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ABSTRACT

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This experiment was conducted to investigate the effects of different levels of intralist similarity in beginning reading instruction, upon rate of learning, upon subsequent word recognition skills, and upon tendency toward generalization. Forty-two kindergarten children participated in the acquisition phase of the program by learning one of three lists composed of four words. It had been found in a preliminary investigation with subjects who did not participate in the main experiment that the individual words composing the three lists were not differentially difficult to learn outside the context of their respective lists. The lists differed, however, in intralist similarity. One of the two acquisition measures in the main experiment supported the hypothesis that high intralist similarity impedes rate of acquisition; the other measure did not support the hypothesis. The two extreme intralist-similarity groups were given training to a criterion of two successive random presentations of their respective lists with no errors. After reaching criterion these two groups were given word recognition and generalization tests for the words in their respective lists. The data supported the hypothesis that high intralist similarity in beginning reading results in greater word recognition skills and lesser tendency to make falsely generalized responses to other words. The possible relationship of discrimination pretraining to the above findings was discussed speculatively.

THE EFFECTS OF INTRALIST SIMILARITY ON ACQUISITION
AND GENERALIZATION IN BEGINNING READING INSTRUCTION

by

Beth Anne McCutcheon

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INTRODUCTION

Learning to read is an important part of early education, and the process has stimulated a great amount of interest and research during the past several decades. It has been approximated that the average five- or six-year-old child has a speaking vocabulary of several thousand words (Barbe, 1965). Upon entering school the child must be taught to relate these speech sounds to printed symbols. It is important to know the conditions under which individuals confuse or fail to recognize words. The many variables which are involved in this highly complex process are of concern to psychologists and educators.

Investigators in the field of reading instruction have theorized that some words are more difficult than others for the beginning reader to learn. There is evidence in the literature that the rate of learning to read particular words may be related to word frequency and/or familiarity. Hildreth (1935) found that children have less difficulty recognizing words which have occurred frequently in their conversation or to which they have been frequently exposed. Tilley (1936) stated that a child may experience difficulty with words if he does not understand the ideas conveyed by the printed symbol. Anderson and Dearborn (1952) suggested that words which are not included in the child's "meaning vocabulary" amount to nonsense syllables.

Although meaningfulness may be a relevant factor in the retention of words, it should not be indicated that meaningfulness is essential to learning to read. Children can be trained to recognize words that have no definite meaning for them. Dewey (in Barbe, 1965) found that

children can be taught to pronounce words even when they are unable to identify objects which the words represent.

The detection of cues that are used in making a response is important to the understanding of beginning reading. Marchbanks and Levin (1965) have reported that letters rather than word shape are the main cues for word recognition. After three-letter and five-letter words were presented to kindergarten and first-grade children, the children were asked to choose the most similar word from a list of words. Each of the response-word items contained a cue from the stimulus word. The most important cue, as defined by the specific words chosen, was the first letter. The second most important cue was the last letter. The children employed word shape as the least important cue. Hill (1936), also, found that the first and last letters of a word serve as cues in learning to read. Three types of discrimination situations were tested: (a) single letters were tested for discrimination; (b) word-like letter combinations with a single letter changed from word to word in such a way as to leave the configuration unchanged and in systematically varied positions (beginning, middle and end) were presented; (c) words whose letter items and configuration remained constant while the order of the letters was changed about were presented. In addition to the finding that the beginnings and ends of words served more frequently as cues, it was found that the middle section gave rise to the most errors, whereas identical configuration between two words caused few errors. Also, there was a relatively large number of errors when the order of the letters was changed about while the letters and configuration remained the same. In this study the configuration of a word referred to its

geometrical shape. Tall, long and short letters are some of the factors making up geometrical form. Other investigators have also found that the initial and terminal letters are the most important cues (Levin, Watson, Feldman; 1964).

One technique which has been utilized to avoid learning to read on the basis of single letters has involved preliminary training in discriminating words to be later learned. Discrimination pretraining, as this technique is typically identified, has been demonstrated to facilitate the rate of learning words for beginning readers. Muehl (1960) investigated the effects of three different types of discrimination-pretraining stimuli on the later learning of a list of words. The three types of stimulus material included: (a) the same words as those appearing in a vocabulary list to be later learned, (b) different words from those to be later learned, and (c) geometric forms. The group given discrimination pretraining with the specific words learned the vocabulary list significantly faster than the other two groups. There was not a significant difference in learning performance between the group pretrained on different words and the group pretrained on geometric forms. The Muehl findings were corroborated in another study by Staats (1962). There were two experimental groups of beginning readers. One group received discrimination pretraining with words identical to those to be later learned, while the other experimental group received pretraining with the letters composing the words in the list. There was also a control group which received no discrimination pretraining. The group which received discrimination pretraining on the individual words to be later learned performed significantly better in learning to read the words than did the other two groups. The

difference between the means of the group pretrained on the letters composing the words and the group who had no pretraining was not significant.

There is evidence in the literature that intralist similarity, also, influences the process of learning to read. Formal intralist similarity refers to the number of different letters utilized in constructing a list of words to be learned. A list that utilizes a large variety of letters of the alphabet for a constant number of words is regarded as having low intralist similarity; correspondingly a list which includes only a small number of letters for the same number of words is characterized as having high intralist similarity.

When the words in a list to be learned are exceedingly dissimilar from each other, appropriate discriminations can be made by responding to any one of a number of relevant cues. Such a list could be quickly learned by responding on the basis of one or two letters per word. Such learning would, however, necessarily result in a large number of incorrect generalizations when new words were presented. Learning a more similar list of words would be a slower process; but, once learned, there should be fewer incorrect generalizations to other words due to the necessity of responding to more cues in a single word with high intralist similarity words.

A recent study by Samuels and Jeffrey (1966 b) supports the conclusion that intralist similarity is a relevant variable affecting the rate of learning to recognize words and that children identify many words on the basis of single letters under conditions of low intralist similarity. Using the paired-associate anticipation method and an artificial alphabet which resembled Oriental symbols, three groups of children were taught three different lists of four words

which varied in intralist similarity. It was found that acquisition of reading responses was faster with low intralist similarity but that incorrect generalization of the response to other words was considerable. That is, more generalization was evinced when a new but similar word was substituted for the original word. It was found that high intralist similarity impeded the rate of acquisition of reading responses; however, the subjects made fewer falsely generalized responses to other words in the testing situation. Samuels and Jeffrey concluded that children should be taught to attend to all of the symbols that comprise the word or else they will make errors in reading due to identification of the word based on one letter.

It was the purpose of this study to repeat the Samuels and Jeffrey (1966 b) study using real words rather than nonsense symbols. In as much as the investigation dealt with the relationship between the words in training lists, it was important that the individual words which comprised the separate lists should not be differentially difficult.

The data were intended to answer the question: To what extent does intralist similarity affect, for beginning readers, (1) rate of acquisition, (2) subsequent recognition skills, and (3) tendencies toward generalized incorrect responses to other words?

METHOD

Subjects

The subjects were 82 children from kindergartens at two locations of Hester's Creative Schools for Children in Greensboro, North Carolina. Forty children from one location served in a preliminary study, and 42 children from a second location participated in the main experiment.

The training sessions for the preliminary study group were conducted at the kindergarten. The training sessions for the main experiment were conducted in a 5 x 10 ft. room at the University of North Carolina at Greensboro. The room was adequately lighted and ventilated and free from distracting noises. These subjects were transported from their kindergarten to the laboratory for individual, single sessions.

Apparatus

(1) Three lists of four words were used (see Appendix). List I contained four, four-letter words constructed from four different letters of the alphabet. List II had four, four-letter words constructed from eight different letters of the alphabet. List III had four, four-letter words constructed from sixteen different letters of the alphabet. Lists I through III were developed to represent decreasing degrees of intra-list similarity.

(2) The words were typed on 5 x 8 in. index cards using an Underwood elementary typewriter with 1/2-in. type. Lower-case letters were used.

Standardization of Word Difficulty

In order to control for differences in the difficulty of

individual words composing the three lists a preliminary procedure was instituted. It was necessary to demonstrate that the words were not differentially difficult outside the context of their respective lists.

Four lists of three words each were compiled by taking one word from each of the three lists, described in the Apparatus section, which were to be used in the main experiment. Each of these four lists of words was presented ten times to one of four groups of ten subjects who did not take part in the main experiment. Membership in the four groups was determined by the following procedure: The four lists to which subjects might be assigned were randomized; the subjects were then sequentially assigned to one of the lists as they came into the laboratory. Each subject was shown the three words in his respective list one at a time and asked if he recognized any. If the subject indicated that he did not know any of the words, each was pronounced by the experimenter. All subjects who were able to read any of the words on the first presentation were eliminated from the experiment. The subject was then instructed to read each word. Correct responses were verbally reinforced; incorrect responses were corrected. After the total number of errors for each word had been determined, the original lists were reassembled and an analysis of variance performed in order to determine if there were any significant difference in number of errors for the individual words comprising the three lists to be used in the main experiment.

Experimental Procedure

Acquisition Training. Forty-two subjects who had not participated in the preliminary project were assigned to three groups, each of

which was subjected to a different word list. As in the above procedure, the three lists to which subjects might be assigned were randomized; the subjects were then sequentially assigned to one of the lists as they came into the laboratory. The subjects were told individually that they were going to play a game. Each subject was shown the four words in his respective list one at a time and asked if he recognized any. If the subject indicated that he did not know any of the words, each was pronounced by the experimenter. Again all subjects who were able to read any of the words on the first presentation were eliminated from the experiment. The subject was then instructed to "read" each word. Correct responses were verbally reinforced; incorrect responses were corrected. All subjects in the acquisition groups were given 18 repetitions of their respective lists and each correct response was recorded.

Criterion Training. Following the 18 presentations of the lists Groups I and III were given additional training with the words in their respective lists until each subject reached a criterion of two presentations of the list with no errors. The order of the individual words composing the lists was determined randomly by shuffling the cards on which the words were printed before each presentation. It will be remembered that the subjects in Groups I and III learned the lists with the most and least intralist similarity, respectively. By prior decision Group II was eliminated at this point in the study in order to allow comparison of only the two extreme groups and in order to remain consistent with the methodology of the Samuels and Jeffrey (1966 b) study.

Measures

(1) Rate of Learning Lists. There were two measures of rate of learning. The first was the number of incorrect responses made during the first 18 presentations of the respective lists. The second measure was the number of trials necessary for groups learning Lists I and III to reach a criterion of two times through their respective lists with no errors. The words were presented in random order to each subject after the first 18 presentations.

(2) Word Recognition. After reaching the above described criterion of two correct times through their respective lists, Groups I and III were presented four lists of three words. Each list contained one word from the four words previously learned by the subject and two similar words. These similar words differed from the original word by one or two letters. The initial letter from the original word was retained for each of the two new words in each list. Each subject was instructed to find the originally learned word, which was pronounced by the experimenter.

(3) Generalization Test. After reaching criterion, the subjects in Groups I and III were presented a list of words which were similar to their originally learned list; however, one new letter was substituted for one of the letters in each original word. The subjects were instructed to read the words. If the new words were incorrectly identified as the word from the original list, generalization was said to have occurred. If the word was identified as any other word or if the subject said that he did not know the word, generalization was not scored.

RESULTS

Standardization of Word Difficulty

Forty subjects who did not participate in the main experiment completed the preliminary procedure of standardization of individual word difficulty for the three lists. The means and standard deviations for number of errors made on the individual words composing Lists I, II and III are presented in Table 1. It can be seen in Table 1 that the differences among the means were quite small. An analysis of variance as described in Lindquist (1953, pp. 49-66) indicated no significant differences among the means for Lists I, II and III ($F = .03$). The heterogeneity of the variances was investigated with the largest- F -ratio technique developed by Hartley and illustrated in Walker and Lev (1953, pp. 191-192). The variances were not found to be significantly different ($F_{\max} = 7.10$).

Experimental Results

Rate of Learning Lists. The first measure of the effects of intralist similarity upon rate of acquisition was the total number of errors in 18 presentations of Lists I, II, and III, respectively. The means and standard deviations are presented in Table 2.

It can be seen in Table 2 that these data do not support the hypothesis that high intralist similarity impedes rate of acquisition. The largest number of errors occurred on List II, a list which involved only moderate intralist similarity. An analysis of variance was performed on these data. It can be seen in Table 3 that there were significant differences among the mean error scores for the three lists. Tests of the significance of differences in means for individual pairs

TABLE I

Means and Standard Deviations for Number of Errors for Individual Words in Lists I, II, and III During Preliminary Determination of Word Difficulty

List	I	II	III
Mean	13.5	14.2	13.1
Standard Deviation	22.01	15.02	8.26

TABLE 2

Means and Standard Deviations for Total Number of Errors
in 18 Presentations of Lists I, II, and III

List	I	II	III
Mean	19.86	27.14	18.21
Standard Deviation	7.47	11.10	8.70

TABLE 3

Summary of Analysis of Variance for Rate of Acquisition Among Lists I, II, and III

Source	df	Sum of Squares	Mean Squares	F
Total	41	3944.12		
Treatment	2	632.33	316.17	3.72*
Error	39	3311.79	84.92	

* $P < .05$

as described in Lindquist (1953, pp. 90-96) were also performed on these data and are reported in Table 4. It can be seen in Table 4 that there was only one significant difference in the predicted direction, the difference between Lists II and III. The largest- F -ratio technique was used to investigate the heterogeneity of the variance among the three lists. The variances were found not to be significantly different ($F_{\max} = 2.21$).

Trials to Criterion. The second measure of the effects of intralist similarity upon rate of acquisition was the number of trials necessary for the subjects learning Lists I and III to reach a criterion of two consecutive times through their lists without error. The words in the lists were presented in serial order for the first 18 presentations and thereafter in random order.

The data for trials to criterion very strongly support the hypothesis that high intralist similarity impedes rate of acquisition. The means and standard deviations for trials to criterion for Lists I and III are presented in Table 5. It can be seen in Table 5 that the mean number of trials to criterion for the high intralist similarity group was 36.21, while the corresponding mean for the low intralist similarity group was 21.36. An analysis of variance was performed on these data, and the corresponding F score is presented in Table 5. It can be seen that there was a statistically significant difference between the means at the .001 level. The largest- F -ratio technique was again employed to investigate the heterogeneity of variance between the two lists. As shown in Table 5, there was a significant difference between the two variances at the .001 level.

TABLE 4

Summary of the Tests of the Specific Differences in Means
between Lists I and II, Lists I and III, and Lists II and III

	List II	List III
List I	7.29*	1.64
List II		8.93*

* $P < .05$

TABLE 5

Means, Standard Deviations, \bar{F} Scores, and \bar{F}_{\max} Scores for Measures Used with Criterion Groups Learning Lists I and III

Measures	List I (High Similarity)		List III (Low Similarity)		Analyses	
	Mean	S.D.	Mean	S.D.	\bar{F} Scores	Variance \bar{F}_{\max} Scores
Trials to Criterion	36.21	10.84	21.36	2.24	25.24*	23.41*
Word Recognition Test (Errors)	.86	.95	2.14	.66	17.26*	.48
Generalization Test (Errors)	1.14	1.03	3.57	1.09	37.17*	.89

* $P < .001$

Word Recognition Test. It had been hypothesized that low intralist similarity fosters word learning on the basis of only parts of the entire stimulus configuration, often a single letter. Word learning in such fragmented fashion would necessarily result in a large number of incorrect identifications of similar words. On the Word Recognition Test the subjects who had reached criterion with either Lists I or II were directed to find the word from their respective lists pronounced by the experimenter from a list of three similar words.

The means and standard deviations for the number of errors on the Word Recognition Test for Lists I and III are also presented in Table 5. It can be seen that the mean number of errors for the low-intralist-similarity group was 2.14 for four words while the corresponding mean for the high-intralist-similarity group was .86. An analysis of variance was performed on these data. Table 5 shows that the means for the high and low intralist similarity groups were significantly different at the .001 level. It can also be seen in Table 5 that the largest-F-ratio technique for investigating the heterogeneity of the two variances resulted in a nonsignificant ratio.

Generalization Test. The second measure of the effect of intralist similarity upon the tendency toward incorrect identification of similar words was the total number of errors on the Generalization Test. It will be recalled that on this test the subjects who had reached criterion with either List I or List III were instructed to read a list of four words that were similar to the words in the originally learned lists. Generalization was scored if the words were incorrectly identified as the originally learned words.

The means and standard deviations for the number of errors on the Generalization Test for Lists I and III are presented in Table 5. It can be seen in Table 5 that the mean number of errors for the low intralist similarity group was 3.57 for four words while the corresponding mean for the high intralist similarity group was 1.14. An analysis of variance was performed on these data, and it is summarized in Table 5. It can be seen in Table 5 that there was a significant difference between the means at the .001 level. It can also be seen that the variances were found not to be significantly different.

DISCUSSION

The children who were trained to read words of low intralist similarity did reach criterion before those who were trained to read words of high intralist similarity. Thus, the data for trials to criterion strongly supported the hypothesis that high intralist similarity impedes the rate of learning. The findings for the number of errors on 18 presentations of lists of high-, moderate- and low- intralist-similarity words (Rate of Learning Lists Test) failed to support the hypothesis that increasing intralist similarity impedes the rate of learning words, however. More errors were made on the moderate-similarity list than on either the high- or low-intralist-similarity lists. Only one specific comparison was significant in the predicted direction. Because the data for trials to criterion for Lists I and III strongly supported the hypothesis it was suspected that methodological problems might have obscured the relationship between intralist similarity and the rate of learning the lists.

It will be recalled that the four words in each of the respective word lists were presented 18 times in a fixed order. The rigid order of presentation rendered it possible for the subject to memorize the order of the words instead of learning to respond differentially on the basis of textual stimuli. It was observed that the subjects frequently attempted to count the number of cards remaining in the stack before responding to the presented word. Memorizing word order is a different type of perceptual task from learning to read the words. The stimulus-configuration (including intralist similarity) of the text becomes

unimportant as a cue when the task changes from one of reading to one of memorizing word order. It is possible that random-order presentations of the lists might have resulted in demonstrated differences in the rate of learning the lists which varied with respect to intralist similarity. It should be added, however, that the writer is unable to explain why the moderate similarity list was the most difficult to learn.

The data from both the Word Recognition Test and Generalization Test consistently indicated that training on lists of low similarity leads to incorrect identifications and false generalizations when new but similar words confront the beginning reader. It has been stated (Diack, in Cutts, 1964) that teaching beginning reading with words chosen on the basis of their gross perceptual differences engenders the tendency to learn words on the basis of a single letter or some other readily apparent difference. Under these circumstances the beginning reader achieves false success in that there is a faster rate of acquiring a low similarity list but the economy is lost when the child is unable either to recognize the originally learned word in a list of similar words or to identify similar words as being different.

Because the factor of discrimination has been a major theme, it is interesting to speculate concerning the effects of discrimination pretraining upon the findings of this study. It is the belief of the writer that the effects of discrimination pretraining would depend upon the particular stimuli utilized. If pretraining were conducted with only those words composing the lists to be later learned, the high intralist similarity group would learn to discriminate very similar words, while the low intralist similarity group would learn to discriminate only very different words. The added discriminability of

the respective lists would probably cause the low intralist similarity group to lose its previous advantage in rate of learning to criterion. The high intralist similarity group would, however, probably maintain its advantage on the Word Recognition and Generalization Tests because of being the only group to have previously learned to discriminate very similar words. If, however, the words used in the discrimination pre-training also included words very similar to those composing the lists, the advantage for high intralist similarity on the Word Recognition and Generalization Tests would probably be lost.

SUMMARY

This experiment was conducted to investigate the effects of different levels of intralist similarity, in beginning reading instruction, upon rate of learning, upon subsequent word recognition skills, and upon tendency toward generalization. Forty-two kindergarten children participated in the acquisition phase of the program by learning one of three lists composed of four words. It had been found in a preliminary investigation with subjects who did not participate in the main experiment that the individual words composing the three lists were not differentially difficult to learn outside the context of their respective lists. The lists differed, however, in intralist similarity. One of the two acquisition measures in the main experiment supported the hypothesis that high intralist similarity impedes rate of acquisition; the other measure did not support the hypothesis. The two extreme intralist-similarity groups were given training to a criterion of two successive random presentations of their respective lists with no errors. After reaching criterion these two groups were given word recognition and generalization tests for the words in their respective lists. The data supported the hypothesis that high intralist similarity in beginning reading results in greater word recognition skills and lesser tendency to make falsely generalized responses to other words. The possible relationship of discrimination pretraining to the above findings was discussed speculatively.

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APPENDIX

Word lists for High, Moderate, and Low intralexical similarity (List I, Moderate
Similarity List II, and Low intralexical similarity List III)

List I	List II	List III
corn	corn	corn
dear	dear	dear
dead	dead	dead
dark	dark	dark

APPENDIX

APPENDIX

Word Lists for High Intralist Similarity (List I), Moderate
Intralist Similarity (List II), and Low Intralist Similarity (List III)

<u>List I</u>	<u>List II</u>	<u>List III</u>
deed	most	gram
dear	made	left
dead	road	wish
dare	rest	buck