Bulletin of the Psychonomic Society
1977, Vol. 10 (6), 493-495

Transfer in the W_1-R_2 verbal discrimination paradigm as a function of instructions

N. JACK KANAK and ZULEKHA MEHTA
University of Oklahoma, Norman, Oklahoma 73019

The W_1-R_2 verbal discrimination transfer paradigm was found to produce pronounced positive transfer, relative to a nonspecific control, when subjects were explicitly informed of the interlist relationship. The instructional variable was suggested as important in reconciling discrepancies in previous literature.

The present study investigated the influence of instructions concerning the interlist relationship between wrong- (W) and right- (R) item alternatives in the W_1-R_1, W_1-R_2 verbal discrimination transfer paradigm. In this paradigm the W items of List 2 are identical to the W items of List 1, while the R items of List 2 are new, unrelated items. Performance is typically compared to a nonspecific transfer control, W_1-R_1, W_2-R_2, in which List 2 involves both new W and R items.

According to the frequency theory of verbal discrimination learning (Ekstrand, Wallace, & Underwood, 1966), the W_1-R_2 paradigm should be governed by Rule 2 (select the subjectively least frequent item) early in List 2 practice. As List 2 practice continues, however, the initially "less frequent" R item should accumulate frequency units at a more rapid rate than the W item, based on the counting postulates of frequency theory, and the discrimination based on differential frequency should break down followed by a switch to a Rule 1 mode of responding (select the subjectively most frequent item). Thus, relative to the W_2-R_2 control, frequency theory predicts early positive transfer followed later by negative transfer, since Rule 1 is the appropriate mode of responding for the control group throughout List 2 practice.

A number of studies have shown support or at least partial support for the predictions. Underwood, Jesse, and Ekstrand (1964), in a study important to the later development of frequency theory, supported the prediction with a relatively fast anticipation interval presentation rate (1.5:2 seconds), but not with a slower rate (3:2). King and Levin (1971), in a study varying degree of List 1 learning, generally supported frequency theory, but the across-trial effects relative to the control were not consistently present within each degree of List 1 learning. Unlike the Underwood et al. (1964) study, subjects were not informed of the interlist relationship. Schneider and Goulet (1973), varying the type of pronunciation of List 1 items on the test trial (pronouncing both items and identifying the item considered correct or identifying and pronouncing only the item considered correct) found the predicted interaction of W_1-R_2 performance across trials, which varied as predicted with the pronunciation manipulation. That is, the amount of early positive transfer was greater and the crossover with the control group occurred later for the group which pronounced both items in List 1. In each of the above studies, except King and Levin (1971) which provided only mixed support for frequency theory, the subjects were fully informed of the interlist relationship.

In contrast, a number of studies in which subjects were not so informed produced results which fail to support frequency theory by finding early and continuing negative transfer in W_1-R_2 relative to the control (e.g., Kanak & Dean, 1969, Experiment 1; Kanak & Rabenou, 1975; Kausler & Dean, 1967; Kausler, Fulkerson, & Eschenbrenner, 1967). The results of these studies were interpreted as supporting the hypothesis that incidentally learned associations between W and R items of List 1 enter into a competition-unlearning relationship (A-B, A-C) with the incidental learning of List 2 associations, thereby increasing intentional discrimination learning task difficulty. Support for the competition-unlearning hypothesis was further shown by Kausler et al. (1967) in significant retroactive inhibition effects in the retention of List 1 associations for W_1-R_2 relative to the W_2-R_2 control. Additional support for the incidental learning hypothesis has been obtained in other paradigms involving potential competition between incidentally learned associations (e.g., Kanak & Dean, 1969, Experiment 2; Kanak & Knight, 1974).

The literature therefore strongly implicates the instructional variable as a determinant of whether the W_1-R_2 paradigm produces results consistent with frequency theory or with the hypothesis that incidental associative learning mechanisms interact with frequent mechanisms to determine resultant transfer. Therefore, the present experiment varied the presence or absence of instructions concerning the interlist relationship to directly test these implications.

Requests for reprints should be addressed to N. Jack Kanak, Department of Psychology, University of Oklahoma, Norman, Oklahoma 73019. The authors acknowledge the University of Oklahoma Research Council for funds supporting the study.

METHOD

Subjects and Design

The subjects were 64 undergraduate students enrolled in introductory psychology courses at the University of Oklahoma. None had participated in prior human learning experiments. Sixteen subjects were assigned by a randomized block procedure to the four principal conditions, and the list variants within the conditions, in order of their appearance at the laboratory. The experimental design was a 2 by 2 factorial with transfer paradigms (W_1-R_1, W_1-R_2 and W_1-R_1, W_2-R_2) crossed with instructions or no instructions concerning the interlist relationship.

Materials

The word lists were constructed from a pool of 56 associatively unrelated words of A or AA Thorndike-Lorge frequency. Associative relatedness was controlled via the use of the Palermo and Jenkins (1964) and Shapiro and Palermo (1968) norms. Form class (noun or adjective) was controlled such that there were no pairs of mixed form class and the proportion of nouns and adjectives composing each list was equal. Twenty-eight words were randomly selected and randomly paired to form List 2 of 14 pairs for both the W_1-R_2 and W_2-R_2 paradigms. The 28 remaining words were similarly paired to form List 1 of the W_2-R_2 paradigm. List 1 for the W_1-R_2 paradigm consisted of List 2 W items and R items selected from List 1 of the W_2-R_2 paradigm. Within each of these derived lists, four list variants were derived varying W- and R-item function and word pairings. There were four random serial orders of each list and within each list spatial position of the R item was unsystematically varied, with sequences of the same consecutive spatial position limited to no more than three. The pairs were typed in horizontal juxtaposition and the R item was underlined in the feedback interval.

Procedure

The lists were presented to individual subjects using a Lafayette memory drum with the anticipation method. The pairs were presented at a 2:2-sec rate with a 4-sec intertrial interval. The subjects were given standard verbal discrimination learning instructions prior to beginning practice on List 1, with no indication that a second list would follow. List 1 learning was carried to a criterion of two consecutive perfect trials. Following acquisition of List 1, uninstructed subjects were told that they were to learn a second list, using the same procedure as before, but with no information provided concerning the interlist relationship. Instructed subjects were given explicit information about the interlist relationship in terms of which items were new or old. Specifically, subjects in the W_1-R_2 condition were told the list would consist of W items from List 1 continuing to function as W items and paired with new R items. Subjects in the W_2-R_2 condition were told that both the W and R items would be new and no old items retained. List 2 practice was carried to a criterion of two consecutive perfect trials.

RESULTS AND DISCUSSION

List 1 Acquisition

A 2 by 2 by 4 (list variants) analysis of variance of the number of trials to criterion yielded no significant main effects or interactions (all ps $>$ .14). The same analysis of the total number of errors to criterion yielded identical conclusions (all ps $>$ .35). The overall means for trials and errors were 8.49 and 23.68. These results indicate comparable degrees of List 1 practice and difficulty for all groups, and list variants was omitted as a factor in subsequent analyses.

Table 1
Mean Trials to Criterion, Trial 1 Errors, and Total Errors on List 2

		Trials	Trial 1 Errors	Total Errors
W_1-R_2	Instructed	3.37	1.62	5.37
	Uninstructed	5.44	6.06	15.12
W_2-R_2	Instructed	5.06	7.75	15.81
	Uninstructed	4.50	6.75	12.94

List 2 Transfer

Table 1 presents the means for trials to criterion, Trial 1 errors, and total errors. The Paradigm by Instructions interaction was highly significant on each measure, with F values (1 and 60 df in each case) and MSe values, respectively, of 9.25 and 2.98 for trials, 21.20 and 5.58 for Trial 1 errors, and 16.64 and 38.31 for total errors. Post hoc comparisons were made with Tukey's test on each dependent variable and all comparisons reported as significant were significant at the .01 level. All significant comparisons reported were significant across all three measures. Under instructed conditions, the W_1-R_2 paradigm was in each case superior to the W_2-R_2 control. Instructions facilitated W_1-R_2 transfer relative to no instructions, but the instruction factor did not affect the control group. Under no instructions, the W_1-R_2 condition required more trials and produced more total errors than the control group, but the differences were unreliable.

An additional analysis was performed on the List 2 total error data by separating subjects into slow and fast learners within each paradigm on the basis of the median List 1 trials. Previous research (Kanak & Knight, 1974) has shown that slow List 1 learners are more subject to associative interference in another competition paradigm involving re-pairing of List 1 R and W items on List 2. Ties at the median were broken by a random assignment of tied subjects to the slow and fast cells within each of the four conditions, and this procedure was checked to confirm a lack of bias. A 2 (slow vs. fast) x 2 x 2 analysis of variance was then conducted. The instruction, slow-fast, and paradigm main effects were significant and, more importantly, the Instructions by Paradigm and Paradigm by Slow-Fast Learners interactions were both significant [Fs(1,56) = 22.66 and 5.12, respectively, MSe = 28.13]. The Instructions by Paradigm interaction produced the same significant Tukey's comparisons as in previous analyses, but in addition the W_1-R_2 group ($\bar{X}$ = 15.12) was significantly inferior to the control ($\bar{X}$ = 12.94) under no instructions ($p < .01$). This result supports the incidental associative interference hypothesis and most previous studies employing uninformed subjects. Tukey's comparisons within the Paradigm by Slow-Fast interaction indicated that the 16 slow List 1 learners made significantly more List 2 errors ($\bar{X}$ = 14.75) than did fast learners ($\bar{X}$ = 5.75) in the W_1-R_2 paradigm but did not differ in the W_2-R_2 paradigm

($\bar{X}$s = 15.87 and 12.87). The latter result indicates that the significant difference in the W_1-R_2 paradigm is not simply a result of slow learners continuing to be slow learners. In addition, fast List 1 learners in the W_1-R_2 paradigm made significantly fewer errors ($\bar{X}$ = 5.75) than did fast learners in the control group ($\bar{X}$ = 12.87). These results support previous findings that slow List 1 learners, who presumably develop more and stronger incidentally learned W_1-R_1 associations, experience pronounced incidental associative interference, while fast learners experience little and may perhaps use a list-wide strategy of "avoiding" old W-item alternatives. This seems particularly true of the eight instructed fast W_1-R_2 learners who made an average of .75 List 2 errors, with five of the subjects making no errors, as opposed to an average of 14.00 for instructed fast W_2-R_2 learners. Uninstructed fast W_1-R_2 learners made an average of 10.75 errors compared to uninstructed fast W_2-R_2 subjects, whose mean was 11.75. Thus, instructions play a particularly important role in reducing W_1-R_2 errors, with the effect being greater for fast learners.

With regard to the trend of performance across List 2 trials, both the instructed and uninstructed W_1-R_2 conditions failed to support the prediction of increased errors corresponding with the prediction from frequency theory of a switch from a Rule 1 to a Rule 2 mode of responding across trials. On Trial 1 the instructed W_1-R_2 condition produced an average of 1.62 errors vs. 7.75 for the control condition, while the mean errors per trial across Trials 2-5 were .87 and 2.15, respectively. For the uninstructed conditions, mean Trial 1 errors were 6.06 and 6.75 for the W_1-R_2 and W_2-R_2 conditions, respectively, while the mean errors per trial across Trials 2-5 were 1.97 and 1.50, respectively. Thus, instructions produced early and continuing positive transfer for W_1-R_2, while uninstructed W_1-R_2 subjects moved from near-chance performance on Trial 1 to negative transfer on later trials relative to the control group. Although the present results do not indicate that the instructional variable accounts for the discrepancies in the literature in across-trial results, they do indicate that instructions may reconcile the discrepancies concerning overall positive vs. negative transfer on the measure of total errors or trials.

REFERENCES

EKSTRAND, B. R., WALLACE, W. P., & UNDERWOOD, B. J. A frequency theory of verbal discrimination learning. *Psychological Review*, 1966, **73**, 566-578.

KANAK, N. J., & DEAN, M. F. Transfer mechanisms in verbal discrimination. *Journal of Experimental Psychology*, 1969, **79**, 300-307.

KANAK, N. J., & KNIGHT, J. M. The re-pairing decrement in verbal discrimination transfer: Further evidence favoring associative mechanisms. *Journal of Experimental Psychology*, 1974, **103**, 304-309.

KANAK, N. J., & RABENOU, B. Incidentally learned associations and imagery in verbal discrimination transfer. *Bulletin of the Psychonomic Society*, 1975, **6**, 177-180.

KAUSLER, D. H., & DEAN, M. G. Supplementary report: Direct and mediated transfer for right and wrong responses in verbal discrimination learning. *Journal of Verbal Learning and Verbal Behavior*, 1967, **6**, 672-674.

KAUSLER, D. H., FULKERSON, F. E., & ESCHENBRENNER, A. J., JR. Unlearning of List I right items in verbal discrimination transfer. *Journal of Experimental Psychology*, 1967, **75**, 379-385.

KING, M. E., & LEVIN, I. P. Tests of frequency theory in verbal discrimination transfer with varying paradigms and List 1 trials. *Psychonomic Science*, 1971, **25**, 226-228.

PALERMO, D. S., & JENKINS, J. J. *Word association norms: Grade school through college.* Minneapolis: University of Minnesota Press, 1964.

SCHNEIDER, H. G., & GOULET, L. R. Pronunciation in verbal discrimination learning and transfer. *American Journal of Psychology*, 1973, **86**, 339-343.

SHAPIRO, S. I., & PALERMO, D. S. An atlas of normative free association data. *Psychonomic Monograph Supplements*, 1968, **2**, No. 12(Whole No. 28).

UNDERWOOD, B. J., JESSE, F., & EKSTRAND, B. R. Knowledge of rights and wrongs in verbal discrimination learning. *Journal of Verbal Learning and Verbal Behavior*, 1964, **3**, 183-186.

(Received for publication August 24, 1977.)