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AUTHOR Levin, Joel R.; And Others
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ABSTRACT

Recent evidence suggests that whereas pictures are more easily recognized, discriminated, associated, and recalled than their corresponding verbal labels, this is not the case in concept acquisition/utilization tasks. If such evidence is interpreted in terms of a "frequency theory" perspective, one would expect the typically obtained frequency judgment differences between pictures and words to be reduced if "conceptual" frequency judgments are required. This expectation was confirmed in three experiments in which subjects were presented with one of two types of visual or verbal stimuli, categorized or uncategorized, with varying frequencies. Subjects for the first experiment were sixth and seventh graders. Subjects for the second and third experiment were students in a college psychology class. (Author/RKM)

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by

Joel R. Levin, Lyle E. Bourne, Jr., M. A. Yarbrough,
Elizabeth S. Shaffer, Thomas M. DeRose, and Vicki Hanson

Report from the Project on Children's Learning and Development

Joel R. Levin
Principal Investigator

Wisconsin Research and Development
Center for Cognitive Learning
The University of Wisconsin
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ABSTRACT

Recent evidence suggests that whereas pictures are more easily recognized, discriminated, associated, and recalled than their corresponding verbal labels, this is not the case in concept acquisition/utilization tasks. If such evidence is interpreted in terms of a "frequency theory" perspective, one would expect the typically obtained frequency judgment differences between pictures and words to be reduced if "conceptual" frequency judgments are required. This expectation was confirmed in three experiments.

I

INTRODUCTION

Recent evidence suggests that the superiority of pictorial over verbal stimuli in discrimination learning tasks (cf. Rowe & Paivio, 1971; Rowe, 1972; Wilder & Levin, 1973) may be attributable to subjective frequency differences associated with the two types of material. In a series of experiments in which items were presented with varying frequencies (generally from one to five times), we have found that lists consisting of pictures produce frequency judgment performance which differs from that produced by lists consisting of the verbal labels of those pictures (Ghatala & Levin, 1973, 1974; Ghatala, Levin & Wilder, 1973). In particular, pictures are consistently judged with less variability and with greater accuracy than words. Theoretically, such picture-word differences in subjective frequency, combined with the tenets of frequency theory (Ekstrand, Wallace & Underwood, 1966), should be sufficient to account for picture-word differences in discrimination learning and, indeed, they are (Levin, Ghatala & Wilder, 1974).

In contrast to these results, however, Levin (1974) has concluded that although picture-over-word effects have been repeatedly demonstrated in tasks demanding item recognition, item discrimination, and item recall (cf. Paivio, 1971), they have not been obtained in tasks involving the formation or utilization of conceptual categories. It is possible that the unique perceptible features of a picture may interfere in some way with the formation of semantically broader (generally more abstract or inclusive) concepts.

The three experiments reported here were conducted to determine whether such effects would extend to frequency judgments of categories. That is, even though pictures are more easily recognized and discriminated in comparison to their verbal counterparts, does the specificity of pictures or their luminating perceptible features prevent subjective frequency units from generalizing across different category instances of the same category? In Experiments 1 and 2 we utilized narrowly defined categories (e.g., *boot* as represented by a cowboy boot and a rain boot), whereas in Experiment 3, in an effort to establish the generality of our results, we used somewhat broader concepts (e.g., *clothing* as represented by a shirt and a dress).

II

EXPERIMENTS 1 AND 2

METHOD

Design and Materials

The design consisted of four experimental conditions as defined by the combination of two types of stimulus materials (Pictures vs. Words) and two list types (Uncategorized vs. Categorized).

In the Uncategorized Picture condition, the stimuli were 44 line drawings of familiar objects (e.g., a rain boot, an alarm clock, a farmhouse). In the Uncategorized Word condition, the objects' printed verbal labels were used ("rain boot," "farm house"). In each condition, 34 of the items were randomly distributed among the 4 frequency levels represented in the study list. The 10 remaining stimuli were used as filler (or zero-frequency) items on the test list. The study list consisted of 16 pictures (or words) presented once, 9 presented twice, 5 presented three times, and 4 presented four times, resulting in a total of 65 study presentations. The order of study presentations was random, subject to the restriction that items with multiple occurrences were distributed equally in each equal-sized section, with the number of sections determined by the frequency. Thus, an item presented twice occurred once in each half of the list, an item presented three times appeared in each third of the list, and an item presented four times appeared in each quarter of the list. The same item never appeared in adjacent positions. Of the 16 items occurring once, 4 were randomly assigned to each quarter of the list. The test list consisted of the 34 study list items plus the 10 filler items. The order of test presentations was random.

In the Categorized conditions, the stimuli consisted of different instances from the object classes represented in the Uncategorized conditions. That is, for items presented once on the study list, a different instance of the same category appeared on the test list (e.g., a cowboy boot during study and a rain boot during test). For items presented more than once during study, a different category instance appeared on each study presentation as well as on the test list (e.g., a "two" item consisted of an electric clock and a grandfather clock during study and an alarm clock during test). The order of study and test presentations in the Categorized conditions duplicated that of the Uncategorized conditions.

The line drawings were photographed and mounted, one to a slide. The word pairs (modified nouns) were typed in primary type, photographed, and mounted one to a slide.

Subjects

In Experiment 1 the subjects were 120 sixth and seventh graders from an elementary school in a semirural Wisconsin community. Within each grade, subjects were randomly assigned to one of the four experimental conditions. Fifteen sixth and fifteen seventh graders were thus assigned to each condition.

In Experiment 2 the subjects were 48 volunteers from an introductory psychology class at the University of Colorado, who were fulfilling a course requirement. Twelve subjects were randomly assigned to each of the four experimental conditions.

Procedure

All subjects were tested individually, with the slides presented at a 5-sec. rate. All subjects were told that they would be shown several items, some of which would occur more than once, and that they should pay close attention because later they would be asked questions about the items. The subjects in the Categorized conditions were told that repetitions would consist of different instances of the same category. Moreover, in Experiment 2 subjects in the Categorized conditions were informed that their subsequent task would be to estimate the number of times each category had been presented (since information obtained in Experiment 1 and in a subsequent experiment indicated that the task was too difficult without this additional instruction). A sample item appropriate for each condition was presented prior to administration of the actual list.

After viewing the study list, subjects were given the appropriate test list at the same 5-sec. rate. The subjects were instructed to respond to each item, guessing if uncertain, by saying the number of times that the item (or category, in the case of subjects in the Categorized conditions) had previously occurred. They were told that some items (categories) would be presented that they had not seen before, and for these stimuli they were to respond "zero." To help clarify the task, the previous sample item was re-presented.

RESULTS AND DISCUSSION

The dependent variable consisted of the number of correct frequency judgments made by a subject across the 44 test list items. The results for each experiment, expressed as percentages and broken down according to the type of stimulus materials (Words or Pictures) and list (Uncategorized or Categorized), are presented in Table 1. For each experiment, separate

TABLE 1

FREQUENCY JUDGMENT ACCURACY IN EXPERIMENTS 1 AND 2
(MEAN PERCENT CORRECT)

	Experiment 1	Experiment 2
Uncategorized List		
Pictures	74.9	83.5
Words	57.2	67.6
	(88.3)	(71.0)
Categorized List		
Pictures	48.9	59.1
Words	44.5	52.1
	(134.7)	(235.5)

Note: Pooled variances are in parentheses.

picture-word comparisons were made on each list type. Each comparison was evaluated with $\alpha = .05$. Consider first the Uncategorized list. In both experiments subjects in the Picture condition were more accurate than were those in the Word condition, t (58) = 7.31 and t (22) = 4.62 respectively. This finding corroborates the typically obtained picture-over-word effect in frequency judgment tasks (cf. Ghatala & Levin, 1974). When the Categorized list data are considered, however, there is no evidence of the effect, t (58) = 1.44 and t (22) = 1.12, both p's > .10.

The data of Experiments 1 and 2 suggest the usual advantage of pictures over words in frequency discrimination (Uncategorized list) disappears when ordinal frequency judgments are required (Categorized list). Before generating a host of explanations for the latter condition as meaningful, however, we might treat it as an artifact. Two alternative possibilities. In the first place, it could be argued that the nonsignificant differences were due to an effective "floor" phenomenon which resulted from Categorized subjects learning little or nothing from study list presentation. However, in view of the finding that the minimum level of performance for these subjects in the two experiments was 44.3 percent (see Table 1)--which represents a score well above ($p < .01$) the computed "chance" levels (24.7 percent or 36.4 percent, assuming either a proportional or the optimal guessing strategy respectively)--there is reason to discount this argument.

It could also be argued that subjects viewing the categorized list of words received an undue advantage over subjects viewing pictures in that for them the target category was explicitly pointed out with each instance (e.g., "a <u>tool</u>," "a <u>boat</u>"), whereas for subjects given the categorized list of pictures the target category had to be deduced. Indeed, certain pictures were not categorized in the intended manner and/or could not be unambiguously associated with only one category by some subjects. Note, however, that this explanation is not completely satisfactory either. If Categorized subjects given the word list relied mainly on the second word in each pair, then their average performance should closely approximate that of <u>Uncategorized</u> subjects given the word list which, as may be seen in Table 1, it did not (a weighted across-experiment average of 46.7 percent correct in the Categorized Word condition versus 69.2 percent correct in the Uncategorized Word condition). On the other hand, since there may be an element of truth to the above speculation, a third experiment was conducted with new materials. As will be seen, the new materials also permitted an assessment of item and category frequency judgments based on a common list.

EXPERIMENT 3

METHOD

Subjects and Design

The subjects were recruited from the same pool as those serving in Experiment 2. Forty-eight subjects were equally divided among word and picture stimuli in either an Item Judgment or a Category Judgment task. All subjects were tested individually.

Materials and Procedure

Sixteen category labels, and from one to five of the most common instances of each, were selected on the basis of the Battig and Montague (1969) category norms. Thus, categories such as *clothing, furniture, vegetables, musical instruments,* and the like were included. Slides consisted either of line drawings representing the category instances or of single words representing them (e.g., "shirt," "dress").

The same study list (consisting of either words or pictures) was shown to subjects performing both tasks. The list contained 67 item presentations, each of the 16 categories differing with respect to the number of instances representing it and the number of repetitions of each instance. For the study list, between one and four different instances combined with between one and four exposures of each instance (determined according to a prearranged format) were randomly allocated to the 16 categories. For example, the category *tools* was represented by the single instance "hammer" which was presented only once. In contrast, the category *toys* contained the single instance "doll" which was presented four times; and the category *vegetables* contained the instance "carrot" presented once, "bean" presented once, "peas" presented once, and "corn" presented three times. As in the first two experiments, repetitions (of both items and same-category instances) occurred in different segments of the list.

Following study, the subjects performing the Item Judgment task were presented with a 32-item list (including 16 "zero" items from previously seen categories, e.g., "celery" from the *vegetables* category) and were asked to estimate how many times each instance had occurred on the study list. The subjects performing the Category Judgment task had been initially provided with a list of the category labels to be represented, as well as apprised of the nature of the list and their task. They were presented with the 16 "zero" items and asked to estimate how many different instances from each category had been presented (ignoring repetitions of the same instances).

RESULTS

In the Item Judgment task, subjects viewing pictures were more accurate (an average of 86.7 percent correct) than those viewing words (69.3 p[illegible] t (22) = 4.32, confirming the previous results based on different m[illegible] Also in support of the earlier findings, no difference between subj[illegible] shown pictures (57.8 percent) and words (54.7 percent) was detected on the Category Judgment task, $t < 1$. Once again, it cannot be argued that the latter task was simply too difficult, inasmuch as the mean performances more than doubled the computed "chance" level of 25 percent. No other interesting results emerged when more fine-grained analyses of the data were conducted, i.e., when the item vs. category repetition information was examined.

IV

GENERAL DISCUSSION

The present research provides evidence that picture-word differences in subjective frequency accrual (see Ghatala & Levin, 1974) may be restricted to nonconceptual tasks. In particular, the superiority of pictures over words on an instance recognition task disappeared on one requiring instance classification. In the usual (nonconceptual) frequency judgment task, it may well be that (following Paivio, 1971) with pictures, subjects are encoding unique perceptual information in addition to the verbal information elicited by the pictures' labels, and that either or both of these codes may be re-evoked by the test stimuli.

In the conceptual frequency judgment task, however, subjects benefit not from the particular characteristics of stimuli but rather from the generalized, more abstract features which form the basis for classification. These abstractions are probably most easily represented by a verbal code (but see Rosch, in press). Thus, on such a task, pictures lose the advantage of perceptual uniqueness that operates in item recognition tasks. (Note, however, that the finding in the present experiments that pictures were no worse than words in the category judgment task suggests that subjects are able to switch their attention from the pictures' dominant perceptible properties to those more abstract features necessary for efficient conceptual frequen udgment performance.)

It is worth noting that the slight (though statistically nonsignificant) advantage of pictures over words in the conceptual tasks of the three experiments is in contrast to results of various concept acqu sition and problem-solving studies where the difference is frequently significant in the opposite direction (see Levin, 1974). However, in such studies, the nature of the task--in particular, the nature of the relationships among stimuli--is usually not made explicit to subjects (e.g., Runquist & Hutt, 1961; Deno, 1968), unlike the procedures adopted here, especially those for Experiments 2 and 3. Extending this contrast in the other direction, it has been reported that pictures may even facilitate certain conceptual activities (e.g., prose comprehension) when the pictures are used in conjunction with verbal materials (see, for example, Bransford & Johnson, 1973; and Levin, 1974). Thus, the finding that pictures are not facilitative when used instead of verbal materials (as was the case here) is not inc patible with the prose comprehension findings (for supporting data, see Levin, 1973, and Harris & Rohwer, 1974).

Finally, some extensions of the present results are clearly indicated. Would, for example, picture-word differences diminish on a discrimination learning task that capitalizes on the conceptual relationships among stimuli? Some preliminary work by Ingison and Levin (in press) may even serve to frame this question within a developmental perspective. Since young children are influenced relatively more by the dominant perceptible characteristics of pictures than are older subjects, the largest picture-word difference reductions on such a task might be expected in younger populations. In fact, the presently available empirical evidence (e.g., Wohlwill, 1968; Hollenberg, 1970) is consistent with these speculations.

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