The Effects of Different Levels of Processing on Memory Performance

An Honors Thesis (ID 499)

by

Peggy G. Adams

Thesis Director

Dr. Gary F. Meunie

Ball State University

Muncie, Indiana

May, 1974
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Introduction</td>
<td></td>
</tr>
<tr>
<td>i. Review of Literature</td>
<td>1</td>
</tr>
<tr>
<td>ii. Statement of the Problem</td>
<td>2</td>
</tr>
<tr>
<td>II. Method</td>
<td></td>
</tr>
<tr>
<td>i. Subjects</td>
<td>2</td>
</tr>
<tr>
<td>ii. Experimental Apparatus</td>
<td>2</td>
</tr>
<tr>
<td>iii. Description of the Experiment</td>
<td>3</td>
</tr>
<tr>
<td>III. Results and Discussion</td>
<td></td>
</tr>
<tr>
<td>i. Results</td>
<td>4</td>
</tr>
<tr>
<td>ii. Discussion</td>
<td>5</td>
</tr>
<tr>
<td>iii. Conclusions</td>
<td>6</td>
</tr>
<tr>
<td>IV. References</td>
<td>7</td>
</tr>
</tbody>
</table>
Since the time when the Petersons (1959) did their work on the psychology of short-term memory, research in the area of memory has increased. The Petersons found that recall of individual verbal units decreased with the length of the retention interval. Later work has shown that amount of long-term retention is affected by knowledge of a final recall task. (Meunier, 1974 and Meunier, 1972).

Taking a somewhat different angle of attack, some recent experiments have attempted to find differences in long-term retention based on the type of rehearsal. Bergman (1968) found forgetting curves for nouns which were to be recalled using various types of cues: semantic, phonetic, graphic, and contiguity. Bergman found that recall was better for the semantic cues. The general results of his experiment supported the idea that the primary difference between short-term memory (STM) and long-term memory (LTM) is the nature of the holding mechanism. In some recent work done by Elias and Perfetti (1973), it appeared that semantic encoding of information leads to better recognition memory. This semantic encoding seems to be "the nature of the holding mechanism" for long-term memory. Elias and Perfetti state in their report that the storage of semantic information is undoubtedly the main characteristic of long-term storage.

Another point of view on memory research is proposed by Craik and Lockhart (1972). They propose that memory is a function of the depth of processing and that stimuli may be retained over a short period by
processing at a constant depth. The depth of processing implies a
greater degree of semantic or cognitive analysis. Craik and Lockhart also
propose that when attention is diverted from the processing of information
the information will be lost at a rate appropriate to the level of
processing, i.e. the deeper the level, the slower the loss.

The current experiment attempted to combine ideas from several of the
above approaches. Basically, it tried to discover if the amount of
rehearsal affects retention at each of two levels of processing. The
shallow level consisted of orthographic processing and the deeper level
consisted of semantic processing. The amount of rehearsal was varied
by having S's answer one, two, or three questions about a number of
stimulus words. The questions pertained to either orthographic or semantic
aspects of the word. In order to control for possible effects of
knowledge of a final recall test, half of the S's were informed of the final
test at the beginning of the experiment, and half were not. According to
Craik and Lockhart's model, it was expected that retention would be
better for those items processed semantically, and the amount of retention
would vary with the amount of rehearsal.

METHOD

The S's were one-hundred twenty-eight Ball State University students
enrolled in introductory psychology classes. The students were given
extra course credit as incentive for participation in the experiment.

The stimulus items were thirty-six words selected from a sample
compiled by Kucera and Francis (1967). These words were chosen from a
group of words which appear approximately two times per one-hundred thousand words. Four other similar words were also presented, but they served only as buffer items. Two of the buffer words were presented before the thirty-six stimulus words and two after.

The stimulus words were presented, one at a time, onto a standard movie screen using a Kodak Carousel slide projector. Each word was presented for seven seconds after which time it was automatically removed from the screen. The experiment was conducted with groups of S's ranging from two to six subjects per group. Each member of a group of S's was given a forty-page booklet containing pages of questions to be answered about the stimulus words, one page per word.

Each group of S's was given the same set of instructions with one exception: half of the groups were informed that they would be tested for recall after all of the words were presented, while the remaining S's were not so informed. This divided the S's into aware (A) and unaware (UA) groups. The S's in all groups were instructed to answer the question or questions on the first page for the first word, the second page for the second word, etc. The nine possible questions were read to the S's before the experiment began. Also, the S's were able to see the questions for the next stimulus item before the stimulus was presented. In each booklet the questions for the buffer words were the same. The types of questions were divided into two groups, orthographic and semantic. The actual questions are presented in table 1. Orthographic and semantic questions were never mixed on any page, and the number of questions to be answered on each page was either one, two, or three. The pages of questions were randomized in each booklet. This resulted in a 2 x 3 design
Semantic Questions

Is the word an animate or inanimate object?
If it is animate, is it plant or animal?
If animal, is it a vertebrate or invertebrate?
If plant, is it flowering or non-flowering?
If it is inanimate, is it a natural or artificial object?
If inanimate, is it a solid or a liquid?

Orthographic Questions

How many letters are there in the word?
How many vowels are there in the word?
Which letter from this word occurs last in the alphabet?

Table 1.

yielding six possible combinations of type and number of questions per page. Each combination appeared six times within the thirty-six pages for the thirty-six stimulus words. Each question on a page constituted a rehearsal of the stimulus item.

The amount of time between presentation of the stimulus items varied with the amount of time required for the S's to finish answering all of the questions on a page, but it averaged out to be about five seconds. After all of the stimuli and buffer words were presented, the S's were given five minutes to write as many of them as they could. Both A and UA S's were instructed in like manner concerning the final recall test.

RESULTS AND DISCUSSION

An analysis of variance was done on the data. The four buffer words were not included in the analysis in order to minimize any primacy or recency effects. There was no difference found in the amount of recall
between A and UA groups. Therefore, the data from both of these groups were combined for the other analyses. The results are presented in the following graph:

A significant interaction was found between the amount of processing and the level at which the processing occurred. There was no difference in recall for the orthographically processed items. The amount of recall remained about the same despite the increase in amount of processing. With semantic processing, however, the amount of recall increased directly as the number of questions, i.e., the amount of processing, increased. Therefore, it appears that extra processing of stimuli is not beneficial or has no significant effect at a shallow level of processing; but at a deep level of processing, extra rehearsal does augment later recall.

One relationship which was not analyzed specifically was the possibility of a difference in retention of animate and inanimate words within the semantic processing group. The experimental paradigm was based on the assumption that there were two and only two levels of processing being utilized; one for the semantically processed words and one for the
orthographically processed words. The three orthographic questions all appear to be at the same level. The six semantic questions, when viewed with an animate-inanimate division of questions, appear to have some variability in level of processing. The first of these semantic questions in the table is, of course, common to the two groups. The difference occurs among the remaining questions. For the inanimate items, the questions do not appear to delve as deeply into the nature of the object as do the questions about the animate items. This could lead to a difference in level of processing for the two groups, both being processed at a deeper level than items which were orthographically processed. If this was the case, the curve for semantically processed animate items and semantically processed inanimate items would average out to be the curve seen in the graph for the semantically processed words. This possibility will need to be studied further.

Taking the semantically processed group as a whole and comparing it with the orthographically processed group, and ignoring the above possible differences, Craik and Lockhart's model is supported: the amount of rehearsal aids retention when processing is carried out at a deep level (semantic) but not when processing is at a shallow level (orthographic); and the amount of recall is greater for the more deeply processed items.
REFERENCES


