Reviewing transfer from verbal discrimination to paired-associate learning

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The purpose of the present paper was to reexamine transfer from verbal discrimination to paired-associate learning in light of hypotheses derived from the frequency theory of verbal discrimination learning. With this in mind, two groups of subjects learned a verbal discrimination list followed by a paired-associate list. For one group, the lists were made up of consonant-vowel-consonants while for the others, nouns were used. In each paired-associate list, three types of pairs were used; pairs in which the verbal discrimination correct items became paired-associate responses while the incorrect items became stimuli, pairs in which this situation was reversed, and completely new pairings. As in previous studies, no differential transfer was found.

Studies attempting to find transfer from verbal discrimination to paired-associate learning have had, at best, limited success. Of special interest in this type of transfer is a paired-associate list made of the identical items that were used in the verbal discrimination task. Battig, Williams, and Williams (1962) studied transfer from a 12-item verbal discrimination list to a 12-item paired-associate list. Four of the pairs were used in each of the two lists. In one case, the correct items of the verbal discrimination list became the stimulus in the paired-associate list with the incorrect item becoming the response (hereafter called C-S) while for the other two pairs this situation was reversed (C-R pairs). The results indicated no difference in transfer between these two types of pairs when compared to pairs in the paired-associate list which were completely new to the subject. The authors concluded, based on these pairs and the others in the list, that there was "no evidence for any facilitation of paired-associate performance by prior verbal discrimination learning involving the paired-associate material" (Battig et al., 1962).

In attempt to explain the results from the previous experiment, Battig and Brackett (1963) conducted the same type of transfer under a variety of experimental conditions. Using a mixed list design, four of the 12 pairs were constructed using the same items in both lists. Again two of these four were C-S pairs while the other two were C-R pairs. As in Battig et al. (1962), no significant transfer was found for these two types of pairs when compared to control pairs. Battig and Brackett again found "no positive transfer from identical pairings on verbal discrimination and paired-associate lists."

Of interest in both studies was a recall task required of subjects between verbal discrimination and paired-associate tasks. In this recall task, all verbal

discrimination items were presented and the subject was required to recall the items that had been paired with the item presented. Both studies found that the subjects made more correct responses when the incorrect items were presented than when the correct items were presented. This is the same procedure as the "test" trial in the study-test method of paired-associate presentation, but analysis of the paired-associate data revealed no significant difference between the C-S and C-R pairs. Also of importance was that the study-test procedure was used in both studies.

Spear, Ekstrand, and Underwood (1964) did find transfer from verbal discrimination to paired-associate learning. When comparing appropriate pairings and inappropriate pairings to control pairs, they found positive transfer for the appropriate pairs and negative transfer using the inappropriate pairs. As in Battig et al. (1962) and Battig and Brackett (1963), the appropriate pairs were divided into two subgroups. One subgroup could be renamed C-S pairs while the others would be C-R pairs. As in the other two studies, no significant difference was found between these two types of pairings.

Although all three studies have made important contributions to the investigations of transfer between paradigms and learning by contiguity, they seem to leave one problem unsolved. The problem is the lack of significance between the C-S and C-R transfer pairings. It seems that, based both on theories of paired-associate learning and verbal discrimination learning, a difference between these two types of pairs should be expected.

Battig (1968), reviewing theories of paired-associate learning, identified 10 possible processes that might need to be accomplished for paired-associate learning to occur. Of these 10 processes, it was demonstrated by Underwood and Schulz (1960) that response learning and stimulus-response associations may be the two most important processes of the entire group. Battig (1968) defined response learning as being "able to produce or

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recall the response in the absence of the response term" while the associative stage involves the development of associations between the stimulus and response terms. A review of paired-associate learning by Ellis (1972) indicates that considerable positive transfer results when the response learning stage is made less difficult. Thus it seems that any task that makes the response items more recognizable, thereby making them easier to learn, will facilitate paired-associate learning. Predicting from the frequency theory of verbal discrimination learning it would seem that verbal discrimination learning would facilitate response learning in certain situations.

According to frequency theory, a verbal discrimination list is learned on the basis of frequency cues. The subject makes a series of responses to the pairs of items in the list. Each response adds a frequency unit to a member of a pair. As the subject goes through the list a number of times, these frequency units begin to accrue to the correct and incorrect items. The frequency units accrue to the correct items at a faster rate than to the incorrect items and the frequency difference is used by the subject to make the discrimination. At the end of verbal discrimination learning all of the correct items in the list have many more frequency units than the corresponding incorrect items.

Ellis (1972) states that the greater frequency of responses in a paired-associate list, the easier the list is to learn. If these correct items are made responses in a paired-associate list while the incorrect become stimuli, this should facilitate paired-associate learning because of the greater frequency of the response terms which leads to faster response learning. If this situation is reversed in the construction of the paired-associate list, one does not expect as much transfer because the incorrect items do not have as much experimental frequency and the subject must spend more time in response learning.

The second of the two stages is the association stage. That an association forms between two items of a pair in a verbal discrimination list has already been demonstrated (Spear et al., 1964). When the same pairings are used in a paired-associate list, learning is facilitated. A number of verbal discrimination studies have supported this finding and more importantly have found differences between the C-S and C-R transfer.

As previously mentioned, Battig, et al. (1962) and Battig and Brackett (1963) found that subjects could recall more correct verbal discrimination items when presented with the incorrect item than if the situation was reversed. This indicates two things; first, that an association had been formed between correct and incorrect items and second, that the association was stronger when going from incorrect to correct.

This same result was found by Kanak (1968), who required subjects to recall correct items when presented incorrect items and recall incorrect items when presented correct items. In agreement with the studies

by Battig and his associates, Kanak found significantly more recall when going from incorrect to correct. Again, there is evidence that associates are formed and are stronger going from incorrect to correct. It is important to note that this is analogous to the test trial of paired-associate learning when conducted using the "study-test" method.

The question is why has differential transfer not been found when going from verbal discrimination to paired-associate learning? If the subjects can recall the correct item better than the incorrect item, why are not C-R paired-associate pairs learned more rapidly than the C-S pairs?

One possible explanation could be the meaningfulness of the items used in the transfer task. Battig and his associates and Spear et al. used low meaningful items in the construction of the verbal discrimination and paired-associate lists. Ellis (1972) states that response meaningfulness has a large effect on paired-associate learning. If the meaningfulness of the response is low, it is possible that the preceding verbal discrimination learning does not familiarize the subjects with the items to the extent necessary for a difference to appear between the two types of paired-associate pairs. Perhaps if the meaningfulness of the items were increased, a significant difference would appear between the C-R and C-S paired-associate pairs.

The purpose of the present study was to test these implications derived from theory and results of previous studies. Transfer from verbal discrimination to paired-associate learning was compared using nouns and nonsense syllables. Both paired-associate lists contained C-S pairs, C-R pairs, and new pairs. It was predicted that positive transfer would be obtained with both types of experimental pairs with more for the C-R pairs.

METHOD

Design

For the verbal discrimination task, two levels of meaningfulness, nouns and nonsense syllables, defined two experimental groups with 13 subjects per group. Each group was given six trials in which to learn the verbal discrimination list. In paired-associate learning, meaningfulness was also included as a variable. In addition, transfer pairing was included as a within-group variable. Three transfer pairings or sublists were used; correct items become stimuli (C-S), correct items become responses (C-R), and new paired-associate pairings. Again there were 13 subjects per group and each subject was given six trials to learn the paired-associate list.

Apparatus and Procedure

To construct the verbal discrimination lists, 24 words, the first word in a category, were taken from Battig and Montague's (1969) lists while 24 nonsense syllables, with association value from 17 to 25, were selected from Archer's (1960) norms. Both groups of items were randomly paired to give one 12 pair noun list and one 12 pair nonsense syllable list. One item of each pair in both lists was randomly selected to serve as the correct item. In addition, the nouns selected from Battig and Montague were

translated into Spanish. The nonsense syllables were compared, when possible, to the norms of Young and Webber (1968) to control for possible differences in association value for a Spanish-speaking population.

In constructing the paired-associate lists, eight of the 12 pairs in each of the verbal discrimination lists were used in the paired-associate lists. Four paired-associate pairs were made by using a correct verbal discrimination item as the stimulus and the incorrect item of the same pair as the response. These have been referred to as C-S pairings. The other four were made in the opposite manner by making an incorrect item a stimulus and the correct item of the same verbal discrimination pair as the paired-associate response (C-R pairings). For the final four paired-associate pairs of each list, eight additional items were selected from both Battig and Montague and Archer and these were randomly paired to give the new pairings in both the noun list and the nonsense syllable list. Again the nouns were translated into Spanish and the nonsense syllables compared to the Spanish norms. One item of each pair was randomly selected to be stimulus while the other became the response.

Both tasks were presented by using a test booklet which utilized the study-test method. The first page of the booklet contained instructions for verbal discrimination learning. After each subject understood the instructions, they were asked to turn to the next page and verbal discrimination learning began. This page was a study trial which contained a list of all verbal discrimination pairs with the correct items underlined. The subjects were given 36-sec to study the pairs, or approximately 3-sec per pair. Following this, the subjects turned to the next page and began the test trial. On this trial, the pairs were again listed and the subject was required to write down beside each pair the item he believed to be correct. Again they were given 36 sec to accomplish this task. This was the procedure for the first 12 pages of the booklet following the first set of instructions as the subjects alternated between study and test trials. Four different orders were used for these trials to control for serial order effects while the position of the correct item, top or bottom, was controlled to prevent position effects.

Following the last verbal discrimination test trial were instructions for paired-associate learning. The next 12 pages of the booklet were analogous to the study and test trials of verbal discrimination learning. On the study trials, all of the paired-associate pairs were listed and the subjects given 36 sec to study them. On test trials, only the stimulus terms were listed, and the subjects were required to write down the response that had been paired with each stimulus item. Again they were given 36 sec. As in verbal discrimination learning, four different orders across study and test trials were used to prevent serial order effects.

Subjects

Twenty-six Spanish-speaking students were used as subjects. All were enrolled in a class of introductory statistics at the University of the Americas. All were naive to verbal discrimination and paired-associate tasks.

RESULTS

Verbal Discrimination Learning

An analysis of variance was performed on the data collected from the verbal discrimination task. The analysis indicated only three significant effects. One of these was the main effect of meaningfulness [$F(1,24) = 11.22$, $p < .01$]. This was due to the fact that performance on the noun list was superior to that on the list of nonsense syllables. Also significant was the main effect for trials [$F(5,120) = 10.54$, $p < .01$]. This

indicates that performance improved over trials. Finally the Meaningfulness by Trials interaction was significant [$F(5,120) = 4.99$, $p < .01$]. This significant interaction resulted from a difference in performance improvement. The nonsense syllable list had a steeper learning curve than did the noun list.

Paired-Associate Learning

An analysis of variance was also performed on the data collected from paired-associate learning. Again a significant effect for meaningfulness was found [$F(1,24) = 272.38$, $p < .01$]. As in verbal discrimination learning, performance on the noun list was far superior to that on the nonsense syllable list. The trial main effect was also significant [$F(5,120) = 15.33$, $p < .01$], indicating that performance on the paired-associate task improved over trials.

One significant interaction, the Trials by Sublist by Meaningfulness interaction, was found to be significant, [$F(10,240) = 3.00$, $p < .01$]. This interaction is due to differences in the learning rate of the three sublists between the two experimental groups. This interaction did not seem to have any behavioral significance and, for this reason, no further explanation will be given. The means and standard deviation of the experimental groups collapsed over trials are presented in Table 1.

After conducting the initial analysis on the data collected from paired-associate learning, it appeared that there was no transfer from verbal discrimination to paired-associate learning. However, based on experiments such as Kanak (1968), it seemed possible that transfer might have occurred on early paired-associate trials and that if an analysis was done simply on the first test trial, significant transfer from verbal discrimination to paired-associate learning might be found.

For this reason, an analysis of variance was performed on the data collected from Trial 1 of paired-associate learning. The analysis revealed only one significant effect, that of meaningfulness [$F(1,24) = 107.93$, $p < .01$]. This difference again indicates that high

Table 1
Means and Standard Deviations for Each Experimental Group
on Each of the Sublists for Both the Complete
Analysis and Trial 1 Analysis

		C-R	C-S	New
Complete Analysis				
CVC	Mean	.60	.74	.73
	SD	.72	.89	.98
Noun	Mean	3.77	3.68	3.68
	SD	.58	.80	.52
Trial 1 Analysis				
CVC	Mean	.23	.23	.23
	SD	.44	.44	.44
Noun	Mean	3.46	2.69	3.15
	SD	.88	1.32	1.14

meaningful pairs are easier to learn than low meaningful pairs. No other main effects or interactions were found to be significant again indicating no transfer from verbal discrimination to paired-associate learning. The means and standard deviations of the Trial 1 analysis are also presented in Table 1.

DISCUSSION

The only conclusion that can be drawn from the results of the present study is that there is no transfer from verbal discrimination to paired-associate learning. For this reason, the results support those by Battig, Williams, and Williams (1962) and Battig and Brackett (1963). However this poses a problem because it does not support predictions drawn from the frequency theory of verbal discrimination learning or the results of the experiment by Spear, Ekstrand, and Underwood (1964).

Frequency theory states that correct items will have more frequency units than the corresponding incorrect items following verbal discrimination learning and both will have more units than new items. Based on conclusions by Battig (1968) anything that makes a response item more familiar during paired-associate learning should facilitate response learning and, for this reason, the learning of the paired-associate list. The assumption was made that increasing the experimental frequency of a word would make it more familiar to the subject at the beginning of paired-associate learning and if these words became response then paired-associate learning would be facilitated. Based on this, it was assumed that positive transfer would be obtained with both C-S and C-R sublists with more transfer for the C-R type because of the greater frequency of the correct items. This was the basic finding of Spear et al., although no differences were found between the C-S and C-R types.

As noted previously, no difference was found in the present study between the C-S, C-R, and new pairs within the two experimental lists. One possible explanation is that the new pairs were less difficult than the C-R and C-S pairs and for this reason the transfer effects were hidden. Although this was not determined experimentally, this seems unlikely because all sublists of nonsense syllables were drawn from the same general association level and all nouns were the first listed in their category. Also similarity was controlled as much as possible. Therefore this explanation does not seem to be an adequate one for the present results.

Battig et al., Battig and Brackett, and Kanak demonstrated that following verbal discrimination learning, subjects could recall more correct items when given the incorrect item as a cue than incorrect items when presented correct items. This is analogous to the first trial of paired-associate learning. In this study, no significant effect other than meaningfulness was found in the analysis of the first trial of paired-associate learning again indicating no transfer effects.

There is one important difference between the two situations. In the present study, a "study" trial preceded the first test trial while in the studies mentioned above the test trial preceded the initial study trial. It is possible that during the first study trial, the subject would spend most of the time allotted concentrating on those pairs which were made up of new items. The assumption here is that he would already have some knowledge of the correct response for the C-S and C-R pairs. It would then be possible that, at the beginning of the first trial, all responses would be about equal with regard to familiarity and there would be no transfer effects. When the test trial precedes the study trial

this would not occur and transfer be found.

The fact that a mixed list was used supports this explanation. The paired-associate lists used in this study contained 12 pairs; four of each type. This means that following verbal discrimination learning, only four paired-associate pairs were unfamiliar to the subjects. It is not hard to visualize a subject concentrating on these four pairs during the first paired-associate study trial, thus making all paired-associate responses of equal familiarity. The means of the three sublists, especially in the high meaningful group, support this conclusion. It appears the subjects in the low meaningful group were not aided by the frequency units in any way.

This proposition could easily be tested by using unmixed lists. In this manner, the number of pairs of each type would be increased and an individual subject would see only one type. This would control for the effects discussed above. It could then be determined if there is transfer from verbal discrimination to paired-associate learning. A second method would be to precede the study trial with a test trial. This would also control the study time spent by subjects on the new pairs.

Also proposed was a possible effect of meaningfulness on transfer between the two tasks. The results indicated an effect for meaningfulness in both tasks but no differential transfer effects. It appears that transfer, or lack of it, is consistent across levels of meaningfulness.

In summary, no transfer was found between verbal discrimination and paired-associate tasks supporting conclusions of Battig and his associates (Battig et al. and Battig and Brackett). However, due to predictions made from frequency theory which predicts positive transfer and the Spear et al. study which found positive transfer, possible explanations for the results of the study were suggested.

REFERENCES

- Archer, E. J. A reevaluation of the meaningfulness of all possible CVC trigrams. *Psychological Monographs*, 1960, 74, (IV, Whole No. 497).
- Battig, W. F. Paired-associate learning. In T. R. Dixon and D. L. Horton (Eds.), *Verbal behavior and general behavior theory*. Englewood Cliffs, N. J.: Prentice-Hall, 1968, Pp. 122-148.
- Battig, W. F., & Brackett, H. R. Transfer from verbal-discrimination to paired-associate learning: II. Effects of intralist similarity, method, and percentage occurrence of response members. *Journal of Experimental Psychology*, 1963, 65, 507-514.
- Battig, W. F., & Montague, W. E. Category norms for verbal items in 56 categories: A replication and extension of the connecticut category norms. *Journal of Experimental Psychology Monograph*, 1969, 80, No. 3.
- Battig, W. F., Williams, J. M., & Williams, J. G. Transfer from verbal discrimination to paired-associate learning. *Journal of Experimental Psychology*, 1962, 63, 258-268.
- Ekstrand, B. R., Wallace, W. P., & Underwood, B. J. A frequency theory of verbal discrimination learning. *Psychological Review*, 1966, 73, 566-578.
- Ellis, H. C. *Fundamentals of human learning and cognition*. Dubuque, Iowa: Wm. C. Brown, 1972.
- Kanak, N. J. The effects of rate of exposure upon simultaneous intentional and incident verbal-discrimination learning. *Psychonomic Science*, 1968, 12, 141-142.
- Spear, N. E., Ekstrand, B. R., & Underwood, B. J. Association by contiguity. *Journal of Experimental Psychology*, 1964, 67, 151-161.
- Underwood, B. J., & Schulz, R. W. *Meaningfulness and verbal learning*. Chicago: Lippincott, 1960.
- Young, R. K., & Webber, A. W. Materias verbales para uso en estudios del aprendizaje. *Revista Interamericana de Psicología*, 1968, 2, 49-60.

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