ASSOCIATIVE RELATIONS IN VERBAL DISCRIMINATION LEARNING

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ABSTRACT

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DISCRIMINATION LEARNING

by Cheryl Bowshier Whalen

According to the two-stage memory model, storage processes in verbal discrimination (VD) learning are crucial. Any existing relation which allows items of a pair to be more easily combined during storage, such as strong intrapair associative relations, aids learning because the pair may be stored as a unit, thus reducing the memory load. The present experiment is a test of the two-stage memory model assumption that storage processes are crucial to the learning of associative pairs.

Four fourth-grade and four sixth-grade groups were given three study trials and three test trials alternately on each of two 24-pair VD lists. Half the pairs on each list were strong associates; the other half were unrelated pairs. Pairing on the study and test trials was manipulated. The pairing was either constant or varied from trial to trial resulting in four conditions: CC, CV, VC, and VV. The first letter designates whether the pairing was constant (C) or varied (V) on the study trials; the second, the test trial condition.

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Under constant study conditions associative relations facilitated performance. Under varied study conditions, performance on associative pairs was inferior or equivalent to that on unrelated pairs. All associative conditions were significantly different from each other suggesting that rearranging the pairing on test trials affected performance as well as rearranging the pairing on study trials. A corollary to the two-stage memory model was suggested to account for these differences.

All unrelated conditions were statistically equivalent with the exception of U-VV which was significantly inferior to all other unrelated conditions. Association by contiguity was suggested as a possible explanation.

Under constant study conditions, the grades were statistically equivalent. However, the grades significantly differed when the pairing on study trials was varied. One hypothesis presented for this difference was that sixth graders were more able to cope with an inconsistent situation. A second hypothesis presented was that this difference tapped a critical change in children within this age range.

Approved A. M. Barch
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TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

INTRODUCTION

The frequency theory of verbal discrimination (VD) learning proposed by Ekstrand, Wallace, and Underwood (1966) postulates that the cue for discrimination is the subjective frequency difference between the correct (C) and incorrect (I) alternatives (items) of a VD pair. Each response to an item adds one frequency unit. Whenever a subject perceives, pronounces, or rehearses an item, frequency units are added. The perception of each alternative is referred to as a representational response (RR). Pronouncing an item aloud during anticipation is called a pronounciation response (PR). The rehearsal response is referred to as the rehearsal-of-the-correct-alternative response (RCR). The RCR is a pronouncing of the C item implicitly or explicitly, and it may occur more than once after the subject is supplied with information about which item is C. No rehearsal of the I item is assumed to occur.

The frequency theory also proposes a fourth response mechanism capable of adding frequency units to VD items. The frequency of a given item may be increased if that item has occurred elsewhere in the list as an implicit associative response (IAR). The subject may confuse an IAR with an RR, so that IARs may add frequency units in the same sense that an RR does.

During a particular VD trial, all items receive at least one frequency unit from the RR. As VD learning progresses, the C item accumulates more frequency units than the I item as a result of the subject's rehearsal of the C item and the additional presentation of the C item under some feedback conditions, e.g., anticipation. Ignoring whether the PR occurs to the C or I item, a differential frequency of at least 2:1 in favor of the C item is built up due to RCR. This increase in favor of the C item makes discrimination on the basis of differential frequency possible: the subject is able to choose either the most frequent item in a pair (Rule 1); or the least frequent item in a pair (Rule 2).

Frequency theory specifies that the more similar two items are, whether within a pair or between pairs, the more likely an RR, PR, RCR, or IAR made to one item will be confused with an RR, PR, RCR, or IAR made to the other one. This confusion between items leads to a blurring of frequency differentials, thus producing poorer learning by the subject. Ekstrand et al. (1966) specifically predicted greater interference from intrapair associative relations than from interpair associative relations due to the possible priming effect that might take place for the IARs when associates are presented simultaneously.

Interpair Similarity

Using nonsense syllables, Underwood and Archer (1955) obtained interference when formal interpair similarity was increased from a low to a high level of similarity. However, their rules for forming the high formal similarity list resulted in similarity not only between pairs but within pairs. When intrapair similarity was held to a minimum, Battig and Brackett (1963) did not find clear-cut differences with three levels of formal interpair similarity.

Ekstrand *et al*. (1966) tested aspects of the frequency theory by varying relative frequency within VD pairs through the use of similarity relations between pairs. They reasoned that when the same item or strong associates are presented as the C item in two pairs, additional frequency units are added to the C items. The result is a greater differential frequency in favor of the C item and a facilitation of learning. When the same item or strong associates are the I items in two pairs, the I items receive additional frequency units, thereby decreasing the frequency difference between C and I items and producing interference. When the same item or strong associates are C in one of the two pairs and I in the other pair, maximum interference occurs because the frequency cue is very difficult to use. Rule 1 is appropriate for some pairs and Rule 2 for others.

VD learning was found to be facilitated to an equivalent degree when the same item or strong associates were presented as the C item in two pairs. Interference occurred as predicted when the same item was I in two pairs. However, the group receiving strong associates as I items in two pairs did not show measurable interference effects in comparison to a control group receiving unrelated VD pairs; nor did it differ from the group receiving the same words as I items in two pairs. That is, there was no indication that strong associates as I items in two pairs measurably influenced the subjective frequency difference between C and I items. The condition in which the same item was C in one pair and I in the other produced twice as many errors as strong associates under the same condition and both showed interference in relation to the control group.

In summary, contrary to the frequency theory prediction, increasing formal interpair similarity does not seem to produce interference when intrapair similarity is low. In the extreme case of formal similarity, where one of the items in each of two pairs is identical, the frequency theory predicts the results exactly. These generalizations are dangerous, for the two studies on which they are based used different experimental materials. Words with their concomitant meanings may not necessarily behave as nonsense syllables behave. However, the frequency theory does not differentiate between the two: presumably they should behave similarly.

Frequency theory does not fully explicate interpair associative similarity. The fact that strong associates are facilitative when they are the C items in two pairs but not interfering when they are the I items in two pairs is unexplained: the first result implies that IARs are functioning as assumed; the second, that IARs are not functioning as assumed.

Intrapair Similarity

Underwood and Viterna (1951) compared VD lists of high and medium intrapair meaningful similarity. Interpair similarity was low. They found a small but significant difference in learning in favor of the medium similarity group. Edwards (1966) used a four-choice VD task to study separately the effects of within-display and between-display similarity. Within-display similarity did not affect learning of nonsense syllables, but did interfere with the learning of forms. Between-display similarity retarded performance with both nonsense syllables and forms.

Two studies have compared the performance of normal and deaf subjects on VD tasks in which intrapair similarity was varied. Putnam, Iscoe, and Young (1962) found that highly meaningful similar word pairs were easier to learn than unrelated pairs for both normal and deaf adolescents. Youniss, Feil, and Furth (1965) reported that deaf adolescents find physically similar pairs more difficult than unrelated ones, but that this is not true for pairs with similar meaning. Normal adolescents and normal and deaf college students had greater difficulty with the meaningfully similar pairs.

Barch, Lippman, and Whalen (1967) found that the VD learning of grade school children depended upon the type of intrapair similarity and frequency of usage. For low frequency of usage words, learning was facilitated by both formal similarity (e.g., "leopard-leper") and meaningful similarity (e.g., "muck-filth"). For very frequently used words, formal similarity (e.g., "desk-deck") and meaningful-formal similarity combined (e.g., "began-begun") produced interference. However, meaningfully similar pairs did not differ from unrelated pairs. Strongly associated word pairs were significantly easier to learn than any other class of common words.

In the above study, the only criterion for calling a pair meaningful was that the words have similar meaning. Thus, the meaningfully similar class of pairs included some strong associates with similar meaning (e.g., "pretty-beautiful"). Meaningfully similar pairs which were strongly associated were among the easiest in the list. Thus, whatever made high associative pairs easier did not exclude pairs that were synonyms of each other. Subsequent unpublished research by Barch and associates has confirmed the facilitation found for associative pairs in both mixed and unmixed lists with grade school children.

To explain the paradoxical finding that intrapair associative similarity facilitated learning, Barch et al. (1967) proposed a two-stage memory model which asserts that subjects attempt to reduce the memory load as much as possible in the VD task. To do this they "tag" or "code" one item of a pair as C, then collapse the pair and its tag together for storage. The number of memory units is the number of collapsed pairs. During the test trial the collapsed unit is searched for and retrieved, unfolded, and inspected for the tagged C item. The linguist Yngve (1960) has proposed a similar memory load reduction model to account for sentence production.

In the Barch et al. (1967) model storage processes are most crucial. Any existing relation which allows items of a pair to be more easily combined aids learning, because once the pair is collapsed the tag is safe from interference. Any relations conflicting with the intrapair relation interfere with the combining process. As a result, the tag for the C item may be lost before storage, i.e., the C item may be forgotten; or the members of the pair may have to be stored separately, increasing memory load, and leaving the tag highly susceptible to interference.

The ease of combination for any pair depends on the relative strength of the intrapair relation as compared to alternative relations for the items.

The more linguistically sophisticated the subject, the more likely it is that he has potential alternative relations. Thus, college students may not benefit as much by intrapair associative relations. Because the obtained associative effect was so strong with grade school children, Barch et al. (1967) hypothesized that associative pairs are at least as easy to learn as unrelated pairs for college students. Support for this prediction has come from a study by Eberlein and Raskin (1968) in which interpair association produced significant interference in the VD learning of college students, whereas intrapair associations had no effect.

In summary, whether or not intrapair similarity facilitates, interferes with, or makes no difference in learning is a complex interaction between the type of interpair similarity, the age of the subject, and the frequency of usage of the stimulus material.

Purpose

The purpose of the present experiment was to compare the predictions of the frequency theory and the two-stage memory model concerning the effects of intrapair and interpair associative similarity.

Both the two-stage memory model and the frequency theory predict interference from having associates in the list but not paired together (interpair associations). The frequency theory predicts that rearranging the pairing of unrelated items is not detrimental to learning. For the frequency theory, the unrelated items will always retain their frequency units even when they are not paired consistently with the same other unrelated item. The two-stage memory model says nothing about unrelated items so cannot make a prediction.

The present experiment is a direct test of the two-stage memory model's assumption that storage processes are crucial. If this is so, rearranging the pairing on the study trials, and thus upsetting the combining of items in pairs, will produce more interference than rearranging on the test trials. Rearranging the pairing should interact with item type according to the two-stage memory model, i.e., the learning of associative items is more interfered with if the rearranging occurs on study trials than is the learning of unrelated items. The frequency theory does not make specific differential predictions concerning rearranged pairing on study trials and test trials. Presumably both cause equal interference for associative pairs but none for unrelated pairs.

METHOD

Subjects

The *S*s were 105 fourth-grade and 113 sixth-grade children from two Lansing, Michigan elementary schools. The four classrooms in each grade were alphabetically halved, resulting in groups of 11 to 16 *S*s each. Each group was assigned to one of the four experimental conditions. Seven fourth-grade and three sixth-grade *S*s were omitted for response alternation or responding more than once per item. To assist statistical analysis, additional *S*s were nonsystematically eliminated until the four experimental conditions contained 22 fourth-grade and 26 sixth-grade *S*s each.

Materials

All but six of the words used to form 48 verbal discrimination pairs were A or AA on the Thorndike-Lorge (1944) general count. The exceptions, which occur in associative pairs (A pairs) only, were: bug, hammer, insect, navy, subtract, and thirsty. Only bug, thirsty, and subtract occurred less than 100 times in the Thorndike-Lorge count of 120 juvenile books.

Half of the 48 verbal discrimination pairs were high A pairs; the other half were unrelated pairs (U pairs). Except for two continuation pairs ("sail-boat" and "cry-baby") and two contrast pairs ("bad-good" and "army-navy"), the A pairs were a stimulus item and its most frequent free associate as given by the Palermo and Jenkins (1964) and Entwisle (1966) word association norms for children. The four exceptions lacked children's norms, but previous data indicated they would act similarly to the other A pairs. The U pairs had no primary associative links within or between pairs.

Two VD lists of 12 A pairs and 12 U pairs each were constructed. Formal and meaningful similarity between pairs on a list was minimized. The correct words were chosen so that formal and meaningful similarity within or between lists could not be used as differential cues for learning the correct words. Each of the lists had an alternatively-keyed version in which all the correct words on Key A became incorrect on Key B, and vice versa.

For each list three study trials and three test trials using six different serial orders of the pairs were prepared. A pairs and U pairs were intermixed. No pair appeared in the same serial position, nor was it preceded or followed by a given pair more than once. The left-right sequence of C and I items within a pair varied across the trials. Approximately half of the correct words on each trial occurred first in a pair and the other half second.

Voice recordings of both study and test trials were recorded by the E on Scotch magnetic low-print tape using a 602-2 Ampex recording system. A Stowe memory drum was used for timing. The clicking of the drum mechanism was minimally present on the tape. A 5 sec. presentation rate per pair was used for both study and test trials, i.e., 5 sec. occurred between the beginning of the first word of one pair and the beginning of the first word of a succeeding pair, with about 1 sec. required for saying each word of the pair.

The test trials consisted of the sequential number of each pair followed by the pair itself (e.g., "one, pretty-beautiful"). Test trials were recorded first on a master tape. The same version of these test trials served as a presentation for the two alternately-keyed conditions. Thus, possible accidental uses of stress or intonation could not in any systematic way indicate which word of a pair was correct.

On the study trials, 2.5 sec. after the beginning of a pair, the correct word was repeated and identified as correct (e.g., "beautiful is correct"). After each study trial was recorded, the relevant test trial was recorded from the master tape onto the final presentation tape. The intertrial interval was 10 sec.

Procedure

The experiment was given to groups of 11 to 16 _S_s each. The _E_ read the instructions to the _S_s and clarification was given whenever necessary. The VD lists were presented via a Wollensak tape recorder.

The alternating study trial-test trial procedure was used to separate in time the hypothesized storage and retrieval processes of the two-stage memory model and to study separately the effects of intrapair and interpair associative relations.

The _S_s received three alternating study and test trials on each list. Lists were presented in the same order for all groups since counterbalancing the lists would have required an unwieldy number of groups. The list given first will be referred to as List 1 (L-1), the second as List 2 (L-2). Each group received both lists under one experimental condition. There was 5 to 8 min. between lists.

_S_s responded on a special answer sheet on which, for each pair, they circled a "1" if the correct word occurred first in the pair and a "2" if the correct word occurred second.

Experimental Conditions

Pairing on the study and test trials was manipulated. The pairing was either constant or varied. On the constant trials, each word was always paired with its mate, i.e., each word was paired with the word with which it had originally been paired when constructing the pairs. On the varied trials, the words were never paired with any other word more than once. Any correct word from a given A pair was always paired with an incorrect word from another A pair; U words were likewise paired with U words.

All possible combinations of pairing were used, resulting in four conditions: CC, CV, VC, and VV. The first letter designates whether the pairing was constant (C) or varied (V) on the study trial; the second, the test trial condition. The study trials for Conditions CC and CV were identical; likewise, the study trials for VC and VV. The test trials for Conditions CC and VC were identical; likewise, the test trials for CV and VV.

RESULTS

Since the two lists could not be counterbalanced, it was not possible to distinguish differences due to presentation order of the lists from differences due to possible differential list difficulty. Therefore, the two VD lists were combined and list position was not used as a variable in the statistical analysis.

A 2 × 2 × 2 × 2 analysis of variance (Table 1) showed all main effects to be significant except Grades. A items ($\bar{X}$ = 49.31) were easier than U items ($\bar{X}$ = 47.95). Constant Study Conditions ($\bar{X}$ = 51.64) were easier than varied Study Conditions ($\bar{X}$ = 45.62). Constant Test Conditions ($\bar{X}$ = 49.91) were easier than varied Test Conditions ($\bar{X}$ = 47.35). However, the interpretation of the main effects was modified by the significant interactions found.

The Item Type × Study Conditions × Test Conditions interaction was significant, $F(1,184) = 3.95$, $p < .05$. The Newman-Keuls Test (Winer, 1962) comparing the means for this interaction is shown in Table 2. All comparisons between A and U items within a particular Condition were significant except A-VV and U-VV. A items were easier than U items under both Condition CC and Condition CV; U items were easier than A items under Condition VC; and, A and U

Table 1.--Summary of Grades × Study Conditions × Test Conditions × Item Type Analysis of Variance Comparing the Mean Total Correct Responses (L-1 and L-2 Combined)

Source	df	Mean Square	F
Between Ss	191		
Grades (G)	1	113.27	1.08
Study Conditions (SC)	1	3,468.01	33.02**
Test Conditions (TC)	1	625.26	5.95*
G × SC	1	932.03	8.87**
G × TC	1	.03	<1
SC × TC	1	13.86	<1
G × SC × TC	1	367.54	3.50
Error (b)	184	105.03	
Within Ss	192		
Item Type (I)	1	178.76	11.37**
I × G	1	.01	<1
I × SC	1	969.01	61.64**
I × TC	1	8.76	<1
I × G × SC	1	7.88	<1
I × G × TC	1	82.40	5.24*
I × SC × TC	1	62.16	3.95*
I × G × SC × TC	1	23.36	1.49
Error (w)	184	15.72	
Total	383		

*$p<.05$

**$p<.01$

Table 2. Newman-Keuls Test for the Item Type × Study Conditions × Test Conditions Interaction (Mean Number Correct)

A-VV	U-VV	A-VC	U-VC	U-CV	U-CC	A-CV	A-CC
43.43	44.74	45.86	48.17	48.76	49.82	52.19	55.45

Table 3. Newman-Keuls Test for the Grades × Study Conditions Interaction (Mean Number Correct)

4-VS	6-VS	6-CS	4-CS
43.34	47.56	50.70	52.74

Note: Any two means underlined by the same line are not significantly different.

items did not differ significantly under Condition VV. For the A items, all Conditions were significantly different and were ordered from easiest to most difficult in the following manner: A-CC, A-CV, A-VC, A-VV. Conditions U-CC, U-CV, and U-VC were not significantly different. However, Condition U-VV showed significantly poorer performance in comparison to all other U Conditions.

The only significant interactions involving the Grade variable were the Grade × Study Condition interaction, $F(1,184) = 8.87$, $p<.01$, and the Grade × Item Type × Test Conditions interaction, $F(1,184) = 5.24$, $p<.05$. The Newman-Keuls comparison between means for the Grade × Study Conditions interaction appears in Table 3. The performance of constant Study Conditions was better than the performance of varied Study Conditions for both grades. Under constant Study Conditions, the fourth grade and sixth-grade groups do not differ significantly. Under varied Study Conditions, the performance of the fourth graders was significantly inferior to the sixth graders.

Table 4.--Newman-Keuls Test for the Grade × Item Type × Test Conditions Interaction (Mean Number Correct)

4-U-VT	4-A-VT	6-U-VT	4-U-CT	6-A-VT	6-U-CT	4-A-CT	6-A-CT
46.70	46.75	46.92	48.02	48.85	49.96	50.68	50.79

Note: Any two means underlined by the same line are not significantly different.

The Newman-Keuls comparison between means for the Grade × Item Type × Test Conditions interaction is shown in Table 4. Generally, the groups under constant Study Conditions consistently performed better than those groups under varied Test Conditions although not always significantly better. Irregardless of grade, the A items under constant Test Conditions were easiest. Under constant Test Conditions, the grades do not significantly differ on the A items. However, under constant Test Conditions the sixth graders made significantly more correct responses on the U items than the fourth graders. There were no significant differences between grades or item types under varied Test Conditions.

DISCUSSION

Barch, *et al*. (1967) found A pairs to be easier than U pairs for fourth, sixth, and eighth grade children. The present experiment replicated this finding for fourth and sixth graders under presentation conditions which eliminated any possible accidental effects from voice cues. The facilitation produced by associative relations resulted in a significant Item Type main effect even though more errors occurred on A items than on U items under Conditions VC and VV.

Varying the conditions under which *S*s study or are tested affected performance. It can be seen from Table 3 and Table 4 that constant study or constant test conditions facilitated performance irregardless of both grades and item types.

As predicted by the two-stage memory model, there was a significant Item Type × Study Conditions × Test Conditions interaction. A comparison of A pairs and U pairs showed that under constant study conditions, associative relations facilitated performance. It is assumed that the strong intrapair associative relationship expedited tagging, collapsing, and combining during storage. When the pairing was varied during study trials, interpair associative relations were much stronger than intrapair, thus hindering performance on A pairs.

Significant differences were found between all associative conditions. The conditions for A items ranked from least to most difficult were A-CC, A-CV, A-VC, A-VV. Neither the frequency theory nor the two-stage memory model explain these results entirely.

The frequency theory predicts that intrapair and interpair associative relations are interfering when one associate is C and the other I in two pairs. It does not make predictions as to the differential effects of study or test conditions. Therefore, it offers no explanation as to why the conditions ordered in this fashion.

The two-stage memory model predicts that intrapair associative relations are facilitating under constant study conditions, i.e., interpair associative relations are relatively more interfering when they occur on study trials than when they occur on test trials. Intrapair associative relations were the most facilitating under constant study conditions. A comparison of the means shows that there is a large drop from A-CV to A-VC. The A pairs under constant study conditions performed better than all other groups and the A pairs under varied study conditions performed worse than all other groups.

However, there was some decrement in performance when A pairs were rearranged on test trials only (Condition

CV as compared to CC) and some gain from having the two items of an A pair presented together on test trials only (Conditions VC as compared to Condition VV). The two-stage memory model makes no specific predictions as to the effects of intrapair associative relations on test trials.

Perhaps storage processes also occur during the test trials. If this corollary to the two-stage memory model is true, on the test trials the Ss would be retrieving, unfolding, and inspecting the pairs for the tagged C item as well as saving the tag, recombining, and recollapsing. Some of these operations may be incompleted, thus causing a decrement in performance. Applying this corollary to the results obtained for Conditions CV and VC makes it clearer.

Under Condition CV, the items of a particular A pair are in two different serial positions in the list. For the item first to appear, the A pair is retrieved, unfolded, and inspected for the tagged C item. If that pair is not re-stored correctly, the tag may be lost before the second item of that pair appears. A testable consequence of this corollary is that the items appearing first for particular A pairs should show more correct responses than those items occurring second, i.e., performance should be better the first time either item of an A pair is presented than the second time an item from that A pair is presented.

Another explanation may be made for these results. Suppose the Ss prefer to know which item of a pair presented on a CV test trial is correct. If the pair "water-beautiful" were presented and "beautiful" were correct, the Ss may first retrieve the pair "water-thirsty," look for its tag, and see that "thirsty" is correct. However, this does not tell the S which of the two words presented was correct. Therefore, if allowed enough time, the S may then retrieve the pair "beautiful-pretty," see that "beautiful" is correct, and only after retrieving both these pairs respond.

Indirect evidence has shown that younger children perform best when given time to search for the correct response (Suppes and Ginsberg, 1962). If grade school children perform in this fashion on a VD task, there should be a developmental difference between grade school and adult Ss, because there is evidence that adults perform equally well under conditions in which the verbal reinforcement is right or wrong on a VD task (Spence, Lair, and Taylor, 1963). This assumes that a self-generated reinforcement functions similarly to reinforcement given by an outside source. The specific prediction would be that no difference would occur between Groups A-CC and A-CV for adult Ss. An unpublished study by Whalen and Barch, using essentially the same design as the present experiment and college students as Ss, showed no differences between A-CC and A-CV.

This second explanation may be tested in other ways. One obvious way is to present items singly on the test trials. This technique would also allow a direct test of the two explanations presented. The first explanation treats correct and incorrect alternatives as the same. All that is important is which alternative occurs first in serial position. It predicts that when A items are presented singly, the first item of an A pair is more likely to be responded to correctly. The second explanation predicts performance is better, and the latency of responding shorter, when the correct alternative is presented singly than when the incorrect alternative is presented.

A comparison of Groups A-VC and A-VV showed some gain from having A pairs presented together on test trials. This gain is not enough to counteract the interference generated from strong interpair A relations on the study trials under Condition VC, for Group A-VC performs significantly poorer than Group U-VC. The interpretation that storage processes also occur during the test trials may be extended to cover the results found under Condition VC.

Because the A items are not presented together on study trials, collapsing and combining does not occur. Tagging, however, may occur. On the test trials when A pairs are presented simultaneously, the S may spend most of his time trying to combine and collapse, and in so doing lose the tags. This would most likely affect Test Trial 2. Having the two items of an A pair presented together on Test Trial 1 for the first time sensitizes the S to the fact that these relationships are there. The S may spend

Study Trial 2 trying to utilize these strong associative relationships and thus not be tagging the correct items. The trial analysis on L-1 showed Test Trial 2 under Condition VC to be significantly inferior to Test Trial 3. This effect is all the more striking because no other trials within experimental conditions were significantly different. This suggests that this sensitization to the associative relations is occurring, but that by the third trial, the S has, in effect, learned to work with it.

When U items were rearranged on either study trials (Condition CV) or test trials (Condition VC), but not on both (Condition VV), no significant differences occurred when compared to constant study and test conditions (Condition CC). When the pairing of U items was rearranged on both study and test trials, performance significantly dropped in comparison to all other unrelated conditions. This decrement is unexplained if one assumes the necessary and sufficient condition for VD learning is the presence of a differential frequency between C and I items.

The two-stage memory model, if it predicts anything for U items, would predict a difference in favor of U-CC over U-VV. It has no specific predictions concerning Groups U-CV and U-VC. This model was designed to account only for strong associative relations.

However, Spear, Ekstrand, and Underwood (1964) reported that an association due to contiguity is developed between the C and I items in a pair. Let us assume associations by contiguity are facilitating in the same way that strong pre-existing associative relations are. Then, to the extent that associations by contiguity develop, VD learning should be facilitated. The present results showed that learning was facilitated whenever U items were presented under conditions that would be expected to build up contiguous associative strength in a pair, i.e., whenever conditions were constant, either on study trials, test trials, or both. When conditions did not favor such contiguous associations, performance deteriorated.

Contiguous associations thus seem to perform in a manner similar to strong associative relations. They do not perform exactly in the same way, either because they did not reach sufficient strength to cause differences between Groups U-CC, U-CV, and U-VC, or because interpair contiguous associations are not interfering.

Under constant study conditions, the performance of school children in different grades was statistically equivalent. However, the grades significantly differed when the pairing on study trials was varied. Varying the study trials interfered with the performance of both grades, but significantly more interference occurred for the fourth grade. One hypothesis for this difference is that the sixth graders are more able to cope with a varied and inconsistent study situation because they have two years more experience with using words and with learning situations in general. A second hypothesis is that this difference taps a critical change in children within this age range with respect to their ability to handle inconsistent situations when pairs of commonly used words are used. In no previous research using commonly used words by Barch and associates were differences found between fourth and sixth graders. Only when _S_s were given low frequency words under constant conditions did fourth and sixth graders differ.

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APPENDICES

APPENDIX A

LISTS

List 1

Associative Pairs	Unrelated Pairs
bad - good	able - deep
cold - hot	calm - huge
high - low	tall - poor
chair - table	fruit - shoulder
army - navy	bird - desk
king - queen	back - curtain
you - me	under - along
always - never	then - quite
go - stop	lift - act
cry - baby	best - noise
thirsty - water	smooth - train
sad - happy	important - yellow

List 2

<u>Associative Pairs</u>	<u>Unrelated Pairs</u>
black - white	evil - fast
there - here	heat - dollar
baby - cry	they - of
long - short	sweet - quiet
beautiful - pretty	better - large
bug - insect	inch - ear
girl - boy	note - game
nail - hammer	strong - deck
boat - sail	milk - car
hard - soft	miss - prevent
begin - start	bent - glad
subtract - add	jump - receive

APPENDIX B

INSTRUCTIONS

Instructions

I'm Mrs. Whalen from Michigan State University. We are going to play a word game. In this word game you will have to learn some words. You will have to listen very carefully.

When I turn on the tape recorder, you will hear a list of pairs of words. One word in each pair will be correct. You must learn the correct words.

First, all the pairs of words will be presented in a study trial and you will be told which word is correct in each pair. For example, you might hear, "Book-Marble, Book is correct" or "Frog-Apple, Frog is correct."

After you have heard all the pairs and have been told which word is correct in each pair, the pairs will be presented again. This will be a test to see how well you can remember the correct words. On the test trials, only the pairs will be presented and you must tell me which word in each pair is correct.

This is how you are to tell me. If you will look at your answer sheet you will see that under Test 1, for example, there are the numbers 1 to 24. After each of these numbers is a 1 and a 2. If the first word of pair presented during the test trials is correct, you would circle 1; if the second word of a pair is correct you would circle 2. For example, you know that Book is correct. If Book occurred first in the pair you would circle 1; if Book occurred second in the pair you would circle 2. What would you do if I said "Book - Marble?" (Answer from children.) What would you circle if I said "Apple - Frog?" (Answer from children.)

The correct words are always the same, but whether they come first or second in the pair changes.

Are there any questions?

Now we're ready to start Study Trial 1. Remember on the study trials you don't write--just listen and try to learn the correct words.

(Stop tape between Study 1 and Test 1.) Now we're ready for Test Trial 1. Please answer every item. If you're not sure which word of a pair is correct, guess. Remember if the first word of pair is correct, circle 1; if the second word of a pair is correct, circle 2.

(At beginning of List 2.) On the second part of the experiment, everything is exactly the same, except that you will be learning a new list of words. Your job is still to learn the correct words. Ready? We'll start with Study Trial 1 again.