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ABSTRACT

A well established finding in the discrimination learning literature is that pictures are learned more rapidly than their associated verbal labels. It was hypothesized in this study that the usual superiority of pictures over words in a discrimination list containing same-instance repetitions would disappear in a discrimination list containing different-instance repetitions. The subjects were 120 volunteer college students, ranging in age from sixteen to twenty-four years, who were paid for their participation. Consistent with data obtained in an earlier frequency judgment experiment, and as would be predicted from the frequency theory of discrimination learning, the picture-word differences that were observed under the standard version of the task disappeared when the conceptual version was administered. (RB)

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PICTURE-WORD DIFFERENCES IN DISCRIMINATION LEARNING: II. EFFECTS OF CONCEPTUAL CATEGORIES

by

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Report from the Project on
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ABSTRACT

College students were presented with either a pictorial or a verbal discrimination list for three trials under: (1) standard conditions or (2) conditions where on each trial the items in each pair were replaced by different items from the same conceptual categories. Consistent with data obtained in an earlier frequency judgment experiment, and as would be predicted from the frequency theory of discrimination learning, the picture-word differences that were observed under the standard version of the task disappeared when the conceptual version was administered.

I

INTRODUCTION

A well established finding in the discrimination learning literature is that pictures are learned more rapidly than their associated verbal labels (Ghatala, Levin, & Makoid, 1975; Rowe, 1972; Rowe & Paivio, 1971; Wilder & Levin, 1973). The present study follows directly from this finding plus a simple set of premises. First, the frequency theory of discrimination learning (Ekstrand, Wallace, & Underwood, 1966) holds that successful performance on this task is attributable to an apparent frequency differential between correct and incorrect pair members. Second, it has been discovered on the basis of subjects' frequency judgment performance that pictorial stimuli produce more stable apparent frequencies than their printed verbal labels (Ghatala & Levin, 1973, 1974; Ghatala, Levin, & Wilder, 1973; Levin, Bourne, Yaroush, Ghatala, DeRose, & Hanson, in press); from a frequency-theory perspective, this is sufficient to account for the picture-word discrimination learning difference mentioned at the outset. Third, it has been noted that when subjects are asked to judge item frequencies for which repetitions consist of different instances from the same conceptual category, rather than of same-instance repetitions, pictures do not produce more stable apparent frequencies than words (Levin et al., in press). Finally, recent studies have shown rather dramatically that manipulations which eliminate apparent frequency differences between sets of materials also eliminate discrimination learning differences associated with the same sets of materials (Ghatala & Levin, in press; Levin, Ghatala, & Wilder, 1974).

Piecing together this information, we were led to the prediction that the usual superiority of pictures over words in a discrimination list containing same-instance repetitions would disappear in a discrimination list containing different-instance repetitions. In particular, in a discrimination learning task where the same items are not repeated from trial to trial and the subject must base his or her discriminations on the conceptual categories associated with correct items, no picture-word differences should obtain.

II

METHOD

DESIGN AND MATERIALS

There were six conditions defined by the factorial combination of stimulus materials (Pictures and Words) and three different list types (one Concept and two Control lists). Three of the most common instances of each of 36 salient categories were selected from the Battig and Montague (1969) norms. Instances of these categories were prepared either as line drawings (Pictures) or as their corresponding verbal labels (Words). One category, for example, was Insect, represented by bee, ant, and spider as instances. These materials were prepared on 5" x 8" cards, with a pair of items printed side by side on each card, one from each of the 36 categories, for a total of 18 pairs.

SUBJECTS

The subjects were 120 volunteer college students, ranging in age from 16 - 24 years, who were paid for their participation. They were randomly assigned to one of the 6 conditions, 20 subjects per condition.

PROCEDURE

All subjects were tested individually at a 5-sec. presentation rate per pair. A pair of items, when first presented, was unmarked, and the subject was instructed to examine the pair. After 5 secs. the experimenter turned the card, revealing the second card on which one of the two prior items was starred. Subjects were instructed to remember the starred item for a later test. In Concept lists, subjects were instructed that all items would be instances of a particular category, and that they were to remember this category so that on subsequent test trials they would be able to indicate which category was correct (i.e., had been starred). Subjects were told that the correct category would remain the same although its representative instance would change. They were given three trials, with the instance illustrating each of the 36 categories differing on all three trials. For subjects in the two Control conditions, the particular item which was correct in each pair remained the same on all trials, as in the standard discrimination learning task. Items presented on Trial 2 of the Concept list were used in one of the Control lists and items presented on Trial 3 were used in the second Control list. After the initial presentation of the list, pairs of items (or categories) were presented for a second time in a different random order. Within pairs, right-left placement was switched for half the pairs. Subjects were asked to point to the correct member of each pair and to guess if uncertain. The subject had 5 secs. to respond, after which the pair of items reappeared with the correct item starred. A third trial was given with a second test, items or categories occurring once again in a different order and with different right-left within-pair placements for half the items.

III

RESULTS

MAIN ANALYSIS

The dependent variable of interest was the number of correct responses on the two test trials obtained on the Picture and Word Concept lists. Consistent with the predictions derived from Levin et al. (in press) and in contrast to the usual picture superiority which emerges in discrimination learning tasks when the same stimuli are repeated across trials, the average performance of Picture Concept subjects was equivalent to (in fact, descriptively worse than) that of Word Concept subjects; the mean number of correct responses in the two conditions were 24.6 and 25.6 out of 36 respectively, $|t| < 1$. At the same time, subjects in both Concept conditions were clearly learning something, as evidenced by the significantly better than chance performances in each condition, both p's < .001.

Mean performances on both Picture and Word Control lists were very near ceiling (at least 32 out of 36) and, consequently, statistical differences between Picture and Word subjects were difficult to obtain. While Picture subjects were descriptively superior on both Control lists (means of 33.8 vs. 32.8 and 34.4 vs. 32.0), only the latter difference was statistically significant ($p < .025$).

SUPPLEMENTARY ANALYSIS

Since it was apparent that an 18-pair list was not sufficiently difficult for adult subjects--most of our previous work with these same materials has involved children--the two Control lists were combined to form a 36-pair list in an effort to produce clear picture-word differences with the present pool of materials. The Concept list, however, could not concomitantly be expanded in length since it already included 36 Battig and Montague (1969) categories and it is virtually impossible to produce others that are salient and yet nonoverlapping with those already in the list. Consequently, 24 additional subjects were recruited from a population similar to that of the main experiment and randomly assigned in equal numbers to the expanded Picture and Word Control lists. Following the same procedures as before, we found that Picture and Word Control subjects did indeed differ significantly: the mean number of correct responses in the two conditions were 67.0 and 62.2 out of 72 respectively, $t\ (22) = 2.32$, $p < .05$.

IV

DISCUSSION

The results confirm frequency-theory expectations. In particular, when discrimination learning differences can be traced to corresponding apparent frequency differences, and when alternative materials are constructed which reduce or eliminate the apparent frequency differences, then the corresponding discrimination learning difference should also be reduced or eliminated. In the present context, the picture-word difference in discrimination learning (e.g., Rowe & Paivio, 1971), which can be traced to the more stable apparent frequencies of pictures (e.g., Levin et al., in press), can be eliminated by using category rather than item repetitions of pictures and words.

This empirical result, while consistent with earlier research, is not entirely satisfying from a theoretical standpoint; it does not, in and of itself, explain <u>why</u> pictures produce more stable apparent frequencies which, according to Ekstrand et al.'s (1966) frequency theory, is the reason that pictures are learned better than words in the usual discrimination learning task. Nor does it explain <u>why</u> conceptually related pictures and words do not differ in apparent frequency and, hence, do not differ in discrimination learning performance. There are a number of plausible explanations, however, some of which have been offered previously. For example, Paivio's (1971) "dual coding" interpretation is one reasonable possiblity. When it comes to processing pictures in the same-instance repetition case (for both frequency judgments and discrimination learning), subjects might rely on a direct imaginal code, as well as on a verbal code evoked with high probability. With words, the verbal code is evoked directly, and the imaginal code is assumed to be evoked with a lesser likelihood. Since subjects may draw from two codes more reliably for pictures than for words, they are more likely to recognize previously exposed pictures. In the case of different-instance repetitions, however, a reliable imaginal code associated with pictures is no longer available, since the particular visual representations change from instance to instance. Both pictures and words would be assumed to suffer comparably as a result of the particular verbal label changing across instances. Hence, the recognition advantage, due to pictures possessing a unique representation, may be seen to disappear when it comes to recognizing different category instances.

An alternative explanation can be (and in fact, has been) phrased in terms of irrelevant-attribute interference (see Levin, in press). In a number of concept-learning studies in which pictures and words have been compared, it has been found that there is either no difference between the two types of stimuli or that words are learned more rapidly (e.g., Katz & Paivio, 1975; Runquist & Hutt, 1961). Some authors have proposed that pictures may draw subjects' attention toward unique perceptible features (e.g., particular details visible in the picture) and away from the more abstract features which form the basis for efficient classification and conceptual performance. Indirect support for this notion was hinted at by Deno (1968), as well as in the Levin et al. (in press) study, where it was found that there was a frequency judgment advantage of repeated different-instance pictures over words when the repeated instances shared perceptual similarities.

Finally, and somewhat related to the preceding explanation, it can be argued that in contrast to a particular picture, a particular word may be used to represent a wide range of distinguishable instances. The word shoe, for example, is certainly less specific with respect to the particular type of shoe, including shape and size, than is a picture of a particular shoe. It is in this sense that words may be thought of as being more "abstract" (in contrast to the Paivio, 1971, sense) than pictures, and to possess wider and more complex associative networks (see Otto, 1964). Since these properties of words should be conducive to efficient concept acquisition, it is not surprising that the usual same-instance recognition advantage of pictures disappears or even reverses when different-instance recognitions are required. As was implied previously, it would be of interest to manipulate independently the perceptual and verbal characteristics of pictures in order to estimate the respective contributions of each to conceptual performance.

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