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ABSTRACT

This study was concerned with the development of a program for teaching high speed word recognition through training in more sophisticated decoding strategies. The method reported focused on training the student to use minimal visual information while making maximum use of contextual cues in word recognition. The emphasis was on directing attention away from decoding toward extracting meaning from the passage. The 32 poorest readers in the regular second grade reading program in a middle class suburban elementary school were selected as subjects. A 2x2x2 factorial design was used with the subjects who were randomly assigned to one of eight groups. The first experimental factor consisted of the use of hypothesis test training in which the subjects are trained to use context as an aid in high speed decoding. The second experimental factor consisted of repeated reading training which gave the subject practice in using reading as a wholistic process. The third factor consisted of isolated word recognition in which the subject was given extensive practice in recognizing words flashed with a projector. It was concluded that hypothesis test training and repeated reading training led to improvement in reading skill and perhaps a combination of the two is efficacious, but that isolated word training is not effective. (WR)

FINAL REPORT

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AN EXPERIMENTAL PROGRAM FOR TEACHING HIGH SPEED WORD RECOGNITION AND COMPREHENSION SKILLS

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Teaching High Speed Word Recognition Skills

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Abstract

This program operationalizes a method for teaching high speed word recognition through training on more sophisticated decoding strategies. At the present time most reading methods tend to focus on initial skills. The method reported here focuses on training the student to use minimal visual information while making maximum use of contextual cues in word recognition. The emphasis is on directing attention away from decoding so that it can be directed toward extracting meaning from the passage. The techniques and skills employed can be used in the classroom with a broad spectrum of students.

A 2x2x2 factorial design was used with students reading at the second level who were randomly assigned to one of eight groups. The first experimental factor consists of the use of hypothesis/test training in which the subjects are trained to use context as an aid in high speed decoding. The second experimental factor consists of repeated readings training which gives the subject pratice in using reading as a wholistic process. The third experimental factor consists of isolated word recognition in which the subject

is given extensive practice in recognizing words flashed with a projector.

The results indicated that children trained in hypothesis/test procedures were significantly better on eight of twelve dependent variables. Repeated readings training also produced significantly better performance on seven of the twelve dependent variables. Isolated word recognition led to no significant improvement in reading performance.

It was concluded that hypothesis/test training and repeated readings training led to improvement in reading skill and perhaps a combination of the two is efficacious, but that isolated word recognition training is not effective.

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Introduction

Most of the reading research effort, up to the present time, has been directed toward understanding and facilitating the beginning reading process and current reading methods tend to focus on initial skills. The research reported in this study tests three different methods for teaching intermediate reading skills. The methods and their interactions which were tested were the hypothesis/test, flashed word, and repeated readings methods.

Hypothesis/test method. This method based on a partial model of word recognition (Samuels, 1970) trains students to use the kinds of decoding strategies which intermediate and fluent readers are probably using. There are few, if any, studies in the literature attempting to train students at this level. Possible reasons for the dearth of research on training intermediate and fluent reading processes include; reading, as a covert process, is difficult to study; descriptions of the word recognition process appear to be in conflict (Gough, 1972; Kolers and Lewis, 1972; Cattell, 1885); and until recently we did not have explicit, testable models of recognition and information processing (Williams, 1971). The recent advances in models of recognition, reading, and information processing (Singer and Ruddell, 1970; Davis, 1971) have been most useful in suggesting explicit pedagogical approaches for teaching more sophisticated reading strategies.

The partial model of word recognition is not an entirely new idea. In many ways it is similar to the Halle and Stevens (1964)

analysis by synthesis model of speech recognition and to Bruner's (1951) hypothesis testing and Solley and Murphy's (1960) trial and check. Ryan and Semmel (1969) have also written about the word recognition process in which they state, "Expectancies about syntax and semantics within context lead the reader to form hypothesis which can be confirmed or not confirmed with only a small portion of the cues available in the test (p. 59)." What these models appear to acknowledge is that recognition is a constructive process in which output is different from and greater than the input. Implications of these models for reading would be that given context and but a single letter from a target word the reader ought to be able to generate the entire word from this minimal visual letter cue.

The technique of supplying a missing word where context and a deletion are given has come to be called the "cloze procedure." For example, given red, white and _____, a subject may be required to fill in the deleted word.

In this study, the cloze procedure was used as a means of training subjects to make predictions from context.

Other researchers have employed the cloze technique in trying to develop new reading methods based upon the use of context in predicting a target word. Some 20 years ago Wilson L. Taylor introduced the cloze procedure as "a new tool for measuring readability." He defined cloze as "a method of intercepting a message from a 'transmitter' (writer or speaker), mutilating its language patterns by deleting parts, and so administering it to 'receivers' (readers and listeners) that

their attempts to make the patterns whole again potentially yield a considerable number of cloze units." (1953, p. 416) More simply stated, cloze is a procedure in which words are deleted at random or according to some predetermined pattern and the reader or listener is asked to fill in the missing words.

Investigations using cloze procedure in the past have focused on three areas; cloze as a measurement device, cloze as a measure of readability, and cloze as a measure of comprehension.

A few studies have reported the use of cloze as a teaching technique. Several of these studies (Friedman, 1964; Schneyer, 1965; Blumenfield and Miller, 1966; Bloomer et al., 1966 and Guice, 1969) reported no significant differences in reading comprehension after using cloze as a teaching device. There are certain similarities in these studies. First, the subjects were either college level readers (Friedman, 1964; Blumenfield and Miller, 1966; Guice, 1969), late elementary (Schneyer, 1965), or secondary readers (Bloomer, et al., 1966; Heitzman and Bloomer, 1967). Second, the deletions were made at some set rate of every nth word, and finally, no specific instruction was given.

The few studies (Bloomer, 1962; Martin, 1968; Kennedy and Weener, 1973) which have given support to the use of cloze as a means of instruction have in common a real attempt to adapt the cloze procedure to instructional situations. There also seems to be some evidence that deletions of lexical elements is superior to an every nth word system which tends to correlate most with IQ.

Perhaps the most striking overall feature of the research on using cloze as an instructional device is the lack of consistent findings. There does seem to be some direction for further research, however. Future studies should employ lexical element deletions, actively teach strategies for making the closure, use more sophisticated design and measures, and, perhaps, use subjects relatively less experienced in reading.

According to the partial model of word recognition, four processing stages are involved in recognizing a target word. In the first stage the words preceding the target word are read for meaning. This information is used in the second stage to generate one or more hypotheses as to the identity of the target word. In the third stage, visual information consisting of one or more letters is picked up from the target word and tested against the predicted word. In the final stage, the hypothesis is accepted or rejected depending on whether or not the word fragments perceived match the expected word. Speed of recognition is determined partly by the amount of information provided by context and partly by the amount of visual information from the target word necessary for verifying a prediction. The less visual information required, the faster is the recognition.

Predictions based on this model suggest that skilled readers have better word recognition because of superior processing strategies at each of the four stages described above. Tests of this hypothesis comparing adults and children (Samuels and Chen, 1972) and good versus poor readers at the elementary school level (Begy and Samuels, in preparation) indicated that the better readers were more accurate in

generating the target word when given context; required less visual information from a target in order to identify the word; were better able to identify letters from the target word which could serve as a cue to recognition (in the absence of total recognition); and were more willing to alter an incorrect identification of a target word.

While this partial model of word recognition has proven useful, it has a major problem. The amount of time necessary to generate a prediction is in the neighborhood of 200 ms. (Posner and Boies, 1971). Since it takes about 250 ms. or less to recognize a word in isolation, this model does not account for the high speed recognition responses of fluent readers reading meaningful material (Cosky and Gough, 1973). While the hypothesis/test procedure is too slow for what goes on in fluent reading, the model seems to account for intermediate levels of reading skill. For the high speed recognition responses of fluent readers the model requires further refinement.

Utilization of the hypothesis/test model assumes that the subject has some decoding facility, since the first stage of the model is the build up of information which is then used as the basis of the prediction.

It is apparent that beginning and fluent readers are using different strategies in recognizing a word found in a passage. Beginning readers who are not yet automatic in their decoding tend to stay at the surface level rather than at the deep structure level. Consequently, they would have difficulty in using context as an aid in word recognition. Thus, in addition to training the beginning

reader to use the hypothesis/test strategy, it is necessary to develop his sight recognition vocabulary sufficiently to allow him to use the deep structure in making predictions.

Flashed word recognition. This method was tested as a way of developing a sight recognition vocabulary. To properly use the hypothesis/test method, the reader must be able to use the information contained in prior context as a basis for making predictions. Numerous requirements abound for making use of context. The reader must be able to decode the words, know their individual meanings, relate the individual word elements to each other (such as "dog under the house") and these processes must be done with sufficient ease and rapidity so as not to exceed the capacity of short term memory. A common observation made by teachers is that children who laboriously decode words in a sentence often fail to comprehend the sentence. In addition to accuracy in decoding, speed seems to be essential if short term memory limits are not to be exceeded.

In the flashed word condition, for purposes of developing skill in decoding words encountered in context, the subjects were given intensive training in isolated word recognition. There is some evidence that isolated word recognition is related to the ability to read in context. MacGinitie (1973) states that if one knows the 1,000 high frequency words in English he can identify 3/4's of the words used in school books. Shankweiler and Liberman (1972) have found that the ability to recognize words in isolation is highly related and fundamental to the ability to read in context.

Method of repeated readings. This method can be considered new in the field of reading and consequently there is a lack of research literature to draw upon. Its origin began when Samuels and Dahl sought applications for automaticity theory applied to reading (see next section for discussion of automaticity).

Samuels and Dahl noted that the usual classroom practice in reading was to have children read different passages from their reading text books each day. This practice often prevents the student from mastering the contents of a page. The concept of mastery as used here goes beyond mere accuracy in word recognition.

What was needed was a method for developing highly skilled behavior. Several areas came to mind, namely in music, dance and sports where it was thought this goal was accomplished. A characteristic which was noted in training musicians was that in beginning stages, the student is given a few musical pieces to practice and told to study it for a considerable length of time, often a week. The teacher has two goals, the reduction of errors and an increase in fluency. Through repeated practice these goals can be accomplished. One frequently finds that even the highly proficient musician continues to practice the basic exercises. In sports, as in music, similar training practices are found. In sports such as golf and wrestling, and in dancing there are basic moves which are practiced for years.

The training procedure which was developed in reading was an attempt to mirror the procedures used in the psycho-motor domain where highly skilled performance is the goal. For want of a better

name, the method was called repeated readings. The student was asked to read a passage of fixed length. Word recognition errors and reading speed were recorded with each reading of the passage. It was assumed that with each reading, word recognition errors would decrease and speed would increase. Comparing this method to that used in music, one notes the similarities. The music teacher expects accuracy and fluency to increase. Translating these terms to reading, we too expect accuracy to increase but fluency for us became a rate measure. In the reading situation, the student was asked to continue working on the passage until his rate reached a criterion level. To move to the next passage, it was not necessary to have recognized all the words with 100% accuracy but it was necessary to reach the speed criterion.

The decision to place the emphasis on speed (fluency) criteria rather than accuracy was that for most classroom situations in reading there is already a heavy emphasis on word recognition accuracy and even minor mistakes, such as failure to pronounce plural (boys) or past tense (wanted) markers, which are missing or not emphasized in some dialect, lead to teacher correction. Because of the strong emphasis on accuracy already found in classrooms, students frequently develop halting reading habits. Futhermore, there can be a trade-off between accuracy and speed, and placing an undo emphasis on the first can inhibit the latter. In addition, pilot work indicated that in the process of emphasizing speed, accuracy would improve also.

A number of caveats were borne in mind in using the method of repeated readings. First, there was the problem of comprehension. Would this method ignore meaning? To the contrary, repeated readings should encourage comprehension moreso then readings which do not reach some mastery level. The second problem lead to do with motivation. Would this method lead to boredom? Pilot observation indicated that children were highly reinforced as they noted improvement. With these cautions in mind and with suggestive positive evidence from pilot studies, the method of repeated readings seemed appropriate for further testing.

Automaticity applied to reading. Accuracy in word recognition is not enough. The skill must be developed beyond accuracy to automaticity. Edmund Huey captured the essence of automaticity 65 years ago when he wrote:

> "To perceive an entirely new word or other combination of strokes requires considerable time, close attention, and is likely to be imperfectly done, just as when we attempt some new combination of movements, some new trick in the gymnasium or new 'serve' at tennis. In either case, repetition progressively frees the mind from attention to details, makes facile the total act, shortens the time and reduces the extent to which consciousness must concern itself with the process." (Huey, 1908, MIT Press 1968, p. 104).

All of us have experienced the development of automatic behavior. Take for example, the development of skill in driving. The beginning driver must focus his attention on the mechanics of driving. He must concentrate and think about the sequence of events which lead to the safe movement of the car. Since the beginning driver's

attention is on the mechanical act of driving, he can think of little else nor can he easily engage in conversation while driving. The skilled driver has progressed to the point where the mechanics of getting the car moving safely along a road requires little of his attention. Consequently, the skilled driver, whose skill in the mechanics of driving is at the automatic level, is able to focus his attention on other things, such as listening to a companion's conversation or thinking about some matter of consequence. Only when some unusual event occurs, does the skilled driver have to switch his attention back to the car or ther road. When this occurs, he must cut off conversation or stop his private thoughts.

There is a direct parallel to the development of automaticity in driving and in reading. The beginning reader focuses attention on the mechanics of decoding. When attention is on decoding, the reader has great difficulty in getting the meaning of the passage. The skilled reader, on the other hand, can do the mechanics of decoding automatically, thus freeing his attention to focus on meaning. Only when an unusual word appears, does the skilled reader have to switch his attention back to the mechanics of decoding the new word.

Although Huey described automatic behavior in a most concise manner in 1908 and people were intuitively aware of their own automatic behaviors both before and after Huey's book was published, psychologists choose to ignore it as an investigative field until recent years.

Even today the literature dealing straightforwardly with automaticity is sparse. Schmidt (1968) defines "automatization" as the "dropping out of conscious cues in learning." The novice consciously goes through the steps in performing a task while the experienced performer completes the sequence unconsciously combining each of the steps into what appears to be one fluent act. At some time, however, each of the constituting behaviors needed to be learned, practiced, and totally integrated before this smooth, effortless performance could occur. Posner (1969) offers a two part definition of automaticity. First is the replacement of external cues needed to guide behavior with internal cues -- exteroceptive cues replace by proprioceptive cues -- and second t[illegible] process of reducing the amount of attention needed to perform a task. The skilled typist is able to listen and respond to questions while continuing to type from copy because the primary task (typing) is being guided by internalized or proprioceptive cues. The beginning typist depends upon conscious cues -- listening to the keys strike and visual feedback to guide her behavior. If an error is made its exact nature and time of occurrence is known immediately. When the skilled typist's attention is redirected to the primary task in response to proprioceptive guidance cues suddenly reporting some subtle discrepancy -- a break in rhythm or a failure to make one correspondence with the copy -- she must search visually for the error, which is usually

found near to, but not at, the point where she stopped typing.

The hallmark of skilled, fluent reading is that the decoding can be and most frequently is done automatically. The proficient reader cannot stop himself from reading whatever familiar words come into his view; road signs, billboards, titles flashed on a television screen are all read automatically. Every fluent reader was at one time a novice reader whose plight is very aptly described by Smith (1971):

> "Life seems particularly difficult for the beginning reader--so many necessary things are difficult for him at the outset that will be easier when his reading skills develop. For example, the mere fact that a child cannot read very fast puts a heavy burden on memory and attention systems that are both inexperienced and overloaded with all kinds of instructions and rules." (p. 3)

A behavior is automatic when it can be performed without attention, while attention is directed elsewhere, according to LaBerge and Samuels (1973). Consider two tasks which at the unskilled stages could not be performed simultaneously. Two such behaviors which cannot be performed together at low levels of skill development are sight reading music while at the piano and shadowing speech. After training, if both tasks can be performed simultaneously at least one of them is automatic. Highly skilled piano players can sight read music and shadow speech. In this case, it is the piano playing which is automatic. (Allport, et. al., 1972).

To appreciate the power of "automatic decoding" as a psychological process, it is necessary first to discuss the limits of human attention. A quarter of a century of research on attention has led to the conclusion that the brain acts as a single channel processor. This means that at any given moment, attention can only be at one place at a time. If two sources of information are presented simultaneously to a person, each of which demands attention for its processing, the individual finds he cannot process both simultaneously. The individual must choose between them. This dilemma has been described as the "cocktail party problem", a situation one encounters at a party where there are a number of interesting conversations going on at the same time and competing for one's attention. Several choices are available to a person faced with competing sources of information. One choice involves attending solely to one conversation and ignoring the other sources. The other choice involves attention switching. The individual may be able to follow two or more conversations by rapidly switching attention back and forth. However, at any moment, one's attention can only be on one conversation at a time. The fact that the brain acts as a single channel communication device and can only be attentive to one information source at a time, poses important limitations on the beginning reader with regard to comprehending what was decoded.

If decoding requires attention then it will be impossible to simultaneously comprehend. In order to simultaneously decode and comprehend, the decoding must be done automatically so that attention can be directed at the task of extracting meaning from the passage. The goal for the student in the reading situation is to develop decoding skills to the automatic level so that access of meaning can go on simultaneously with the decoding process.

Method

Subjects:

The subjects in this study were selected from the second grade student body (N=78) in a middle class suburban elementary school in the Bloomington School District.

The thirty-two poorest readers in the regular reading program were selected as subjects. These subjects were randomly assigned to one of eight groups in a 2x2x2 factorial design.

Figure 1 shows the treatments received by the subjects in each of the eight groups.

Insert Figure 1 about here

Design:

A 2x2x2 factorial design was used. The first factor in the design consisted of training on the subskills used in hypothesis/test word recognition. There were two levels in this factor. Either the student received the training or he did not. The second factor was training in isolated word recognition. Again, either the student received the training or he did not. The third factor was training in repeated readings. Here, also, either the student received the training or he did not.

Procedure. (Independent Variables)

Hypothesis/test. The following subskills and methods of instruction were derived from a task analysis of the model of word recognition.

The seven component skills derived from the model are as follows:

1. Training on the ability to say a word given an initial sound. S was given drills of the following nature:

Stimulus: E says, "Tell me a word starting with the sound /p/."

Response: S gives a word starting with that sound. Any word starting with the sound is acceptable.

2. Training on the ability to determine the beginning letter of a spoken word. S was given drills of the following nature:

Stimulus: E asks, "What is the first letter in the word 'girl'?"

Response: S gives the name of the initial letter in "girl", i.e., "g".

3. Training on the ability to visually recognize the initial letter of a word presented orally. S was given drill of the following nature:

Stimulus: E says, "What is the first letter in the word 'boy'?" Then, E shows a card with the letters "b", "c", "t", "r" printed on it.

Response: S points to the letter "b".

4. Training on the ability to use auditory context to predict words that could logically follow. S was given a drill of the following nature:

Stimulus: E says, "My mother sleeps on her _____."

Response: S predicts the missing word. Any word which makes sense is acceptable.

5. Training on the ability to use auditory context to predict word(s) that could logically follow in a sentence hearing just the initial sound of the word. S was given drill of the following nature:

Stimulus: E says, "The cat ran after the /m/_____."

Response: S predicts what the missing word might be. The words must begin with the /m/ sound and make sense in the context.

6. Training on the ability to use visual context to predict word(s) that would logically follow in a sentence without seeing the initial letter of the word. S was given drill of the following nature:

Stimulus: E shows the following in printed form: The children open the _____.

Response: S is asked to read and predict the word in the blank. E tells S whatever word S cannot read in context. Any word which makes sense is acceptable.

7. Training on the ability to use visual context to predict word(s) that could logically follow in a sentence when given the initial letter of the target word. S was given drill of the following nature:

Stimulus: E shows the following in printed form:

The girl ate the b_____.

Response: S is asked to read this and predict the word in the blank. Any word beginning with "b" which makes sense is acceptable.

An informal inventory of the subskills mastered at the beginning of training revealed that additional training on constructing a word

given an initial sound, telling the starting letter of a word just heard and recognizing the initial letter of a word heard (subskills 1, 2, and 3) was unnecessary. Therefore, instruction on the subskills actually was restricted to subskills 5, 6, and 7.

The experimental teacher and her assistants stressed the goals of accuracy and speed when delivering this instruction. Accuracy was emphasized as desirable when accompanied by speed of response.

For examples of materials used to teach these subskills see Dahl, P.J. et. al., 1973.

Isolated word recognition. The subjects who received automaticity training on recognition of words in isolation were given practice beyond simple accuracy. The words used in training were from the word lists of the Macmillan Basic Reading Series and from the Dale List of 3000 Familiar Words. A carousel projector was used to flash words at a rate controlled by a Hunter timer. Initially the words were flashed at a visual duration threshold of 2.5 seconds. When the words were mastered at this rate, they were moved to progressively shorter exposures (2 sec., 1.5 sec., 1 sec.). When a subject reached the criterion level of accuracy at the fastest rate, he moved on to another tray of words. Two projectors were in use simultaneously to allow students to move to the next tray without delay. Adult supervision was provided at all times. Subjects in this condition received training on 800 words in this fashion.

Repeated readings. The subjects who received repeated readings training received practice beyond accuracy.

A one hundred word passage typed on a 5 x 8 index card was read orally by the student to a research assistant. The RA recorded the reading rate and the number of recognition errors on a graph for each passage. The reading rate was arrived at by finding the time taken to read the passage on a computer print out which translated the rate to words per minute. The student reread the passage at his desk and recorded the number of readings on a personal chart until called on by a research assistant to read orally again. This sequence continued until the criterion of a rate of 100 WPM was reached. Then the student began a new passage.

The level of difficulty of the passages was individually controlled for each student. An initial reading rate on a passage of 35-50 WPM was considered an acceptable level of difficulty. If a student's initial reading of a passage was less than 35 WPM, he was given an easier selection . If the initial rate was 60+ WPM, the student was given a more difficult selection. Generally, word recognition errors were not considered in this determination. As the rate of reading increased, the number of errors consistently decreased so this measure was considered redundant. If, however, an unusual number of errors (greater than 15%) was made by a student on a passage, teacher discretion was used to adjust the difficulty of the next passage.

The passages were selected from a wide range of materials including supplementary readers, library reference books, and

high school and college textbooks. The selections were ordered by difficulty and then random readability tests done by the Fries method were done to check on the assigned level.

Initially, all students in this condition were given a passage at the third grade level. By the end of training, students were reading selections ranging from the fourth grade level to thirteenth grade level.

Subjects in all 8 groups of the study received equivalent amounts of daily instruction. Basal readers were used in all groups for basic reading instruction. Twenty minutes daily training was given for each experimental - factor. During experimental training, control subjects received additional basic reading instruction.

Procedure. (Dependent Variables)

Speed of tachistoscopic recognition. The eight groups of subjects were tested on speed of word recognition using a 2 channel scientific prototype tachistoscope. Each subject was tested under four conditions. The stimulus conditions and the target words are presented in Figure 2. There were two target words in each condition.

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Insert Figure 2 about here

Description of conditions. The target words had frequency values approximately equal to one another, about 400-600 occurences per million words. These frequency values are an average of the Thorndike count and the Lorge count.

Words in condition 1 were presented without a stimulus providing context. Words in condition 2 and 3 were selected such that association values between them in condition 2 were high (47 between cold and snow, 113 between green and grass) and those between s_1's and s_2's in condition 3 were low (0 between blue and ocean, 0 between beautiful and song). These associative values were taken from Jenkins and Palermo's Word Association Norms (1960). This control on word association was done to permit evaluation of word association effect on the visual duration threshold of a target word.

Procedure. Each subject was given warm-up on the tachistoscope to familiarize him with the task. The warm-up tasks were analgous to the conditions found in the test proper, but different words were used.

The four conditions were randomly administered. The method of ascending limits was used in determining visual recognition threshold. That is, the first time the word appeared the exposure time was very short. With each subsequent presentation of the word the exposure time was increased until the subject gave two correct recognition responses. For purposes of analysis the average visual duration threshold of the two correct responses was used.

As soon as the subject read the first s_1 word of the pair, it was terminated and then for 20 ms. the target word was flashed. S then was to identify that word. If he could not do this, the word pair was presented again and again with the exposure duration of the target word increasing 10 ms. each time. An experimental event was

completed as soon as S could identify the target twice.

Cloze test. A passage at the 3rd reading level was selected for this test. The deletions for both the cloze and the modified cloze tests were not based on any prescribed nth word system but rather were chosen by the experimenter on the basis of adequate context clues. Most of the deleted words were content words or descriptors. The test was read orally to a research assistant by each subject. No feedback was given during the reading. Only exact answers were scored as correct.

Modified cloze test. A passage at the 3rd reading level was selected for this test. The cloze procedure was modified by giving the letter or letters of the initial sound of the word as an additional clue. The test was read orally to a research assistant by each subject. Again, no feedback was given during the reading and only exact answers were scored as correct. See Dahl, P.J. for sample tests of both cloze and modified cloze tests.

Timed oral reading. A 100 word selection at the 3rd grade level was selected for this test. Each subject read the selection orally to a research assistant. The assistant recorded the time the subject required to read the passage and the number of recognition errors. All subjects were given these instructions, "Read this to me. If you don't know a word, either guess or skip it. Begin whenever you're ready."

MacGinitie Reading Test, Primary CS, Speed and Accuracy for Grades 2 & 3.

This group test was administered using the instructions accompanying it. The test provided both a measure of reading rate and a measure of comprehension.

Flashed word recognition test. A carousel tray consisting of 80 words was used in this test. Forty of the words were randomly selected from the 800 words practiced by subjects in the isolated word recognition condition. The second group of forty words were selected from a pool of words not yet practiced by the subjects in the isolated word recognition condition.

Each subject was tested individually by a research assistant. A timer controlling the rate at which the words were flashed was set at 500 milliseconds. Each subject was assigned two scores, one for the words practiced by subjects in the isolated word recognition condition and one for the new words that had not been practiced by subjects in the isolated word recognition condition.

Results

Data analysis for this section will be presented in two parts. The first part will contain the descriptive statistics for each of the groups on the battery of test given. The second part will contain the inferential statistics.

Descriptive statistics. Table 1 shows the main effects as expressed in means for each treatment on the dependent variables. Inspection of the mean scores for the factors of hypothesis/test and repeated readings indicates that on nearly all comparisons the scores tend to favor subjects who received this type of experimental training over their controls. The factor of isolated word recognition does not apparently indicate any differences between experimental and control.

Table 2 shows mean scores on interaction of repeated readings and word recognition for the dependent variables.

Table 3 shows mean scores on interaction of hypothesis/test and word recognition on the dependent variables.

Table 4 shows the mean scores on interaction of hypothesis/test and repeated readings for the dependent variables.

Table 5 indicates the mean scores on 3 way interactions on the dependent variables.

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(Insert Tables 1-5 about here

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Inferential statistics.

Cloze test. As seen in Table 6, the 3 way analysis of variance on the cloze test indicates significant ($p < .01$) main effects for hypothesis/test and repeated readings. The word recognition factor did not approach significance. There was a significant ($p < .05$) two-way interaction for hypothesis/test and repeated readings.

Modified cloze test. As seen in Table 6, three-way analysis of variance on modified cloze indicated significant main effects for hypothesis/test ($p < .01$) and word recognition ($p < .05$). It should be noted that the repeated readings factor, as seen in Table 7, approached significance. None of the interactions were significant.

Gates-MacGinitie Reading Test, Primary CS, Speed and Accuracy for Grades 2 and 3 (number correct). As seen in Table 6, the three-way analysis of variance on the number correct in seven minutes on the Gates-MacGinitie indicates significant ($p < .01$) scores only on the hypothesis/test variable. . None of the other values were significant.

Timed oral reading test (number of recognition errors). As seen in Table 6, the three-way analysis of variance on timed oral reading - number of recognition errors indicated only one significant main effect ($p < .05$) for repeated readings.

Timed oral reading test (number of seconds required to read a 100 word passage). As seen in Table 6, the three-way analysis of variance indicated significant ($p < .05$) - $p < .01$) effects for hypothesis/test training groups, repeated readings, and the interaction of these two variables. No other effects were significant.

Gates-MacGinitie Reading Test, Primary CS, Speed and Accuracy for Grades 2 and 3 (number attempted). As seen in Table 6, in the seven minute period given to subjects, a significantly ($p < .01$) greater number was attempted by the hypothesis/test group. None of the other effects were significant.

Flashed word recognition test (words used in training). On this test words used in training by the word recognition group were given as a post-test to all groups. As seen in Table 6, the three-way analysis of variance indicated, contrary to expectations, that the hypothesis/test and repeated readings groups had significant main effects ($p < .01$) but there was no significant effect for the carousel trained group. There was a significant two-way interaction ($p < .05$) for hypothesis/test and word recognition groups.

Flashed word recognition test (new words). As seen in Table 6, when words which had never been used in training were presented with a carousel, there were significant ($p < .05$) main effects for hypothesis/test and repeated readings.

Tachistoscope Test.

Condition 1 - high frequency words in isolation. As seen in Table 6, the analysis of variance on speed of word recognition for words presented in isolation indicated no significant differences.

Condition 2 - high strength word associates. As seen in Table 6, the analysis of variance on speed of recognition for high strength

Condition 3 - low strength associates. As seen in Table 6, the analysis of variance for speed of word recognition for low strength

associates revealed no significant differences.

Condition 4 - word recognition in sentences. As seen in Table 6, the analysis of variance for speed of word recognition for target words presented in sentences indicated significant ($p < .01$) main effects for hypothesis/test and repeated readings. No other effects approached significance.

Discussion

As indicated earlier in this report, the study had a number of purposes. These purposes consisted of determining if the three factors used in the design were capable of improving reading performance of these second grade children. The three factors used in the study were: training in hypothesis/test techniques, training on a new method of teaching reading which was called repeated readings, and flashed word recognition. Since a completely crossed design was used it was possible to determine not only the main effects of each of these factors but the interactions. Thus, with this design it was possible to find out if combinations of treatments were even more facilitative than the presentation of single factors.

Training on the use of hypothesis/test techniques is by no means a new idea in reading pedagogy. Although numerous researchers have recognized the importance of hypothesis/test techniques, numerous studies have failed to find any advantage for training in use of this strategy. A possible reason for the failure to find improvement in reading as a result of hypothesis/test training is that a competent and complete task analysis of the skills necessary for hypothesis/test use has not been done. However, in this study and in several earlier ones (Samuels, Dahl and Archwamety, in press) a task analysis was done and the necessary subskills identified and facilitation in reading was found.

The use of repeated reading seems an innovation in reading. A search of the literature revealed no systematic work on this training procedure. Although in psychomotor activities, namely in sports, and to a large extent, in the study of musical instruments, the student engages in repeated practice on fairly constrained movements. The purpose of this repeated practice is to develop skills that go beyond mere accuracy. Analysis of the reading act indicates that there may indeed be improvement in reading when the student reads a passage a number of times in order to develop fluency.

The rationale for including practice on recognizing flashed words presented with a carousel projector was that high frequency words are of great value in reading the usual material which children encounter. Obviously, there is a great deal of efficiency in being able to recognize this type of vocabulary with a rapid sight recognition ability.

Completely randomized groups were used in this study and after eight months of training, testing began. It is quite helpful for the reader to look at the summary table of significant f values for all dependent variables. The reader may note that the tests which were given can be conveniently divided into tests of reading speed and comprehension.

Of the three experimental factors used in this study, it is quite clear that only two produced significant results. The treatment which seems to have the greatest number of significant f values is

the hypothesis/test treatment. The second treatment which produced significant differences in reading is the repeated reading factor. On the third factor, which was training on recognizing words flashed with a carousel projector, one notes that of the twelve dependent variables, only one reached significance and this at the $p < .05$ level. Judging from these results, one may state that two of the factors, hypothesis/test training and repeated readings training seems to make a difference in the students' ability to read with speed and comprehension.

Another question of great importance has to do with the interaction of treatments. While it is clear from these results that hypothesis/test training makes a difference in the child's reading ability and repeated reading makes a difference, a further question would have to do with the advisability of combining both these factors in training. When one looks at the summary table for interactions, one notes that there are two significant f values for hypothesis/test training and repeated readings. One of the significant values was on the use of the regular cloze test while the second one was on timed oral reading where the number of seconds to read a 100 word passage was computed. Bormuth (1966) considers the cloze test to be a reliable test of reading comprehension. The reader should note that on the regular cloze test there were simply deletions made in a passage and the child was to fill in the exact word in order to receive credit. In order for the child to perform this task appropriately, it was

necessary for him not only to read the context material but also to understand the context to provide the missing word. Comprehension is required in this task and one notes on the interaction of treatments that when the child receives both bypothesis/test and repeated readings training he seems to show superiority in comprehension. In addition, the speeded oral reading measure further supported the notion that a combination of treatments was efficacious.

There was a third significant interaction and this appeared where the student received a combination of hypothesis/test and flashed word recognition. The precise variable in which this difference appeared was when flashed words were presented and these words were the exact words used in training. The addition of isolated word recognition training does not seem to be a promising treatment combination for classroom use since there was no significant main effect on this variable.

To summarize the results of this study one might say the following: the main effect of hypothesis/test training and repeated readings training does appear to produce significant and meaningful improvement in reading for both speed of reading and comprehension. In light of the failure to find significant differences across the battery of tests used with regard to the factor of isolated word recognition, it is concluded that this does not seem to be useful training for students. Further discussion is included in this section. The second conclusion is that treatment combinations in which students get both hypothesis/test and repeated readings training does seem

to be a useful combination within the classroom.

As many researchers are well aware, there is currently heated discussion on how reading should be taught. One point of view holds that reading is a wholistic process and is not easily subjected to partitioning and fractionization. Those who hold this point of view are of the opinion that reading should be taught as a unitary, wholistic process in meaningful context. These individuals who subscribe to this point of view would not intentionally divide reading into its subskills. However, should the child request specific information on a particular subskill in reading, then and only under these conditions would the child be taught the particular skill. A very different point of view holds that any complex skill that requires human cognition is in essence a series of subskills. Only when these subskills are integrated through extended practice does the complex behavior appear to be a wholistic process. Until recently, there was data lacking to support this latter viewpoint. However, with the recent series of researches by Guthrie (1973) we now have excellent data to support the viewpoint that reading is made up of component processes. Guthrie demonstrated the component processes viewpoint with tests of reading subskills given to nonfluent readers that clearly support a subskill interpretation of the reading process. There are still other pieces of work that support the notion that reading is a series of subskills. For example: the research of Posner, LaBerge and Samuels

as well as others has now provided us with a variety of data in support of the notion that reading is comprised, at least in the early stages, of subskills.

It is believed that one reason students who are taught the hypothesis/test strategies of reading do better is that the task analysis which was done had identified important subskills in reading and when these are taught and integrated it does in fact increase the childs' ability to read with speed and comprehension as this data appear to indicate.

Still another viewpoint in support of the efficacy of hypothesis/test training is that a major error made by many teachers in the teaching of reading is an overemphasis on accuracy. Instead of helping children to rea...ze that reading is in essence a probablistic process in which we must make predictions about what words are to come, the teachers tend to overemphasize accuracy and thus children are dissuaded from engaging in predictive processing. One of the emphasis in training hypothesis/test strategy is to encourage children to use context and logical knowledge of their language in order to engage in predictive processing and thus facilitate the reading process. Consequently, it would appear that one of the advantages of hypothesis/test training is that children are encouraged to use the same process in reading comprehension that they use in listening comprehension, namely the use of predictive processing.

The findings of this study indicate that repeated readings can be an effective training method. In basic reading methods the student seldom has the opportunity to reread material. Reading at the instructional level, the child must frequently focus his attention on such component skills as decoding, word meaning, etc. Even when the child is able to read with a high degree of accuracy, he will profit from additional opportunities for practice on the same material. The goal should not be mere accuracy but practice beyond accuracy to the automatic level where the child is able to direct his attention away from the component skills.

Many knowledgeable teachers often provide practice beyond accuracy in many aspects of the reading process. However, most of this practice is given on isolated skills. Mastery of these component skills is a necessary prequisite for fluent reading, however, it is not sufficient.

Repeated readings provides the missing practice necessary for early development of fluent reading. Using repeated practice in meaningful context gives the child the opportunity to integrate the subskills. The crucial factor in this training is that the child is practicing beyond accuracy in using the wholistic reading process where the subskills are truly integrated.

An additional advantage of repeated readings training is that it provides frequent feedback in terms the children were able to understand easily. Each child was able to see daily progress on

his individual graph showing his rate and recognition errors on each successive test. In addition to seeing progress toward the criterion rate on each passage the children were also able to see their progress through successively more difficult reading levels. Progression to a more difficult reading level was dependent only on individual reading performance. Therefore, it was possible for any child to be reading more difficult material at this training time than the material used in the basic program.

The third training factor, isolated word recognition, gave no significant results. Although Samuels, Spiroff, and Singer (1974) state that: "In general, efficiency in learning to associate responses to graphic stimuli is significantly greater when the word is presented in isolation than when presented in sentence context or in association with a picture, or both" (p. 10-11), practicing word recognition in isolation after initial acquisition would seem to be of less value. A possible explanation for the failure of this factor to produce significant results in this study is that this is another instance of not giving the subjects the needed practice in integrating the word recognition subskills and establishing the relationships among words as in wholistic reading practice. As early as 1923, Gray reported that he found no correlation between rate of recognition of isolated words and rate of recognition of connected discourse, a further indication to support this analysis. Although no separate records were maintained for those children

who were initially very weak in sight recognition vocabulary, it was the casual observation of the experimenter that these children realized greater benefit from this training. It is possible that this type of training may be beneficial in acquiring or increasing the sight recognition vocabulary but does not achieve the goal of automatic decoding in meaningful discourse. This explanation is offered as a hypothesis that could lead to further investigation.

In conclusion, hypothesis/test appears to be the most promising method for classroom use given the consistently good results and the fact that no special equipment or additional personnel is required. Hypothesis/test training also seems to have the most theoretical support. The results also suggest that repeated readings training might be beneficial in training intermediate readers. This method may have special merit for students who require frequent and immediate feedback of their reading progress for optimal achievement.

Table 1: Mean Scores on Main Effects for Each Treatment on the Dependent Variables

		Comprehension					Rate						
									Tachistoscope				
		Regular cloze test	Modified cloze test	Gates-MacGinite (no. correct)	Timed oral reading (recognition errors) *	Timed oral reading (number of sec. to read 100 word pass) *	Gates-MacGinite (number attempted)	Flashed word recognition (words used in training)	Flashed word recognition (new words not used in training)	Condition 1 * Word in isolation	Condition 2 * High strength associates	Condition 3 * Low strength associates	Condition 4 * Word rec. in sentences
Hypothesis/Test	+	34.12	30.50	26.19	2.31	56.56	18.81	33.31	24.81	205.94	144.06	188.69	80.12
	-	26.25	20.75	26.25	2.56	72.19	12.06	27.36	18.25	231.81	233.37	183.56	155.44
Repeated Readings	+	33.25	27.00	28.00	1.50	53.81	16.50	33.69	25.37	222.19	165.00	181.87	86.56
	-	27.12	24.25	23.46	3.37	74.94	14.37	27.19	17.69	215.56	212.44	191.37	157.00
Isolated Word Recognition	+	30.12	27.44	25.50	2.31	65.25	14.94	31.06	22.50	207.12	145.87	159.18	110.44
	-	30.25	23.81	26.94	2.56	63.50	15.94	29.81	20.56	230.62	231.56	214.06	133.12

* - A low score on these tests is desirable.

Table 2: Mean Scores on Interaction of Repeated Readings and Word Recognition for the Dependent Variables.

Word Rec. / Repeated Readings		Regular cloze test		Modified cloze test		Gates-MacGinite (number correct)		Timed oral reading * (recognition errors)	
		+	-	+	-	+	-	+	-
Repeated Readings	+	33.87	32.62	28.75	25.25	15.50	14.75	1.12	1.87
	-	26.37	27.87	26.12	22.37	13.25	11.75	3.50	3.25
		Timed oral reading * (number of seconds)		Gates-MacGinite (number attempted)		Flashed word rec. (Words used in training)		Flashed word rec. (Words not used in training)	
Word Rec. / Repeated Readings		+	-	+	-	+	-	+	-
	+	57.50	50.12	16.25	16.75	35.00	32.37	26.50	24.25
	-	73.00	76.87	13.62	15.12	27.12	27.25	18.50	16.87
		T-Scope Cond. 1 * Word in isolation		T-Scope Cond. 2 * High strength assoc.		T-Scope Cond. 3 * Low strength assoc.		T-Scope Cond. 4 * Word rec. in sentences	
Word Rec. / Repeated Readings		+	-	+	-	+	-	+	-
	+	187.50	256.87	141.87	188.12	155.00	208.75	84.37	88.75
	-	226.75	204.37	149.87	275.00	163.37	219.37	136.50	177.50

* A low score on these tests is desirable.

Table 3: Mean Scores on Interaction of Hypothesis/Test and Word Recognition for the Dependent Variables

Hypothesis Test	Word Rec.	Regular cloze test		Modified cloze test		Gates-MacGinite (number correct)		Timed oral reading * (recognition errors)	
		+	-	+	-	+	-	+	-
+		34.62	33.62	31.75	29.25	17.00	16.62	2.12	2.50
-		25.62	26.87	23.12	18.37	11.75	9.87	2.50	2.62
		Timed oral reading * (Number of seconds)		Gates-MacGinite (Number attempted)		Flashed word rec. (Words used in training)		Flashed word rec. (Words not used in training)	
	Word Rec.	+	-	+	-	+	-	+	-
+		60.00	53.12	17.87	19.75	31.87	34.75	24.87	24.75
-		70.50	73.87	12.00	12.12	30.25	24.87	20.12	16.37
		T-Scope Cond. 1 * Word in isolation		T-Scope Cond. 2 * High strength assoc.		T-Scope Cond. 3 * Low strength assoc.		T-Scope Cond. 4 * Word rec. in sentences	
	Word Rec.	+	-	+	-	+	-	+	-
+		211.87	200.00	120.00	168.12	149.37	230.00	95.62	80.62
-		202.37	261.25	171.75	295.00	169.00	198.12	125.25	185.62

* A low score on these tests is desirable

Table 4: Mean Scores on Interaction of Hypothesis/Test and Repeated Readings for the Dependent Variables

Repeated Readings Hypothesis Test		Regular cloze test		Modified cloze test		Gates-MacGinite (Number correct)		Timed oral reading * (Recognition errors)	
		+	-	+	-	+	-	+	-
+		35.62	32.62	31.62	29.37	17.50	16.12	1.87	2.75
-		30.87	21.62	22.37	19.2	12.75	9.87	1.12	4.00
Repeated Readings Hypothesis Test		**Timed oral reading * (Number of seconds)**		**Gates-MacGinite (Number attempted)**		**Flashed word rec. (Words used in training)**		**Flashed word rec. (Words not used in training)**	
		+	-	+	-	+	-	+	-
+		53.12	60.00	19.87	17.75	35.25	31.37	27.25	22.37
-		54.50	89.87	13.12	11.00	32.12	23.00	23.50	13.00
Repeated Readings Hypothesis Test		**T-Scope Cond. 1 * Word in isolation**		**T-Scope Cond. 2 * High strength assoc.**		**T-Scope Cond. 3 * Low strength assoc.**		**T-Scope Cond. 4 * Word rec. in sentences**	
		+	-	+	-	+	-	+	-
+		206.87	205.00	141.25	146.87	178.12	201.25	59.37	116.87
-		237.50	226.12	188.75	278.00	185.62	181.50	113.75	197.12

* A low score on these tests is desirable

Table 5: Mean Scores on Three-Way Interactions on the Dependent Variables

		+ Hypothesis/Test											
		Regular cloze test		Modified cloze test		Gates-MacGinite (Number correct)		Timed oral rdg.* (rec. errors)		Timed oral rdg.* (Number of sec.)		Gates-MacGinite (No. attempted)	
Word Rec.		+	-	+	-	+	-	+	-	+	-	+	-
Repeated Reading	+	37.25	34.00	33.75	29.50	18.25	16.75	1.25	2.50	54.25	52.00	19.50	20.25
	-	32.00	33.25	29.75	29.00	15.75	16.50	3.00	2.50	65.75	54.25	16.25	19.25
		- Hypothesis/Test											
Word Rec.		+	-	+	-	+	-	+	-	+	-	+	-
Repeated Reading	+	30.50	31.25	23.75	21.00	12.75	12.75	1.00	1.25	60.75	48.25	13.00	13.25
	-	20.75	22.50	22.50	15.75	10.75	7.00	4.00	4.00	80.25	99.50	11.00	11.00

* A low score on these tests is desirable

Table 5: (Continued)

+ Hypothesis/Test

Word Rec. / Repeated Readings		Flashed word rec. (practiced words)		Flashed word rec. (new words)		T-Scope Cond.1 *		T-Scope Cond.2*		T-Scope Cond.3*		T-Scope Cond.4*	
		+	-	+	-	+	-	+	-	+	-	+	-
+	+	35.00	35.50	26.75	27.75	167.50	246.25	127.50	155.00	125.00	231.25	80.00	38.75
+	-	28.75	34.00	23.00	21.75	256.25	153.75	112.50	181.25	173.75	228.75	111.25	122.50

- Hypothesis/Test

Word Rec. / Repeated Readings		+	-	+	-	+	-	+	-	+	-	+	-
+	+	35.00	29.25	26.25	20.75	207.50	267.50	156.25	221.25	185.00	186.25	88.75	138.75
+	-	25.50	20.50	14.00	12.00	197.25	255.00	187.25	368.75	153.00	210.00	161.75	232.50

* A low score on these tests is desirable

Table 6: Summary Table of Significant F Values for all Dependent Variables

	Regular cloze test	Modified cloze test	Gates-MacGinite (number correct)	Timed oral reading (recognition errors)	Timed oral reading (number of seconds to read no word passage)	Gates-MacGinite (number attempted)	Flashed word recog. (words used in training)	Flashed word recog. (words not used in training)	Tachistoscope Condition 1 Word in isolation	Tachistoscope Condition 2 High strength assoc.	Tachistoscope Condition 3 Low strength assoc.	Tachistoscope Condition 4 Word recog. in sentences
Hypothesis/Test (H)	** 36.41	** 51.94	** 19.01		* 7.12	** 19.28	** 9.85	* 5.02				** 11.16
Repeated Readings (R)	** 22.02			* 6.05	** 13.02		** 12.59	* 6.89				** 12.22
Isolated Word Recognition (W)		* 7.18										
HR (interaction)	* 5.73				* 5.93							
HW (interaction)							* 5.07					
RW (interaction)												
HRW (interaction)												

* $p < .05$, $F = 4.26$
** $p < .01$, $F = 7.82$

Table 7: Summary Table of all F Values for all Dependent Variables

	Regular cloze test	Modified cloze test	Gates-MacGinite (number correct)	Timed oral reading (recognition errors)	Timed oral reading (number of seconds to read no word passage)	Gates-MacGinite (number attempted)	Flashed Word Recog. (words used in training)	Flashed Word Recog. (words not used in training)	Tachistoscope: Condition 1 Word in isolation	Condition 2 High strength assoc.	Condition 3 Low strength assoc.	Condition 4 Word recog. in sentences
Hypothesis/Test (H)	** 36.41	** 51.94	** 19.01	1	* 7.12	** 19.28	** 9.85	* 5.02	<1	3.58	<1	** 11.16
Repeated Readings (R)	** 22.02	4.14	3.64	* 6.05	** 13.02	1.98	** 12.59	* 6.89	<1	1.00	<1	** 12.22
Isolated Word Recognition (W)	<1	* 7.18	<1	<1	<1	<1	<1	<1	<1	3.29	3.56	1.26
HR (interaction)	* 5.73	<1	<1	1.72	<1	<1	2.05	<1	<1	<1	<1	<1
HW (interaction)	<1	<1	<1	<1	<1	<1	* 5.07	<1	1.50	<1	<1	3.50
RW (interaction)	1.11	<1	<1	<1	<1	<1	<1	<1	2.52	<1	<1	<1
HRW (interaction)	<1	1.92	1.19	<1	<1	<1	<1	<1	2.40	<1	<1	<1

* p <.05, F = 4.26
** p <.01, F = 7.82

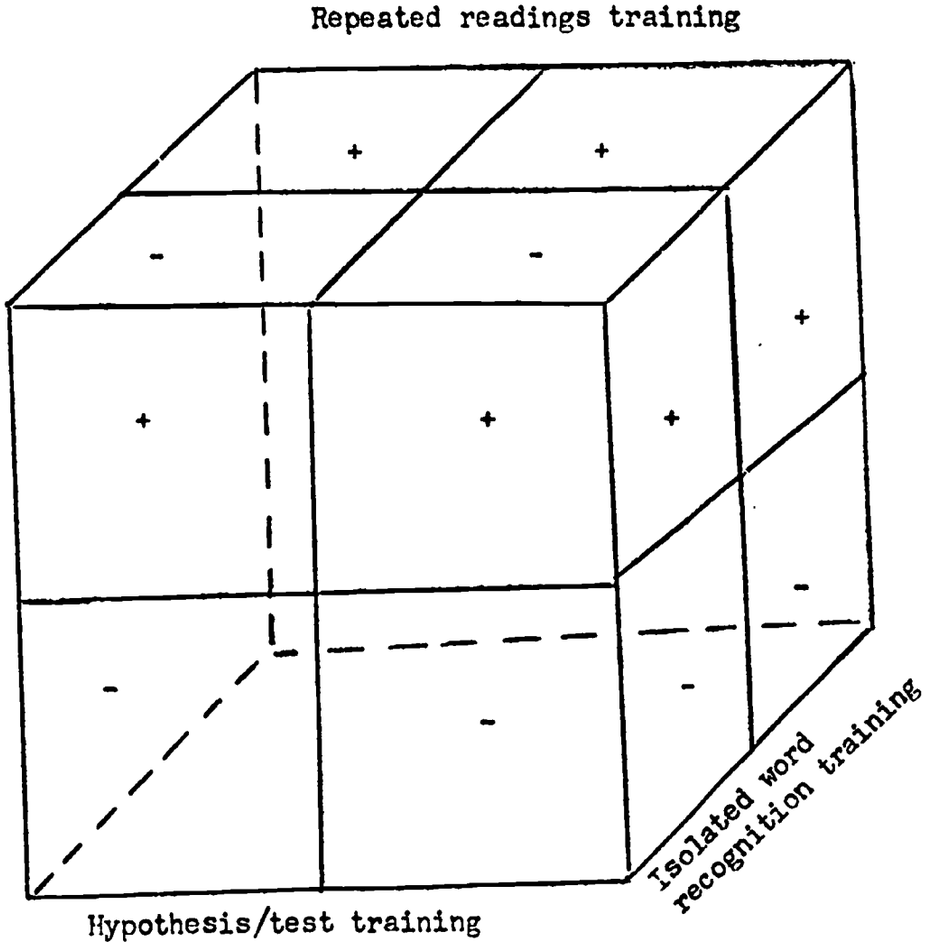

Figure 1: Training combinations received in each of the eight groups.

Condition	S_1	Target Word S_2
1		camp fifty
2	cold green	snow grass
3	blue beautiful	ocean song
4	Lemon has a salty We heard a loud	taste noise

Figure 2: Words used in tachistoscope recognition test.

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