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Rehearsal of the Incorrect Alternative in Verbal Discrimination Learning

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REHEARSAL OF THE INCORRECT ALTERNATIVE IN VERBAL DISCRIMINATION LEARNING

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By

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Introduction

All memory tasks can be divided into those which require recall and those which require recognition. Recall tasks are considered the more difficult of the two tasks, since a response which is not the same as the stimulus must be produced. Recognition tasks, on the other hand, always have the correct item along with a number of incorrect or distractor items, and thus require only that the correct item be identified (i.e., discriminated from the other stimuli). Thus, the response of a name to the picture of somebody or something is a recall task, while the selection of the correct name from a number of alternatives is a recognition task. Other types of common recognition tasks are multiple choice, true-false and matching tests. The present experiment is concerned with the processes involved in recognition learning. In studying the processes of recognition learning, the verbal discrimination task is frequently used, since so many of our recognition tasks involve language symbols. The present experiment examined the processes involved in verbal discrimination learning.

Verbal Discrimination Task

A Verbal Discrimination (VD) learning task is one in which a subject (S) is required to learn to discriminate the correct item from a number of items, the correctness being an arbitrary designation by the experimenter (E). Although any number of items may be presented in a VD task, typically a ten to twenty pair list is presented. The task of the S is simply to learn and identify the correct member of each pair of a list.

Usually several verbal discrimination trials are presented. Either the anticipation procedure (in which each pair of a list is presented for a test interval followed by a study interval) or the study-test procedure (in which all of the pairs of a list are presented for a test trial followed by all the pairs of a list presented for a study trial) may be used.

Frequency Theory of Verbal Discrimination Learning

Ekstrand, Wallace and Underwood (1966) proposed a frequency theory to explain the processes of VD learning. According to frequency theory, S discriminates between the two items of a pair on the basis of the frequency of their occurrence. This frequency of occurrence may accrue from either everyday language use (thus the word "the" has a very high frequency of occurrence while the word "surd" has an extremely low frequency of occurrence) or from the experimental task itself. Experimentally, frequency is built up through four processes (each of which contributes a single frequency unit): the perception of the item called the representation response (RR); the indication (usually vocalization) of the item by S called the pronunciation response (PR); overt or covert practice of the correct item called the rehearsal-of-the-correct-alternative-response (RCR); a response to associates of an item within a list called the implicit associative response (IAR). Thus, using the study-test procedure, for example, during the test trial (if the first trial were a test trial, then S would be guessing) S views both members of a pair (RR) and each item receives one frequency unit. S then informs E of the item thought to be correct (PR) giving that item another frequency unit. If the correct item has been chosen, a 2:1 frequency ratio

would exist in favor of the correct item. But if the incorrect item has been chosen, a 2:1 frequency ratio would exist in favor of the incorrect item. During the study trial the S is shown which member of the pair is correct, and that item receives another frequency unit by the RCR process. A ratio of 3:1 would now exist in favor of the correct item if S had chosen correctly. A 2:2 ratio would now exist if S had chosen incorrectly, but if on the second test trial S would choose correctly, the C item would have four frequency units and the incorrect three frequency units. The second study trial would give the correct item an additional frequency unit resulting in a 5:3 frequency ratio favoring the correct item. Thus learning of a list of items occurs, according to frequency theory, primarily as a result of the RCR process which causes more frequency units to be built up to the correct item than to the incorrect item in the long run. The tendency to choose the high frequency item is called "Rule 1", and the tendency to choose the low frequency item is called "Rule 2." It would appear that rule 1 should be easier to use since it allows S to learn more naturally through positive instances; that is S learns what to do (or say) rather than what not to do (or say).

For example, assume that the words "dog" and "chair" are paired in a VD list, with "dog" arbitrarily predetermined by E as the correct item. Then on the first test trial, the S's perception of "dog" and "chair" would give each item one frequency unit (RR). If the S indicated "dog" to be the correct item, "dog" would receive one more frequency unit; if on the other hand, S indicated "chair" to be the correct item, "chair" would receive one more frequency unit. Thus, after the first test trial

a 2:1 ratio would exist in favor of the item S had indicated. During the study trial, S would see that "dog" is the correct member of the pair and "dog" would get one more frequency unit, due to the rehearsal of the correct alternative response (RCR). A 3:1 frequency ratio would now exist in favor of "dog" if S had previously chosen "dog" on the test trial, but a 2:2 frequency ratio would exist if S had previously indicated "chair" on the test trial. If, on the second test trial, S chose "dog", "dog" would get one more frequency unit (PR). Later, during the second study trial S would see that "dog" is correct and "dog" would get one more frequency unit (RCR); "dog" would then have five frequency units and "chair" would have three frequency units. Furthermore, if "cat" (a very common associate of "dog") would appear elsewhere in the VD list, then "dog" would have received another frequency unit as a result of IAR. Thus, the rehearsal of the correct alternative is primarily responsible for a VD list being learned according to the frequency theory.

Review of Literature

Much of the research on VD learning supports the basic postulates of frequency theory. Ekstrand, et.al. (1966) found that increasing the frequency difference between correct and incorrect items by having an item occur in two pairs improved performance, just as frequency theory would predict. There are, however, several experiments which have found results in disagreement with predictions of frequency theory.

Ekstrand, et.al. (1966) used the theory to explain the results of an earlier experiment (Underwood, Jesse, and Ekstrand, 1964) in which S's were given two successive VD lists to learn. In one condition (R),

new incorrect items were presented on the second list while the correct items for the second list were the correct items from the first list. Since a high frequency ratio in favor of the correct item has been built up in the first task, frequency theory would predict that S's performance in condition R, applying Rule 1, should be initially very good and improve over trials on the second list. In another condition (W) new correct items were presented on the second list while the incorrect items were the incorrect items from the first list. Since (for group W) there was an initial frequency difference in favor of the incorrect item as a result of task 1 learning, S should apply Rule 2 (select the least frequent alternative) and perform very well. However, because S would have been rehearsing the correct alternative, the initial frequency difference (and consequently performance) on the second task should diminish over trials. Consistent with predictions of frequency theory, performance on trial one and all subsequent trials of the second task was essentially perfect for condition R; however, inconsistent with predictions of frequency theory for condition W, performance on trial one and all subsequent trials was high, although not as high as the performance for condition R.

In a similar experiment, Underwood and Freund (1968) systematically manipulated experimental frequency by presenting either zero, two, or five free learning trials on a list of items which in a second (VD) task served as the correct member of pairs (condition C) or incorrect members of the pairs (condition R). Performance in condition C, in agreement with predictions of frequency theory, was virtually perfect across all trials while performance in condition R, in disagreement with

frequency theory, was also high (but not as high as the performance of condition R) across all trials. That is, the frequency theory prediction of decreasing performance over trials on task 2 for condition R did not occur. Thus, the results of this experiment corroborate those of the earlier Underwood, et.al. (1964) experiment.

Raskin, Boice, Rubel and Clark (1968) had findings similar to Underwood, et.al. (1964) in a VD experiment in which S's received two identical VD lists but had the designations of C and I reversed on the second list (condition R), half of the S's being informed of the relation between the lists (R-I), and half of the S's not being informed of the relation between the lists (R-NI). With the exception of the non-informed group's first trial, performance for both groups was high across all trials of the second list. This poor performance for the NI groups on trial 1 of the second list indicates that non-informed S's require one trial to learn the new designations but are able to maintain high performance across trials.

Smith and Jensen (1971) conducted an experiment in which S's rehearsed a practice list containing only the C items, only the I items, or both C and I items prior to VD learning, informing half of S's in each of the above groups of the relationship between the lists. Again, frequency theory would predict that S's rehearsing the I items would initially perform well on the VD list but would return to chance performance on later trials. However, the results showed initially high performance with slow improvement over trials and no return to chance performance.

In a related experiment by Paul (1966), S's either learned a VD list to a criterion of one perfect trial or received additional trials (50%

of the number of trials to reach the criterion) after reaching criterion. S's then transferred to a second task in which the items were the same as in the first task but the correct and incorrect designations were reversed, (i.e., what was correct on task 1 was incorrect on task 2 and vice versa). An analysis of reversals to criterion showed no significant difference between groups of S's receiving additional trials and those who did not, with both groups reaching criterion on the second trial. In other words, even though correct items in the first VD list became incorrect items of initially higher frequency in the second VD list, S's were able to achieve criterion by the second trial.

Crouse (1967) conducted an experiment in which trios of items were used in a transfer task with the C item of a trio in the first list becoming the I item of a trio in the second list (Type 1). This procedure should allow S's partial elimination of the I items, resulting in a two-choice task. The results of the Type 1 group indicated positive transfer relative to the control group which received items in the second list unrelated to the first list, thus supporting the hypothesis that S can and does make decisions based upon the I item.

With the exception of an experiment by Kanak and Dean (1969) all of the experiments in which a condition contained I items of initially higher frequency than the C items, have shown high performance without the expected return to chance performance. To account for these anomalous results, Underwood and Freund (1970) proposed that a return to chance level performance may not be expected, since the frequency among C items from the first task will vary considerably, causing the trial of equality of frequency for pairs on the second task to vary. Therefore, the

performance would tend to cancel or average out. However, when Underwood and Freund attempted to make the point of frequency equality the same for all pairs by controlling frequency inputs from the first list, there was still not a return to a chance.

Hypothesis

Another hypothesis to account for these results is that in addition to the usual RCR there is also a rehearsal-of-the-incorrect-alternative-response (RIR) which is employed whenever S is using Rule 2. RIR causes more frequency units to accrue to the I item than to the C item and enables continued use of Rule 2 by S, resulting in high performance across trials. There is some direct evidence in the area of concept learning (Friebergs and Tulving, 1961) that learning can occur by negative instances (similar to RIR and Rule 2 use in VD learning). Such learning is apparently more difficult than learning by positive instances (similar to RCR and Rule 1 use) since recognizing the incorrect item and saying the correct is more difficult (or at least more circuituous) than recognizing the correct item and saying the correct item (Raskin, Boice, Rubel, and Clark, 1968). Such difficulties will cause slow improvement as previous experimentation has demonstrated and should make Rule 2 more sensitive than Rule 1 to the amount of test time per item. (The shorter the time per item the greater the difficulty: Underwood, Jesse, and Ekstrand, 1964; Crouse, 1967; Ingison and Ekstrand, 1970.)

The present experiment was a direct test of the hypothesis that S continues to use Rule 2 in VD learning in situations in which the I item is initially higher in frequency than the C item leading to higher performance than would be expected by frequency theory. Thus, after having

been in a VD task in which the I item is initially of higher frequency than the C item, S, when presented with new pairs of items (similar to a VD test trial or a paired comparisons task) which have a frequency difference, should make decisions based upon the same rule (Rule 2) as he used in the VD task, and therefore choose the lower frequency item as correct. A standard condition in which the C item is of higher frequency or in which there is no initial frequency difference should use Rule 1, and therefore select the higher frequency item as correct. A study-test procedure would allow for this kind of comparison.

Method

Subjects

One hundred and thirty-five undergraduate psychology students of Kansas State College of Pittsburg, naive to verbal learning experimentation, served as S's as part of a course requirement, with fifteen S's randomly assigned to each cell.

Design and Lists

The design was a 3 x 3 factorial with either one, two, or three VD trials and three types of VD lists: high frequency incorrect (I), high frequency correct (C), or a control list with incorrect and correct of equal frequency (con).

From a randomly selected pool of fifty, five letter words of medium Thorndike and Lorge (1944) count, four lists were made: two tenty item familiarization lists; a ten pair (twenty item) verbal discrimination list; and a twenty item paired comparison list. A different random order was constructed for each of 5 trials for each of the familiarization lists. The verbal discrimination list was made up of ten pairs of words, with ten randomly selected items from one of the familiarization lists and ten different randomly selected items from the original fifty item pool. These items were randomly paired and randomly assigned to top and bottom positions, and three different random orders of the pairs were constructed. Thus, the VD list was so constructed that one member of each pair was and one member of each pair was not in one of the familiarization lists and neither member was in the other familiarization list. (See columns 1 and 2, table 1.) The paired comparison list consisted of the

of the remaining twenty items from the fifty item pool, randomly assigned to top and bottom positions and randomly paired. For the paired comparison list, one item of each pair was in the familiarization list, the other item in the pair was not in the familiarization list. (See table 1.)

Procedure

S's were run in groups of from one to seven and were informed that five different random list orders of twenty items each would be presented for a total of one hundred presentations. S's were instructed to study each item carefully but not the order in which the items appeared. A familiarization list was then given to all groups at a three second rate. The I and C groups saw one familiarization list, the control group saw the other familiarization list.

S's were then given standard verbal discrimination instructions and were asked to record their choice by checking either the top or bottom blank for each pair on a check sheet. After completion of a test trial, the S's were instructed to lay down their pencils and view the screen where the ten pairs were individually presented with the correct word underlined.

In the verbal discrimination task a study-test procedure (three second rate) was used with the first trial being a guessing trial. S's in all three conditions had exactly the same verbal discrimination list (see table 1), but the I condition had an incorrect item with an induced frequency of five (items presented in the familiarization task) and a correct item with no induced frequency. The C condition had the item designations reversed from the I and control groups. That is, the I items had no induced frequency and the C item had an induced frequency of five.

The control condition had items of no induced frequency, since the VD list was not related to their familiarization list. (These relationships among the items for the various groups are shown in table 1.)

All groups were then given the same paired comparison list, (that is, a VD test trial) with a three second presentation rate. S's were instructed to choose and record the correct item in the same way, and on the same basis they did on the previous (verbal discrimination) task. After completion of the paired comparison task, all S's were questioned about their performance on the tasks.

TABLE 1

LIST CONSTRUCTION

CONDITIONS	Lists		
	Familiarization	Verbal Discrimination	Paired Comparison
Incorrect	1-10	31-40	11-20
	11-20	1-10	41-50
Correct	1-10	1-10	11-20
	11-20	31-40	41-50
Control	11-20	31-40	11-20
	21-30	1-10	41-50

Note--Numbers refer to items from the original pool.

Results

Analysis of Verbal Discrimination Task Performance

The mean number of correct items chosen on the last trial for each of the conditions is shown in Figure 1 and Table 2. An analysis of variance of last VD trial performance (Table 3) showed that the main effects of lists and trials were significantly different $F=19.3$, p .01, and $F=17.$, p .01, respectively, but that the interaction between trials and lists was not significant, $F=1.9$, p .05.

Since the overall analysis showed significant differences, a Tukey (a) test (Winer, 1962, p. 87) was used to determine where the differences among the means were. The test was performed on the mean number of correct choices on the last VD trial for both the lists and the trials main effects. Performance with two and three VD trials was significantly, p .01, better than performance with one VD trial with no significant difference in performance between two and three VD trials. Performance for the C cond. was significantly, p .01, better than performance with I cond. and Con. cond., with I cond. and Con. cond. showing no significant, p .01, difference in performance.

Analysis of Paired Comparison Task Performance

The mean number of low frequency items chosen on the paired comparison task is shown in Figure 2 and Table 4. The analysis of variance of paired comparison performance (Table 5) shows that lists were significantly different, $F=33.3$, p .01, but neither trials, $F=.05$, nor interaction between lists and trials, $F=.14$, were significant at the .05 level. The Tukey (a) test was performed on the mean number of low frequency items

chosen for lists. Performance in the high frequency incorrect cond. was better than in the control or high frequency correct cond., p .01, while C cond. and Con. cond. showed no significant difference in performance, p .01.

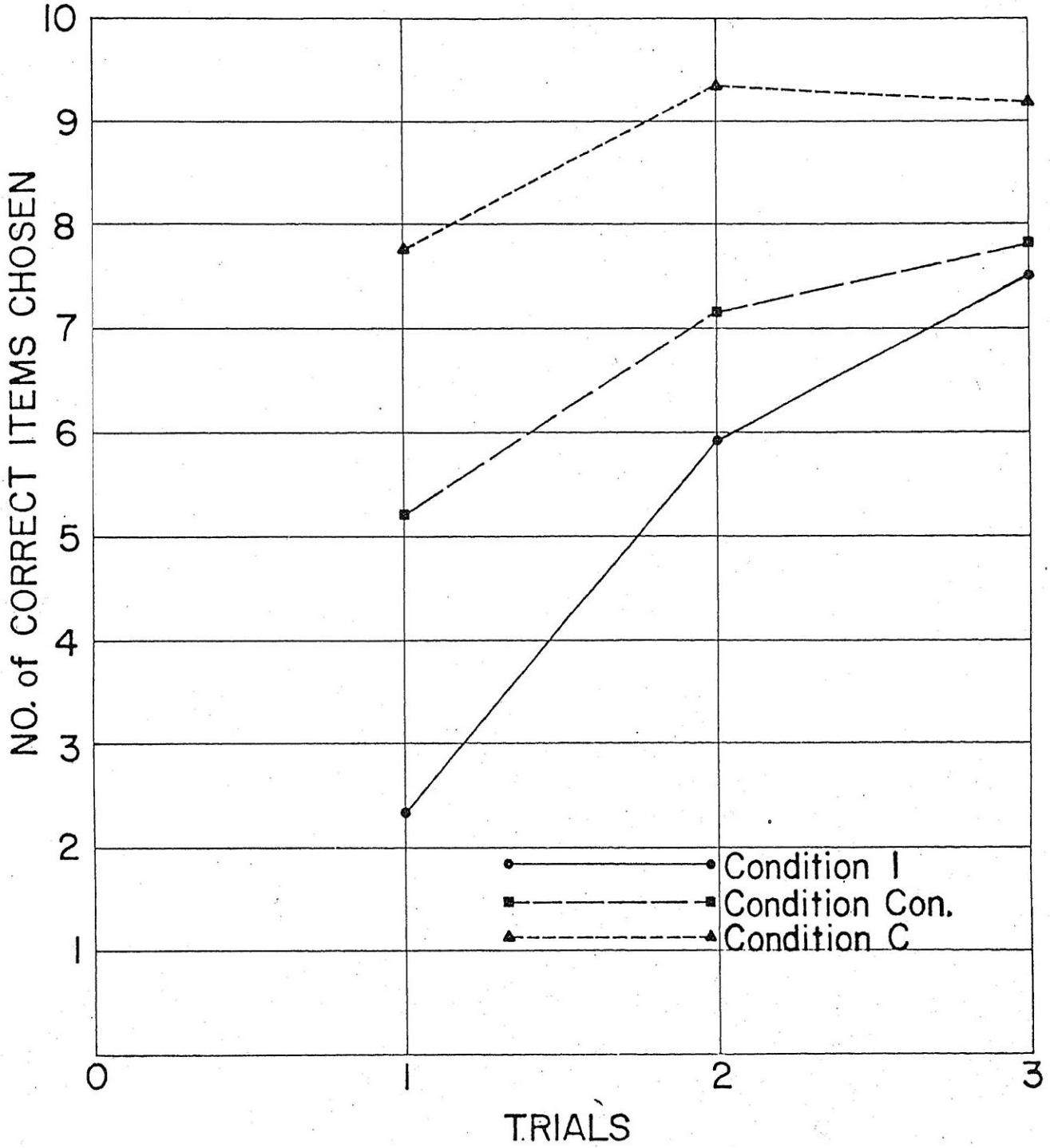

FIGURE 1

Mean Number of Correct Items Chosen on Verbal Discrimination Tasks.

TABLE 2

MEAN NUMBER OF CORRECT ITEMS CHOSEN ON LAST VERBAL DISCRIMINATION TRIAL

Conditions	V. D. Trials		
	1	2	3
Incorrect	2.3	5.9	7.5
Correct	7.7	9.3	9.2
Control	5.1	7.1	7.8

TABLE 3

ANALYSIS OF VARIANCE SUMMARY TABLE FOR NUMBER OF CORRECT ITEMS CHOSEN ON LAST VERBAL DISCRIMINATION TRIAL

Source	SS	df	MS	F
Lists (A)	274	2	137	19.3*
Trials (B)	242	2	121	17. *
AXB	54	4	13.5	1.9
Within Cell	894	126	7.1	
Total	1,284	134		

*p .01

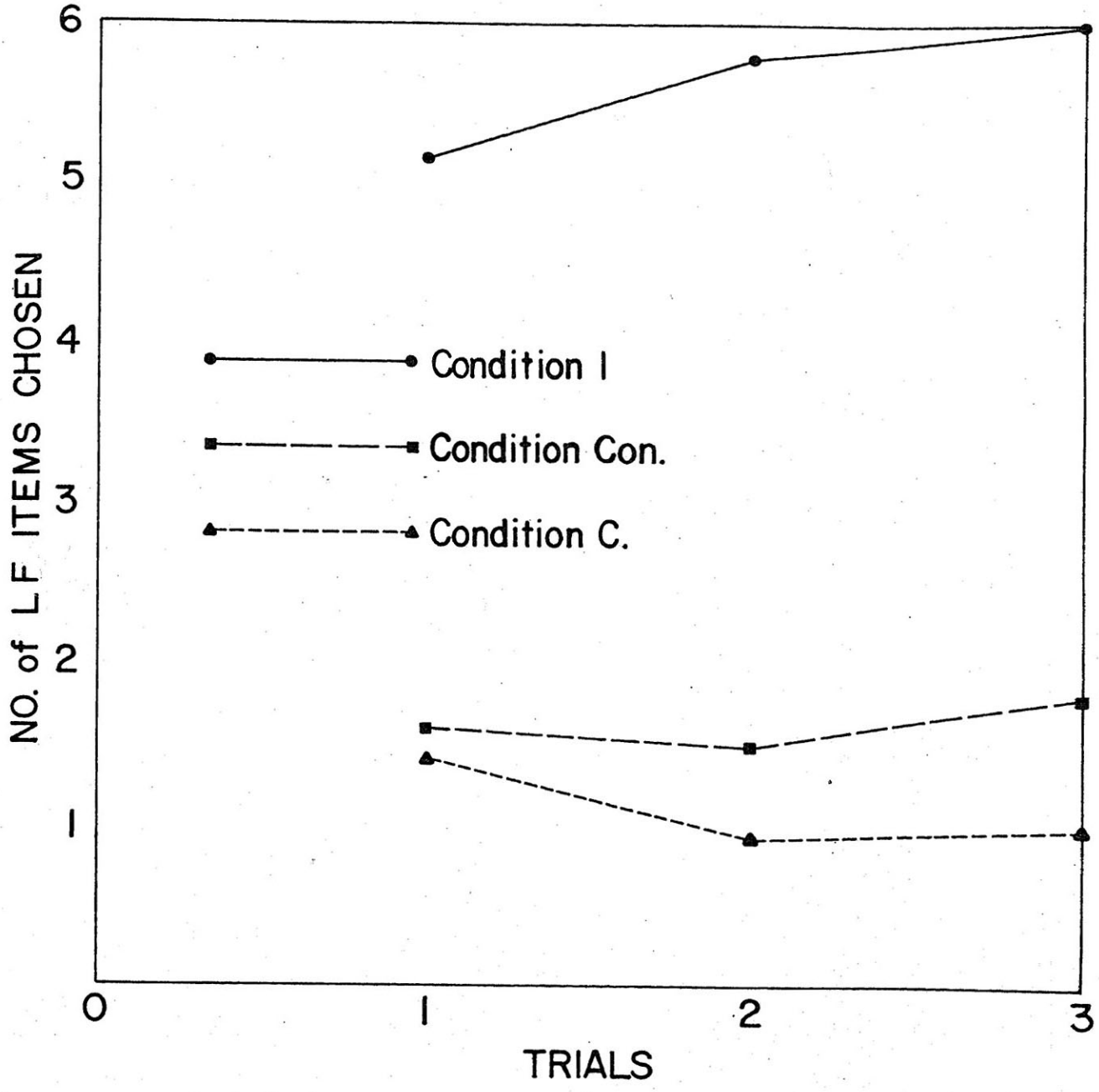

FIGURE 2

Mean Number of Low Frequency Items Chosen on Paired Comparison Task.

TABLE 4

MEAN NUMBERS OF LOW FREQUENCY ITEMS CHOSEN ON THE PAIRED COMPARISON TASK

Conditions	V. D. Trials		
	1	2	3
Incorrect	5.4	5.8	6.0
Correct	1.4	0.9	1.0
Control	1.6	1.5	1.8

TABLE 5

ANALYSIS OF VARIANCE SUMMARY TABLE FOR NUMBER OF LOW FREQUENCY ITEMS CHOSEN ON PAIRED COMPARISON

Source	SS	df	MS	F
Lists (A)	584	2	292.	33.03*
Trials (B)	1	2	.5	.05
AXB	5	4	1.25	.14
Within Cell	1,115	126	8.84	
Total	1,705	134		

*p .01

Discussion

Verbal Discrimination

The mean performance on trial 1 of the VD task (Figure 1) shows the control condition at chance while both the C and I conditions are different than chance, one higher, the other lower. However, the differences between the C and I conditions are simply due to the method of scoring the VD task performance. The familiarization task and verbal discrimination task were exactly the same for both the C and I conditions but the item designations were reversed. Thus, what was scored correct for the C conditions was scored incorrect for the I condition and vice versa. If the scoring were changed, the means on test trial 1 (before any VD feedback) would be exactly the same for the C and I conditions. Consistant with the present results and results of other experiments (Raskin et. al., 1968; Smith & Jenson, 1971; Underwood et. al., 1964), it is apparent that without any previous instruction or experience S tends to select the most frequent item (Rule 1). Clearly, the adoption of Rule 1 in an ambiguous situation such as existed on trial 1 for both the C and I conditions, while perhaps generally a very adaptive response to the environment, is maladaptive for the I condition. However, as soon as some information about the task is available to indicate the task is of a different sort than had been assumed, there is a large increment in performance for the I condition (trial 2, figure 1). Moreover, it appears that the information may be either from outside of the task proper (i.e., instructions) or within the task itself (feedback on the study trial of the present experiment). Also, it appears that a

large part of the initial high positive transfer for the I conditions of other experiments (Underwood, et. al., 1964; Underwood & Freund, 1968), is procedurally bound--specific to those situations in which the anticipation procedure is used and/or instructions are given as to the nature of the task, neither of which was done in the present experiment and consequently negative transfer on trial 1 resulted.

The performance curve for the C cond. was initially high on the first trial with nearly perfect performance on the second trial. Performance on the third trial numerically but nonsignificantly declined, which is attributable to chance. The failure of the C cond. to achieve perfect performance is perhaps due to boredom. As previously mentioned, the use of rule 1 is almost identical with the typical response in verbal discrimination learning. In addition, it is very consistent with every day experience (Freibergs and Tulving, 1961). Thus, it can be suggested that very little learning was needed to achieve the high performance on the C condition and that there would be negligible increments in performance with additional trials. The performance curves for the Con and I conditions, on the other hand, would seemingly have increased with additional trials, since neither the Con nor I conditions achieve the near perfect performance of the C cond., and both show an increase in performance with each trial. Although the shape of the performance curves for the Con and I condition are quite similar, the I condition shows a numerically but nonsignificantly steeper slope. Thus, it would appear that S's in the I condition learn the most from trial one to trial two, the point where they have learned the different nature of the task.

The fact that the performance of I condition rapidly improved on the second trial and had almost equal performance to the Con group on the third trial (Figure 1) illustrates that S's were able to identify the familiar item and use frequency as a discriminative cue. The noticeable increase in performance on the second and third trials was contrary to frequency theory predictions. According to frequency theory an almost negligible discrimination should have existed on the third trial resulting in a return to chance performance. S's noticeable increase in performance could be accounted for if S was rehearsing the incorrect alternative (RIR), and thus a large frequency ratio favoring the I item would exist on the third trial, which would allow S to use frequency as a discriminative cue (recognizing the most familiar item and choosing the other item).

Paired Comparison

In considering rank performance, all groups of S's generally performed as expected on the paired comparison task. The I list groups chose a significantly greater number of low frequency items than the Con or C condition. In a numerical sense, the performance with the I condition was expected to be higher than chance. Examination of the I condition performance on the paired comparison task with three previous verbal discrimination trials, showed that group performance was masking the vast individual differences that existed. Six of the fifteen subjects achieved perfect performance with another S making only one error, five S's maintained the chance level performance on the paired comparison task that they had exhibited on the previous verbal discrimination tasks. The three remaining S's who had on one of the previous verbal discrimi-

nation trials attained perfect performance, later on the paired comparison task either had chance performance or resorted back to rule one usage resulting in a score of zero.

Two complimentary reasons, which both stem from the difficulty of rule two usage, could account for the failure of the I condition to attain perfect performance. The three S's who attained perfect performance on one of the verbal discrimination trials, but who received a score of zero on the paired comparison task, were seemingly failing to continue to use rule two. The change in rule usage of these S's could be due to S's failing to understand the paired comparison task instructions which stressed that S's should make their decisions on the same basis they did in the previous VD task. The S's may have misinterpreted the instructions to mean that S's should resort back to their natural tendency of choosing the most familiar item. S's receiving one verbal discrimination trial would be particularly susceptible to such a misconception. The second reason that not all S's attained perfect performance is suggested by the slight increase in the I condition performance as a function of the number of trials, implying that the I condition would have profited from additional verbal discrimination trials. In an experiment studying overlearning effects on discrimination reversal, it was found that overlearning S's made fewer errors to reversal criterion than S's receiving no overlearning (Paul, 1966). It would appear that overlearning better enables S's in breaking learning set. Thus, it would be recommended that S's should receive additional trials or tasks. In so doing, not only would S's be better able to adapt to the difficulties of rule two usage but would be more accustomed to task variability, and thus more inclined

to continue to use rule two on the paired comparison task. It should be noted that although the present experiment did not control for the time between the familiarization and paired comparison tasks (and therefore time is confounded with number of trials), there were no differences on the PC task attributable to trials. Consequently, this confounding is of no major concern for the interpretation of the results.

Conclusions

The original hypothesis that S's will continue to use rule two when the incorrect item is of initially higher frequency, was confirmed by the I groups choosing a significantly greater number of low frequency items, as a function of the number of previous verbal discrimination trials. Contrary to the observed results, frequency theory would predict a decrease in the number of low frequency items chosen as a function of the number of trials, on the basis that discriminatability between pairs decreases with additional trials until no discriminability exists. Such predictions would probably have been confirmed if S's were rehearsing the correct response but since the results did not indicate this, S's must have used some other mechanism to enable him to continually use rule two. It is suggested that this mechanism is (RIR) rehearsal of the incorrect alternative response.

APPENDIX A

Raw Data
Number of Correct Items Chosen on
Verbal Discrimination Task

Number of Correct Items Chosen on
Verbal Discrimination Task

Condition Incorrect

1 VD	2 VD		3 VD		
1	1	2	1	2	3
7	4	5	3	6	6
3	1	7	0	10	10
1	4	6	0	9	10
6	6	8	2	8	9
1	2	8	0	10	10
0	9	6	0	10	8
0	0	1	5	2	0
1	3	9	8	6	7
0	0	10	3	5	7
6	5	9	8	6	10
0	0	0	0	9	10
9	1	0	0	10	5
1	0	8	3	4	5
0	0	10	3	1	7
0	0	2	0	10	9

Condition Correct

1 VD	2 VD		3 VD		
1	1	2	1	2	3
10	10	9	10	10	10
7	5	10	8	9	10
10	9	10	7	7	9
8	10	10	9	10	10
10	5	7	10	8	9
4	8	10	0	10	9
3	10	10	7	6	4
10	7	10	9	10	10
10	4	8	6	10	10
10	10	10	8	10	10
9	6	9	5	10	10
4	10	10	10	9	10
10	9	7	10	10	10
3	9	10	8	10	8
8	9	9	9	7	9

Condition Control

1 VD	2 VD		3 VD		
1	1	2	1	2	3
3	8	10	4	4	8
8	5	6	7	7	8
3	7	4	6	8	9
8	9	3	7	9	6
6	3	9	4	6	7
6	5	6	4	9	10
4	3	8	4	2	6
4	5	7	6	7	8
5	6	6	3	5	5
6	7	9	6	9	9
5	7	10	5	3	8
5	4	6	4	9	9
6	5	6	7	8	9
5	5	7	5	7	8
2	3	10	4	7	7

APPENDIX B

Raw Data:
Number of Low Frequency Items Chosen
on Paired Comparison Task

Number of Low Frequency Items Chosen
on Paired Comparison Task

Cell 1	Cell 2	Cell 3
9	8	2
10	10	10
1	4	10
4	7	10
4	7	10
0	5	9
5	10	1
10	5	3
9	10	6
0	9	6
10	0	0
0	0	0
10	0	4
9	10	10
0	2	10

Cell 4	Cell 5	Cell 6
0	1	0
0	0	0
0	0	1
0	0	0
0	8	4
0	0	0
8	1	5
0	0	0
0	5	0
0	0	0
0	3	4
6	0	0
0	3	0
7	2	1
0	0	0

Cell 7	Cell 8	Cell 9
0	5	0
4	3	4
0	0	4
0	4	0
2	0	3
0	0	2
2	2	0
0	4	1
0	0	1
0	0	2
1	0	0
3	4	3
2	0	0
0	0	0
10	0	7

APPENDIX C

Raw Data
Multiple Comparisons for Significant
Main Effects Tukey (A) Test

TUKEY (A) TEST ON THE MEAN NUMBER OF CORRECT CHOICES FOR LISTS ON THE LAST VERBAL DISCRIMINATION TRIAL

	I Condition	C Condition	Con. Condition
I Condition	---	156*	63
C Condition		---	-93*
Con Condition			---

*P < .01
q_r entries are computed values for the q_r statistic

TUKEY (A) TEST ON THE MEAN NUMBER OF CORRECT CHOICES FOR TRIALS ON THE LAST VERBAL DISCRIMINATION TRIAL

	1 VD 227	2 VD 335	3 VD 368
1 VD	---	108*	141*
2 VD		---	33
3 VD			---

*P < .01
q_r entries are computed values for the q_r statistic

TUKEY (A) TEST ON THE MEAN NUMBER OF LOW FREQUENCY ITEMS CHOSEN FOR LISTS ON THE PAIRED COMPARISON TASK

	I Condition 259	C Condition 50	Con Condition 73
I Condition	---	-209*	-186*
C Condition		---	23
Con Condition			---

*P < .01
q_r entries are computed values for the q_r statistic

APPENDIX D

List and Placement of Items

Familiarization Task (1)	Familiarization Task (2)	Verbal Discrimination Task	Paired Comparison Task
1 Honey	1 Coach	Clock	Goose
2 Eagle	2 Blade	Trial	Robin
3 Crush	3 Threw	Occur	Shift
4 Trial	4 Weary	Aware	Straw
5 Unite	5 Shift	Stoop	Weary
6 Stern	6 Robin	Prize	Bloom
7 Stoop	7 Waist	Lying	Threw
8 Queer	8 Flood	Crush	Rough
9 Empty	9 Silly	Honey	Apply
10 Aware	10 Upper	Staff	Waist
11 Coach	11 Bathe	Empty	Blade
12 Blade	12 Humor	Nerve	Feast
13 Threw	13 Float	Eagle	Dread
14 Weary	14 Brave	Crown	Flood
15 Shift	15 Royal	Ridge	Broke
16 Robin	16 Yours	Stern	Upper
17 Waist	17 Shirt	Unite	Verse
18 Flood	18 Trunk	Exact	Coach
19 Silly	19 Worse	Wound	Silly
20 Upper	20 False	Queer	Wheat