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# Discrimination learning of pictures and words*

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A verbal discrimination (VD) study-test procedure was used to compare discrimination learning of 14 pairs of pictures, concrete nouns, and abstract nouns. Pictures were significantly easier to discriminate than concrete nouns, which in turn produced significantly fewer errors than abstract noun pairs. The results were attributed to the relative image-arousing capacity of the three types of items, and implications for the frequency theory of VD learning were discussed.

In verbal discrimination (VD) learning, pairs of words rated high on image-arousing capacity (I) and concreteness have been shown to produce significantly fewer errors than pairs of low imagery abstract words (Paivio & Rowe, 1970). This effect is consistent with the positive results obtained for imagery in other verbal learning and memory tasks (Paivio, 1969). The present experiment was an attempt to extend the findings of the Paivio and Rowe study by examining picture discrimination performance in the VD paradigm. Since pictures presumably arouse images more readily than do high-I words, this addition represents an operational extension of the imagery dimension and generates the prediction that pairs of pictures should be even easier to discriminate than high-I word pairs. The superiority of pictorial over verbal material has been demonstrated in paired-associate learning (Paivio & Yarmey, 1966; Wicker, 1970), free recall (Paivio, Rogers, & Smythe, 1968; Sampson, 1970), and recognition memory (Shepard, 1967), but the one available study on picture-word comparisons in VD learning (Goulet & Sterns, in press) showed picture pairs to be inferior to their verbal labels. However, that experiment was conducted with groups of fourth-grade children, and it is still possible that the above predictions hold with adult Ss.

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## METHOD

The Ss were 60 young adults (33 males), aged 14-20, with a median age between 15 and 16 years, most of whom were high school students. All were obtained from a London youth recreation center and were paid $1.00 for participating in the study.

Three 14-pair VD lists were used. Lists C and A comprised high-I concrete nouns and low-I abstract nouns, respectively, selected from the Paivio, Yuille, & Madigan (1968) norms. The mean I ratings were 6.54 for List C and 3.02 for List A. All items had Thorndike-Lorge frequency values greater than 45/million. The meaningfulness (m) of the words covaried with I, but this confounding is unimportant since m has been found to have no effect on VD learning (Paivio & Rowe, 1970). List P comprised pairs of pictures (line drawings) whose labels made up the items of List C. The pictures were selected from a pool for which normative data on labeling consistency, rated familiarity, and labeling latency were available. All were labeled consistently by at least 83% of the normative sample of 30 university students, the mean value being 92. Familiarity and labeling latency were uncontrolled.

The pairs of items were photographed frame by frame on 16-mm black-and-white film, with the words typed in capital IBM Discovery type and presented by means of an LW Motion Analyser. Testing was carried out in groups of 2-6, a total of 20 Ss (11 males) being assigned to each of the three list conditions. Conventional VD instructions for a study-test

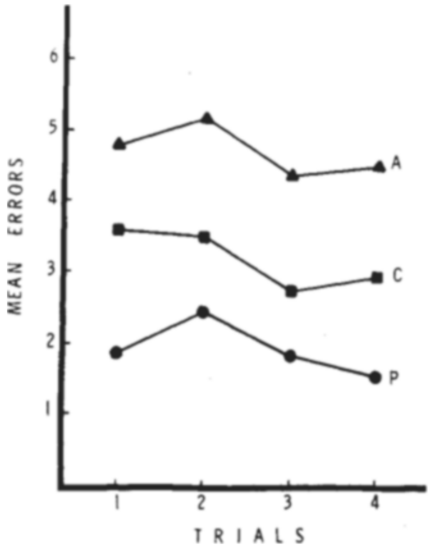


**Fig. 1. Mean errors in VD learning of abstract-word (A), concrete-word (C), and picture (P) lists.**

procedure were given, followed by one study-test trial on a practice list of four pairs of items of the same type (words or pictures) that S received on the experimental list. The pairs were presented at a 2-sec rate on the study trial and a 4-sec rate on the test trial, where each pair appeared for 2 sec followed by a 2-sec blank interval. The intertrial interval was 5 sec. The experimental list was presented for four study-test trials under the same presentation conditions. On the study trials, one randomly selected item in each pair was underlined, while on the test trials the underlining was absent. S recorded his response to each pair in a test booklet. The test booklets contained four pages, one for each trial, with 14 spaces per page. The S wrote the number "1" in the appropriate space if the left-hand member of a pair had been underlined on the study trial and the number "2" if the right-hand item had been underlined. Guessing was encouraged. The pairs occurred in a different random order on each study and test trial. In addition, the spatial position of the items in half of the pairs was reversed on each trial but in such a way that each pair was reversed the same number of times (four) across all orders. The underlined and nonunderlined items occurred equally often in the left and right positions on each presentation of the list, and, to control for item difficulty, half of the Ss in each group received the same list with the opposite items in each pair underlined.

## RESULTS AND DISCUSSION

The mean number of errors for each group is presented in Fig. 1, where it can be seen that the three lists rank in order of difficulty according to the image-arousing capacity of the items. A two-way mixed analysis of variance of the error scores produced a significant main effect of list, $F(2,57) = 13.32$, $p < .001$, and a trials effect that just reached significance at the .05 level, $F(3,171) = 2.66$. The interaction of the two variables was nonsignificant ($F < 1$). The scores were collapsed across trials and post hoc comparisons carried out using the Scheffé technique, which showed that there were significantly fewer errors on List C than on List A, while List P in turn had fewer errors than List C ($p < .01$ in both cases).

The significant difference between Lists C and A corroborates the findings of Paivio & Rowe (1970) and shows that the imagery effect holds across different lists and presentation conditions, since in the former study a mixed-list design and a 3-sec presentation rate were employed. The experiments differ also on several other procedural variables, such as high- vs medium-frequency words, written vs oral responding, and group vs individual testing sessions. In view of the consistent results despite methodological differences between the two experiments, it can be concluded that the effect of the I-value of items in VD learning is robust.

The difference between Lists C and P is as predicted and represents a further extension of the imagery effect. The discrepancy between this result and those reported by Goulet & Sterns (in press) may be due to age differences in the S samples involved or to certain procedural differences. For example, Goulet and Sterns required Ss to verbalize their choice of the correct items during the test exposure of an anticipation procedure. Forcing Ss to respond verbally in this way could retard the learning of picture pairs, especially at the relatively rapid 2-sec rate, both because of the extra time required to label the item selected as the response and the transformation required on the feedback trial to enable S to compare his response with the correct one. Such transformations between the verbal and imaginal coding systems are not required by a nonverbal response procedure like that used in the present experiment.

It is difficult to see how existing theory, i.e., the frequency theory of verbal discrimination (Ekstrand, Wallace, & Underwood, 1966), can adequately incorporate the present findings on picture-word differences, particularly since the theory as it stands concerns itself solely with the properties of verbal items. The superiority of picture pairs over concrete-word pairs in the present case cannot be explained in terms of verbal responding alone, inasmuch as verbal responses are evoked more directly by printed words than by pictures. It is possible, however, that both verbal and imaginal coding of correct items occurred more readily for pictures than for concrete words, since the availability of such a dual representation is presumably greater for pictorial than for verbal material when both are highly meaningful (see Paivio, 1969). Thus a frequency differential based on a combination of verbal and imaginal frequency "units" might have played a greater role in the learning of picture pairs. In any event, the results implicate the operation of nonverbal (i.e., imaginal) encoding mechanisms in VD learning, as previously proposed by Paivio & Rowe (1970) to account for concrete-abstract word differences alone.

The absence of a pronounced trials effect in the data is puzzling, especially since the usual clear decrease in errors over trials did occur for high-I and low-I pairs in the Paivio and Rowe study. It would be important to know which, if any, of the differences between that experiment and the present one might account for this descrepancy, but the finding in no way vitiates the obtained imagery effect.

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