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EFFECTS OF TASK INSTRUCTIONS AND PASSAGE DIFFICULTY ON SEMANTIC AND NON-SEMANTIC PROCESSING OF LINGUISTIC IDEAS[1]

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Summary.—An active role in learning was assumed by the 80 volunteers in this experiment. Three independent variables were manipulated, knowledge of a recognition test, voicing an opinion about the passage, and the difficulty of passage. Three factorial analyses of variance showed significant main effects for knowledge of a recognition test and difficulty of passage on the nonsemantic section of the recognition task; significant three-way interactions of knowledge of the recognition task and voicing of an opinion and difficulty of the passage on the combined questions and on the semantic questions. The results fall within the depth of processing framework of Craik and Lockhart (1972).

Currently, in the psychology of learning, there is an interest in studying events which promote the development of durable memory traces for linguistic ideas. The quality of event or the depth of analysis which the subject brings to the presented material, and the magnitude to which this analysis is developed determine the amount of processing the material will receive, e.g., whether it will be processed either semantically or non-semantically, as well as the durability of the memory trace.

Craik and Lockhart (1972) have developed a single-process framework of memory which offers some explanations concerning the organizational processes involved in memory. They hypothesize that the persistence of the memory trace is a function of the depth of processing (the amount and type of rehearsal), with deeper levels of processing being associated with more elaborate, longer lasting, and stronger traces. In a more recent study by Wilson and Tyler (1976), the more a subject attended the more strongly was meaning of that material stored in memory. It seems evident that the quality of event which a subject creates around a stimulus plays an important function in the processing of linguistic ideas.

The purpose of this study was to analyze those conditions which aid subjects in directing their attention to the presented material. In this manner, it is believed that we can examine those external conditions which encourage subjects to rehearse the material better to process it to a semantic or deeper level. The use of the term, subject's selective learning, is applicable because the subject experiences a series of events and has the flexibility to employ any event or combination of events which help facilitate the subjects' deeper analysis of the ma-

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terial. Seaman and Murray (1976) have found that subjects were able to determine the depth of processing the presented material would receive by varying their perceptual analysis.

In the study conducted by Sachs (1967), the quality of event, i.e., the amount and type of perceptual analysis which a subject focuses on specific words or sentences and the type of memory processing these words or sentences received as a result, was an important factor, as was the type of memory storage employed, i.e., short- or long-term, and the type of learning, intentional or incidental. Her results showed understanding of a sentence or paragraph was not contingent upon the adding up a cluster of meanings or individual words. Rather it was based on the understanding of the meaning which the clustered words express.

Many previous experiments have manipulated variables such as the rate of presentation, the number of presentations of the list, and the type of recognition questions, to find their influence on the subject's perceptual analysis of the material (Mechanic, 1964; Bransford & Franks, 1971). The depth to which the material was processed was under the control of the experimenter. The subject assumed a passive role in the experiment. We deem it necessary to allow the subjects a more active role so we can investigate those conditions selected by subjects to process the presented material more easily to a semantic level. In a way this approach to learning focuses attention on the conditions occurring during the encoding phase rather than concentrating on the natural, organizational processes incurred during the storage or retrieval phases. In other words, one might ask what conditions will direct the subject's analysis of the presented material so that encoding and future retrieval of the information is facilitated? This experiment attempted to analyze learning from this standpoint and to establish a framework from which future experiments and modifications could be made.

The independent variables were knowledge of a recognition task following the presentation of a paragraph, the voicing of an opinion about the material heard, and the difficulty of the passage. It was hypothesized that the group given instructions to voice an opinion after the presentation of a paragraph, knowledge of a recognition task, and presented a difficult passage would score higher on recognition than any other group because this group would process the information more deeply than the other groups. Thus, the three-way interaction among these variables was predicted to be significant.

Method

Subjects

Subjects were 80 undergraduates, 47 females and 33 males, all of whom were non-psychology majors. All subjects volunteered. One subject was discarded because of an inability to answer the questions on the recognition task correctly without the aid of the experimenter.

Apparatus

The equipment employed consisted of an Arrow tape recorder Model No. C-2600 and 8 cassette cartridge tapes (which contained the instructions for each group as well as the passage they were to hear). Also, a questionnaire was used for the recognition test. The two passages were based on a paragraph taken from a seventh grade religion book (Ehlan, 1974, p. 201). The easier passage was quoted verbatim from this source. The second, more difficult passage, contained the same concepts as the first. However, the vocabulary and sentence structure were made more complex so as to require a more advanced reading level.

Procedure

The eight groups were formed by orthogonally combining the three variables, knowledge of a recognition test or no knowledge, voicing of an opinion or not voicing an opinion, and easy or difficult passage. There were 10 subjects in each group. The subjects were assigned to groups through a process of residual randomization. Each subject was presented with one passage.

Each subject was asked to sit comfortably and relax in a chair before the experiment began. After about 1 min. the subject was instructed to pay attention to the tape. The subject then heard the instructions, then the tape recorder was turned off, and the experimenter instructed the subject to follow along the passage (which was to be heard on the tape) with a written copy of the paragraph. The subject was then told not to read faster than the voice on the tape nor to reread any of the material. Then the tape recorder was started again and the passage was replayed.

After the completion of the paragraph, the subjects in the "no-voicing-opinion" groups immediately received the recognition test, while the subjects in the "voicing-an-opinion" groups voiced their opinion of the passage they had heard before being given the test. It took about 40 sec. for those who voiced an opinion to do so.

The recognition test consisted of 18 multiple-choice questions (10 relating to the non-semantic aspects of the passage and 8 related to the semantic content). The subject was given an unlimited amount of time to complete the recognition test. Each subject was told to answer every question and not to review or change any previously answered one.

The independent variables were knowledge of a recognition task, voicing of an opinion, and difficulty of paragraph. The dependent variable was the number of correct responses made on the recognition task. Three $2 \times 2 \times 2$ factorial analyses of variance were performed on the data: the first was on total correct scores on the recognition task; the second was on total correct scores on the non-semantic section of the recognition task; the third was on total correct scores on the semantic section of the recognition task.

Results

Data were analyzed by three $2 \times 2 \times 2$ factorial analyses of variance with eight independent groups and 10 observations per group. The first analysis was on total scores, the second on scores for the non-semantic questions only, and the third on scores for the semantic questions only. The analyses were run on a 4053 computer.

On the analysis for total scores, the only significant effect was the three-way interaction ($F = 4.58$, $p < .05$, $MS = 23.11$). As can be seen in Table 1, the group that had knowledge of a recognition task, voiced an opinion, and received the difficult passage performed significantly better than any other group on total correct scores. Also, those who were in the voicing of an opinion groups performed better on the difficult passage than those subjects who had the easy passage.

TABLE 1

Mean Correct And Standard Deviations For Each Treatment Group On Three Sections Of Recognition Task

Type of Recognition Test	No Knowledge of Recognition Test				Knowledge of Recognition Test			
	Voice Opinion		No Voice Opinion		Voice Opinion		No Voice Opinion	
	Easy	Hard	Easy	Hard	Easy	Hard	Easy	Hard
Total								
M	12.1	12.4	11.2	12.8	11.6	13.5	13.3	12.2
σ	2.3	2.3	2.5	1.8	1.7	2.5	1.9	2.4
Non-semantic								
M	5.7	6.5	4.8	6.5	6.1	6.9	6.6	6.7
σ	1.2	1.4	2.0	1.4	1.6	1.4	1.5	1.4
Semantic								
M	6.4	5.9	6.4	6.3	5.5	6.6	6.7	5.5
σ	1.5	1.2	1.1	1.1	1.6	1.3	1.1	1.9

The analysis of variance for the scores on the non-semantic questions found that the main effect of knowledge of a recognition task was significant ($F = 4.03$, $p < .05$, $MS = 9.80$). As can be seen from the means in Table 1, subjects who knew a recognition task would follow got more non-semantic questions correct ($M = 6.6$ correct) than those who did not know about the future recognition task ($M = 5.9$ correct). The main effect of difficulty of passage was also significant ($F = 5.95$, $p < .01$, $MS = 14.45$). Those subjects who had the hard passage got more non-semantic questions correct ($M = 6.6$) than those who had the easy passage ($M = 5.8$ correct).

On the analysis of variance for the semantic questions, once again, the only significant effect was for the three-way interaction ($F = 4.40$, $p < .05$, $MS = 9.11$). The means found in Table 1 show that scores on the easy passage were higher than scores on the difficult passage, except for the group which had knowledge of a recognition task, voiced an opinion, and had the difficult passage. When knowledge of a recognition task was given, scores on the easy passage were higher when the subjects did not give an opinion than when they gave an opinion. The opposite was true of the difficult passage when knowledge of a recognition task was present, i.e., giving an opinion facilitated recognition and not giving an opinion interfered with recognition.

Discussion

The hypothesis that subjects who knew about the recognition test and who had to voice an opinion on the hard passage would get the most correct was confirmed, for total scores and non-semantic scores ($M = 13.5$ and 6.9 correct, respectively). For semantic scores ($M = 6.6$ correct), the group which knew about the recognition task and did not voice an opinion on the easy passage ($M = 6.7$ correct) was the only group that contradicts this generalization for semantic scores.

The results of this experiment fit nicely into the depth of processing framework of Craik and Lockhart (1972). They have proposed a continuum of memory with shallow processing (non-semantic, extraction of specific words, or sounds) at one end and deep processing (semantic extraction of abstract ideas) at the other extreme. The amount of attention or rehearsal the subject focuses on the material, in part, determines the depth of processing. The more rehearsal, the deeper is material stored. However, a subject could rehearse a particular passage repeatedly until it is learned verbatim, but this does not mean that it has been processed to a deep level. It is at this point the term subject selective learning (mentioned earlier) is applicable. The authors believe that once the subject is aware of what is required in a particular learning situation (in this case knowledge of a recognition task or voicing of an opinion) strategies will be developed that will enable adequate performance in that learning situation. Thus the subject's attention will be directed at either rehearsing in a non-semantic or semantic manner. This processing will result in long-lasting memory traces but the type of trace varies. The results confirm this viewpoint. Subjects who had knowledge of a recognition task performed better on the non-semantic section than did those subjects who did not have knowledge of the recognition test. It appears that having knowledge of a recognition task enables the subject to focus attention on and subsequently process the information in a non-semantic manner.

On the non-semantic aspect of the recognition task, the hard passage was recalled better than the easy passage regardless what group subject was in; while on the semantic section of the task, the easy passage was recalled significantly better than the difficult passage with the exception of those subjects who were in the group who knew of the recognition task, voiced an opinion, and heard the

difficult passage. It is believed that the more abstract a word or phrase is, the fewer the word associations that it elicits. Thus future recognition of the specific word presented is facilitated. With a more concrete word, subjects can make many word associations which create difficulties in recalling the precise word at a later time. For example, a word like 'vehicle' elicits few word associations while a word like 'car' can elicit many. Since a more concrete word like 'car' does elicit many word associations, its meaning is readily apparent. As a result, it is easier for subjects to semantically encode a word which is familiar, or more easy to understand, than a term which elicits fewer associations. In other words, the more abstract a word or phrase is, the easier it is to remember the specific material presented while the more concrete the phraseology, the easier it is to process the term to a deeper level. However, when the passage is difficult and the subject must voice an opinion about the material and knows he will be tested on it, he processes the material in as deep a manner as possible. Thus these subjects did best on the semantic portion of the recognition test.

From the results of this experiment, we can make the following assumptions: (1) The level of concreteness of a word or phrase will, in part, determine the depth to which it is processed. (2) The type of processing the material receives (either semantic or non-semantic) will be determined by what is required by the learning situation. In conclusion, this experiment is another confirmation of the heuristic benefits of Craik and Lockhart's depth of processing theory.

REFERENCES

BRANSFORD, J. D., & FRANKS, J. J. The abstraction of linguistic ideas. *Cognitive Psychology*, 1971, 2, 331-350.

CRAIK, F. I., & LOCKHART, R. S. Levels of processing: a framework for memory research. *Journal of Verbal Learning and Verbal Behavior*, 1972, 11, 671-684.

EHLAN, M. A. *Think: the word is life*. Beverly Hills: Benziger, 1974.

MECHANIC, A. The responses involved in the rote learning of verbal materials. *Journal of Verbal Learning and Verbal Behavior*, 1964, 3, 30-36.

SACHS, J. S. Recognition memory for syntactic and semantic aspects of connected discourse. *Perception and Psychophysics*, 1967, 2, 437-442.

SHAMAN, J. G., & MURRAY, P. Depth of processing in recall and recognition memory: differential effects of stimulus meaningfulness and serial position. *Journal of Experimental Psychology: Human Learning and Memory*, 1976, 2, 680-687.

WILSON, W. M., & TYLER, L. K. Memory and levels of processing in a psycholinguistic context. *Journal of Experimental Psychology: Human Learning and Memory*, 1976, 2, 112-119.

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