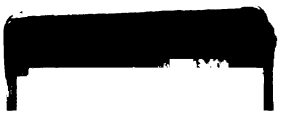
TRANSFER IN THE A - B, A - D PARADIGM AS A FUNCTION OF RESPONSE MEANINGFULNESS

Thesis for the Degree of M. A.

MICHIGAN STATE UNIVERSITY
WAYNE H. DECKER

1968



TRANSFER IN THE A-B, A-D PARADIGM AS A FUNCTION OF RESPONSE MEANINGFULNESS

By

Wayne H. Decker

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF ARTS

Department of Psychology

1968

ABSTRACT

TRANSFER IN THE A-B, A-D PARADIGM AS A FUNCTION OF RESPONSE MEANINGFULNESS

by Wayne H. Decker

The present study of paired-associate learning was concerned with comparing transfer in the A-B, A-D paradigm (old stimuli, new responses on List 2) at two levels of response meaningfulness. Transfer was measured by comparing performance of the A-B, A-D subjects with that of the A-B, C-D (new stimuli, new responses) control subjects on List 2. Previous studies had found less negative transfer (inferiority of the A-B, A-D subjects to the A-B, C-D subjects) with low meaningfulness responses than with high meaningfulness responses.

The two stage analysis of paired associate learning maintains that there are two overlapping stages in P-A learning. These are the response learning stage and the associative stage. Since the A-B, A-D paradigm involves learning new responses to old stimuli, it was expected that the A-B, A-D subjects would be equal to the A-B, C-D subjects in response learning but would be inferior in the associative stage of learning. Thus, in the A-B, A-D paradigm, negative transfer occurs in the associative stage alone and should not be affected by response meaningfulness. The previous findings of less negative transfer with low meaningfulness responses

were not predicted by the two stage analysis.

Since subjects in previous studies were given a specified number of trials on each list, it was suggested that those in the low response meaningfulness condition had not been given sufficient opportunity to demonstrate the effects of associative interference as had those with high meaningfulness responses. In order that all stages of learning could be studied in all Ss, the Ss in the present study learned List 2 to the criterion of one perfect trial. Two purposes of the present study were to determine whether transfer differed as a function of response meaningfulness when the trials to criterion measure was used and to determine whether elimination of the response learning stage would eliminate the difference in transfer. The latter hypothesis was tested by utilizing an associative matching procedure for half of the Ss, whereby the responses were selected from a card rather than learned.

The results indicated that the three variables, meaningfulness, paradigm, and procedure all influenced learning, but no interactions were significant. It was concluded that transfer does not differ as a function of response meaningfulness when a trials to criterion measure is used. Since transfer did not interact with meaningfulness, the hypothesis that associative matching would eliminate the interaction was meaningless. The failure to find a difference in transfer as a function of response meaningfulness was seen as support for the adequacy of the two stage analysis.

Approved Gordon Wood

Date August 9, 1968

ACKNOWLEDGMENTS

I wish to thank Dr. Gordon Wood, my adviser, for his help and guidance in this project. The assistance and criticism of Dr. James Phillips and Dr. David Raskin are also greatly appreciated.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

INTRODUCTION

Various studies have utilized a two stage conception in the analysis of paired-associate learning (e.g. Underwood, Runquist, & Schulz, 1959; Horowitz, 1962). The two stages assumed are a response learning stage and an association learning stage. According to Underwood et al. (1959) the response learning stage necessarily precedes the association learning stage, as responses must be learned before they can be available for association to stimuli. It also seems that the two stages overlap, since some responses in a list probably are being associated to their respective stimuli as other responses are being learned.

Predictions yielded by the two stage analysis have been partially successful in transfer studies involving response meaningfulness as a variable. Jung (1963) found negative transfer for the A-B, C-B paradigm (relative to an A-B, C-D control group) with responses of high meaningfulness and positive transfer in the same paradigm when the responses were low in meaningfulness. Jung suggested that positive transfer occurred in the response learning stage since the responses were the same in both lists and negative transfer occurred in the associative stage because these old responses had to be associated with new stimuli in List 2. With low response meaningfulness the response learning was so difficult that the

positive transfer during the response learning stage was greater than the negative transfer of the associative stage. With high meaningfulness responses, however, the response learning was less difficult and negative transfer was the net result.

The A-B, A-Br paradigm (same stimuli and responses in both lists, but they are repaired) has also been found to follow the predictions of the two stage analysis. Merikle and Battig (1963) obtained positive transfer with low response meaningfulness and negative transfer with high response meaningfulness. The above explanation of transfer in the A-B, C-B paradigm also applies to the A-B, A-Br paradigm. Thus, both the A-B, A-Br and the A-B, C-B paradigms have been found to interact with response meaningfulness since positive transfer has been found with low response meaningfulness and negative transfer with high response meaningfulness.

Although the two stage analysis predicts a paradigm X response meaningfulness interaction for the A-B, C-B and A-B, A-Br paradigms (relative to A-B, C-D controls), the two stage analysis does not predict a Paradigm X Meaningfulness interaction for the A-B, A-D paradigm. Negative transfer is to be expected in the associative stage, as new responses must be associated with old stimuli. Yet, no difference as a function of paradigm (zero transfer) would be predicted in the response learning stage since both the experimental (A-B, A-D) and control (A-B, C-D) groups must learn new re-

sponses. Since the amount of response learning is the same for both the experimental and control groups, there is little reason to expect an interaction between response meaningfulness (low vs. high) and paradigm (A-B, A-D vs. A-B, C-D).

However, several studies (Jung, 1963; Merikle & Battig, 1963; Goulet, 1965; Houston, 1965) have found an interaction between response meaningfulness and paradigm (A-B, A-D vs. A-B, C-D). Jung and Goulet found less negative transfer with low than with high response meaningfulness. That is, the performance of the subjects in the experimental group with low meaningfulness responses was less inferior to the low meaningfulness control group than the performance of the high meaningfulness experimental group was to the high meaningfulness control group. Neither Merikle and Battig nor Houston found significant differences among three levels of response meaningfulness, although slightly less negative transfer occurred with low meaningfulness responses than with high meaningfulness responses. One purpose of the present study was to assess further whether the Paradigm X Meaningfulness interaction in the A-B, A-D paradigm is a reliable finding. A second purpose, which depended upon obtaining of the interaction, was to test a two stage analysis explanation of the Paradigm X Meaningfulness interaction. However, the reliability of the Paradigm X Meaningfulness interaction is placed in doubt by some aspects of previous studies.

In presenting data which showed the mean number of overt intrusion errors (responses that belong in the list but are

given to the wrong stimuli) across trials on List 2 with each of two response meaningfulness levels, Jung (1963) suggested that the portion of training in which the overt errors increased to a peak corresponded to the response learning stage, while after the peak, as the number of errors per trial decreased, the associative stage was dominant. With the A-B, A-D and A-B, C-D paradigms the mean number of intrusions increased throughout the ten trials given on List 2 with low meaningfulness responses, but a peak had been reached at approximately the fourth trial with high meaningfulness responses. Possibly less negative transfer occurred with low response meaningfulness because fewer trials were spent by the Ss in the associative stage as compared to the Ss with high meaningfulness responses. Subjects in the low meaningfulness groups may have been primarily in the response learning stage during the ten trials and performance in this stage may be expected not to differ as a function of paradigm since both the A-D and C-D groups are in the process of learning new responses. Those in the high meaningfulness groups, however, learned the responses in fewer trials and, therefore, had sufficient trials to manifest the negative transfer of the associative stage.

Further support for this view was suggested by the fact that Jung's (1963) low response meaningfulness List 1 required a mean of 23.45 trials to reach a criterion of a perfect trial. It seems to follow that ten trials on List 2 was not enough to adequately demonstrate the effects of the negative transfer of the associative stage when such difficult responses had to be

learned. Jung's high meaningfulness groups needed only 10.50 trials to learn List 1, therefore, ten trials on List 2 seem to have been sufficient in showing negative transfer which occurred in the associative stage. Thus, the Paradigm X Meaningfulness interaction may have been due to the differences in the degree of learning achieved in ten trials as a function of response meaningfulness. Similarly, Goulet (1965) presented fifteen List 2 trials, but the high meaningfulness Ss had required 13.82 trials to learn List 1, while 26.45 trials were needed by the low response meaningfulness subjects. The studies which have obtained the least differences in transfer among response meaningfulness levels have given the most trials on List 2 relative to the number of trials necessary to learn List 1 to the criterion of one perfect trial (Merikle and Battig, 1963; Houston, 1965). In order to allow the occurrence of the associative stage at all meaningfulness levels, Ss in the present study were taken to a criterion of one perfect trial on List 2.

Ekstrand (1966) points out some of the difficulties involved in determining the point at which response learning is completed. A major difficulty results from the fact that the response learning and associative stages overlap. To eliminate the uncertainty as to the stage involved and to view more clearly the effects of the interference in the associative stage, half of the Ss in the present study learned List 2 using an associative matching procedure so that response learning was not necessary (Horowitz, 1962). It was expected that if, a paradigm X meaningfulness interaction occurred

using a regular anticipation method, the interaction would be eliminated by the associative matching procedure since response meaningfulness should have little effect upon the associative stage. That is, a response meaningfulness X paradigm X learning procedure interaction was expected.

METHOD

Design. A 2 X 2 X 2 factorial design was used with a separate group of Ss utilized in each of the eight conditions. The variables investigated were response meaningfulness (high vs. low with the same level of meaningfulness used on both lists in every condition), paradigm (A-B, A-D vs. A-B, C-D), and learning procedure on List 2 (regular anticipation vs. associative matching).

Materials. The lists utilized were identical to those of Jung (1963). These are presented in Appendix A. Each list contained six paired associates which had two-syllable adjectives as stimuli and trigrams as responses. Interlist and intralist similarity were minimized as much as possible for both stimuli and responses. Response similarity was minimized by using any given letter only once in a given list. Similarity of List 1 and List 2 responses was minimized by not permitting any letter used in both lists to occupy the same position in the two trigrams in which it appeared. Trigrams with summed letter counts of 9-14 and 46-79 were used for the low and high meaningfulness lists respectively (Underwood and Schulz, 1960, Appendix F).

Procedure. The Ss were given instruction regarding P-A learning and the anticipation method. They were told that they were to learn six pairs of items consisting of an

adjective and a nonsense syllable and were shown examples similar to the pairs utilized in the task. They were told that the pairs would appear on the memory drum in front of them with the adjectives appearing initially alone and then, after a short time, with the appropriate nonsense syllable. The Ss were instructed that after studying thepairs the first time through the list, they should attempt to anticipate the correct nonsense syllable for each adjective presented thereafter by spelling it aloud. They were informed that the appearance of a strip of masking tape in the memory drum window indicated the end of one trial and the beginning of the next trial.

About one min. after learning List 1 to the criterion of one perfect anticipation trial, Ss were given the instructions for List 2. Half of the Ss were instructed to learn List 2 in the same manner as they had learned the first list. The remaining half of the Ss, the associative matching groups, did not learn the second list in the same manner as they had learned the first. These Ss were given a 3 in. x 5 in. card which had the correct responses for List 2 randomly printed on it. The Ss held the card and could refer to the list for the correct response upon being presented each stimulus. Thus, the necessity of the response learning stage in paired associate learning was eliminated. In this way the difficulties in studying the associative stage were lessened. All Ss were taken to a criterion of two perfect trials on List 2 to insure that all Ss had at least two trials.

The lists were presented on a Stowe memory drum at a 3:3 sec. rate with an intertrial interval of 6 sec. The lists were randomized with three different orders being utilized in order to minimize the possibility of serial learning.

Subjects. The Ss were 104 undergraduate students enrolled in introductory psychology classes at Michigan State University. They were randomly assigned to the eight groups with each group consisting of 13 students. Two persons had to be discarded and replaced due to failure to learn List 1 to a criterion of one perfect trial.

RESULTS

List 1 Learning. The mean number of trials to criterion for the Ss with high meaningfulness responses was 8.77 for the A-D, associative matching group, 7.62 for the C-D, associative matching group, 9.15 for the A-D, regular anticipation group, and 9.08 for the C-D, anticipation group. The means of the trials to criterion for the low response meaningfulness conditions were 15.00 for the A-D, associative matching group, 17.00 for the C-D, associative matching group, 10.77 for the A-D, anticipation group, and 12.38 for the C-D anticipation group. An analysis of variance indicated that response meaningfulness was the only variable affecting group differences, $F(1,96) = 20.99$, $p<.001$. Neither paradigm, $F<1$, nor procedure (regular anticipation vs. associative matching), $F(1,96) = 2.41$, $p>.10$, were significant. In addition, no interactions were found to be significant. Since the groups differed only as a function of response meaningfulness, the only variable manipulated in List 1, it is likely that the groups differed little in learning ability.

List 2 Learning. The number of trials to each successive criterion was determined for each S in order that each S would be represented at each stage of learning. The mean number of trials for each group is presented in Table 1. The sum of trials to successive criteria score shown in the ex-

Table 1. Mean number of trials to each criterion on List 2 for each condition.

	Number Correct						
	1	2	3	4	5	6	Sum
A-D, High *m*, Associative Matching	1.23	1.46	1.77	2.31	2.85	4.62	14.23
C-D, High *m*, Associative Matching	1.00	1.15	1.31	1.46	1.69	2.31	8.92
A-D, Low *m*, Associative Matching	1.69	2.46	3.23	4.00	5.54	7.31	24.23
C-D, Low *m*, Associative Matching	1.31	1.54	2.08	2.54	3.00	5.15	15.61
A-D, High *m*, Anticipation	1.31	1.85	2.08	2.77	4.23	5.85	18.08
C-D, High *m*, Anticipation	1.00	1.23	1.38	1.85	3.00	4.23	12.69
A-D, Low *m*, Anticipation	2.15	2.92	3.77	6.15	8.08	10.15	33.23
C-D, Low *m*, Anticipation	1.31	2.38	3.85	4.77	6.92	10.38	29.46

treme right column of the table is presented to give a more general measure of overall performance than the number of trials to the criterion of a perfect trial provides.

The sum of trials to successive criteria scores for List 2 revealed significant main effects of the three variables: Procedure, F (1,96) = 12.84, $p < .001$; Meaningfulness, F (1,96) = 32.70, $p < .001$; and Paradigm, F (1,96) = 7.45, $p < .025$. Thus, the Ss given lists with high meaningfulness responses were superior to those given lists consisting of low meaningfulness responses. Performance was better with the associative matching procedure than with the anticipation procedure and negative transfer was demonstrated by the superiority of the Ss in the C-D conditions as compared to those in the A-D groups. No interactions were found to be significant at the .05 level. The lack of a Meaningfulness X Paradigm interaction, $F < 1$, does not support the first hypothesis that negative transfer differs as a function of response meaningfulness. The second hypothesis, that of a Meaningfulness X Paradigm X Procedure interaction was of no interest since it was dependent upon obtaining of a Meaningfulness X Paradigm interaction. The F value for Meaningfulness X Paradigm X Procedure was found to be < 1. Although response meaningfulness had less effect when the Ss did not have to learn the responses, the Meaningfulness X Procedure interaction was not significant F (1,96) = 3.20, $p < .10$. Similar findings were revealed by analysis of the number of trials to one perfect trial with the exception that paradigm was not significant, F (1,96) = 3.07, $p < .10$. Findings based on the number of trials to two perfect trials were consistent with those based on one perfect trial.

The mean number of trials to two and three correct anticipations were considered to determine whether there were any initial effects which did not persist throughout learning. At these early stages, however, only main effects were significant. An analysis of variance of the mean number of trials to two pairs correct showed Procedure, F (1,96) = 5.45, $p < .025$; Meaningfulness, F (1,96) = 22.85, $p < .001$; and Paradigm, F (1,96) = 9.90, $p < .005$, to be significant. Analysis of the number of trials to three correct responses produced similar findings with the exception that the significance level of Paradigm dropped, F (1,96) = 3.97, $p < .05$. Since no interactions were found early in learning, the hypotheses again were not supported.

To determine whether the findings were a function only of the measures used, the number of correct responses in Trials 1 and 2 was determined for each S. Using this measure Jung (1963) found a significant Meaningfulness X Paradigm interaction. In the present study the Meaningfulness X Paradigm interaction was not significant when the measure of the number of correct responses in Trials 1 and 2 was used, F (1,96) = 2.61, $p < .25$. The main effects of the three variables were all significant at the .001 level. The Fs for Procedure, Meaningfulness, and Paradigm were 16.52, 50.22, and 18.46 respectively. All interactions other than Meaningfulness X Paradigm had Fs < 1. Thus, by using another measure the first hypothesis that there was a Meaningfulness X Paradigm interaction received slightly more support but did not reach significance.

DISCUSSION

There was not a significant difference in transfer as a function of response meaningfulness when a trials to criteria measure was used. This finding held early in the learning of List 2 as well as in learning the list to a criterion of one perfect trial. The failure to find a Meaningfulness X Paradigm (A-B, A-D vs. A-B, C-D) interaction seems to suggest that previous findings (e.g. Jung, 1963; Goulet, 1965) of the interaction were influenced by the fact that subjects differed in stage of learning when the trials were terminated. Evidently the Ss in the low meaningfulness groups of previous studies spent little time in the associative stage as compared to the high meaningfulness groups and associative interference did not have as great an effect. Thus, there was less negative transfer with low meaningfulness responses. Presumably, the present study, which took Ss to a criterion of a perfect trial, allowed the effects of associative interference to be demonstrated at both levels of response meaningfulness, and the amount of negative transfer did not differ with meaningfulness. Since a Meaningfulness X Paradigm interaction was not found, the hypothesis that elimination of the response learning stage with the use of the associative matching procedure would eliminate the interaction (Meaningfulness X Paradigm X Procedure interaction) was of no interest.

The findings of the present study offer weak support for

the two stage analysis of P-A learning. Since the two stage analysis does not predict a Meaningfulness X Paradigm interaction for the A-B, A-D paradigm relative to the A-B, C-D control paradigm, the finding of such an interaction would have demonstrated the analysis to be inadequate in its description of the A-B, A-D paradigm. Failure to find the interaction, then, can be interpreted as weak support for the two stage analysis of P-A learning. However, caution must be taken when considering support of a null hypothesis as theoretical evidence.

In going beyond determining whether transfer is positive, negative, or zero to compare amounts of transfer under various conditions, a scaling problem arises. It has been common practice to compute transfer by subtracting the means of the experimental and the control groups and then to compare the mean differences of various conditions. Different conditions, such as differing levels of meaningfulness, may have incomparable scales. Perhaps a mean difference of 2 trials to criterion would be very little in a low meaningfulness condition where many trials are required, whereas 2 trials might be a large difference in a high meaningfulness condition requiring relatively few trials to learn the list to criterion. While numerically the mean differences are equal, they may reflect vastly different amounts of transfer. Perhaps some other measure of transfer such as the mean ratio of the experimental group to the control group is needed. The mean ratio measure would assume that if the experimental group required twice as

many trials to learn a list as the control group in each of two conditions, transfer was equal. The comparison of transfer across conditions in the present and other studies has been handicapped by the lack of an answer to this scaling problem. The effects of various conditions upon learning would be better understood if this problem were resolved.

SUMMARY

Transfer was determined at two levels of response meaningfulness in the A-B, A-D paradigm (old stimuli, new responses) relative to the A-B, C-D (new stimuli, new responses) control paradigm. Previous studies had found less negative transfer (inferiority of the A-B, A-D subjects to the A-B, C-D subjects) with low meaningfulness than with high meaningfulness. This finding is not accounted for by the two stage analysis of paired-associate learning.

The two stage analysis of P-A learning maintains that there are two overlapping stages in P-A learning, the response learning stage and the associative stage. Since the A-B, A-D paradigm involves learning new responses to old stimuli, it was expected that the A-B, A-D subjects would be equal to the A-B, C-D subjects in response learning but would be inferior in the associative stage of learning. Thus, differences in transfer as a function of response meaningfulness was not predicted by the two stage analysis since the source of negative transfer in the A-B, A-D paradigm is the associative stage.

Since subjects in previous studies were given a specified number of trails on each list, it was suggested that those in the low response meaningfulness condition had not been given as sufficient an opportunity to demonstrate the effects of associative interference as had those with high

meaningfulness responses. In order that all stages of learning could be studied in all Ss, the Ss in the present study learned List 2 to the criterion of one perfect trial. Two purposes of the present study were to determine whether transfer differed as a function of response meaningfulness when the trials to criterion measure was used and to determine whether elimination of the response learning stage would eliminate the difference in transfer. The latter hypothesis was tested by utilizing an associative matching procedure for half of the Ss, whereby the responses were selected from a card rather than learned.

The results indicated that the three variables, meaningfulness, paradigm, and procedure all influenced learning, but no interactions were significant. It was concluded that transfer does not differ as a function of response meaningfulness when a trials to criterion measure is used. Since transfer did not differ with meaningfulness, the hypothesis that associative matching would eliminate the difference was meaningless. The failure to find a difference in transfer as a function of response meaningfulness was seen as weak support for the adequacy of the two stage analysis.

REFERENCES

Ekstrand, B. R. A note on measuring response learning during paired-associate learning. J. verb. Learn. verb. Behav., 1966, 5, 344-347.

Goulet, L. R. Interlist response meaningfulness and transfer effects under the A-B, A-D paradigm. J. exp. Psychol., 1965, 70, 264-269.

Horowitz, L. N. Associative matching and intralist similarity. Psychol. Rep., 1962, 10, 751-757.

Houston, J. P. Supplementary report: Transfer as a function of meaningfulness. J. verb. Learn. verb. Behav., 1965, 4, 339-340.

Jung, J. Effects of response meaningfulness (m) on transfer of training under two different paradigms. J. exp. Psychol., 1963, 65, 377-384.

Merikle, P. M. and Battig, W. F. Transfer of training as a function of experimental paradigm and meaningfulness. J. verb. Learn. verb. Behav., 1963, 2, 485-488.

Underwood, B. J., Runquist, W. R., and Schulz, R. W. Response learning in paired-associate lists as a function of intra-list similarity. J. exp. Psychol., 1959, 58, 70-78.

Underwood, B. J., and Schulz, R. W. Meaningfulness and verbal learning. Chicago, 1960.

APPENDIX A

PAIRED-ASSOCIATE LISTS

PAIRS WITH HIGH MEANINGFULNESS RESPONSES

List 1

A-B, A-D		A-B, C-D	
urbane	OPF	rising	OPF
devout	VIL	open	VIL
gallant	QUC	merry	QUC
stable	ABD	expert	ABD
active	WEM	total	WEM
husky	STX	insane	STX

List 2

(Both Paradigms)

devout	XYW
active	ENT
husky	HOS
stable	JAK
urbane	UVR
gallant	IMP

APPENDIX B

TRIALS TO SUCCESSIVE CRITERIA FOR EACH SUBJECT

A-B, A-D, HIGH m, ASSOCIATIVE MATCHING GROUP

Number Correct

Subjects	1	2	3	4	5	6
1	1	1	1	2	3	5
2	1	1	2	2	2	5
3	2	2	3	4	4	5
4	1	1	1	1	1	1
5	1	1	2	3	3	6
6	1	1	1	2	2	5
7	2	2	2	3	4	4
8	1	1	1	2	2	2
9	1	1	1	1	2	2
10	1	1	1	2	2	2
11	1	1	1	1	1	4
12	1	4	4	4	8	12
13	2	2	3	3	3	7

A-B, C-D, HIGH *m*, ASSOCIATIVE MATCHING GROUP

Number Correct

Subjects	1	2	3	4	5	6
1	1	1	1	1	1	2
2	1	1	1	1	1	2
3	1	2	2	2	2	3
4	1	1	1	1	1	1
5	1	2	3	3	4	4
6	1	1	2	2	2	2
7	1	1	1	1	2	3
8	1	1	1	1	1	2
9	1	1	1	1	1	3
10	1	1	1	1	1	1
11	1	1	1	1	1	1
12	1	1	1	3	4	5
13	1	1	1	1	1	1

A-B, A-D, LOW m, ASSOCIATIVE MATCHING GROUP

	Number Correct					
	1	2	3	4	5	6
Subjects						
1	1	2	5	5	10	11
2	2	3	4	4	7	7
3	1	1	2	3	3	5
4	3	4	6	7	7	14
5	1	3	3	5	7	11
6	1	1	1	1	3	3
7	1	1	1	2	3	6
8	1	1	1	2	3	4
9	2	2	2	2	2	3
10	1	2	2	3	3	3
11	1	2	2	4	6	6
12	6	8	9	10	14	14
13	1	2	4	4	4	8

A-B, C-D, LOW m, ASSOCIATIVE MATCHING GROUP

	Number Correct					
	1	2	3	4	5	6
Subjects						
1	1	1	3	3	4	4
2	3	4	5	7	7	16
3	3	3	3	3	3	3
4	1	1	1	4	4	7
5	1	1	2	2	2	7
6	1	2	3	3	3	4
7	1	1	1	1	1	1
8	1	1	3	3	6	6
9	1	1	1	1	1	5
10	1	1	1	1	2	3
11	1	2	2	3	3	6
12	1	1	1	1	1	3
13	1	1	1	1	2	2

A-B, A-D, HIGH m, ANTICIPATION GROUP

Number Correct

Subjects	1	2	3	4	5	6
1	1	1	1	2	3	5
2	1	2	2	3	7	8
3	1	2	2	3	3	5
4	2	2	2	2	4	7
5	1	1	1	2	3	4
6	1	3	4	4	8	8
7	1	1	1	1	4	5
8	1	2	2	2	3	5
9	3	3	3	5	5	6
10	1	1	1	2	3	4
11	1	1	1	2	2	2
12	1	1	3	3	4	11
13	2	4	4	5	6	6

A-B, C-D, HIGH *m*, ANTICIPATION GROUP

Number Correct

Subjects	1	2	3	4	5	6
1	1	2	2	2	3	4
2	1	1	1	1	2	3
3	1	1	2	2	5	10
4	1	2	2	3	4	5
5	1	1	1	1	1	2
6	1	1	1	1	2	2
7	1	1	1	2	2	2
8	1	2	2	5	11	14
9	1	1	1	1	1	2
10	1	1	1	2	2	4
11	1	1	1	1	2	2
12	1	1	2	2	3	3
13	1	1	1	1	1	2

A-B, A-D, LOW *m*, ANTICIPATION GROUP

Number Correct

Subjects	1	2	3	4	5	6
1	1	2	3	3	6	6
2	2	2	3	8	8	15
3	3	4	4	8	9	12
4	4	4	7	8	9	15
5	2	3	3	6	12	14
6	1	1	1	1	5	6
7	2	6	7	9	12	12
8	1	2	2	3	3	5
9	2	3	3	4	5	6
10	3	3	3	5	6	8
11	2	3	7	16	20	23
12	3	3	3	5	6	6
13	2	2	3	4	4	4

A-B, C-D, LOW *m*, ANTICIPATION GROUP

Number Correct

Subjects	1	2	3	4	5	6
1	1	3	3	6	6	7
2	2	2	3	4	5	6
3	1	3	5	7	10	13
4	1	2	2	3	4	6
5	1	3	8	9	20	29
6	2	2	3	5	8	14
7	1	3	5	5	9	22
8	2	3	3	3	7	8
9	1	2	4	4	4	6
10	1	2	4	4	4	4
11	1	2	4	5	5	6
12	1	2	2	3	3	6
13	2	2	4	4	5	8