Intralist categorization in paired-associate learning[1]

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Paired-associate learning was retarded significantly when groups of pairs in the list appeared with a common label. The decrement was due largely to increased interference (response competition) among pairs sharing the same label. It is concluded that labels serve to categorize the pairs in the list.

When familiar labels (e.g., words) and low-meaningful trigrams together constitute the elements of compound stimuli in a list of paired associates, it has been reported that the labels are utilized more in learning than the trigrams (Cohen & Musgrave, 1964). In this previous research different labels appeared with each pair in the list. The purpose of the present research was to determine the effect on performance of having the same label appear with more than one pair in the list; for example, Night:WUG-Dentist; Night: VOB-Surveyor; Party: GIK-Jeweler; Party: CEF -Hunter. Under the latter procedure, the labels cannot directly function as completely effective stimuli because each is paired with several responses. However, they can provide a basis for the organization of pairs into categories, each resistant to interference from other categories. Specifically, interpair associations may develop among groups of items sharing the same label (Within-categories), thereby decreasing response competition from groups sharing other labels (Between-categories). At the same time, however, the addition of labels to the list may increase associative interference Within-categories as a result of increased stimulus similarity among items sharing the same label (e.g., Postman & Phillips, 1964). To help clarify the issue, the present study compared paired-associate (PA) learning with and without labels. To gain additional information on the effects of labels, amount of formal similarity (letter duplication) between subsets of trigrams (S terms) was also included as a variable in the design: previous research has shown an increase in the utilization of added cues with an increase in trigram similarity (e.g., Cohen & Musgrave, 1966; Newman & Taylor, 1963).

Method

Two basic lists of 16 pairs each were used. One had low and the other high S-term (trigram) similarity (Sim). The 16 low-Sim S terms used 19 consonants and six vowels. To create high-Sim S terms, four subsets of trigrams were constructed from three consonants and one vowel, with no duplication of letters between the four subsets. Average Archer (1960) association values for low and high S terms were 23.3% and 21.3%, respectively. Response terms for both lists were 6-8 letter occupation names. Each of the lists was learned with and without labels. Under the Label condition, four common nouns were used as labels, each occurring four times in the list. Care was taken to avoid selection of labels which had obvious pre-existing associations with response terms. In the low-Sim list, label-S term pairings were determined randomly. In the case of high-Sim, the pairings were also random with the restriction that each label appear once within each subset of similar S terms. It is important to note that this method of pairing produced high S-term Sim Between categories and low S-term Sim Within categories of pairs sharing the same label. Thus the design was a 2 by 2 factorial with low vs high S-term Sim as one factor and Labels vs No Labels as the second factor.

Each of the four lists was learned by a different group of college students (N = 16-19). All Ss practiced the list for 15 trials using the pairing-test (recall) method (Battig & Brackett, 1961). The pairs of each list were prepared on 2 x 2 in. slides and projected through a Carousel projector at a 4-sec rate with a 45-sec interval between trials and between pairing and test series within trials. Labels always appeared to the left of the S terms. The Ss were run in subgroups of 3-5. Upon entering the laboratory, all Ss were read standard PA instructions which made no mention of the labels. During the test series Ss wrote their responses on an answer sheet numbered consecutively from 1-16. The E read aloud the ordinal number of each test item as it was presented to help Ss maintain their place in the list. Order of presentation of the list was varied according to a prearranged (latin square) sequence.

Results

The mean number of total errors to a criterion of one errorless trial or a maximum of 15 trials was tabulated separately for each condition. Under the No Label condition, the means were 41.3 and 75.4 with low- and high-Sim S terms, respectively. With Labels, these values were 66.2 and 129.3, respectively. Both the overall slower learning with high- (100.8) than low-Sim S terms (54.1) and with Labels (95.1) than No Labels (58.4) proved to be significant ($Fs > 14.00$, $df = 1/67$, $p < .001$). Also, the data suggest that the decrement attributable to labeling was larger with high- than low-Sim S terms. Although the Sim by Label interaction fell slightly short of significance ($F = 3.89$, $df = 1/67$, $p < .10$), the termination of learning after 15 trials probably served to attenuate the effect.

In an effort to specify the source of interference under the Label condition, the locus of overt substitution errors was also examined. When groups of pairs have the same label, substitution errors can be responses from within the same category (Within-errors) or from other categories (Between-errors). Since the lists used within each Sim condition contained exactly the same pairs, it was possible to tabulate Within- and Between-errors for Ss in both Label and No Label conditions. In the No Label condition, this was accomplished by examining responses to pairs which appeared with a common label in the Label condition. To obtain the scores, the percentage of Within-errors of the total number of overt substitution errors was calculated separately for each S in each condition. The results showed more per cent Within-errors under the Label than No Label condition both with low- (34.6 vs 15.9, respectively) and high-Sim S terms (32.6 vs 8.9, respectively). Conversely, there were fewer per cent Between-errors with Labels (65.4 vs 84.1 with low-Sim and 67.4 vs 91.1 with high-Sim S terms). In all four instances the differences were significant ($Fs > 12.00$, $df > 1/32$, $p < .005$). It should be noted that in terms of absolute number of errors, more Within- and Between-errors occurred under the Label than No Label condition, although differences between conditions were substantially greater for Within-errors. Also significant was the difference in per cent Within-error scores for Ss learning low- (15.9) and high-Sim S terms (8.9) under the No Label condition ($F = 7.21$, $df = 1/34$, $p < .025$). This reduction in Within-errors with high-Sim seems attributable largely to the increased number of Between-errors therein which were responses from pairs containing similar S terms: 64.5% of all the Between-errors fell into this category, as compared with 45.5% under the Label condition.

Discussion

The results of the present research clearly demonstrate a significant decrement in PA performance from the addition of labels to groups of pairs comprising the list. Moreover, the deleterious effect of labeling seems mostly due to increased response competition among pairs sharing a common label, as evidenced by the occurrence of significantly more (per cent) Within- and fewer Between-category substitution errors with than without labels. Thus the results point to the use of labels by Ss to categorize pairs in the list even though overall learning is thereby retarded. Similar categorization effects have been reported for pairs presented simultaneously for learning (Brown & Brown, 1965; Brown & Read, 1966) and for pairs sharing conceptually similar S terms (Underwood, Ekstrand, & Keppel, 1965, Exp 5). In addition, the present findings suggest an increase in the utilization of labels with an increase in list difficulty, as indicated by the relatively greater decrement from labels in the high- than low-similarity list. Since it has been shown elsewhere that this increase in utilization may serve to facilitate learning when different labels are added to each pair in the list (Cohen & Musgrave, 1964), it would appear that speed of PA learning will first decrease and then increase as number of labels increases from zero to complete overlap. It cannot be ascertained from the present data, however, whether this is a continuous or discontinuous function, i.e., whether the shift to relative facilitation will occur prior to complete overlap. More systematic research is needed to specify more precisely the nature of the relationship.

The failure to find an overall reduction in Between-category errors with labels may derive from the use herein of labels which were conceptually unrelated to the responses paired with them. If related labels had been used a reduction in interference might have occurred. Nonetheless, the approach taken here appears to be a potentially useful one for the further investigation of organizational processes in verbal learning.

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Note

1. This investigation was supported by Public Health Service Research Grant MH-11179-02, 03 to the first author, and by a National Science Foundation Predoctoral Traineeship to the second author.