AN ABSTRACT OF THE THESIS OF

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Title: INVESTIGATION INTO THE POSSIBILITY OF AN AUDITORY VON RESTORFF EFFECT

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It has been determined that when an item is isolated or made different in a list of homogeneous items, the learning of the isolated item will be facilitated. This phenomenon was first investigated by von Restorff and has since been known as the von Restorff effect. However, past research has utilized visual stimuli. The purpose of this study was to determine if a von Restorff effect could be demonstrated when auditory stimuli were employed.

In this study a serial learning task was employed which consisted of nine three-letter nouns that occur with equal frequency in English usage. Subjects for this experiment were thirty males and thirty females from Introductory Psychology classes at Emporia Kansas State College. The subjects were divided into a male control and experimental group and a

female control and experimental group with each group containing fifteen subjects. For the control groups the serial list was taped using a male voice. For the experimental groups the same serial list was taped in the same male voice except for the number six serial position which was taped in a female voice. The subjects learned by the anticipation method the order of the nine nouns to the criterion of two perfect consecutive trials. Statistical significance was determined through the use of a 2 X 2 analysis of variance.

Analysis of the data indicated that there was a significant difference in mean number of errors for serial position six between the isolated and non-isolated conditions. The significance was at the .01 level of probability. No significant difference was demonstrated between males and females at the .05 level of probability, and no significant differences were demonstrated at the other eight serial positions. The results of this study demonstrated that a von Restorff effect does occur when auditory stimuli are employed in learning a serial list of nouns.

INVESTIGATION INTO THE POSSIBILITY OF AN AUDITORY VON RESTORFF EFFECT

A Thesis

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the Department of Psychology

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by

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Approved for the Graduate Council

Chapter 1

INTRODUCTION

The development of the theoretical background will be discussed in this chapter. In addition to the theoretical background, the following sections are discussed: The statement of the problem, statement of hypotheses, purpose of the study, significance of the study, definition of terms, and the limitations of the study.

THEORETICAL FORMULATION

It has been found that when an "isolated" item is included in a list of relatively homogeneous items, the subjects learn the isolated item quickly as compared with non-isolated items. This phenomenon was first investigated by von Restorff, as reported by Koffka, and has thus been known as the von Restorff effect.[1]

Wallace, in a review of the literature, has shown the von Restorff effect to be a pervasive phenomenon.[2] It has been evident under a variety of tasks and conditions including serial learning tasks, paired-associate learning tasks, free recall, and immediate memory tasks.

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[1]Kurt Koffka, Principles of Gestalt Psychology (New York: Harcourt and Brace, 1935), pp. 481-492.

[2]William P. Wallace, "Review of the Historical, Empirical, and Theoretical Status of the von Restorff Phenomenon," Psychological Bulletin, 63 (1965), pp. 410-424.

Numerous attempts have been made to explain the von Restorff effect (e.g., Gibson,[3] Newman and Saltz,[4] and Green[5]). However, the original findings by von Restorff were interpreted in a Gestalt theoretical framework.[6] The neural trace was the construct employed to explain isolation. Each item in a list sets up a neural trace. When items are similar, as in a homogeneous list, their traces lose some of their individuality and form an aggregation. The aggregation provides a background against which the trace of a particular item can stand out. Von Restorff suggested that the item became isolated in the trace system. The processes of organization occurring within the trace system follow the same laws as the organization of perceptual stimuli. Thus, by the "law of similarity" a distinct item against a homogeneous background will be better retained because there is an aggregation of the traces of the homogeneous items causing any single item to lose its identity. The trace of the isolated item becomes the "figure" which stands out against the aggregated homogeneous traces, the "ground." Theoretically, the stimulus used to effect the trace systems, whether it be auditory or visual, should be of little consequence.[7]

Despite the long history of interest in the general nature of the

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[3]Eleanor J. Gibson, "Intra-list Generalization as a Factor in Verbal Learning," Journal of Experimental Psychology, 30 (1942), pp. 185-200.

[4]S. E. Newman and E. Saltz, "Isolation Effects: Stimulus and Response Generalization as Explanatory Concepts," Journal of Experimental Psychology, 55 (1958), pp. 467-472.

[5]R. T. Green, "Surprise as a Factor in the von Restorff Effect," Journal of Experimental Psychology, 52 (1956), pp. 340-344.

[6]Koffka, loc. cit.

[7]Ibid.

von Restorff effect dating back to Calkins' investigations, as cited by Wallace,[8] there has not been any systematic investigation to determine if an auditory von Restorff effect exists. The experimentation in the past has dealt exclusively with material presented visually. If the von Restorff effect is to be a truly pervasive phenomenon, the method used to isolate an item, whether it be visual or auditory, should make little difference.

THE PROBLEM

A well established finding in serial learning experiments is that when an item in a serial list is isolated or made different in a list of homogeneous items, the learning of the isolated item will be facilitated. However, previous research has utilized visual stimuli to the exclusion of auditory stimuli. The examiner therefore investigated if a von Restorff effect could be demonstrated when auditory stimuli were employed. Also, would there be a significant difference in learning between males and females as a female voice was isolated among a list of items in a homogeneous male voice?

Statement of the Problem

Can the von Restorff effect be demonstrated in a serial learning task with the use of auditory stimuli?

Is there a significant difference between males and females when a female voice is used to isolate an item from a male voice in a serial learning task?

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[8] M. Calkins, "Association: An Essay Analytic and Experimental," Psychological Review Monograph Supplement, No. 2 (1896), cited by Wallace, op. cit., p. 411.

Statement of the Hypotheses

The von Restorff effect cannot be demonstrated in a serial learning task with the use of auditory stimuli.

There is no significant difference between males and females when a female voice is used to isolate an item from a male voice in a serial learning task.

Purpose of the Study

This study was conducted to determine if the learning of an isolated item in a list of homogeneous items is facilitated when the items are presented auditorily rather than visually. If the von Restorff effect is a truly pervasive phenomenon, then it should be demonstrated with auditory stimuli, as well as visual stimuli.

Significance of the Study

The demonstration that an auditory von Restorff effect does exist, could have many implications in such fields as advertising and education as well as any other area where much of the material is presented through an auditory medium. It is presently being used by many people without the knowledge that it is in fact being used, and without the empirical evidence to demonstrate if it is being used in a manner that facilitates learning. Finally, it is hoped that this initial investigation into the auditory von Restorff effect will serve as a catalyst for further investigation into this area.

DEFINITION OF TERMS

Serial Learning

In serial learning certain responses are learned in an exact prescribed order. In serial memorizing, a set of words must be recalled in the order of first presentation.[9]

Isolated Item

To isolate an item refers to emphasizing that single item, e.g., printing one of the items in a distinctive type face.[10]

Homogeneous Items

Homogeneous items are items which show sameness or marked likeness in the quality or attribute under consideration.[11]

Intrusion Error

In serial learning experiments, substituting a response that was not in the original list, or making a response from the original list but in the wrong place is called an intrusion error.[12]

LIMITATIONS OF THE STUDY

This study was made with a sample of college students enrolled in Introductory Psychology classes at Emporia Kansas State College. There

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[9] Horace B. English and Ava Champney English, A Comprehensive Dictionary of Psychological and Psychoanalytical Terms (New York: David McKay, 1958).

[10] Ibid.

[11] Ibid.

[12] Ibid.

was no attempt to control for number of years in college or age, although most of the students who participated in the study were probably freshman of eighteen or nineteen years of age, as that is the usual class standing and age for Introductory Psychology students. Sixty subjects were used in this study and although it is felt that this is an adequate number, a larger sample could perhaps enhance the validity of the results. Since this study utilized college students, it is assumed that these subjects were more intelligent than the general population, and as such may have been a factor in the learning of a serial list.

Chapter 2

REVIEW OF RELATED LITERATURE

The purpose of this chapter is to review and examine all literature relating to the von Restorff effect. Included in this chapter are sections on the historical background, properties and characteristics, and interpretations of the von Restorff effect.

HISTORICAL BACKGROUND

In 1933 von Restorff reported a series of studies that concluded that when isolating an item against a crowded or homogeneous background, the learning of that isolated item will be facilitated. For example, von Restorff, as cited in Koffka,[13] presented a series of ten items to subjects followed by ten minutes of memorizing a meaningful text. On the first day, subjects were presented a list of ten different items (a word, a geometric figure, a number, etc.). On the second and third days, they were shown either a list of nine numbers and one syllable or nine syllables and one number. Compared to the recall of the unweighted repeated items, the isolated numbers placed against a homogeneous background showed higher recall scores. Much research has been done since then to confirm these original findings.

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[13] Koffka, loc. cit.

There are three major ways that isolation has been manipulated. The first one involves making a homogeneous item different by manipulating its physical appearance (e.g., printing it in red when the other items are printed in black).

A second way isolation may be produced is through direct manipulation of the items. This may be accomplished by inserting a different type of item within a list of homogeneous items (e.g., a nonsense syllable among nouns).

A third way isolation has been manipulated is through the structural organization within a list. The structural method was developed by Siegel to reduce intraserial interference differences between massed and isolated items.[14] Isolation is produced by embedding an item of one type within a series of items of the other type. A massed item is one preceded by terms from the same element type. This method makes use of two element types and the same number of items from each type.

There were several studies concerned with the effect of vividness on learning which antedated von Restorff's 1933 article. The early investigators were mainly interested, though, in discovering various factors which influence learning.

One of the first experimenters to explore vividness was Calkins, as cited in Wallace.[15] She attempted to assess the relative significance of frequency, vividness, recency, and primacy as conditions of

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[14]P. S. Siegel, "Structure Effects Within a Memory Series," Journal of Experimental Psychology, 33 (1943), pp. 311-316.

[15]Calkins, loc. cit.

association. A frequent item was one appearing two or three times in the list, while the first and last items represented the primacy and recency elements, respectively. Vividness was accomplished by varying size, color, or number of digits in the numerals that appeared in the list. Her results indicated that all conditions led to better recall with frequency and vividness showing the greatness influence.

Since vividness was accepted as a factor influencing recall, Jersild designed a study to compare different methods of producing vividness.[16] He read seventy statements of biographical facts to 253 subjects, and then tested for immediate recall of facts. He used six methods to make the sentences vivid. Sentences were preceded by an emphatic statement, followed by an emphatic statement, read louder than normal, accompanied by an articulate gesture, accompanied by the experimenter banging his fist on the table, or read slowly. The results indicated that all devices used except that of speaking slowly served to aid in recall. The most effective devices used appeared to be that of preceding or following a sentence with an emphatic statement.

The early studies just presented involved a single trial and free recall of the list. This method did not take into account ordinal position effects. Van Buskirk was the first to compare a vivid item with another item in the same position.[17] Vividness was accomplished by increasing the size of print and the color of a nonsense syllable in a

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[16] A. Jersild, "Primacy, Recency, Frequency, and Vividness," Journal of Experimental Psychology, 12 (1929), pp. 58-70.

[17] W. L. Van Buskirk, "An Experimental Study of Vividness in Learning and Retention," Journal of Experimental Psychology, 15 (1932), pp. 563-573.

list of nine. The results indicated that the vivid item had an advantage over the control items. Van Buskirk was the first to control for ordinal position of the items. It was not until the von Restorff experiments appeared though, that the vividness-isolation problem changed from one concerned with describing the effect to one of trying to explain why isolation of an item facilitates learning.

PROPERTIES AND CHARACTERISTICS

Influence of Isolation on Learning a List of Items

If an isolated item in a list is learned more readily than its non-isolated counterpart, then one may anticipate that the entire list containing the isolated item would be superior in learning over the list of all homogeneous items. Young and Supa were concerned with ascertaining the memory span of subjects for series of entirely similar elements as compared to the memory span of subjects for series in which the last three elements were different in kind than those that began the series.[18] They found longer memory spans for lists containing dissimilar types of materials than for lists containing all homogeneous items.

Smith and Stearns made direct comparisons of the overall learning of a thirteen-item list containing an isolated item and a thirteen-item homogeneous list.[19] All subjects learned both an isolated and a homogeneous list each day for five days. There was slight evidence for

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[18] C. W. Young and M. Supa, "Mnemic Inhibition as a Factor in the Limitation of the Memory Span," American Journal of Psychology, 54 (1941), pp. 546-552.

[19] M. H. Smith Jr. and Ellen G. Stearns, "The Influence of Isolation on the Learning of Surrounding Materials," American Journal of Psychology, 62 (1949), pp. 369-381.

higher recall scores for the lists containing the isolated item.

In contrast with the preceding reports, most studies have demonstrated that a list containing an isolated item, when compared to the homogeneous list does not enjoy any superiority in overall learning (e.g., Jensen, [20] Newman and Saltz,[21] and Steil and Hynum[22]). One conclusion may be that the facilitation in learning of an isolated item is obtained at the expense of other items in the list.

Effect of Isolation on Long Term Retention

Several investigators have reported that isolation enhances retention (e.g., Buxton and Newman,[23] Jones and Jones,[24] Kothurkar,[25] and Van Buskirk[26]). Postman and Phillips demonstrated slight evidence for better retention of isolated items after a twenty minute interval.[27]

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[20]Arthur R. Jenses, "The von Restorff Isolation Effect With Minimal Response Learning," Journal of Experimental Psychology, 64 (1962), pp. 123-125.

[21]Newman and Saltz, loc. cit.

[22]Peter Steil and Leslie Hynum, "The von Restorff Isolation Effect Employing One and Three Isolates," Psychological Reports, 27 (1970), pp. 963-966.

[23]C. E. Buxton and E. B. Newman, "The Forgetting of 'Crowded' and 'Isolated' Materials," Journal of Experimental Psychology, 26 (1940), pp. 180-198.

[24]F. N. Jones and Margaret H. Jones, "Vividness as a Factor in Learning Lists of Nonsense Syllables," American Journal of Psychology, 55 (1942), pp. 96-101.

[25]V. K. Kothurkar, "Learning and Retention of an Isolated Number of the Background of Meaningful Material," Indian Journal of Psychology, 31 (1956), pp. 59-62.

[26]Van Buskirk, loc. cit.

[27]L. Postman and Laura W. Phillips, "Studies in Incidental Learning: I. The Effect of Crowding and Isolation," Journal of Experimental Psychology, 48 (1954), pp. 48-56.

Saul and Osgood in a situation similar to Postman and Phillip's study could demonstrate no such effect after a twenty-four hour delay.[28] With a similar method and a fifty minute retention interval, Green also failed to show that the isolated items increased their advantage over the homogeneous items during the delay interval.[29]

Newman presented twenty-one subjects a single list of eight nonsense syllables and the subjects were later presented three similar lists in quick succession.[30] One may think of the single list as the isolated elements and the triple lists as the crowded elements. The crowded elements refer to those elements that are homogeneous. Relearning tasks were administered after one, twenty-four, and forty-eight hours. In terms of percentage savings scores, the triple lists showed little difference among time intervals while the single list declined steadily. However, after forty-eight hours the single list was still ahead of the crowded lists.

The major problem with the preceding studies is that they have not controlled for degree of learning, a factor known to have considerable influence on retention.[31] The isolated item is learned to a higher degree and more rapidly than its corresponding control item, as

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[28] E. V. Saul and C. E. Osgood, "Perceptual Organization of Materials as a Factor Influencing Ease of Learning and Degree of Retention," Journal of Experimental Psychology, 40 (1950), pp. 372-379.

[29] Green, loc. cit.

[30] E. B. Newman, "Effect of Crowding Material on Curves of Forgetting," American Journal of Psychology, 52 (1939), pp. 601-609.

[31] B. J. Underwood, "Degree of Learning and the Measurement of Forgetting," Journal of Verbal Learning and Verbal Behavior, 3 (1964), pp. 112-129.

demonstrated by tests of immediate recall. Any attempts to make comparisons on the retention of these items is then confounded by differences in degree of learning. For this reason it is difficult at this time to ascertain if isolation facilitates retention.

Spread of the Isolation Effect

Much attention has been accorded to the question of what effect isolating an item has on the immediate adjacent items. Jones and Jones presented a syllable list with isolation achieved by printing the seventh item in red with the remaining items as well as the items of the control group printed in black.[32]

There was a slight advantage for the sixth and eighth items in the isolated list as compared to their counterparts in the control list.

Smith obtained similar findings using a thirteen-item list of adjectives.[33] It was determined that the items on either side of the isolated term were recalled to a greater extent than were items on either side of the critical item in the control list. A subsequent study by Smith failed to replicate this finding,[34] and Smith and Stearns found a slight advantage to the item that followed the isolated term, but not on the item that preceded it.[35]

The spread of isolation studies considered thus far have

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[32] Jones and Jones, loc. cit.

[33] M. H. Smith Jr., "Spread of the Isolation Effect in Serial Learning," American Psychologist, 3 (1948), p. 235.

[34] M. H. Smith Jr., "The Influence of Isolation on Immediate Memory," American Journal of Psychology, 62 (1949), pp. 405-411.

[35] Smith and Stearns, loc. cit.

accomplished isolation by printing one item in a distinct color. Jenkins and Postman produced isolation by substituting a three letter noun in a list of nonsense syllables.[36] The control group received a list of nonsense syllables. Performance was significantly better in the control group on the item immediately following the critical item as was the item preceding it. To account for their results, Jenkins and Postman suggested that isolation attracts attention to the particular isolated item. Attention leads to increased rehearsal time and, consequently, a lowered rehearsal time for the succeeding items.

Tatuno established isolation in a manner similar to the above study by Jenkins and Postman, although he was unable to demonstrate consistent spread effects.[37] There did appear to be a slight inhibitive spread of the isolation effect to succeeding items.

It does not appear, at present, that any definite conclusions as to the spread of the isolation effect can be reached. There has been little evidence of enhancement of the immediately adjacent items when isolation was produced by substituting a different kind of material in the list. There has been some facilitation, however, when isolation was achieved by printing one item in a different color.

Stimulus Versus Response Isolation

Kimble and Dufort, using paired-associate lists, presented evidence that isolated pairs were learned faster than control pairs

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[36] W. O. Jenkins and L. Postman, "Isolation and Spread of Effect in Serial Learning," American Journal of Psychology, 61 (1948), pp. 214-221.

[37] T. Tatuno, "On the Effect of the Isolated Term and the Identical Term in Serial Learning," Japanese Psychological Research, 3 (1961), pp. 17-27.

when the isolation was among stimuli, but not when the isolation was among responses.[38] They presented ten pairs of meaningful words with two paralogs embedded among the stimuli for one group and among the responses for the second group. The isolated pairs were learned faster than the average of the massed pairs when paralogs were among stimuli. However, meaningfulness appears to be confounded with isolation in this study, since it is known that variations in response meaningfulness influence performance more than do variations in stimulus meaningfulness.[39]

Nachmias, Gleitman, and McKenna undertook a study to correct Kimble and Dufort's confounding.[40] They used three types of materials: two-place numbers, nonsense syllables, and five-letter adjectives. Materials were counterbalanced yielding twelve different paired-associate lists. The results obtained from sixty subjects revealed a significant von Restorff effect, but no main effect for type of isolation (stimulus or response) and no interaction. Isolation was effective among both stimuli and responses and to about the same extent.

Newman compared stimulus and response isolation produced by color

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[38] G. A. Kimble and R. H. Dufort, "Meaningfulness and Isolation as Factors in Verbal Learning," Journal of Experimental Psychology, 50 (1955), pp. 361-368.

[39] B. J. Underwood and R. W. Schulz, Meaningfulness and Verbal Learning (New York: Lippincott, 1960), pp. 267-271.

[40] J. Nachmias, H. Gleitman, and V. McKenna, "The Effect of Isolation of Stimuli and Responses in Paired Associates," American Journal of Psychology, 74 (1961), pp. 452-456.

or by meaningfulness.[41] The results indicated that when the stimulus term was isolated, performance was facilitated. However, when the response term was isolated, performance was facilitated if the isolation was produced by color, but not when it was produced with meaningfulness.

An explanation has been offered by Horowitz which accounts for the above findings in terms of a two-stage theory of paired-associate learning.[42] It was suggested that when either the stimulus or the response of a pair is dissimilar from other items, associative learning is facilitated. The pair will be learned rapidly if the isolated item is a stimulus, because only associative learning is required of it. If the isolated item is a response then response learning is also required of it, and its meaningfulness then becomes important. Greater difficulty in response learning with the low meaningful, isolated responses would then offset any advantages due to their isolation.

Comparisons of the distinctive term as a stimulus and as a response have also been attempted with serial learning tasks. Response comparisons are made by considering the learning of the isolated term as opposed to the control item. Stimulus comparisons are made by considering the learning of the term that immediately follows the critical item in each list.

Roberts constructed four fifteen-item serial lists composed of

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[41] S. E. Newman, "Paired Associate Learning as a Function of Stimulus Term and Response Term Isolation" (paper read at Psychonomics meeting, St. Louis, August 30, 1962).

[42] L. M. Horowitz, "Associative Matching and Intralist Similarity," Psychological Reports, 10 (1962), pp. 751-757.

meaningful words and paralogs.[43] He found an effect of isolation only for responses, and only when meaningful words were embedded in lists of paralogs. The findings of other investigators (e.g., Jensen,[44] Kimble and Dufort,[45] and Saltz and Newman [46]) have been consistent in demonstrating a von Restorff effect for the response term, but not as a function of stimulus isolation.

Newman and Saltz presented one of the few demonstrations of better recall for an item following an isolated item in a serial list than for an item following the non-isolated control item.[47] At this time these results are the exception rather than the rule.

Although it appears that the von Restorff effect is present only as a function of response isolation, difficulties in identifying the effective stimulus in serial learning (e.g., Horowitz and Izawa,[48] and Young[49]) would seem to make conclusions about stimulus and response isolation comparisons in a serial learning task somewhat tenuous.

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[43] W. A. Roberts, "A Further Test of the Effect of Isolation in Serial Learning," American Journal of Psychology, 75 (1962), pp. 134-139.

[44] Jensen, loc. cit.

[45] Kimble and Dufort, loc. cit.

[46] E. Saltz and S. E. Newman, "The von Restorff Isolation Effect: Test of the Intralist Association Assumption," Journal of Experimental Psychology, 58 (1959), pp. 445-451.

[47] Newman and Saltz, loc. cit.

[48] L. M. Horowitz and C. Izawa, "Comparison of Serial and Paired-Associate Learning," Journal of Experimental Psychology, 65 (1963), pp. 352-361.

[49] R. K. Young, "Tests of Three Hypothesis About the Effective Stimulus in Serial Learning," Journal of Experimental Psychology, 63 (1962), pp. 307-313.

To summarize these findings one must be cautious in interpreting the serial learning studies. With paired-associate learning, Horowitz's analysis appears to be sensible and does fit the data. However, with serial lists it is possible to obtain an isolation effect as a function of response isolation even when the isolated item is a paralog embedded in a high meaningful list (e.g., Kimble and Dufort,[50] and Saltz and Newman[51]). On the other hand, Roberts failed to find facilitation of learning when paralogs were isolated.[52] It may well be that response learning difficulty is suppressing the isolation effect to some extent, but other factors may also be involved.

Degree of Isolation and Ease of Learning

An important question one may raise concerns the effect of various degrees of isolation. For example, is an item that is made more distinct from other list members easier to learn than one that is made distinct from other members, but to a lesser degree?

Indications that there was a direct relationship between degree of isolation and speed of learning were presented in the original von Restorff paper.[53] When she increased the difference between repetitions and isolation, there was an accompanying effect of superior recall of isolated material.

Phillsbury and Raush extended the number of isolated items from one

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[50] Kimble and Dufort, loc. cit.

[51] Saltz and Newman, loc. cit.

[52] Roberts, loc. cit.

[53] Koffka, loc. cit.

to three to investigate how decreasing the degree of isolation would effect recall.[54] The isolated material maintained a clear advantage over the massed material, but it was gradually reduced as the number of isolated items increased.

Degree of isolation as it relates to ease of learning was also investigated by Gumenik and Levitt.[55] The degree of isolation of a nonsense syllable in a serial learning list was manipulated by varying the difference between the size of the isolated item and the size of the list's other items as all were projected on a screen. The isolated item was projected at one of four sizes, each being a constant fraction of the next largest size. It was found that ease of learning the isolated item was a direct linear function of the degree of isolation. The degree of isolation, however, had no significant effect on ease of learning non-isolated items, either at different serial positions, or in general.

It is now generally accepted that ease of learning an isolated item is directly related to the degree to which that item is isolated. However, further research is needed to determine why this is so.

Incidental Learning

Studies on incidental learning have raised the question of whether the von Restorff effect appears when subjects are not instructed to learn.

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[54] W. B. Pillsbury and H. L. Raush, "An Extension of the Kohler-Restorff Inhibition Phenomenon," American Journal of Psychology, 56 (1943), pp. 293-298.

[55] W. E. Gumenik and J. Levitt, "The von Restorff Effect as a Function of Difference of the Isolated Item," American Journal of Psychology, 81 (1968), pp. 247-252.

The typical procedure has been to compare the learning of a list between one group that was instructed to learn the list and a second group that was not instructed to learn the list.

It has been suggested by Mechanic that operations which increase the probability that subjects will make a differential response should facilitate learning.[56] If isolating an item may be considered as increasing the probability that a differential response will be made to that item, then one might expect a more pronounced isolation effect under these conditions.

Koyanagi compared incidental and intentional learning using three methods of manipulating isolation (color, material, and structural differences).[57] The ninth item in a seventeen-item, free learning list was isolated. Structural isolation was achieved by using two different types of material and had a before and after condition. An isolation effect was noted for intentional learners in all groups except the structural after condition and the isolation by color condition. The only isolation effect obtained for incidental learners occurred with the isolation by material condition.

The failure to find an isolation effect with intentional learners in the structural after condition is consistent with studies by Saul and

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[56] A. Mechanic, "The Responses Involved in the Rote Learning of Verbal Materials," Journal of Verbal Learning and Verbal Behavior, 3 (1964), pp. 30-36.

[57] K. Koyanagi, "Studies in Incidental Learning," II. Intraserial Interference," Tohoku Psychologica Folia, 15 (1957), pp. 1-12, cited by Wallace, op. cit., pp. 416-417.

Osgood,[58] Koyanagi,[59] and Saltzman and Carterette.[60] It is not consistent, however, with findings of Siegel[61] and Postman and Phillips.[62] In agreement with Koyanagi's[63] results are the consistent failures to obtain an isolation effect with incidental learners and structural isolation (e.g., Koyanagi,[64] Postman and Phillips,[65] and Saltzman and Carterette[66]).

Gleitman and Gillett failed to find a significant isolation effect for incidental learners with isolation by differences in material.[67] However, their results were in the direction favoring the isolated items. The isolated items did not have as high degree of isoaltion as did Koyanagi's study, therefore, one would expect less of an isolation effect.

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[58] Saul and Osgood, loc. cit.

[59] K. Koyanagi, "Studies in Incidental Learning: I. Intention of Learning and the Isolation Effect," Japanese Journal of Psychology, 27 (1957), pp. 270-278.

[60] I. J. Saltzman and T. Carterette, "Incidental and Intentional Learning of Isolated and Crowded Items," American Journal of Psychology, 72 (1959), pp. 230-235.

[61] Siegel, loc. cit.

[62] Postman and Phillips, loc. cit.

[63] Koyanagi, cited by Wallace, loc. cit.

[64] Koyanagi, "Intention of Learning and the Isolation Effect," pp. 270-278.

[65] Postman and Phillips, loc. cit.

[66] Saltzman and Carterette, loc. cit.

[67] H. Gleitman and E. Gillett, "The Effect of Intention Upon LEarning," Journal of General Psychology, 57 (1957), pp. 137-149.

It appears that intent to learn is an important variable influencing the von Restorff effect. There is little data to support a significant isolation effect among incidental learners.

Background Meaningfulness

Background meaningfulness has received some attention as a possible influence on the von Restorff effect. The question at hand is whether the magnitude of the von Restorff effect will vary as a function of the meaningfulness of the background stimuli (the homogeneous items in the list).

Rosen, Richardson, and Saltz compared the serial learning effects of an item typed in red among eight other items typed in black.[68] The two groups used contained either high or low meaningful items. The results revealed a significant main effect for isolation and a significant isolation by meaningfulness interaction. Isolation enhanced learning, and the enhancement was greater in the low meaningful list.

Similar types of studies by Kothurkar[69] and Samuels[70] appear to substantiate these findings. The studies to date have been consistent in demonstrating that the magnitude of the isolation effect decreases as a function of increasing background meaningfulness.

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[68] H. Rosen, D. H. Richardson and E. Saltz, "Supplementary Report: Meaningfulness as a Differentiation Variable in the von Restorff Effect," Journal of Experimental Psychology, 64 (1962), pp. 327-328.

[69] Kothurkar, loc. cit.

[70] S. Jay Samuels, "Relationship Between FOrman Intre-List Similarity and Magnitude of the von Restorff Effect," (Proceddings, 75th Annual Convention, American Psychological Association, 1967).

INTERPRETATIONS OF THE VON RESTORFF EFFECT

Many attempts have been made to explain the isolation effect. The two major directions that attempts at explanation have taken are; von Restorff and the Gestalt school of thought,[71] and Gibson's interference theory.[72]

Studies of Gestalt and Interference Theory

Von Restorff incorporated her original results in a Gestalt theoretical framework. The neural trace was the construct used to explain isolation. Each item in a list sets up a neural trace. In a homogeneous list the traces lose their individuality and form an aggregation which provides a background against which the trace of an isolated item can stand out and thus become isolated in the trace system. Thus, by the "law of similarity" a distinct item against a homogeneous background will be better retained.[73]

Gibson demonstrated that a paired-associate list with a "low stimulus generalization" tendency (dissimilar forms paired with nonsense syllables) was learned more rapidly than a list with a "high stimulus generalization" tendency (similar forms paired with nonsense syllables).[74] Gibson suggested that generalization occurs between the items of a list, and consequently, differentiation of the items is an important feature of

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[71] Koffka, loc. cit.

[72] Gibson, loc. cit.

[73] Koffka, loc. cit.

[74] Eleanor J. Gibson, "A Systematic Application of the Concepts of Generalization and Differentiation to Verbal Learning," Psychological Review, 47 (1940), pp. 196-229.

learning. Isolation increases this differentiation; therefore, an isolated item is learned more rapidly. Thus, Gibson made use of the concepts of interference and competing responses to generate von Restorff's results. Isolation aids discrimination and learning because it reduces interference from other list members.[75]

Siegel proposed to test the Gestalt explanation for the von Restorff effect.[76] Siegel used two item types (nonsense syllables and numbers) occurring with equal frequency within a free learning list. Isolation was achieved by preceding and following an item of one type with several items of the other type. His results were consistent with von Restorff's original findings. The isolated items were recalled better than the massed items. Siegel regarded his findings as strong support for Gestalt organizational laws of memory, but conceded that his results were also consistent with interference theory.

Saul and Osgood attempted to separate the isolation effects as they relate to original learning and memory by manipulating isolation structurally.[77] They duplicated Siegel's experimental design and added two delayed retention tests. They did not obtain a complete replication of Siegel's results. They found a significant isolation effect only for the first isolated item within the list. There was also no evidence of better retention of the isolated items after one or twenty-four hours. Interference theory can account for these results by claiming that the

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[75]Gibson, "Intra-list Generalization as a Factor in Verbal Learning," pp. 185-200.

[76]Siegel, loc. cit.

[77]Saul and Osgood, loc. cit.

second isolated item is subject to both proactive and retroactive interference from similar items, but intralist interference is mainly retroactive for the first isolated item. It is not clear how Gestalt theory can account for these results.

Stimulus and Response Generalization

Newman and Saltz made several predictions about isolation in serial learning emanating from the concepts of stimulus and response generalization. It was predicted that (a) the isolated item would be learned more rapidly than its non-isolated counterpart, (b) the isolated item would appear as an intrusion error less than the non-isolated control, (c) isolation should facilitate learning a response to the isolated item as a stimulus, and (d) learning a list with an isolated term should be more rapid than learning a control list.[78]

The above predictions by Newman and Saltz were tested by using a thirteen word serial list. In the isolated condition the seventh item was a paralog. The results demonstrated that isolation facilitated the learning of the isolated term and suggested that learning of a response to the isolated term as a stimulus was facilitated. The remaining two predictions received no support.

Roberts tested the possibility that the failure to find facilitation in learning the list with the isolated item occurred because the isolation did not sufficiently reduce generalization.[79] Roberts used three isolated terms among a fifteen-item list, and his

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[78] Newman and Saltz, loc. cit.

[79] Roberts, loc. cit.

results were consistent with those of Newman and Saltz. The results of this study are substantiated by Jensen,[80] and Steil and Hynum.[81]

Lively investigated Newman and Saltz's predictions in short term memory.[82] Isolation was produced at different list positions by embedding consonants among digits and digits among consonants. It was found, as predicted, that performance on the item following the isolated item was superior to performance on the comparable control item. The isolated item also appeared less often as an intrusion, which does not agree with previous research. Contrary to predictions, the isolated item was not recalled with greater frequency than the control item. Also, the list containing the isoalted item was not learned more rapidly than its control counterpart. The predictions made by Newman and Saltz may need to be revised since the research has been unable to completely substantiate them.

Organizing Influence of the Isolation Effect

In a free recall situation there is evidence that subjects organize their responses in some orderly fashion.[83] It may be inferred that organization is an important influence on the learning process, to the extent that recall reflects what occurs during learning. It has been suggested that the main benefit of manipulated isolation is in the

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[80] Jensen, loc. cit.

[81] Steil and Hynum, loc. cit.

[82] Barry L. Lively, "The von Restorff Effect in Short Term Memory," Journal of Experimental Psychology, 93 (1972), pp. 361-366.

[83] E. Tulving, "Subjective Organization in Free Recall of "Unrelated" Words," Psychological Review, 69 (1962), pp. 344-354.

serial organization of the list (e.g., Smith,[84] and Smith and Stearns[85]).

Smith and Stearns manipulated isolation by presenting one item in a serial learning list in red print, with the remaining items in black print.[86] The learning curves suggested that learning the isolated list was greater in the later stages of learning. It is suggested that this is due to the responses being known, the problem during this stage being to get them in the correct order. The red item aids in establishing order, thus, an advantage for the isolated list late in learning.

Gleitman and Gillett claimed that part of the von Restorff effect is due to the subject's deliberate attempts to organize the material.[87] Jensen,[88] Bone and Goulet,[89] and Goulet, Bone and Barker[90] have shown that learning those items per se in a serial list is not affected by isolation, but order of learning those items is affected. However, the organizing aid of the isolated item is specific to that item.

The isolated item does not appear to serve as an anchor point around which new items are learned. No evidence was found to suggest

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[84]Smith, "The Influence of Isolation on Immediate Memory," pp. 405-411.

[85]Smith and Stearns, loc. cit.

[86]Ibid.

[87]Gleitman and Gillett, loc. cit.

[88]Jensen, loc. cit.

[89]Ronald B. Bone and L. R. Goulet, "Serial Position and the von Restorff Effect," Journal of Experimental Psychology, 76 (1968), pp. 494-496.

[90]L. R. Goulet, R. N. Bone, and D. D. Barker, "Serial Position, Primacy and the Von Restorff Isolation Effect," Psychonomic Science, 9 (1967), pp. 529-530.

that the isolated item divides the serial lists into two parts, each learned serially. The data suggest that organizational aids are specific to the isolated item.

Surprise and Attention

Green suggested that better recall for the isolated item was due to the "surprise" aroused by being unexpectedly presented with a different type of item.[91] The first isolated item in a list will have greater "surprise value" than subsequent isolated items. Green tested his hypothesis by presenting twenty-item, free learning lists with two structurally isolated elements. The results supported his hypothesis.

Green proposed to reduce the surprise factor by instructions as to the nature of the list.[92] It was predicted that such instructions would reduce the recall of the first isolated item. The results supported his predictions to a limited degree. At the second isolated position, the instructed group displayed significantly better recall than the uninstructed group. Also, the differences between groups on the first isolated item were not as large as anticipated.

Deutsch and Sternlight examined Green's surprise hypothesis under conditions of absolute isolation by creating a situation in which the surprise value of an item was eliminated, but in which isolation still existed.[93] Under these conditions, superior learning of the isolated

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[91] Green, loc. cit.

[92] R. T. Green, "Surprise, Isolation, and Structural Change as Factors Affecting Recall of a Temporal Series," British Journal of Psychology, 49 (1958), pp. 21-30.

[93] Martin R. Deutsch and Manny Sternlight, "The Role of Surprise in the von Restorff Effect," Journal of General Psychology, 76 (1967), pp. 151-159.

item was obtained as compared to its homogeneous counterpart. These results suggest the inadequacy of the "surprise" explanation for the von Restorff effect.

Green revised his thinking on the von Restorff effect and suggested the possibility that "attention getting value" of structural change within a list was responsible for the better recall of the isolated item.[94] Green tested this by constructing free learning lists of twelve-items each (six nonsense syllables and six numbers). Green's results and the results of other investigators (e.g., Swartz, Pronko, and Engstrand,[95] and Kroll[96]), led to the suggestion that structural change, and the attention it attracted, was the relevant variable in the von Restorff effect.

Wing and Painter questioned Green's interpretation and attempted to replicate his study.[97] They used a free learning list of six three-letter nonsense syllables and six three-digit numbers, whereas Green used two-letter nonsense syllables and two-digit numbers. They failed to replicate Green's results although differences in procedure may explain the discrepant results.

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[94]Green, "Surprise, Isolation, and Structural Change as Factors Affecting Recall of a Temporal Series," pp. 21-30.

[95]P. Swartz, N. H. Pronko, and R. D. Engstrand, "An Extension of Green's Inquiry Into Surprise as a Factor in the von Restorff Effect," Psychological Reports, 4 (1958), pp. 431-432.

[96]Neal E. A. Kroll, "The von Restorff Effect as a Function of Method of Isolation," Psychonomic Science, 26 (1972), pp. 333-334.

[97]J. F. Wing and B. Painter, "Intraserial Interference versus Structural Change Explanations of Isolation Effects in Immediate Recall," (paper read at American Psychological Association, Los Angeles, September 9, 1964).

Both attention and organization are relatively unrefined concepts as used in explaining the von Restorff effect. The proponents of each position do not elaborate on why such factors lead to facilitation of learning. Consequently, their theories have remained at a descriptive level.

CONCLUSIONS

At the theoretical level, the von Restorff effect remains controversial. It appears that a combination of theories will be necessary to explain it adequately. That is, depending on the task and the method of manipulating isolation, different processes may be involved. It may be necessary to extend existing theories, but such extensions have yet to be developed and tested.

The literature does not contain any mention of testing for an auditory von Restorff effect. Jersild did present material verbally although it involved only a single trial and free recall of the list.[98] It also did not compare an isolated item to a control item and did not take into account ordinal position effects. It may therefore be concluded that the research is void of any experimentation to determine if an auditory von Restorff effect exists.

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[98] Jersild, loc. cit.

Chapter 3

METHODS AND PROCEDURES

The purpose of the methods and procedures was to objectively measure if isolation of an item in a homogeneous serial list of auditory items would facilitate learning. Included in this chapter are sections on population and sampling, procedure and data collection, materials and instrumentation, and data analysis.

POPULATION AND SAMPLING

The subjects for this experiment were sixty volunteers from Introductory Psychology courses at Emporia Kansas State College. The two control groups consisted of a group with fifteen males and a group with fifteen females. An identical number of subjects according to sex was used for each of the two experimental groups.

The subjects were experimentally naive in reference to learning experiments. They were randomly divided into the experimental or control groups by an assigned number and the use of a table of random numbers.

PROCEDURE AND DATA COLLECTION

The testing was done in an individual testing situation with the examiner present at all times. The testing was done in the psychology testing laboratory at Emporia Kansas State College and was free from

outside distraction. All testing was done in the late morning and early afternoon hours with the subjects being instructed to select a time when fatigue or hunger would not interfere in their performance. The nature of the study was not divulged until after all subjects had been tested. All subjects were told not to talk about the nature of the study with any classmates until the completion of the testing. When questions were raised concerning the instructions that were read to them, a simple paraphrasing proved to be sufficient.

MATERIALS AND INSTRUMENTATION

In this experiment a serial learning task was employed. The serial list consisted of three-letter nouns of equal occurrence obtained from Thorndike and Lorge[99] and as used by Steil and Hynum.[100] Equal occurrence of words was derived by Thorndike and Lorge by tabulating millions of printed words from a variety of sources. The order of the items in the serial list was: Man, Air, Dog, War, Hat, Fly, Oil, Ear, and Law. Careful consideration was given to the selection and order of the nouns to prevent possible common associations between nouns.

For the control group the serial list was taped using a male voice. The same serial list for the experimental group was taped in the same male voice except for the number six serial position (fly) that was taped in a female voice. Previous experiments have shown that in a nine

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[99] E. L. Thorndike and I. Lorge, The Teacher's Word Book of 30,000 Words (New York: Columbia University Press, 1944).

[100] Steil and Hynum, loc. cit.

item list, position six is generally the most difficult to learn.[101] Items in both lists were presented in a fixed order. There was a six-second interval between the presentation of each word, as the subjects needed an adequate amount of time to anticipate each item. The serial lists were taped on a standard cassette tape recorder. Fifteen consecutive identical recordings of the list were made to insure against the possible loss of concentration and consequent invalidation of the subject's responses due to rewinding the tape.

Each subject was tested individually and was urged to guess if uncertain. On each recall trial the correct recall, intrusion error, or error was noted. The experimenter sat behind the subjects to record the subject's reponses. This was done to prevent the subjects from getting any cues from the examiner. The procedure was repeated until the criterion of two perfect trials was reached.

Instructions presented to each subject were as follows:

> In the following experiment you are required to learn a list of words in the same order as you hear them presented to you from the tape recorder. There will be a six-second interval between words. After the presentation of each word you are to say verbally what the next word in the list will be. That is, anticipate what the next word will be. This procedure will be continued until you can recite perfectly the list for two consecutive trials. Please respond verbally and if you are not sure, please guess. The list will be played through once and you are to begin responding when you hear a tone that signals the start of the list again. If there are any questions, please ask them at this time.

Immediately after the instructions were read and questions answered, the experiment commenced.

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[101] Arthur R. Jensen, "An Empirical Theory of the Serial Position Effect," Journal of Psychology, 53 (1962), pp. 127-142.

DATA ANALYSIS

For this study the number of errors for each group was computed along with mean number of errors and standard deviations. The statistical procedure used to analyze the data was a 2 X 2 random effects analysis of variance. For the data analysis an error was defined as an intrusion error or a failure to respond.

Chapter 4

ANALYSIS OF DATA

This study was designed to investigate the possibility of a von Restorff effect when auditory stimuli are employed. This chapter will include how the data were analyzed, tables of means and standard deviations, and tables for the results of the 2 X 2 analysis of variance for each position.

STATISTICAL ANALYSIS

For this experiment the mean number of errors and the standard deviations were computed for each group and for each serial position as presented in Table 1. The null hypotheses under investigation were as follows:

> The von Restorff effect cannot be demonstrated in a serial learning task with the use of auditory stimuli.
>
> There is no significant difference between males and females when a female voice is used to isolate an item from a male voice in a serial learning task.

Table 2 indicates that there was no significant difference between mean number of errors for serial position one, at the .05 level of probability between the isolated and non-isolated condition and between males and females. There was no significant interaction effect. Thus, there was no significant difference between the control and experimental groups in the learning of serial position one.

Table 1

Means and Standard Deviations for Number of Errors for Each Serial Position in the Control and Experimental Groups

Control Groups

Position	Male Mean	Male SD	Female Mean	Female SD
1	.267	.457	.733	1.222
2	1.066	1.162	.800	.774
3	.933	.798	.333	.487
4	1.533	1.684	1.733	2.153
5	2.066	1.907	1.666	1.112
6	2.800	2.596	2.600	1.919
7	2.066	2.051	1.733	1.579
8	2.066	2.086	1.733	1.437
9	2.466	2.356	1.400	.828

Experimental Groups

Position	Male Mean	Male SD	Female Mean	Female SD
1	.666	1.175	.400	.910
2	.600	.736	.733	1.099
3	.933	.798	1.000	1.511
4	1.533	1.684	1.466	1.641
5	1.466	1.245	1.466	1.457
6	1.600	1.502	1.000	1.558
7	1.600	1.638	1.200	1.698
8	2.133	1.684	1.600	1.121
9	1.866	.915	1.600	1.183

Table 2

Summary Table of Analysis of Variance
For Number of Errors at Position 1

Source	df	SS	MS	F	p
A (type of list)	1	.017	.017	.017	NS
B (sex)	1	.150	.150	.153	NS
A X B	1	2.017	2.107	2.060	NS
Error	56	54.800	.979		
Total	59	56.984			

An F of 4.00 was necessary for significance at a probability of .05.

Table 3 indicates that no significant difference between mean number of errors exists between the experimental and control conditions for serial position two, at the .05 level of probability and that there was no significant interaction effect. Consequently, the learning of serial position two was not affected by sex or by the type of list.

The statistical analysis for serial position three indicates, as seen in Table 4, that no statistical difference between mean number of errors exists at the .05 level of probability. There was also no significant difference obtained for an interaction effect. There was no significant difference in the learning of serial position three due to the variables of sex or type of list that was learned.

Table 5 indicates that no significant difference exists between mean number of errors at serial position four at the .05 level of probability. There was no significant difference obtained for the interaction effect. No significant difference in learning between

Table 3

Summary Table of Analysis of Variance
For Number of Errors at Position 2

Source	df	SS	MS	F	p
A (type of list)	1	1.066	1.066	1.151	NS
B (sex)	1	.066	.066	.071	NS
A X B	1	.601	.601	.649	NS
Error	56	51.867	.926		
Total	59	53.600			

An F of 4.00 was necessary for significance at a probability of .05.

Table 4

Summary Table of Analysis of Variance
For Number of Errors at Position 3

Source	df	SS	MS	F	p
A (type of list)	1	4.266	4.266	3.983	NS
B (sex)	1	.066	.066	.061	NS
A X B	1	.268	.268	2.50	NS
Error	56	60.000	1.071		
Total	59	64.600			

An F of 4.00 was necessary for significance at a probability of .05.

subjects according to sex and type of list was obtained for serial position four.

The analysis of the data for serial position five as seen in Table 6 indicates that no significant difference exists between mean number of errors at the .05 level of probability. There was no significant interaction effect obtained. Thus, the learning of serial position five was equal for males and females and for those in the isolated and non-isolated conditions.

Table 7 indicates that there was a significant difference between mean number of errors at the .01 level of probability between the isolated and non-isolated conditions at serial position six. However, there was no significant difference between males and females and there was no significant interaction effect at the .05 level of probability. This indicates that the subjects in the isolated condition learned item six quicker than those in the non-isolated condition. There was no difference in learning though, between males and females.

The analysis of the data for serial position seven as seen in Table 8 demonstrates that no significant difference between mean number of errors exists at the .05 level of probability. The data also indicate that there was no significant interaction effect. Consequently, the learning of serial position seven was not affected by sex of the subject or the type of list the subject learned.

The analysis of the data as shown in Table 9, for serial position eight, demonstrates that no significant difference between mean number of errors exists at the .05 level of probability. The data indicate that there was no significant interaction effect. The learning of serial position eight was the same for all subjects.

Table 5

Summary Table of Analysis of Variance
For Number of Errors at Position 4

Source	df	SS	MS	F	p
A (type of list)	1	1.667	1.667	.520	NS
B (sex)	1	.267	.267	.083	NS
A X B	1	.066	.066	.021	NS
Error	56	179.334	3.202		
Total	59	181.334			

An F of 4.00 was necessary for significance at a probability of .05.

Table 6

Summary Table of Analysis of Variance
For Number of Errors at Position 5

Source	df	SS	MS	F	p
A (type of list)	1	2.400	2.400	1.122	NS
B (sex)	1	.600	.600	.281	NS
A X B	1	.600	.600	.281	NS
Error	56	119.734	2.138		
Total	59	123.334			

An F of 4.00 was necessary for significance at a probability of .05.

Table 7

Summary Table of Analysis of Variance
For Number of Errors at Position 6

Source	df	SS	MS	F	p
A (type of list)	1	29.400	29.400	7.782	.01
B (sex)	1	2.400	2.400	.635	NS
A X B	1	.600	.600	.158	NS
Error	56	211.600	3.778		
Total	59	244.000			

An F of 4.00 was necessary for significance at a probability of .05

Table 8

Summary Table of Analysis of Variance
For Number of Errors at Position 7

Source	DF	SS	MS	F	p
A (type of list)	1	3.750	3.750	1.222	NS
B (sex)	1	2.016	2.016	.657	NS
A X B	1	.017	.017	.006	NS
Error	56	171.867	3.069		
Total	59	177.650			

An F of 4.00 was necessary for significance at a probability of .05.

Table 10 indicates that no significant difference between mean number of errors exists for serial position nine at the .05 level of probability. There was no significant interaction effect obtained. Thus, the learning of serial position nine was not affected by the sex of the subject or the type of list learned by the subject.

Based on the results of this experiment, the von Restorff effect was demonstrated with the use of auditory stimuli and thus the null hypothesis was rejected. The results also indicate that there was no significant difference between males and females, thus, the null hypotheses that states that there would not be a significant difference between males and females was accepted.

Table 9

Summary Table of Analysis of Variance
For Number of Errors at Position 8

Source	df	SS	MS	F	p
A (type of list)	1	.017	.017	.006	NS
B (sex)	1	2.817	2.817	1.072	NS
A X B	1	.150	.150	.057	NS
Error	56	147.200	2.628		
Total	59	150.184			

An F of 4.00 was necessary for significance at a probability of .05.

Table 10

Summary Table of Analysis of Variance
For Number of Errors at Position 9

Source	df	SS	MS	F	p
A (type of list)	1	.600	.600	.283	NS
B (sex)	1	6.666	6.666	3.146	NS
A X B	1	2.400	2.400	1.133	NS
Error	56	118.667	2.119		
Total	59	128.333			

An F of 4.00 was necessary for significance at a probability of .05.

Chapter 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The organization and findings of the study are discussed in this chapter. Suggestions are made as to how the data may be utilized and the course that future research might take. Included in this chapter are sections on the summary, conclusions, and recommendations.

SUMMARY

The von Restorff isolation effect was examined with the use of auditory stimuli, as previous research has dealt exclusively with visual stimuli. The purpose of this study was to determine if the use of a female voice among a list of items presented by a male voice would facilitate learning. Also, since a female voice was isolated among a list presented by a homogeneous male voice, would there be a significant difference between males and females. Sixty subjects learned by the anticipation method the serial order of nine three-letter nouns to the criterion of two perfect consecutive trials. All subjects learned the same responses with only stimulus properties of the isolated item in the experimental treatment being altered. Statistical significance was determined through the use of a 2 X 2 analysis of variance. Participation in this study was strictly voluntary. The subjects were assigned randomly to the control or experimental group by an assigned number and a table of random numbers.

CONCLUSIONS

Analysis of the data indicated clearly that there was a significant difference between mean number of errors for serial position six between the isolated and non-isolated conditions. The significance was obtained at the .01 level of probability. However, no significant difference between mean number of errors could be demonstrated for males and females and there was no significant interaction effect at the .05 level of probability at serial position six. There were no significant differences demonstrated at the other eight serial positions. The important feature of this data is that a von Restorff effect does occur when auditory stimuli are employed. The results are consistent with the well documented existence of the von Restorff effect when visual stimuli are used.

This initial investigation into the auditory von Restorff effect, if substantiated, could have important effects wherever verbal materials are employed. It could aid the educator in knowing when to use an inflection of the voice to gain the maximum effect. Advertisers would be aided in knowing when and how to use a different voice, or exclamatory remark, to draw maximum attention to their product.

The visual von Restorff effect is already utilized in education and advertising. The important concept in a textbook that is underlined or in boldface type is an example of how it is used in education. Advertisers use similar methods as can be seen in advertisements that use boldface type, larger printing, or a different color to draw attention to their place of business, product, or to inform the public about sales and promotions. It is felt that it is only a matter of time before verbal

material may be manipulated in much the same manner. It is up to future research into the auditory von Restorff effect to demonstrate how this can be best accomplished.

RECOMMENDATIONS

Although this study clearly indicates the existence of an auditory von Restorff effect it is only a preliminary study, and as such, would support the apparent need for future research into this particular phenomenon. It is hoped that future research would utilize a larger sample, a more varied sample in terms of educational background, and control the variable of age more closely. These additional controls would enhance the validity of future findings. Since this study utilized a female voice among male voices a study to investigate if the results from this study could be replicated using a male voice among homogeneous female voices should prove enlightening. It seems apparent that other sources of stimuli besides three letter nouns could be used in the future, as there should not theoretically be any difference in the results obtained. An interesting way to manipulate future results would be to vary the degree of isolation, or make the difference between voices more distinct or similar, to discover if this has an effect on learning. There are many different ways future studies may be designed with the most immediate need being to see if the results obtained from this study can be replicated.

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