A STUDY OF ISOLATION EFFECTS DURING THE ACQUISITION AND RECALL OF SPELLING WORDS

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ABSTRACT

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by Terry TenBrink

The problem of studying the effect of isolating some of the letters in a spelling word has for the past two or three decades been dismissed as unfruitful. Recent studies, however, present evidence that students tend to make the greatest number of spelling errors at the middle positions of a word. This evidence reopens the question concerning the effect of isolating some of the elements in a spelling word, for it suggests that words might be conceived of as serial lists, exhibiting typical serial-position phenomena.

This study was designed to study the nature of isolation effects on spelling. Specifically, answers were sought to the following questions: If more errors are made in the middle of a spelling word (serial-position phenomenon), will isolating the middle position reduce those errors (Von Restorff phenomenon)? Will the reduction be great enough to cause an overall reduction of errors for the entire word? Is the effect of isolation within a given spelling word independent of variations occurring within the list of words (context variables)? What context variables might influence the isolation within the individual words?

Onehundred sixth grade pupils were selected from seven private elementary schools in western Michigan. They were assigned randomly, to one of the following six conditions: control, constant-consistent

cuing, constant-consistent cuing control for color per se, constant-inconsistent cuing, intermittent-consistent cuing, and constant-consistent cuing shift. The Ss in all conditions were taught twelve spelling words by rote and learned all words to a criterion of two successive correct responses. A recall task was administered one week after the learning task.

The Data were analyzed on an acquisition measure (trials to criterion) and a recall measure (words wrong on recall task). The results of these analyses did not support the hypothesis that isolating the middle three letters of a nine-letter spelling word would significantly aid the learning and recall of the words. The question of whether the effect of isolation within a given spelling word is independent of context variables was not answered by the results of this study.

The discovery of the sub-group from a school which taught a "whole" approach to spelling led to the hypothesis that isolation treatments would interfere with learning and recall for these Ss, but would have an opposite effect for the remaining Ss. This hypothesis was partially supported by evidence of significant interactions between the treatment effects and the sub-groups on both the acquisition and recall measures. Further clarification was sought by analyzing the sub-groups separately and the only significant main effects disclosed was on the recall measure for the "whole" group. Individual comparisons showed that the control group made significantly fewer errors than the other groups which did not differ significantly from each other.

It was noted that although almost all of the differences which existed among the various conditions were not statistically significant, the results for the "part" approach were all in the expected direction and the results for the "whole" approach were almost a mirror image of the "part" approach. It was suggested, therefore, that further research be conducted which would account more precisely for the variable of pretraining. The spelling task does lend itself to experimental manipulation and a number of future research problems were suggested.

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By

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CHAPTER I

INTRODUCTION

The problem of studying the effect of isolating some of the letters in a spelling word has for the past two or three decades been dismissed as unfruitful. Horn (1940, 1950, 1960), Fitzgerald (1951) and Foran (1952) claim that only a relatively few persons make errors in the same position in spelling words and therefore it is not worthwhile to consider the effect of marking "hard spots". However, recent studies (Jensen 1962; Kooi, Schutz, & Baker, 1965; and Guinagh et. al., unpublished, 1966) present evidence to show that second graders through college students all tend to make the most errors in the middle positions of a word. This evidence reopens the question concerning the effect of isolating some of the elements in a spelling word for it suggests that words might be conceived as serial lists, exhibiting serial-position phenomena on a spelling task (listing the letters in the correct order).

One of the earliest and most extensive studies which concerned itself with isolation of elements in a spelling task was conducted by Tireman (1929). His study involved over 4,000 pupils of grades four, six, and eight and included over a half million spellings. He concludes his study with the following statements:

> "...one is impressed with the consistency with which the data shows that marking hard spots is of little or no value. ...the people who advocate marking the hard spots are not only suggesting a useless device but possibly a harmful one."

Tireman's study was performed in the classroom and the students studied their words for a period of one week as they were accustomed to. Some Ss studied from lists in which tne words contained isolated elements (capitalized, underlined, printed in bold-face) and others studied from lists which contained words with no isolated elements. This arrangement left the experimenter with virtually no control over the variables of the learning situation.

Another problem inherent in Tireman's study arises as a result of his method of locating difficult positions in words. The method he used often yielded several difficult positions in the same word. In some cases he had the pupils mark their own "hard spots" and again this often yielded more than one difficult position per word. The question arises as to whether or not an element can be considered isolated when there are other elements in different parts of the word which are similarly made to stand out. (e.g. efficiency was used with the sixth graders and printed: effi<u>ci</u>en<u>cy</u>. Perhaps the pupils were, in fact, diverted from the task of writing all the letters in the right order when they were asked to learn words in which more than one part of the word was isolated in this manner.

Mednick (1964), in discussing Jensen's 1962 spelling study, suggests that isolating the middle part of spelling words will not decrease the number of errors. According to Mednick, if spelling yields the same results as other serial learning tasks, one would expect a decrease in the number of errors made in the

isolated positions but no decrease in the total number of errors for the whole word. This expected result is based on the findings of studies of isolation in serial learning. Jensen (1962b) suggests that associative "...connections are learned in a certain order around an 'anchor' point, which is usually the first item presented." The anchor point, the position around which the other items are learned, has become an important factor in explaining the effect of isolating some part of a serial list. It has been suggested that when an item in a serial list is isolated, it becomes the anchor point and therefore fewer errors are made in that position and correspondingly more errors in some other position.

This seems to be a satisfactory explanation of the effect of isolation when all items are equally easy to learn, but spelling words are not made up of equally easy items, so the effect of isolation in spelling still deserves further study.

The present study is designed to study the nature of isolation effects on spelling. It will seek first of all to answer the following questions: If more errors are made in the middle of a spelling word (serial-position phenomenon), will isolating the middle positions reduce those errors (von Restorff phenomenon)? And, will the reduction be great enough to cause an overall reduction of errors for the entire word? The research which has been done on serial-position and isolation effects leaves many unanswered questions and it is especially difficult to generalize

the findings to a study such as this one, for the spelling task is a different kind of task than the serial-learning or paired-associates tasks which have been used thus far in studying these effects. Three facts in particular must be considered which make the study of isolation within a spelling task unique. First of all, each word can be considered a serial list but in a typical spelling situation the person sees the whole word at once, i.e., he is not presented the word letter by letter through an anticipation method and therefore he is not compelled to learn it that way. In fact, Abernathy (1929) recorded the eye movements of good and poor spellers and noted patterns of eye movements which included many regressions and highly unequal fixation times for the various parts of the word. The anticipation method usually used in serial and paired-associates learning studies would reduce the possibility of unequal fixations on any given item because each item moves out of sight before the next item moves into place, No regressions are possible when the anticipation method is used. In his 1929 study, Abernathy found that the better spellers made repeated surveys of the word as a whole, making several regressions to the difficult part. Perhaps, then, by printing the middle positions (the difficult part) in red the Ss attention would be directed to those letters, causing more regressions to that part as his eyes scan back and forth across the word.

A second unique feature of the spelling task is that the items (letters) are not of equal difficulty and are not independent

of each other. Some letters are more closely "tied" to the sound they represent than other letters. Consonants such as t, b, m, d, and k each represent only one sound, whereas consonants c and g, for example, each have two sounds and furthermore "share" those sounds with other consonants (k and s in the case of c; j in the case of g). Vowels become more difficult still for they each can represent many sounds. The dependence of letters upon the other letters in a word is easily seen. The quality of the sound for a consonant such as b or p, for example, changes considerably depending upon which letter it preceeds or follows in a word. Some letters join together to form a single sound and the same letter combination may not necessarily represent the same sound from one word to the next (e.g. ough as in tough, though, through, etc.). The presence of silent letters within a word is another example of the interdependence among letters. Whether a letter represents a sound or is silent in a word is determined by the context. i.e., the presence or absence of certain other letters or the position of the letter in the word. These unique features of spelling, the inequality of difficulty and interdependence of the letters in the spelling task, are important considerations in light of the various explanations offered for the serial-position and von Restorff phenomena.

Many theoretical and empirical explanations have been offered for the serial-position phenomenon (Deese, 1958; Underwood, 1963). Although Hull's attempts to explain this phenomenon (Hull, 1953; Hull et. al., 1940) are not too widely accepted, an S-R paradigm

is still the most widely used basis for analyzing serial learning. A search for empirical evidence to support the idea that each item in a series is the stimulus for each succeeding item has yielded mostly negative results and has led researchers to a "search for the functional stimulus". (Jensen & Rohwer, Jr., 1965). Some experimenters maintain that position itself acts as the functional stimulus (Schulz, 1955; Young, 1962; Keppel & Saufley Jr., 1964). Other investigators have proposed that some parts of the list are learned predominantly be sequential and other parts predominantly by position associations. Ebenholtz (1963), for example, states that position learning occurs predominantly at the extremes and sequential learning occurs in the middle of the list.

Jensen & Rohwer, Jr. (1965) suggest that although the evidence so far seems to favor a position hypothesis, it is also inadequate to explain fully what is being learned in serial learning. They propose another approach, explained in detail by Jensen (1962c), which regards serial learning as essentially a process of response integration rather than as the acquisition of specific S-R associations. As the authors of this approach have suggested, the idea has not been worked out in enough detail to have much predictive power for specific experimental outcomes.

This brief survey of the major attempts to explain the serial-position phenomenon discloses two important facts. First, all of the approaches assume that each item is independent and some relationship is sought among the items (sequential associations, position

associations, interference due to backward associations, integration of the response items, etc.). These explanations would not generalize readily to spelling because independence of items (letters) cannot be assumed. Secondly, none of these approaches to the serial-position phenomenon have proved to be entirely successful and as suggested by Jensen and Rowher (1965), this has caused a search for the functional stimulus. In spelling, the functional stimulus becomes extremely difficult to isolate because in any given word a combination of letters, as well as individual letters could function as a single item and become the functional stimulus. Furthermore, the fact that certain letter combinations within a spelling word (e.g., "per" or "ab" as in perhaps or absentee) might be differentially meaningful for the Ss greatly reduces the possibility that a given item would act as the functional stimulus for all Ss.

One of the most interesting phenomenon affecting serial position is the von Restorff phenomenon. In 1913 von Restorff reported a series of studies which showed that isolating an item against a crowded or homogeneous background facilitates the learning of that isolated item. Von Restorff interpreted her original results within a Gestalt framework (Koffka, 1935). The neutral trace of the isolated item stands out as a "figure" against the "ground" of the similar traces of the other, non-isolated items. Wallace (1964), in his review of the status of the von Restorff phenomenon, states that isolation has been manipulated in three major ways. The method giving the experimenter the most control over the manipula-

tion of isolation involves an additional operation on an item within a list. Printing an item in red when the remaining items are in black is an example of this kind of manipulation and it allows the isolated term to be compared with itself in a non-isolated condition.

Several explanations have been offered to account for the von Restorff phenomenon. The Gestalt theory has been carefully conceptualized by Koffka (1935). He explains the effect of isolation in terms of figure-ground relationship. Supposedly, the isolated element stands out, becoming the figure, while the rest of the word becomes the ground. The more homogeneous the background against which the isolated element is placed, the more effective the isolation will be. As has already been suggested, the letters in spelling words are not "functionally" similar and the non-isolated elements will probably not be perceived by the subject as a homogeneous group of letters.

A second major explanation of the von Restorff phenomenon is based on the idea of an S-R association. Various researchers have maintained association as basic to their explanations and yet have come to different conclusions as to the specific mechanism(s) involved. Gibson (1942) posited an interference theory which suggests that isolation increases the differentiation of the items thus reducing the interference from other items in the list. In other words, stimulus generalization is reduced. Horowitz (1962) suggests that isolation affects the associative stage in serial learning whereas Saltz and Newman (1959) suggest that early in

learning the influence of isolation occurs mainly during response learning but that as learning progresses it may exert its influence on the associative stage.

Smith (1949) and Smith and Stearns (1949) have suggested that the principle benefit of isolation is in the serial organization of the list. They found that an item which had been isolated in red print (the remaining items were printed in black) aided in establishing order and therefore the isolated lists were learned considerably better than the non-isolated lists in the later stages of learning, viz. after the responses were known and when the problem was one of getting them in the right order. Jensen (1962d) offered further evidence for this explanation by showing that the learning of items per se is not affected by isolation, but that the order of learning those items is affected. Since the items in a spelling list are familiar (letters and/or letter combinations) and are closely tied to the pronunciation of the word it is reasonable to conclude that the largest part of the spelling task is the ordering of the units and therefore the spelling task may provide a useful paradigm for looking at isolation.

Another explanation of the isolation effect was offered by Green (1956). He suggested that the "surprise" aroused by being unexpectedly presented with a different type item accounts for the isolation effect. The results of Green's study supported the hypothesis that there would be a greater von Restorff effect for the first isolated term than for the second isolated term.

A third unique feature of the spelling task is that not only can each spelling word be conceived of as a serial list but it is also an item within a total list. This fact immediately broadens the scope of this study and thus the study will also seek to answer the following questions: Is the effect of isolations within a given spelling word independent of variation occurring within the total list? And if not, i.e. if the effect of isolation within a word is influenced by variations within the list (context variables), then what context variables might influence the isolation within the individual words?

Green (1956), in discussing the "surprise" effect of isolation, suggests that the effect of isolation is due to surprise and that this effect extinguishes when isolation in a list is repeated. His study showed that a second isolated element did not have as great an effect as the first element. In fact only the errors for the first isolated element were significantly reduced in comparison to the other elements in the list. These results suggest that an important context variable might be the number of words in the total list that contain isolation. A possible way of testing this would be to compare the isolation effect on certain "critical" words which contain isolation when these words are contained in two lists - one list in which all the other words in the list also contain isolation (this might be called a constant-consistent list, for all the words are isolated, and each word is isolated in the same way); and a second list in which only the critical words contain isolation and the other words contain no isolation (this might be called an inter-

mittent-consistent list for the words which contain isolation occur only occasionally or intermittently throughout the list). On the basis of Green's study one would predict that the isolation effect within the critical words would be greater when they are contained in an intermittent list than when they are contained in a constant list for the surprise effect would have a greater opportunity to extinguish in the constant list where the subject would be responding to a word containing isolation everytime he made a response. On the other hand, if it is important for the Ss to develop a set to look for the isolated elements in the words, the constant list would produce an optimum context.

Smith and Stearns (1949) manipulated isolation by presenting one item in a serial list in red print and the remaining items in black print. In the later stages of learning, when the responses were known, an advantage for the isolated list was demonstrated. It was assumed that the red item aided in establishing order. Jensen (1962d) also demonstrated that organization of the material is aided by isolation, although he proposed that the organizing aid of the isolated item is quite specific to that item. These studies suggest another possible context manipulation: the position(s) of the color used as a cue. If color is an important cue in helping the S to organize the letters, then shifting the position of the cue-color ought to make it more difficult for the S to use color as a position cue. In order to maintain isolation within a given word while at the same time shifting the position of the cue-color, one could simply switch the colors of the

isolated letters (red) and the non-isolated letters (black). One could begin then, with a word printed in black letters with the middle letters isolated in red and by switching the red and black colors end up with a word printed in red letters with the middle letters isolated in black. The isolated element would remain in the same position but its color would change. (This procedure could be represented as follows: BLACK-RED-BLACK/ switch / RED-BLACK-RED). This shift could be made within a list so that from word to word the red color would not be in the same position, but for a learning task of several trials, each trial would be the same and thus any given word would always have the red in the same position(s). This might be called a constant-inconsistent cuing condition for all the words are isolated but the position of the cue color is inconsistent throughout a given trial. Another way of making this shift would be to keep the red in the same position(s) for all words on one trial and then shift it to the other position(s) on the following trial. Now, within a given trial the position would remain the same but within a given word it would shift from trial to trial. This would represent a situation where the subjects would be asked to shift from a constant-consistent list with the cue color in one position to a constant-consistent list with the cue color in another position, and it might be called a constant-consistent shift condition. On the basis of a Gestalt explanation of isolation effect, there should be no difference between either of these two conditions, nor should the results from either of them be different from the results

of a constant-consistent cuing condition. In all three cases the figure-ground relationship should be maintained. However, on the basis of S-R explanations, which propose that the color aids in organization of the list (Smith & Stearns, 1949; Jensen, 1962d), it would be expected that the two conditions where the cue color is shifted would yield more errors than a constant-consistent condition in which the cue color maintained its position. If the Ss can develop a set quickly enough (within a given trial) and learn to shift that set from trial to trial, then it would be expected that the constant-consistent shift condition would yield fewer errors than the constant-inconsistent condition.

It is possible that effects which might occur in the condition involving shifts in cue color could be due to the fact that one cue color is more effective than another rather than to the experimental manipulations. In order to control for this a constant-consistent list could be devised which would contain all words in red print with black isolation. If this condition would yield results not significantly different from the condition in which all the words were in black print with red isolation, then it could be assumed that any "shift" effect would not be due to differences in the strength of the color of the isolation.

The objectives of this study are:

1. to determine whether or not the von Restorff phenomenon can be produced by isolating the middle letters of spelling words during the learning task.

2. to determine whether or not spelling words will be learned faster and recalled better a week later if the middle letters of the words are isolated during the learning task.

3. to determine the nature of the effect of context (list manipulation) upon the isolation-effect within individual words when the list is manipulated in the following ways:

    a. all of the words in the list are isolated in the same manner (constant-consistent cuing)

    b. one-fourth of the words are isolated in the same manner, and the other three fourths of the words contain no isolation (intermittent-consistent cuing)

    c. all the words are isolated -- one half of them with the cue color in the end positions, the other half with the cue color in the middle positions (constant-inconsistent cuing)

    d. all the words are isolated with the cue color in the middle positions on the odd trials (1, 3, 5, etc.) and with the cue color in the end positions on the even trials (2, 4, 6, etc.) (constant-consistent cuing shift)

CHAPTER II

METHOD

A. Subjects

A total of 120 sixth-grade Ss (54 females, 66 males) were tested in this study. They were selected randomly from the sixth-grade classes of seven private elementary schools in the western Michigan area.

B. Materials

Six 12-item lists of nine-letter words were constructed. Each list contained the same 12 words but the lists varied according to the amount of isolation. Table 1 presents the six lists. The words containing isolation in lists 4 and 5 were selected randomly from the 12 words.

C. Procedures

A separate group of sixth-grade pupils were tested on a large list of nine-letter words. From those words which these pupils were unable to spell, 12 words were chosen for this study. Each word was printed in large print, in all lower-case letters, on a 3 x 5 index card.

All Ss learned the twelve words to a criterion of two correct responses. Each word was presented for five seconds and the experimenter (E) simultaneously gave the correct pronunciation. An unlimited amount of time was allowed the S to write the word immediately after it had been exposed. The entire list was presented in this manner and whenever an S spelled a

TABLE I

A Comparison of the Lists Used for Each of the Six Conditions, Showing the Isolated Elements

C control	E-1 constant-consistent	E-2 constant-consistent (control for color) per se	E-3 constant-inconsistent	E-4 intermittent-consistent	E-5 constant-consistent shifts	
					odd trials	even trials
unanimous	unanimous	unanimous	unanimous	unanimous	unanimous	unanimous
brigadier	brigadier	brigadier	brigadier	brigadier	brigadier	brigadier
euphemism	euphemism	euphemism	euphemism	euphemism	euphemism	euphemism
exchequer	exchequer	exchequer	exchequer	exchequer	exchequer	exchequer
facetious	facetious	facetious	facetious	facetious	facetious	facetious
resonance	resonance	resonance	resonance	resonance	resonance	resonance
xerophyte	xerophyte	xerophyte	xerophyte	xerophyte	xerophyte	xerophyte
voodooist	voodooist	voodooist	voodooist	voodooist	voodooist	voodooist
acquiesce	acquiesce	acquiesce	acquiesce	acquiesce	acquiesce	acquiesce
possessor	possessor	possessor	possessor	possessor	possessor	possessor
bourgeois	bourgeois	bourgeois	bourgeois	bourgeois	bourgeois	bourgeois
cacophony	cacophony	cacophony	cacophony	cacophony	cacophony	cacophony

_____ Red letters

... Black letters

word correctly on two successive trials, that word was removed from the list. This procedure was continued until all the words were learned. A stop watch was used to insure consistent presentation time and to aid in accurately recording the accumulated response time of each S.

The Ss were tested under the following six different conditions:

Control condition (C). The Ss were presented a list which contained no words with isolated elements. The 12 words were presented in a different random order on each trial. The initial order of presentation for the experimental group was the same as the order for the control group. This condition is analogous to a usual spelling list.

Experimental-1 condition (E-1). The Ss were presented a list in which the words consistently had the middle three letters isolated in red print. This condition was used to help determine the effect of isolation within a word and the cumulative effect when all the words in a list were isolated this same way. (constant-consistent cuing).

Experiment-2 condition (E-2). The Ss were presented list 3 in which the words were consistently printed in red with the middle three letters isolated in black print. This condition was used to determine whether the isolation effect was due to the red color or to the contrast between the red and black colors. It served as a control for differences

which might be found between the E-3 & E-5 conditions and the E-1 condition. (constant-consistent cuing - control for color per se).

Experimental-3 condition (E-3). The Ss were presented a list which contained six words with isolation like that found in the E-1 condition and six words with isolation like that found in the E-2 condition. This condition was employed in order to assess the effect of shifting the position of the cue color within the list while within-word isolation remained constant, (constant-inconsistent cuing).

Experimental-4 condition (E-4). The Ss were presented a list in which eight words contained no isolation and the other four words contained isolation like that found in the E-1 condition. This condition was used in order to assess the effect of intermittent-consistent cuing. It was assumed that the surprise element would be strongest in this condition. (intermittent-consistent cuing)

Experimental-5 condition (E-5). The Ss were presented a list like the one used in the E-1 condition on the odd-numbered trials (1, 3, 5, etc.) and a list like the one used in the E-2 condition on the even-numbered trial (2, 4, 6, etc.). This condition was employed in order to assess the effect of shifting from a constant-consistent list with the cue color in one position to a constant-consistent list with the cue color in a different position. (constant-consistent cuing shift)

The Ss were chosen randomly from the sixth-grade pupils of each of the seven participating schools and then assigned to each of the control and five experimental conditions in order of appearance at the testing session. Because the Ss were chosen from each school in multiples of six, they were evenly distributed among the six conditions.

One week after the learning session the Ss were given a recall task. For this task the E pronounced each word in the list. After two pronunciations by the experimenter, the S wrote the word. This procedure was continued until all of the words had been spelled by the subject.

CHAPTER III

Results

In order to determine the effect of isolation on the acquisition and later recall of spelling words, four measures were used: The number of trials to criterion, the number of errors to criterion (computed on the basis of errors made at each letter position), the number of errors on the recall task and the number of words misspelled on the recall task. Intercorrelations among these dependent variables were computed in an effort to establish whether it would be feasible to use only one acquisition measure and one recall measure in the various analyses. The correlation between the acquisition measures (trials to criterion, errors to criterion) was $r = .97$. A correlation of $r = .83$ was obtained between the recall measures (errors on recall, words wrong on recall). On the basis of these results, it was decided to employ trials to criterion (acquisition measure) and words wrong on recall (recall measure) as the dependent variables in the subsequent analyses.

Table 2 presents the means and standard deviations of the number of trials to criterion for each of the six conditions.

Table 2

Means and Standard Deviations of the Number of Trials to Criterion on the Acquisition Task

	Conditions					
	C	E-1	E-2	E-3	E-4	E-5
Mean	53.45	57.00	55.60	58.75	49.55	61.25
S.D.	23.08	30.37	26.82	29.43	21.17	44.00

A 1 x 6 analysis of variance was used to evaluate the data in table 2. The resulting F value (.354, d.f. 5/114) was not significant.

Table 3 presents the means and standard deviations of the number of words wrong on the recall task for each condition.

Table 3

Means and Standard Deviations of the Number of Words Wrong on the Recall Task

	Conditions					
	C	E-1	E-2	E-3	E-4	E-5
Means	8.15	8.30	8.70	8.65	8.60	7.65
S. D.	2.83	2.05	1.85	1.85	2.37	2.43

A 1 x 6 analysis of variance was used to evaluate the data in table 3. The resulting F value (.60, d.f. 5/114) was not significant.

The data summarized in table 2 and 3 indicate that for the total list of words there was no significant difference in acquisition or recall of the spelling words. These data do not offer any evidence about whether there might be an effect of isolation in the middle portion of the word but which is offset by a rise in errors in some other position. Figure 1 shows for the six groups, the number of recall errors made per letter position. It should be noted that although the curves are all very similar, the errors in the middle position (position #6) for groups E-1, E-2 and E-3 are lower than one would expect in a serial-learning curve.

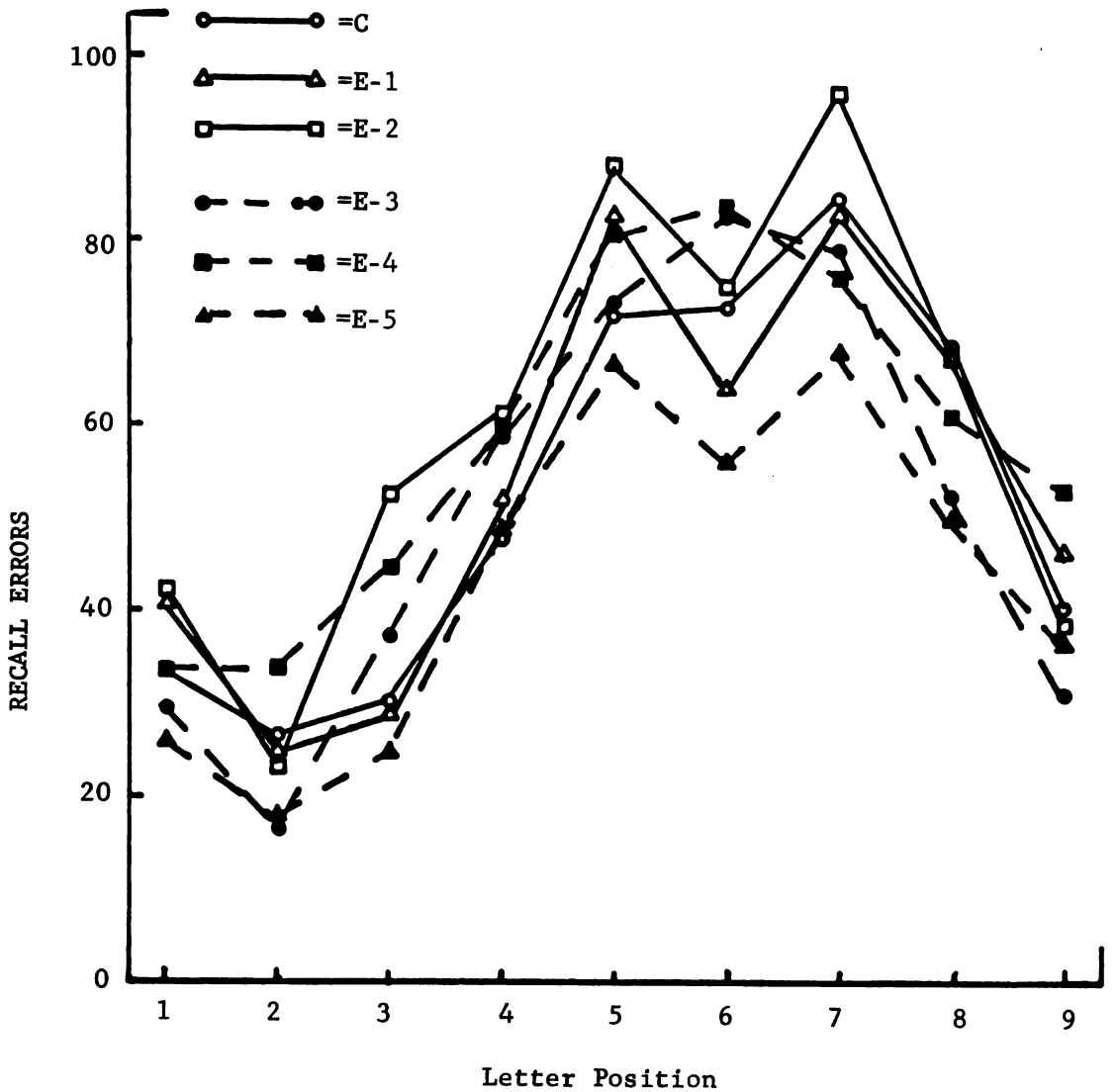

Figure 1

Errors per letter position on recall task for six conditions

The specific objective of trying to determine whether or not isolation is facilitating when the spelling list is comprised of two-thirds of the words with no isolation and one-third of the words with isolation, is only partially answered by the above analyses. It might be argued that the E-4 condition in which only four words contained isolation really did facilitate acquisition and recall for those four words but that when the entire list is considered, the effect is masked because of the many trials and errors made on the other eight words. Thus, only those four words were evaluated for acquisition and recall across the six conditions. Table 4 presents the means and standard deviations of the number of trials to criterion on these four words for each condition and table 5 presents the means and standard deviations of the number of words wrong on the recall task on these four words for each condition.

TABLE 4

Means and Standard Deviations of the Number of Trials to Criterion for the Four Critical Words

Cond	C	E-1	E-2	E-3	E-4	E-5
Means	22.50	22.60	22.90	25.65	21.80	23.50
S.D.s	12.32	12.82	11.29	14.93	11.46	20.91

A 1 x 6 analysis of variance was used to evaluate the data in table 4 and the resulting F value (.162,d.f., 5/114) was not significant. The data in table 5 was also evaluated by a 1 x 6

TABLE 5

Means and Standard Deviations of the Number of Words Wrong on the Recall Task for the Four Critical Words

Cond	C	E-1	E-2	E-3	E-4	E-5
Means	2.70	2.65	3.00	2.80	2.85	2.75
S.D.s	1.19	1.06	.89	1.03	.85	.70

analysis of variance and the resulting F value (.316, d.f., 5/114) was not significant.

A post - facto discussion with the principals of the participating schools led to the discovery of the fact that one of the schools (from which 36 subjects were drawn) used a method of teaching spelling which instructed the pupils to conceive of the word as a whole and to learn it by remembering the whole word and not breaking it down into units. This fact led to the post-hoc hypothesis that perhaps the isolation was in fact hindering the pupil who used this approach because the isolation tends to break up the word. It becomes quite difficult to see a word as a whole unit when color has been used to divide it into thirds (e.g., facetious becomes facetious - the underlined letters are printed in red). In order to test this hypothesis a 2 x 6 analysis of variance was used in which one of the factors was the type of pre-training the pupils had received through their spelling lessons in school and the other was the type of treatment employed in this study. A significant interaction between the two factors would be predicted by the hypothesis.

Table 6 presents the means and standard deviations of the number of trials to criterion on the acquisition task for the 36 pupils who had been taught a "whole" approach in spelling and for the 84 pupils who had been taught the more common approach ("part" approach).

TABLE 6

Means and Standard Deviations of Trials to Criterion for the Two Sub-groups

	Conditions					
	C	E-1	E-2	E-3	E-4	E-5
"Part" Mean N = 84	61.00	45.29	52.57	56.43	49.71	46.74
S.D.	23.24	16.54	26.80	28.78	24.55	23.84
"Whole" Mean N = 36	35.80	82.67	62.67	64.17	49.17	96.50
S.D.	8.43	40.58	25.53	30.21	9.37	57.91

Analyses of variance were used to Evaluate the data in table 6 and the results are presented in table 7. Note that the F value for factor A (the two approaches to learning to spell) is significant at the .01 level. Inspection of table 6 indicates that the subjects who had been taught a part approach required fewer trials to learn the list.

Table 8 presents the means and standard deviations of the number of words wrong on the recall task for the 36 pupils who had been taught a "whole" approach to learning to spell and for the 84 pupils who had been taught the "part" approach. A 2 x 6 factorial analysis of variance was used to evaluate the data in table 8 and

the results are presented in table 9. Note that the F value for the interaction is significant at the .01 level.

TABLE 7

2 x 6 Analysis of Variance Summary
for Sub-groups and Treatments
on the Acquisition Measure

Source	S.S.	d.f.	M.S.	F
A (part/whole)	4424.90	1	4464.00	5.37**
B (treatments)	1670.10	5	334.02	<1
AB (interaction)	17066.33	5	3413.27	4.11**
Exp. error	89772.96	108	831.23	
Total	111303.30	119		

TABLE 8

Means and Standard Deviations of Words Wrong
on Recall for the Two Sub-groups

	Cond	C	E-1	E-2	E-3	E-4	E-5
Part	Means	9.5	7.93	8.71	8.29	8.50	7.36
	S.D.s	1.68	2.09	1.67	2.60	2.65	2.29
Whole	Means	5.0	9.17	7.67	9.50	8.83	7.33
	S.D.s	2.45	1.67	2.23	2.14	1.95	2.66

TABLE 9

2 x 6 Analysis of Variance Summary
for Sub-groups and Treatments
on Recall Measure

Source	S.S.	d.f.	M.S.	F
A (whole/part)	.43	1	.43	1
B (treatments)	16.57	5	3.32	1
AB (interaction)	117.87	5	23.57	4.46**
Exp. error	570.69	108	5.28	
Total	688.99	119		

Because this interaction was significant, it was decided that it would be valuable to look at the results of each group ("part" approach and "whole" approach) separately. Four 1 x 6 analyses of variance were used to analyze the acquisition measures in table 6 and the recall measures in table 8. Table 10 presents the results of these analyses.

TABLE 10

1 x 6 Analysis of Variance Summaries
for sub-groups on the acquisition and recall measures

Pretraining	Measure	Source	S.S.	d.f.	M.S.	F
"Part" Approach n - 84	Acquisition	treatment	2596.00	5	519.20	.819
		exp. error	49484.29	78	633.90	
		total	52040.29	83		
	recall	treatment	36.95	5	7.39	1.45
		exp. error	396.86	78	5.09	
		total	433.81	83		
"Whole" Approach n = 36	acquisition	treatment	14470.33	5	2894.06	2.15
		exp. error	40338.65	30	1344.62	
		total	54808.98			
	recall	treatment	80.92	5	16.18	2.77*
		exp. error	175.32	30	5.84	
		total	256.24	35		

The analyses summarized in table 10 yielded one significant F value. The overall effect of treatment on the recall task for the "whole" approach group was significant at the .05 level. A Neuman Keul's test of individual comparisons was used to identify the conditions which differed significantly from each other and

the test revealed a significant difference (.05 level) between the control condition and the other five conditions which did not differ significantly from each other.

Is the isolation effect producing fewer errors on the isolated elements but increased errors in other letter positions? Figure 2 shows that although the E-1 and E-5 conditions show a reduction of errors in the middle positions, there is no apparent rise in errors in the other positions. Condition E-2 also shows fewer errors in the middle positions but the errors in positions 3 and 4 are equal to or slightly greater than the errors in the same positions for the control condition.

Figure 3 shows that all the curves for the experimental conditions are similar and that the error curve for the control condition is lower than the others and is fairly flattened. This difference between the control and the other conditions illustrates the significant difference disclosed in table 10.

Figures 2 and 3 do show a reduction of errors at the isolated positions (especially apparent in figure 2). To determine whether this apparent difference among the conditions in the number of errors at the isolated positions is significant, further analyses were performed. Table 11 presents the means and standard deviations of recall errors at positions 4, 5, and 6 for the "part" and "whole" approach sub-groups.

1 x 6 analysis of variance procedures produced a non-significant F value 1.47 d.f. 5/78) for the "part" approach means listed in table 11, and a non-significant F value (1.77, 5/30)

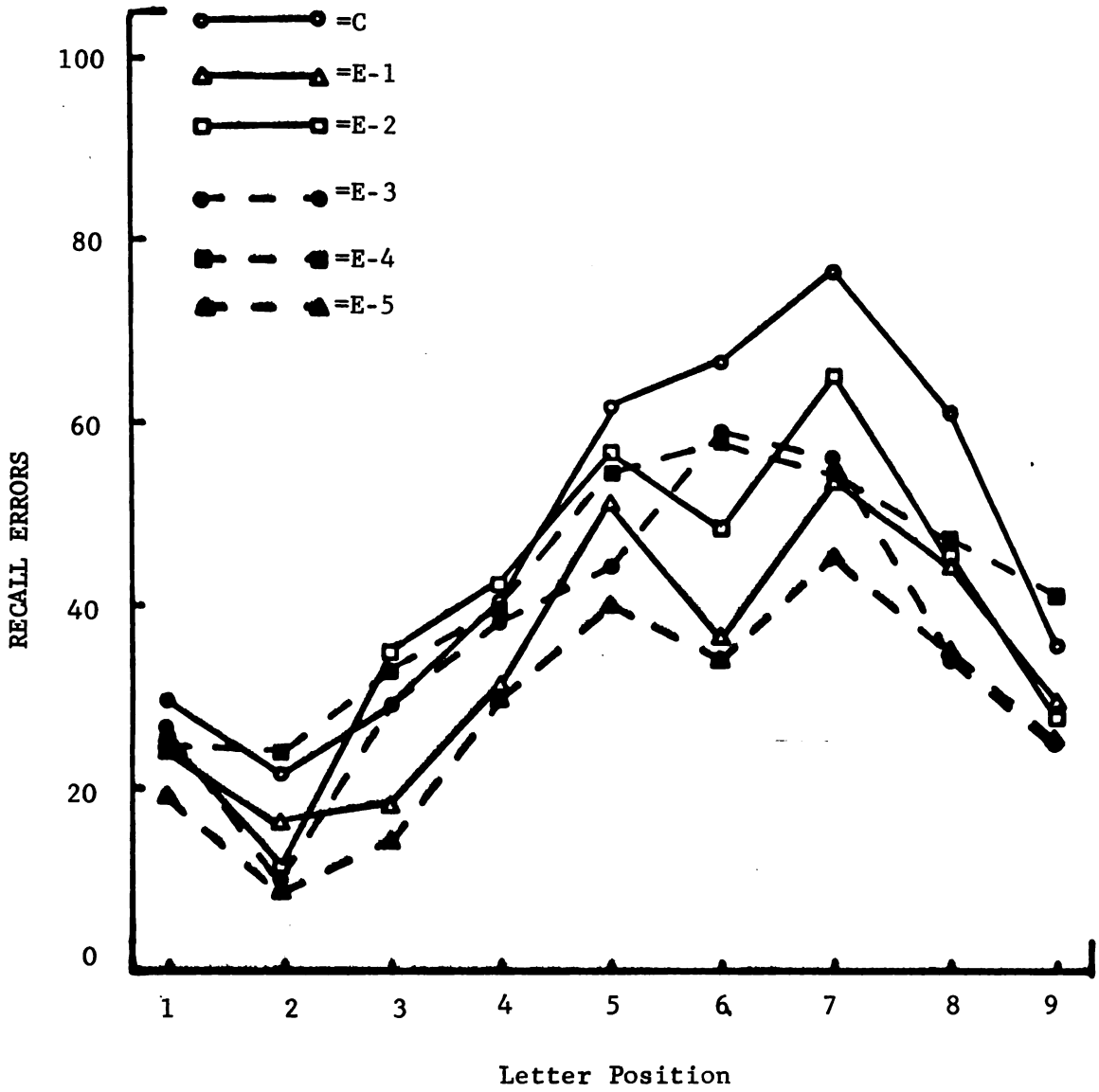

Figure 2

Errors per letter position on recall
task for six conditions
Part Approach Subgroup

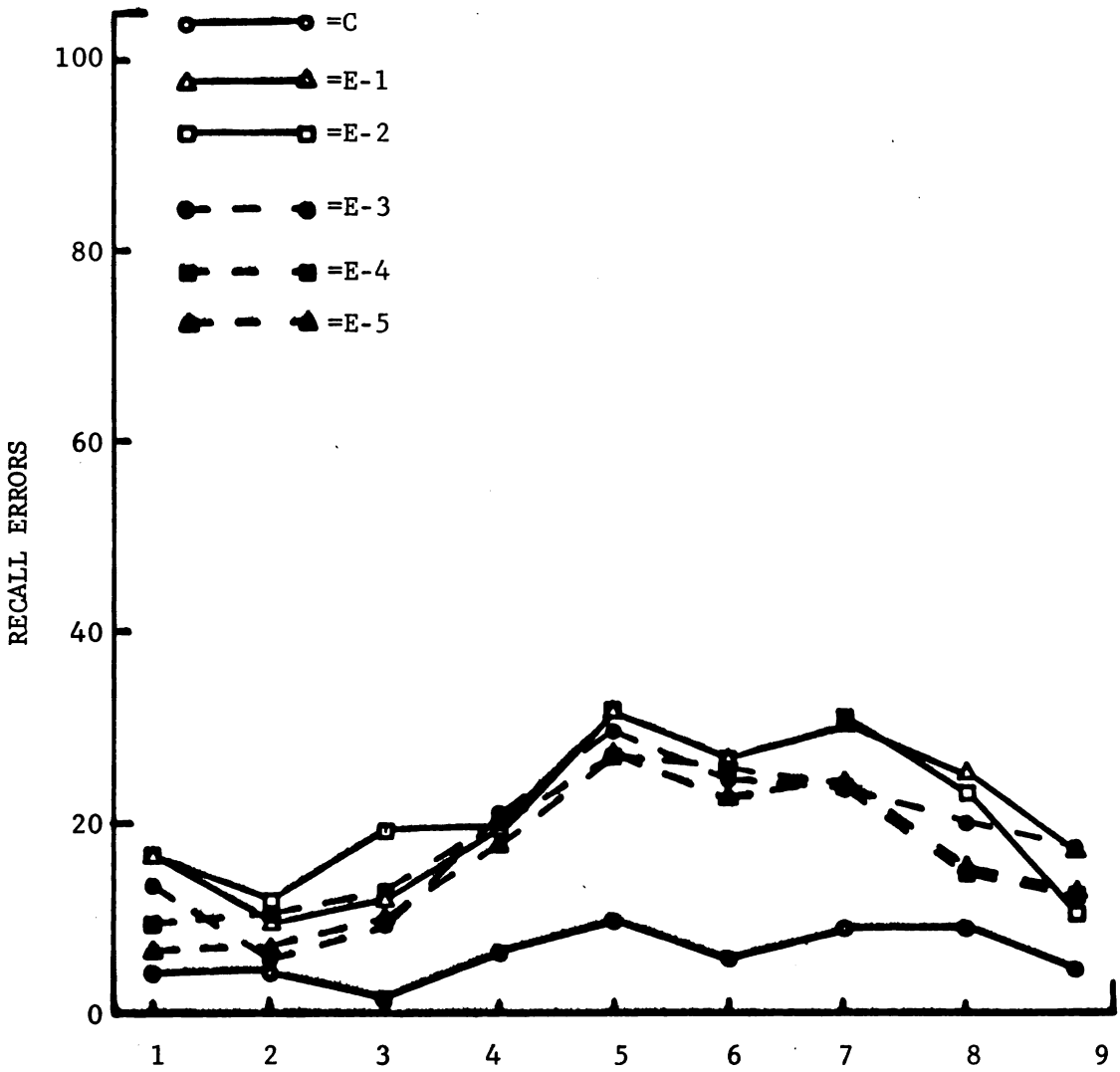

Figure 3

Errors per letter position on recall
task for six conditions
whole approach subgroup

Means and Standard Deviations of Recall Errors at Positions 4, 5, & 6 for the Two Sub-groups

		Conditions					
		C	E-1	E-2	E-3	E-4	E-5
"Part" N = 84	Means	11.71	7.71	9.43	11.21	10.78	7.71
	S.D.	4.95	3.62	4.37	5.31	6.84	2.71
"Whole" N = 36	Means	5.17	13.17	12.50	12.33	12.17	12.00
	S.D.	3.72	7.73	5.25	4.92	2.67	5.10

for the "whole" approach means listed in table 11.

Finally, to determine whether the surprise effect expected in condition E-4 was present in either the "part" or "whole" approach sub-groups, the means and standard deviations of trials was analyzed for the four critical words (those which contained isolation in condition E-4). This information is presented in table 12 and the 1 x 6 analysis of variance disclosed no significant F values. ("Part" approach: $F = 1.21$, d.f. 5/78, "Whole" approach: $F = 1.73$, d.f. 5/30).

TABLE 12

Means and Standard Deviations of Trials
to Criterion on Four Critical Words
for the Two Sub-groups

		Conditions					
		C	E-1	E-2	E-3	E-4	E-5
"Part" N = 84	Means	25.86	18.00	21.43	24.50	22.77	16.36
	S.D.	13.14	6.05	11.00	15.10	14.63	10.33
"Whole" N = 36	Means	14.67	33.33	26.33	28.33	19.67	40.16
	S.D.	3.99	17.25	11.21	14.16	3.14	28.49

CHAPTER IV

DISCUSSION

The results of this study do not support the hypothesis that isolating the middle three letters of a nine-letter spelling word will significantly aid the learning and recall of the words. In fact, with one exception (the E-4 condition on the acquisition measure), the control condition yielded slightly better results on both acquisition and recall than did the other five conditions.

The question of whether the effect of isolation is dependent upon isolation in each word or is also dependent upon isolation in the total list is not answered by the results of this study and the questions concerning the effect of various context variables remain unanswered.

The discovery of the sub-group from the school which taught a "whole" approach to spelling led to complications of interpretation. After the discovery of this group it was hypothesized that isolation treatments would interfere with learning and recall for these Ss, but would have an opposite effect for the "part" group. This hypothesis was partially supported by evidence of the significant interactions between the treatment effects and the sub-groups on both the acquisition and recall measures. Further clarification was sought by analyzing the sub-groups separately. No significant differences were found among the conditions for the "part" approach sub-group on either acquisition or recall. Furthermore, there were no significant differences for the "whole" group on acquisition. On the recall task, however, there was a

significant main-effects (significant at the .05 level). A Neuman Keuls test on all ordered pairs of means disclosed the fact that the control condition differed significantly (.05 level) from the experimental conditions but the experimental conditions did not differ significantly from each other.

Analyses of variance were performed on the mean number of recall errors on the isolated positions for both the "whole" and "part" approach sub-groups. The analyses yielded no significant F values and therefore offered no evidence for an isolation effect on the three isolated elements.

A closer inspection of the mean number of trials to criterion for the "part" approach sub-group (table 6) discloses substantially fewer trials for the E-1 condition than for the other conditions. There is a difference for example of 15.71 mean number of trials to criterion (C=61, E-1 = 45.29). Despite this relatively large difference, the main-effect was statistically non-significant (F=.819, d.f., 5/30 - Table 10). Several factors may be considered as possibly masking the overall effects of the treatments.

First of all, it is possible that the isolation reduced the errors in the middle positions(s) but, as predicted by some investigators (Jensen, 1962, Mednick, 1964), caused a rise in errors in some other position(s). A look at figure 2 however, shows that for the conditions which yielded a drop in errors in the middle positions. (E-1, E-2, and E-5) There is no corresponding rise in other positions. It is interesting to note that the E-3 and E-4 conditions exhibit curves that resemble the serial-position curve

exhibited by the control condition. E-3 is a condition in which the position of the cue color is shifted inconsistently from word to word within a given trial. Perhaps this inconsistency hinders the Ss from developing a set to look for a particular kind of isolation even though for a given word the color is in the same position on every trial. The E-4 condition contains only four words which have isolated elements and it was anticipated that this would heighten the surprise factor thus causing the isolation effect to be greatest for this condition. In order to test this hypothesis, however, the four words had to be examined separately. The analyses of variance produced non-significant Fs and therefore there is no evidence to indicate that intermittent-consistent cuing facilitated learning. This offers no support for a surprise effect such as Green (1956) posited in serial learning.

Secondly, the positions which were isolated may be a factor helping to mask the overall effects of the treatments. In a typical serial-position study the items are presented one at a time using the anticipation approach. In this situation each item is a stimulus for the next. But in this study the entire word is presented at once and it is difficult to identify the stimulus for succeeding elements. Is it a syllable, a group of letters forming a typical sound combination, the whole word, or some other possible letter combination? In an attempt to break up some of the "natural" letter combinations such as syllables or sound units it was decided to isolate the three middle letters rather than just

one letter. Perhaps in so doing, the functional stimulus was not in fact isolated in some of the words for some of the Ss. This could cause a decrease in effectiveness of the cue and possibly a greater variation of results between Ss. The identification of the functional stimulus in spelling words is unanswered in this study and requires further study.

Another factor which may have contributed to the masking of the overall treatment effects lies in the strength of the cue. Perhaps the cue (red letters) was not strong enough. In an informal interview immediately after the testing session was over, some of the Ss were unable to recall the color of the letters and others could not tell the experimenter that the red was in the middle as opposed to it being on the ends. A follow-up study which would strengthen the cue (increasing its intensity or calling attention to it in the instructions) might produce different results. Although the isolation did not significantly affect the results on either acquisition or recall, there is fairly strong evidence for some treatment effects. A closer look at the results of the two sub-groups discloses two interesting facts. First of all, the results for the "part" approach are all in the expected direction (see table 13). On the acquisition measure, the E-1 and E-5 conditions (Constant-consistent per trial) required fewer trials to reach criterion than either of the other experimental conditions. As predicted, the control group yielded the largest number of trials to criterion. On the recall measure the same pattern resulted (the E-1 and E-5 conditions yielding fewest errors and C

TABLE 13

Results of "Part" and "Whole" Approaches for Acquisition and Recall Ordered from Lowest to Highest number of Trials and Errors

Acquisition	Part	Trials	45	46	49	52	56	61
		Cond.	E-1	E-5	E-4	E-2	E-3	C
	Whole	Trials	36	49	63	64	83	96
		Cond.	C	E-4	E-3	E-2	E-1	E-5
Recall	Part	Errors	7.4	7.9	8.3	8.5	8.7	9.5
		Cond.	E-5	E-1	E-3	E-4	E-2	C
	Whole	Errors	5.0	7.3	7.7	8.8	9.2	9.5
		Cond.	C	E-5	E-2	E-4	E-1	E-3

the most errors). Secondly, the results for the "whole" approach are almost a mirror image of the "part" approach. The conditions that tended to aid the "part" approach group tended to hinder the "whole" approach group (Shown in the significant interactions reported in tables 7 and 9). The control condition yeilded the best results for the "whole" approach sub-group on both acquisition and recall, whereas the E-1 condition yielded the most trials and the most recall errors for that sub-group.

Any further research could also possibly account more precisely for the variable of pretraining, i.e. the subjects approach to learning to spell a word. This study seems to indicate that isolation may help some approaches to spelling and hinder others. The question also arises, then, as to which approach is more effective.

The spelling task lends itself to experimental manipulation and a great variety of research problems could be proposed for

future research. One of the more interesting and perhaps more promising problems which might be examined within a spelling framework relates to the search for the functional stimulus. Shepard (1963) has suggested that an extremely important variable to be considered is the analyzability or dimensionality of the stimuli. When the stimuli are uniform and unidimensional, not lending themselves easily to analysis, the predictions made on the basis of an S-R paradigm are quite accurate. However, Shepard suggests that with highly dimensionalized stimuli, selective attention and problems of cuing in an attempt to force the Ss attention to a certain dimension of the stimuli become important, and more elaborate predictive machinery becomes necessary. Within the framework of the spelling task this variable of analyzability could be manipulated in many ways. Some spelling words are obviously more open to analysis than others. For example, there are probably many more ways to analyze "extrapolation" than "house". Words could be analyzed on the basis of sound combinations (e.g., ough as in rough, though, etc.); little words within a larger word (e.g., candidate = can, did, date, ate, at, etc.); letter sequence (e.g. facetious contains all the vowels in the order in which they are usually learned, it is interesting to note that one subject reported using this strategy to help her remember this word); or meaning (e.g., psychology = psych + logy). Other possible dimensions might be discovered. The effects upon learning due to various methods of cuing might also be studied. A further possible manipulation

might involve the construction of lists of words with varying degrees of analyzability or dimensionality. Answers could be sought to questions like: For which kind of list is a certain cuing most effective? or, At what level of dimensionality does it become impossible to direct the Ss attention to a particular dimension? or, Under what conditions and with what theoretical model can accurate predictions be made about which dimensions the Ss will choose to attend to?

An example of an experiment based on the above considerations might be one in which several spelling lists are used in the treatment conditions. Each list would contain words with a different syllable/length ratio, (a possible way to quantify analyzability). An example of this kind of ratio is illustrated in table 14. It might be hypothesized that the smaller the syllable/length ratio, the more easily the word would be learned. Another hypothesis might be that the larger the syllable/length ratio, the greater would be the effect of an isolation condition.

After the testing session, the Ss reported many ways in which they "broke down" or analyzed the words in order to memorize them. Martin, Boersma, and Cox (1965) discovered and classified learning strategies for paired-associates learning. Perhaps a careful study of spelling would disclose a similar classification for the spelling task.

Finally, one of the major problems inherent in the study of spelling is the fact that very little research is available concerning

TABLE 14

A Sample List of Spelling Words
Illustrating Different
Syllable/length
Ratios

words	ratio	words	ratio
people	2/6	gracious	2/8
voodooist	3/9	grandeur	2/8
funnel	2/6	bourgeois	2/9
elephant	3/8	pleasure	2/8
facetious	3/9	fountain	2/8
president	3/9	business	2/8
cacophony	4/9	bouquet	2/7

the variables which influence the ease with which a word is learned. The only variable that has received any attention has been serial-position or position of a letter within a word. Obviously this is only one of a myriad of variables that may be related to acquisition and recall of spelling words.

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A P P E N D I C E S

Instruction to Subjects

The Ss were seated across from E with a 12 inch barrier on the table between the S and the E. The following instructions were given to the Ss by the E.

"I have 12 spelling words on index cards. You are going to learn to spell them. I will hold up a card so you can see it. You will have 5 seconds to study it and then I'll lower it out of sight. As soon as I lower the card you write the word on the paper in front of you. When you've finished writing the word, look up and I'll present the next word. We'll go through all twelve words this way and then I'll take your paper and give you a new one. We'll then go through the same twelve words again following the same procedure. Next, I will correct your spelling and any word that you spelled correctly both times I will remove from the list. Next we'll take the remaining words and go through them, again using the same procedures. Each time you spell a word correctly two times in a row we'll remove it from the list and we'll keep working through this list until you've learned the entire list.

Summary of Supplementary Statistical Analyses

Intercorrelations among Dependent Variables

Acquisition (errors to criterion with trials to criterion) $r = .97$.

Recall (words wrong on recall with errors with recall) $r = .83$

Analysis of Achievement Scores the Six Conditions

1 x 6 ANOVA - $F = .35$ Non-Significant. Therefore there is no significant difference in means of the achievement scores (spelling subscore) for the various groups.

Analysis of difficulty of the four critical words as compared with four other words chosen from the learning task. Comparison was made on the basis of results obtained from the control group only. t-test (mean #9 errors on words 2, 4, 7, 9 with mean number of errors on words 1, 5, 6, 10) yielded $t = .063$ non-significant. Therefore, the critical words were not significantly different on a "difficulty to learn" measure from 4 other randomly selected words.

Hartley's Test for Homogeneity of Variance

Acquisition - Part ($n=14$ $F_{max} = 3.03$ non significant
Whole ($n=6$) $F_{max} = 47.13$ significant at .01 level.

Recall - Part ($n=14$) $F_{max} = 2.40$ non significant
Whole ($n=6$) $F_{max} = 2.51$ non significant

ABSTRACT

A STUDY OF ISOLATION EFFECTS DURING THE ACQUISITION AND RECALL OF SPELLING WORDS

by Terry TenBrink

The problem of studying the effect of isolating some of the letters in a spelling word has for the past two or three decades been dismissed as unfruitful. Recent studies, however, present evidence that students tend to make the greatest number of spelling errors at the middle positions of a word. This evidence reopens the question concerning the effect of isolating some of the elements in a spelling word, for it suggests that words might be conceived of as serial lists, exhibiting typical serial-position phenomena.

This study was designed to study the nature of isolation effects on spelling. Specifically, answers were sought to the following questions: If more errors are made in the middle of a spelling word (serial-position phenomenon), will isolating the middle position reduce those errors (Von Restorff phenomenon)? Will the reduction be great enough to cause an overall reduction of errors for the entire word? Is the effect of isolation within a given spelling word independent of variations occurring within the list of words (context variables)? What context variables might influence the isolation within the individual words?

Onehundred sixth grade pupils were selected from seven private elementary schools in western Michigan. They were assigned randomly, to one of the following six conditions: control, constant-consistent

cuing, constant-consistent cuing control for color per se, constant-inconsistent cuing, intermittent-consistent cuing, and constant-consistent cuing shift. The Ss in all conditions were taught twelve spelling words by rote and learned all words to a criterion of two successive correct responses. A recall task was administered one week after the learning task.

The data were analyzed on an acquisition measure (trials to criterion) and a recall measure (words wrong on recall task). The results of these analyses did not support the hypothesis that isolating the middle three letters of a nine-letter spelling word would significantly aid the learning and recall of the words. The question of whether the effect of isolation within a given spelling word is independent of context variables was not answered by the results of this study.

The discovery of the sub-group from a school which taught a "whole" approach to spelling led to the hypothesis that isolation treatments would interfere with learning and recall for these Ss, but would have an opposite effect for the remaining Ss. This hypothesis was partially supported by evidence of significant interactions between the treatment effects and the sub-groups on both the acquisition and recall measures. Further clarification was sought by analyzing the sub-groups separately and the only significant main effects disclosed was on the recall measure for the "whole" group. Individual comparisons showed that the control group made significantly fewer errors than the other groups which did not differ significantly from each other.

It was noted that although almost all of the differences which existed among the various conditions were not statistically significant, the results for the "part" approach were all in the expected direction and the results for the "whole" approach were almost a mirror image of the "part" approach. It was suggested, therefore, that further research be conducted which would account more precisely for the variable of pretraining. The spelling task does lend itself to experimental manipulation and a number of future research problems were suggested.