PA list. To achieve this, stylized colored drawings of familiar objects were shown individually to a group of 25 judges, who quickly wrote down the name of each object represented. Forty pictures were selected on which there was high agreement concerning the noun label for the object. Twenty pairs were randomly generated by pairing the verbal (noun) forms of the concepts, and each of the resulting pairs was randomly assigned to be represented as one of the four types of pairs of the PA list, i.e., P-P, P-N, etc. Thirty-five mm colored slides were made of each pair as well as of the stimulus member of each pair; the words appeared as block capitals and the pictures were of the colored drawings described above. To control for the difficulty of particular items, two versions (A and B) of the list were prepared. Items that were represented as pictures in list A became words in list B, and vice versa. Thus, P-P pairs in A became N-N pairs in B, P-N pairs in A became N-P in B, and so on. The list A pairs of each type were as follows: leopard-hat, scissors-queen, arrow-umbrella, apple-kite, telephone-shoe (P-P); soldier-key, hammer-chain, horse-camera, ambulance-hand, ladder-cigar (P-N); typewriter-star, book-flag, stove-bullet, snake-house, tree-bottle (N-P); piano-bread, kettle-microscope, knife-clock, pencil-radio, lobster-pipe (N-N).

Four alternating study trials (stimulus and response members presented together) and recall trials (stimulus members alone) were presented to groups of Ss using a slide projector. The pairs and stimulus items were in a different random order on each trial, with the restriction that no particular type of pair (e.g., P-N) appeared in the first or last position on more than one trial. Identical random orders of concept pairs and stimuli were used with lists A and B. No practice trials were given, but the nature of the items and the PA procedure were carefully described. Ss were permitted to use their own labels for pictorial response items, e.g., either "boot" or "shoe" was regarded as a correct response. They recorded their responses in a four-page booklet, each page representing a trial. To facilitate response recording, a column of numbers, 1-20, appeared along the edge of each page and each number was read aloud immediately prior to the presentation of a stimulus item. Each pair was presented for 3 sec. on study trials and each stimulus for 5 sec. on recall trials. A study trial was immediately fol-

lowed by a recall trial, but the interval between a recall trial and the next trial was 3 min., allowing E time to re-shuffle the order of the slides.

The Ss were 84 students from seven different undergraduate psychology courses, some of whom had previously participated in verbal learning studies. Equal numbers were randomly assigned to A and B lists, and Ss were run in four groups with Ns ranging from 19-23.

Results and Discussion

Table 1 shows the mean total number of correct responses for each S-R combination, each mean being based on four trials and five pairs (the counterbalancing procedure involving lists A and B was not treated as a variable). A 2 by 2 analysis of variance for repeated measures yielded a highly significant main effect of picture-word variation on the stimulus side ($F = 27.46$, $df = 1/83$, $p < .001$), indicating better recall with pictures, but no effect on the response side ($F = 0.41$). However, the interaction of stimulus and response mode was also significant ($F = 28.81$, $df = 1/83$, $p < .001$). A Neuman-Keuls test (Winer, 1962) indicated, further, that all differences between the means in Table 1 are significant at the .05 level or better. These differences suggest that pictures as stimuli facilitate PA learning regardless of the nature of the response, although the effect is greater if the response members are words. The effect of response mode is inconsistent, however, pictures as responses being facilitative when the stimulus members are words but detrimental when the stimuli are pictures.

The results are comparable to those previously obtained for noun concreteness and imagery (e.g., Paivio, 1965; Paivio et al, in press), except that noun pairs

in which both members are concrete or high-imagery have generally been easiest to learn, whereas the analogous P-P pairs in the present study were more difficult than P-N pairs. A possible interpretation is that pictures hinder learning as response items because more time is required to decode a picture into a verbal response form than to recall a noun (cf., differences in associative reaction time to pictures and words, e.g., Karwoski, Gramlich, & Arnott, 1944), but this fails to explain the better recall for N-P than N-N pairs and no fully adequate interpretation of the one discrepancy can be suggested. The stimulus superiority of pictures over words is the crucial finding, however, for it confirms and extends findings by Epstein et al (1960) and Wimer & Lambert (1959), and provides further support for the conceptual peg hypothesis.

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Table 1. Mean Total Number of Correct Responses Over Four Trials for Each Stimulus-Response Combination of Pictures and Nouns (N = 84)

Stimulus	Response			
	Picture		Noun	
	Mean	SD	Mean	SD
Picture	15.0	3.1	16.1	2.8
Noun	14.4	3.5	13.5	4.0