THE AVAILABILITY IN MEMORY OF ITEMS THAT ARE

CUED TO BE FORGOTTEN

By

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PREFACE

This experiment is concerned with the availability of forget items and how to-be-remembered and to-be-forgotten material is processed. The increase in the number of forget words that were recalled when a retrieval cue was used and when a retrieval cue was not used in both a blocked and unblocked condition was examined. A completely randomized two by two by two analysis of variance along with four planned comparisons between the remember and forget words without a retrieval cue, between the remember and forget words with a retrieval cue, between the forget words with and without a retrieval cue in the unblocked condition, and between the remember words with and without a retrieval cue in the unblocked condition were performed.

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CHAPTER I

INTRODUCTION

History

The directed forgetting paradigm dates back to a study by Muther (1965) who tested free recall with three conditions; precueing subjects to disregard certain letters, postcueing the subjects to disregard certain letters, and a control condition with the irrelevant letters that were disregarded in the previous conditions removed. He found that recall was better in the control condition than in either the post or precueing conditions. When Muther looked at the errors he found that the cued out letters occurred significantly more than did other letters. The first time it was recognized as directed forgetting, though, was in a study by Bjork, LaBerge and Legrand (1968) when they investigated whether or not subjects could reduce proactive interference of a verbal item if the subjects were signalled just prior to the presentation of a second item that they could forget the first item. The results were that recall of later items was better when the first item had a forget instruction attached to it than when it did not. Recall, however, still was not as good as when only one item was presented. Apparently, subjects could to some extent in this task, selectively forget the first item, thereby reducing the proactive effect on the second item.

Directed Forgetting

Basically the directing forgetting paradigm involves giving the subjects signals to forget particular items that have been presented. There are many ways to present these signals but the primary difference falls into two dimensions: (a) whether subjects are cued to forget or remember sets of items or are cued item by item, and (b) the temporal position of the cue relative to the to-be-remembered items (R-items) and the to-be-forgotten items (F-items) (Bjork, 1972). Subjects can be presented the items in lists one by one and then cued at some time either to forget or to remember the items presented prior to the signal thus making it nearly impossible for the subject to anticipate when an F-cue will appear (Bjork, 1970; Elmes, 1969a, 1969b; Block, 1971).

There is a question, however, about how the F-cue exerts its influence on the processing of information in this task. One interpretation suggests that the effect of having a subject forget certain items comes from differences encountered during the initial processing or the "selective rehearsal" account. Selective rehearsal determines only if an item gets stored in memory, it does not deal with the type of rehearsal that differentiates the accessibility or the availability of items already stored. There are two types of strategies that can be employed with selective rehearsal: (a) each item being elaboratively processed from the time it is presented, but the elaborative processing is discounted for F-items after the F-signal has been presented (Craik & Watkins, 1973), and (b) the items are maintained by rote repetition until their related instruction has been presented and then only the R-items are given further elaborative processing (Woodward, Bjork &

Jongeward, 1973).

One alternative conception is that of "selective search" or that the effect of instructing subjects to forget certain items has to do with a discrimination of the instruction sets after they have already been stored. Specifically what is supposed to happen is that the R-items and F-items are stored separately with R-items having a higher priority for retrieval (Block, 1971; Gardiner, Craik & Birtwistle, 1972). Epstein, Massaro & Wilder (1972) and Epstein & Wilder (1972) conducted experiments which supported the selective search hypothesis. By varying the time available for rehearsal, either filling the postcue interval with an interpolated activity or leaving the interval blank, Epstein, Massaro & Wilder (1972) tested the selective rehearsal hypothesis. The selective search hypothesis was examined by comparing the effectiveness of the forget cue (where the cue was given after each word) in recall and on a matching test, which insured that the search set was identical with and without a forget cue. The results indicated that the forget cue provided the subject with a list tag that can be used to eliminate the F-items as acceptable responses when tested. Epstein & Wilder (1972) continued the research on selective search. Using a paired-associate probe type of procedure, subjects were occasionally tested for F-items. When the subjects were not informed that they were being tested for the to-be-forgotten material, recall was very low. When the subjects were informed that they were being tested for the to-be-forgotten material, recall was equal to lists where no forget cue was used which provides evidence that subjects can maintain selective search.

Possibly the explanation lies in a compromise between the two

alternatives as suggested by Robert Bjork (1970, 1972) where both selective search and selective rehearsal are important. Bjork's compromise states that both selective search and selective rehearsal are instrumental in the processing of to-be-forgotten and to-be-remembered material with selective rehearsal operating during the initial processing and selective search operating after the material has been stored. MacLeod (1975) in an experiment supported Bjork's compromise. He found that both recognition and cued recall were better for the R-items than the F-items. This advantage persisted even after a one week delay. Since the directed forgetting effect did not diminish over the retention interval, it suggests that there is no breakdown in the differentiation of F and R-items in storage. He then proposed an explanation wherein the directed forgetting effect is related to selective rehearsal during the initial processing and to the presence of instruction information stored with the individual items. There is, however, another explanation for the previous results other than selective search or selective rehearsal and this is set differentiation, a hypothesis set forth by Jongeward, Woodward & Bjork (1975). This hypothesis was derived from the subject's "incredible" ability to differentiate R-items and F-items no matter what the conditions (either giving sufficient time for rehearsal or not). This incredible ability was demonstrated by the significant difference between the number of R-items and F-items that were recalled in both conditions. Set differentiation states that F-items and R-items are separated during input and then differentially rehearsed with R-items getting more rehearsal time than F-items, so that in the case of the items being blocked, all R-items would receive the same amount of rehearsal and all F-items would receive the same

amount of rehearsal. Selective search, on the other hand, states that all items, whether F or R, are given the same amount of rehearsal to get them stored in memory, but are then tagged or rehearsed so that R-items are more accessible. Jongeward et al. (1975) feel that set differentiation will eventually replace both selective search and selective rehearsal as the explanation for the processing of to-be-forgotten and to-be-remembered material.

Cued Recall

One aspect to the problem of how to-be-forgotten and to-be-remembered material is processed is the question of the availability of F-items in memory. Tulving & Pearlstone (1966) found that subjects could recall some words very easily from a list of words. By assuming that subjects learn each word at the time of its presentation in the sense that the probability of recalling a word rises from a value of near zero before the presentation to a value close to one immediately after presentation, the failure to recall certain words reflected intratrial forgetting (Tulving, 1964). However, intratrial forgetting, which is only a descriptive label, does not carry any implications as to the fate of the memory traces of the items that are not recalled. Tulving & Pearlstone (1966) worked on the hypothesis that intratrial forgetting represents a failure to "find" otherwise intact traces in the storage. To test this hypothesis they used cued recall and found that the number of words recalled when cues were used was higher than the number of words recalled without cues. They called the words that were retrieved without cues, accessible, while those that were retrieved only with cues were called available.

The use of cues to increase the number of items recalled has been used many times in other experiments with the same results (Tulving & Thomson, 1971; Cohen, 1963). Tulving & Osler (1968) found that cue words or retrieval cues facilitated the recall of R-items when they appeared at both the input and the output and that retrieval cues did not enhance the recall of R-items if they were only presented at the time of the output. Their main conclusion from these results was that retrieval cues will facilitate recall of R-items, but only when the information about them and the relationship between the retrieval cues and the R-items is stored at the same time as the information concerning the words membership in the to-be-remembered group. In another experiment by Thomson & Tulving (1970) it was found that the effectiveness of retrieval cues depends on how strongly associated the cues are to the R-items. Cues that were given during the presentation of the items improved recall even if the cues were not strongly associated to the items. When the cues were only given at the time of recall even though they might have been strongly associated to the items, recall did not differ from noncued recall.

An aspect of cued recall has been demonstrated in experiments designed to illustrate the Gestalt viewpoint in memory. Asch (1969) used pairs of nonsense syllables (like Dat-Nic) with subjects being instructed to pronounce the pairs either as a fused unit ("Datnic") or as separate syllables ("Dat"-"Nic"). Arnold & Bower (1972) used (consonant vowel)-(consonant) pairs with some subjects being instructed to pronounce each unit of the pair separately (Lo-M) and the others told to fuse the units into a single syllable (Lom). In all cases recall, when the first syllable (either Dat or Lo) was given to the subject, was

about twice as good for subjects given unitary pronunciation instruc-
tions than for subjects told to use separate-unit pronunciation. The
part of the word used as the cue is also important. A study by
Horowitz, White & Atwood (1968) had results that showed that the
beginning fragment of a word elicited the correct response more readily
and with the shortest latency. The middle fragment elicited a correct
response least readily and with the longest latency. Thus the best cue
when using a part of a word as a cue is the first part of the word.

Hypothesis

The hypothesis of this experiment is that words that subjects are
told to remember (R-words) are accessible whereas, words that subjects
are told to forget (F-words) are available. When the question of the
availability of F-words is answered, another problem, that of the impor-
tance of input or output mechanisms in the processing of to-be-forgotten
and to-be-remembered material, is also answered. If the F-words are
found to be available, especially in the unblocked condition (when the
R or F cue is given after each word) where rehearsal is at a minimum,
then selective search or output mechanisms are very important in the
processing of to-be-forgotten and to-be-remembered material, probably
even more than selective rehearsal or input mechanisms.

The question of the availability of F-words will be tested by com-
paring the number of F-words recalled with and without the use of a
retrieval cue. If the number of F-words recalled is greater with the
aid of a retrieval cue than without, it would indicate that information
does get input which is not accessible without a cue thus implicating

output factors as responsible. The strongest form of this result would occur if performance on the F and R-items with cueing were the same.

The other factor that this experiment is using to examine the question of the importance of output versus input mechanisms in the processing of R and F-words is blocked and unblocked cueing, or giving the cue to forget or remember after a group of words or after each word. This aspect of the experiment is important because in the unblocked condition rehearsal of F-words is negligible since the forget cue is given right after the word. Thus if the increase in the number of words recalled in the unblocked condition is greater when a retrieval cue is used than when there is no cue, it is probably not due to a rehearsal mechanism but due to an output mechanism.

CHAPTER II

METHODS

Design

The design used was a 2 x 2 x 2 factorial with all three factors
between subjects. The factors were the temporal location of the cue
(blocked, where the cue came after a group of five words and unblocked,
where the cue came after each word), the type of instruction cue to be
used (R, remember and F, forget), and retrieval cues (retrieval cues
used and retrieval cues not used).

Subjects

One hundred and twenty subjects taken from the undergraduate psy-
chology courses at Oklahoma State University were used. Subjects were
randomly assigned to one of four groups at a particular testing session
(since instructions for the blocked and unblocked conditions were dif-
ferent they could not be tested together) with the testing sessions
alternated.

Materials

The equipment used was a Kodak thirty-five millimeter carousel
slide projector, forty slides with words of three or more syllables of
approximately the same language frequency, twenty slides with the letter
R, twenty slides with the letter F, two sets of instructions (for the

unblocked and blocked factors), and four sets of answer sheets (recall F-words, recall R-words, recall F-words given the first syllable of word as a cue, recall R-words given the first syllable of word as a cue).

Procedure

After every subject participating in the experiment had arrived, an instruction sheet, which also contained an answer sheet, was passed out. Subjects were asked to read the instructions but not to turn to the second page or answer sheet. The subjects were then asked if there were any questions. Next using a slide projector the words were flashed onto the screen.

For the blocked condition each block consisted of five words shown at the rate of two seconds per word. A cue to either remember (R) or forget (F) was then shown for two seconds. Eight groups of words were shown in random order (four remember and four forget) with the only restriction being that no more than three groups having the same remember or forget instruction appear consecutively. The unblocked condition had the words shown on the screen followed by an R or F cue at the rate of two seconds per word or cue. The words were randomized with the only restriction being that no more than three words having the same remember or forget instruction appear consecutively.

After the entire list of words was presented the subjects were asked to turn to the answer sheet and were given five minutes for recall. The subjects were told that they could leave before the five minutes were up if they had finished. Questions concerning the experiment were then answered if the subjects had any. Finally the subjects

were asked not to tell what they had to do during the experiment.

Scoring

Scoring of the recall tests was done by counting the number of right answers the subject had written down. Misspelled words were counted as being right although if only a form of the word was written down (e.g., murder instead of murderer) it was counted as an error.

CHAPTER III

RESULTS

Analysis of Variance

A 2 x 2 x 2 (blocking x instruction cue x retrieval cue) analysis of variance was performed on the data. All three main effects, blocking, $F(1, 112) = 6.14$, $p < .05$; instruction cue, $F(1, 112) = 36.07$, $p < .01$; retrieval cue, $F(1, 112) = 307.65$, $p < .01$ were found to be significant. Finding a significant result for the blocking main effect shows that there is a difference in the way the words are presented. There are more words recalled when the instruction cue is given after each word (unblocked) than when the instruction cue is given after a group of words (blocked). A significant result for the instruction cue main effect showed that there was a difference in the number of R and F words recalled. A greater number of R-words were recalled than F-words. Significance in the third main effect, retrieval cue, showed that more words were recalled when a retrieval cue was used than when a retrieval cue was not used.

The blocking x instruction cue interaction and the blocking x instruction cue x retrieval cue interaction were both non-significant. An $F(1, 112) = .44$, $p > .05$, for the blocking x instruction cue interaction and an $F(1, 112) = .09$, $p > .05$ for the three way interaction of blocking x instruction cue x retrieval cue. The blocking x retrieval

cue interaction, however, was significant, $F(1, 112) = 6.14$, $p < .05$ (see Figure 1, Appendix D). This significant result was due to a larger difference between the number of words recalled with a retrieval cue and without a retrieval cue in the unblocked condition than in the blocked condition.

The most important result that was found was a significant instruction cue x retrieval cue interaction, $F(1, 112) = 5.68$, $p < .05$. A significant instruction cue x retrieval cue interaction shows that there is a greater difference between the number of R-words and F-words recalled without the aid of a retrieval cue than with a retrieval cue. This type of result is only possible if output mechanisms or selective search was an important element in the processing of F and R material.

Planned Comparisons

Four planned comparisons (t-tests) were computed on the data from the experiment: (1) between the F and R instruction cues with a retrieval cue, (2) between the F and R instruction cues without a retrieval cue, (3) between the conditions with and without a retrieval cue for the R-words in the unblocked condition, and (4) between the conditions with and without a retrieval cue for the F-words in the unblocked condition.

The result of the t-test between the R and F instruction cues when a retrieval cue was not used was significant, $t(28) = 3.138$, $p < .01$. A greater number of R-words were recalled than F-words if the subjects were not given a retrieval cue. However, the difference between the number of R-words and F-words recalled when a retrieval cue was used was not significant, $t(28) = .518$, $p > .05$. If a selective rehearsal

mechanism was operating during the processing of F and R material, and selective rehearsal only determined whether an item got stored in memory, this result would not be expected. There should have been a significant difference between the number of R-words and F-words recalled even if a retrieval cue was used.

The t-test in the unblocked R condition with the use of a retrieval cue and without a retrieval cue was not significant, $t(28) = 1.97$, $p > .05$. The t-test in the unblocked F condition with the aid of a retrieval cue and without a retrieval cue, however, was significant, $t(28) = 3.05$, $p < .01$. This result shows that a significantly greater number of F-words were recalled when a retrieval cue was used than when a retrieval cue was not used, which could only occur if at least some of the F-words were available in memory.

CHAPTER IV

DISCUSSION

Evaluation of Results

The most important result of this experiment was the significantly
greater increase in the number of F-words recalled when a retrieval cue
was used compared with the increase when a retrieval cue was not used.
This significant increase supports the hypothesis that F-words are
available in memory. The availability of F-words, which was supported
by this experiment can be interpreted as support for the selective
search hypothesis for the processing of F and R material. If rehearsal
to get items into memory were the only mechanism involved in the proc-
essing of F and R material there should be no increase in the number of
F-words recalled when a retrieval cue is used as compared to when a
retrieval cue is not used. Since there was an increase in the number of
words recalled some output or research mechanisms are being used in the
processing of R and F material.

When this increase in the number of F-words is looked at in the
blocked condition only the conclusion that output mechanisms are part of
the total picture of how F and R material is processed. Rehearsal still
can occur in the blocked condition since the F-cue is given after a
group of words. However, in the unblocked condition the instruction cue
is given after each word so that the amount of rehearsal given to

the F-words should be negligible. Yet there was an increase found in the number of F-words recalled between when a retrieval cue was used and when a retrieval cue was not used, significant at the .01 level. If the amount of rehearsal given to the F-words is negligible then rehearsal could not be involved in the increase. If, however, selective search or output mechanisms play an important part in the processing of information this type of result would be expected. An increase in the number of F-words recalled when a retrieval cue is used could only occur if the output mechanisms were part of the processing operation. With this occurring also in the unblocked condition where rehearsal of F-words is negligible it tends to support a selective search hypothesis probably without the use of any input mechanism in the processing of F and R material.

If rehearsal, necessary to get the items stored, was a relevant factor in the processing of F and R material then even with the aid of a retrieval cue, there should be a significant difference between the number of R-words and the number of F-words recalled. The results of this experiment showed that there was not a significant difference between the number of R and F-words recalled when a retrieval cue was used. The amount of rehearsal that is necessary to store items in memory thus, probably is not the determining factor in the processing of R and F material. Selective search, however, states that the difference between R-items and F-items is that they are stored differentially with R-items more accessible. A significant difference between the number of R and F-words when a retrieval cue was used would not be expected if selective search was the main determining factor in the processing of F and R material.

An interesting thing happened during this experiment. Due to an oversight by the experimenter the same retrieval cue (pri) was used for both an F-word (primitive) and an R-word (privilege). Errors due to this oversight were expected in the recall of the F-words (finding privilege instead of primitive), but none were expected in the recall of the R-words (finding primitive instead of privilege). However, this substitution of primitive did occur. In the blocked condition five out of the fifteen subjects who were asked to recall the R-words given a retrieval cue substituted primitive for privilege, while in the unblocked condition six out of the fifteen subjects made the same substitution. If rehearsal or input mechanisms were involved in the processing of F and R material then the substitution of privilege for primitive would probably be found, but the substitution of primitive for privilege would probably not. If, on the other hand, output mechanisms were involved in the processing of F and R material this type of error would not only be possible but probable especially in the unblocked condition where rehearsal is negligible.

Future Research

Future research will be needed to provide an answer to the question of how F and R material is processed. A possible future experiment to try to answer the question would be to combine the procedures used by Jongeward et al. (1975) in their experiment with the procedures used in this experiment. In the Jongeward et al. (1975) experiment the amount of rehearsal time given to the subjects was varied. Some subjects were given sufficient time to rehearse both the F and R-words while the other subjects were not given sufficient time for rehearsal. If the amount of

rehearsal time (whether the time is sufficient or not) is added to using a retrieval cue and if the same results occur (significance in the increase in the number of F-words recalled when a retrieval cue is used when there is not sufficient time for rehearsal) it would lend considerable support for the selective search type of hypothesis, especially if it could be replicated by different experimenters.

Another addition that could be made in future experimentation would be a recognition test. If a recognition test, which is the ultimate retrieval cue, was included in the experiment it could add support to one of the hypotheses of how F and R material is processed. If selective rehearsal is more important in the processing of F and R material then a recognition test should not significantly increase the number of F-words that are correctly guessed compared with the number of F-words that are correctly recalled, however, if there is a significant increase then the selective search hypothesis is supported. Recognition would help to support one hypothesis over the other along with the variation of rehearsal time if added to the present experiment. One problem, though, would be getting the subjects since this type of between subjects design would require approximately 165 subjects.

The difference between the number of R and F-words recalled without the aid of a retrieval cue in the blocked condition was just barely significant at the .05 level. This was probably due to the number of words that were placed in each block. In most experiments (MacLeod, 1975; Jongeward et al., 1975) either three or four words at the most were placed in a block. This experiment, however, had five words per block. Seeing five words before the subject sees the instruction cue can allow the subject to learn more of the F-words than if he saw only

three or four. Thus the number of F-words recalled would be greater for a block of five than for blocks of only three or four, and the difference between the number of R and F-words recalled without the aid of a retrieval cue would be smaller. In a future experiment the number of words in the block should be reduced to three or four instead of using five. By reducing the number of words in a block it should give the experimenter more blocks which would also give a better random pattern to the words.

Summary

This experiment sought to show the availability of F-words and with this result show that output mechanisms play an important part in the processing of F and R material. By comparing the difference in the number of F-words that were recalled with and without the aid of a retrieval cue in both the blocked and unblocked conditions, the availability of F-words was found. When a significant difference was achieved in both the instruction by retrieval cue interaction in the analysis of variance and in the pertinent planned comparisons (between the number of F-words recalled with and without a retrieval cue in both the blocked and unblocked conditions) especially in the unblocked condition, it supported a selective search type of processing hypothesis. This meant that output or search mechanisms most likely were more important than encoding mechanisms in the processing of R and F material. Future experimentation was discussed with possiblities for another experiment which would include the present procedures but also adding a variable concerning the amount of rehearsal time given, lowering the number of words within a block and a recognition test. With these changes a future experiment

could lend more support to either a selective search or selective
rehearsal type of hypothesis for the processing of F and R material.

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APPENDIXES

APPENDIX A

INSTRUCTIONS

INSTRUCTIONS FOR SUBJECTS IN THE

BLOCKED CONDITION

You are about to participate in an experiment involving directed forgetting. The directed forgetting effect is where you are told to use some sort of signal to forget some words you are shown and to remember the other words. Although this type of task may seem simple it does give us quite a bit of information about how a person remembers. This is not a test of your intelligence or personality. If at any time you feel you cannot complete this experiment please notify the experimenter at once.

You will be shown a list of words one at a time on the screen. After a group of words have appeared on the screen the letter R or F will appear. When an R is shown this is a signal for the previous group of words to be remembered and that you will probably be asked to recall them at the end of the experiment. These words will be called R-words. When an F appears after the words it means that the previous group of words are to be forgotten and that you will probably not be asked to recall them. These words will be called F-words. Your best strategy lies in trying to remember the R-words and trying to forget the F-words. You will be given five minutes to recall the words. If there are any questions concerning the instructions please ask the experimenter now. Thank you for your cooperation and any questions you might have concerning the experiment itself will be answered at the end of the experiment.

INSTRUCTIONS FOR SUBJECTS IN THE

UNBLOCKED CONDITION

You are about to participate in an experiment involving directed forgetting. The directed forgetting effect is where you are told to use some sort of signal to forget some words you are shown and to remember the other words. Although this type of task may seem very easy it does give us quite a bit of information about how a person remembers. This is not a test of your intelligence or personality. It at any time you feel you cannot complete the experiment please notify the experimentor at once.

You will be shown a list of words one at a time on the screen. After each word the letter R or F will be flashed on the screen. When the letter R appears this is a signal that the previous word is to be remembered and that you will probably be asked to recall it at the end of the experiment. These words will be called R-words. When an F appears on the screen this means that you will probably not be asked to recall this word and that you should try to forget it. These words will be called F-words. Your best strategy lies in trying to remember the R-words and trying to forget the F-words. You will be given five minutes to recall the words. If there are any questions concerning the instructions please ask them now. Thank you for your cooperation and any questions concerning the experiment itself will be answered after the experiment is over.

APPENDIX B

ANSWER SHEETS

ANSWER SHEET FOR THE RECALL OF R-WORDS WITHOUT

THE USE OF A RETRIEVAL CUE

Please write down all of the R-words that you can recall.

ANSWER SHEET FOR THE RECALL OF F-WORDS WITHOUT

THE USE OF A RETRIEVAL CUE

Please write down all of the F-words you can recall.

ANSWER SHEET FOR THE RECALL OF F-WORDS WITH

THE USE OF A RETRIEVAL CUE

Please recall all of the F-words and write them below. You will
also find the first syllable of the words below to help you in your
task.

for-

mis-

gi-

do-

mod-

reg-

lux-

mis-

fed-

el-

mul-

em-

fi-

par-

ba-

at-

pri-

ig-

glo-

pov-

ANSWER SHEET FOR THE RECALL OF R-WORDS WITH

THE USE OF A RETRIEVAL CUE

Please recall all of the R-words and write them below. You will also find the first syllable of the words below to help you in your task.

pro-

hol-

ma-

af-

pen-

re-

fes-

or-

con-

ob-

mos-

gen-

pi-

fre-

di-

pri-

ab-

mur-

phy-

hor-

APPENDIX C

TABLES

TABLE I

ANALYSIS OF VARIANCE SUMMARY TABLE

	Degrees of Freedom	Sum of Squares	Mean Square	F-Ratio	Critical F
Blocking	1	22.54	22.54	6.14	
Instruction Cue	1	132.31	132.31	36.07	
Retrieval Cue	1	1128.54	1128.54	307.68	
Blocking x Instruction Cue	1	1.63	1.63	.44	3.84 (5% Level)
Blocking x Retrieval Cue	1	22.52	22.52	6.14	
Instruction Cue x Retrieval Cue	1	20.82	20.82	5.68	
Blocking x Instruction Cue x Retrieval Cue	1	.32	.32	.09	6.90 (1% Level)
Within Subjects	112	410.80	3.67		
Total	119	1739.48			

TABLE II

TABLE OF MEANS

Variable	n	Mean
Blocked-Recall R Without Retrieval Cue	15	4.267
Blocked-Recall F Without Retrieval Cue	15	1.467
Unblocked-Recall R Without Retrieval Cue	15	4.933
Unblocked-Recall F Without Retrieval Cue	15	1.333
Blocked-Recall R With Retrieval Cue	15	8.60
Blocked-Recall F With Retrieval Cue	15	7.667
Unblocked-Recall R With Retrieval Cue	15	10.667
Unblocked-Recall F With Retrieval Cue	15	9.067

TABLE III

LIST OF R-WORDS AND THEIR CUES

Words	Cue	Words	Cue
Affection	Af	Horizon	Hor
Festival	Fes	Absolute	Ab
Murderer	Mur	Proposal	Pro
Mosquito	Mos	Reflection	Re
Privilege	Pri	Holiday	Hol
Obstacle	Ob	Ornament	Or
Diamond	Di	Constitute	Con
Penetrate	Pen	Physical	Phy
Frequency	Fre	Majesty	Ma
General	Gen	Piano	Pi

TABLE IV

LIST OF F-WORDS AND THEIR CUES

Words	Cue	Words	Cue
Domestic	Do	Gigantic	Gi
Missionary	Mis	Poverty	Pov
Paragraph	Par	Banana	Ba
Primitive	Pri	Attractive	At
Luxury	Lux	Financial	Fi
Elephant	El	Misfortune	Mis
Ignorance	Ig	Federal	Fed
Embarrass	Em	Multiply	Mul
Glorious	Glor	Modify	Mod
Forbidden	For	Regulate	Reg

APPENDIX D

FIGURES
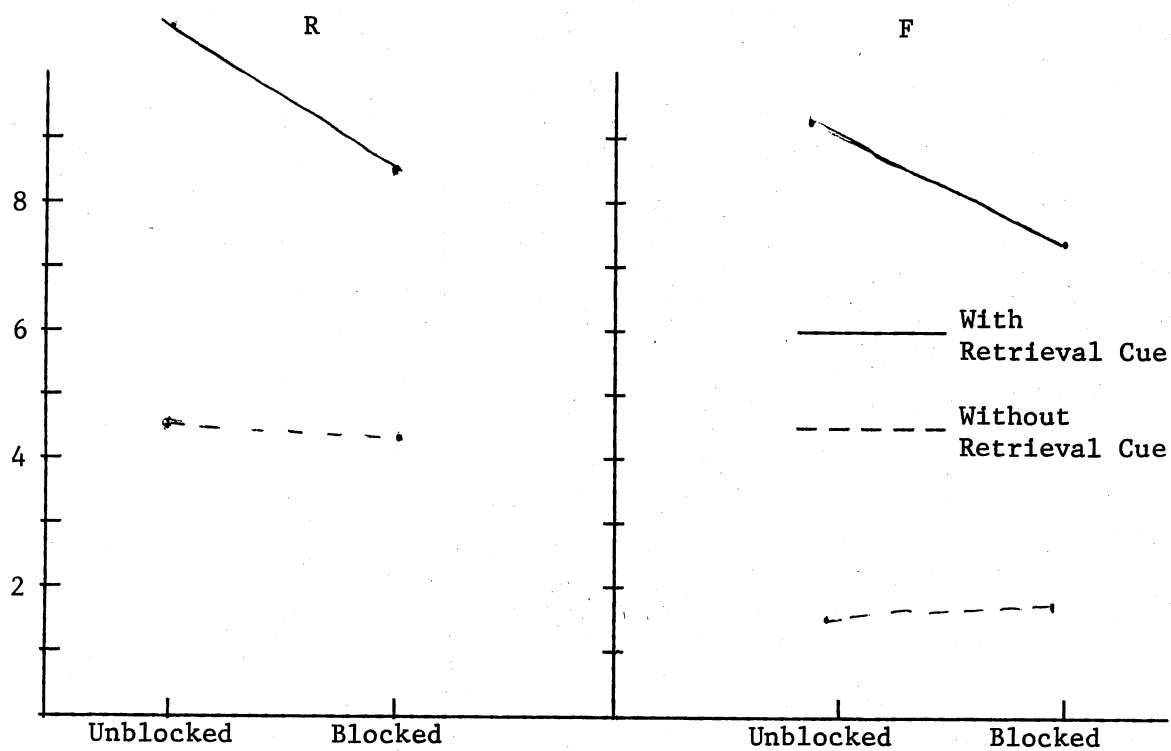
Figure 1. Blocking x Retrieval Cue Interaction
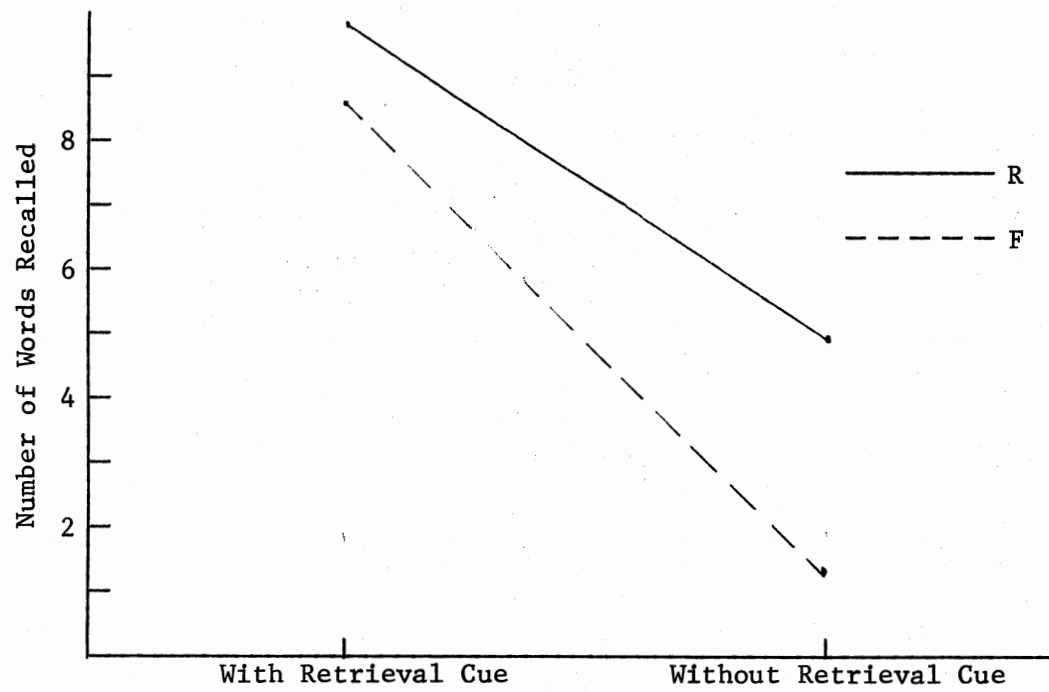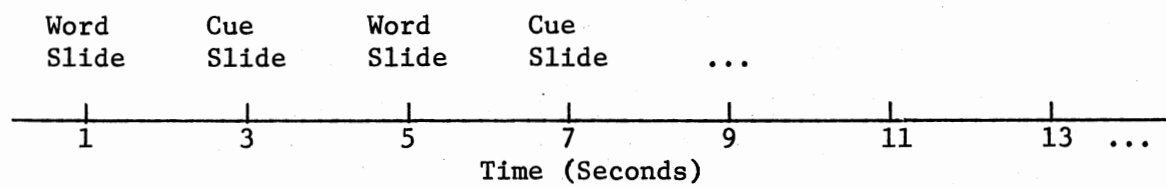
Figure 2.   Instruction Cue x Retrieval Cue Interaction

```
Word        Cue         Word        Cue
Slide       Slide       Slide       Slide       . . .
```

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——+————————+————————+————————+————————+————————+————————+————
  1        3        5        7        9       11       13  . . .
```

Time (Seconds)

Figure 3. Diagram of the Presentation of the Cues and Words
           in the Unblocked Condition

Word Slide	Word Slide	Word Slide	Word Slide	Word Slide	Cue Slide	Word Slide
1	3	5	7	9	11	13

Time (Seconds)

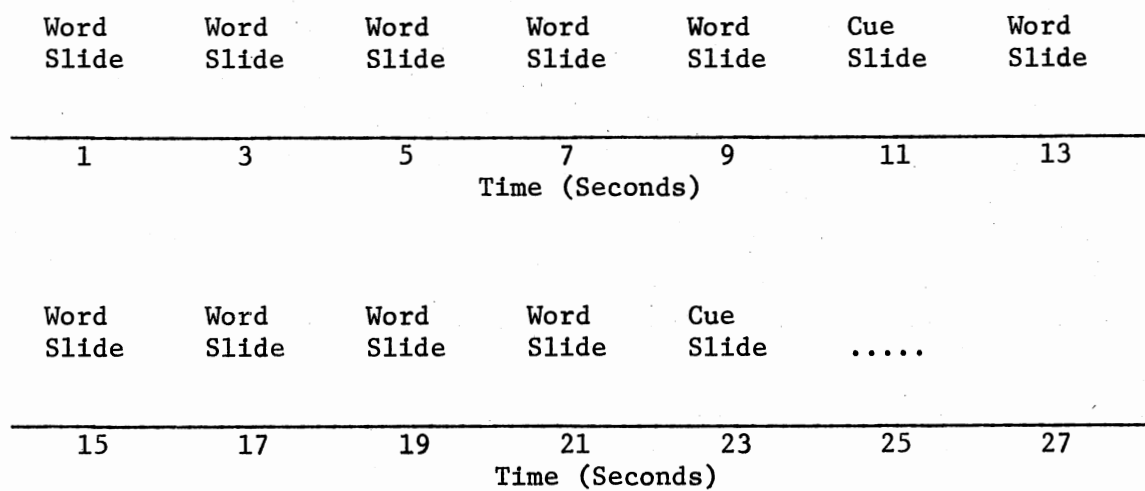| Word Slide	Word Slide	Word Slide	Word Slide	Cue Slide	.....	
15	17	19	21	23	25	27

Time (Seconds)

Figure 4. Diagram of the Presentation of the Cues and Words
in the Blocked Condition

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VITA

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