THE ROLE OF MEMORY IN CONCEPT ATTAINMENT

BY

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THE ROLE OF MEMORY IN CONCEPT ATTAINMENT

A Research Paper

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of the Requirements for the Degree

Master of Arts

in Psychology

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by

Cecil Wood Wingfield

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To the Graduate Council:

I am submitting herewith a Research Paper written by Cecil Wood Wingfield entitled "The Role of Memory in Concept Attainment." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts, with a major in Psychology.

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In a survey of the literature relevant to the role of memory in concept learning, Dominowski (1965) states: "The experimental attempts to specify the effects of memory in concept acquisition have not all been successful in demonstrating a general effect, and the several findings have not yet been integrated."

Research continues, however, and progress in this field has led to the simulation of cognitive behavior by high speed computers. Early computer simulation involved conditions of unlimited memory, but in human learning such factors as forgetting are typical and must be understood and incorporated into the model if programming of computers is to simulate human performance successfully.

In a number of studies dealing with concept formation, memory requirements have been manipulated in a rather direct fashion. The historical precedent for such studies is suggested in a statement by Underwood (1949) after his review of the early concept formation literature: "The work on concept formation has suggested that concepts are more difficult to attain if the subject has to draw on memory to supply the characteristic defining the concept (p. 459)."

Most later research has supported Underwood's notion, and only a few studies have cast doubt upon his hypothesis. Bruner, Goodnow, & Austin (1956) conducted an experiment in which subjects were required to solve two problems with an array of 81 geometric stimulus patterns always available to them, and then were asked to solve for a concept with the array removed. Performance was much poorer in the

latter condition. In another experiment, groups were differentiated on the basis of ordered arrays (stimulus patterns grouped on the basis of color, size, etc., on the board) versus random arrays of stimulus patterns. The hypothesis stated the random array would make it more difficult for the subject to remember which instances had been tested as he proceeded through the problem. More card choices were required for solution with the random arrays.

Conflicting results were reported by Laughlin (1964) who found no difference between ordered and random arrays. A suggested reason for his finding was that subjects may not have selected cards according to the spatial arrangement, thus not making use of the ordered information.

Memory requirements were compared in a different situation by Hovland & Weiss (1953). In this study the order of presentation of instances was controlled by the experimenter. In their first experiment, instances were presented successively (only one instance at a time), whereas in the second experiment all instances were presented at once. For the sequence in which only negative instances occurred, simultaneous presentation was superior to successive presentation in that there were more solvers. For the sequences of positive instances only, the number of solvers was so high in both cases (near 100%) that there was no opportunity for type of presentation to have any effect.

Cahill & Hovland (1960) evaluated the influence of memory upon concept attainment by comparing the simultaneous condition where all previous instances remained as each new instance was added with the successive condition where only the new instance was shown. They

offered evidence that efficiency was greater for the simultaneous condition where the demands upon memory were minimized. However, this increase in efficiency was found only in the negative series. In their conclusions Cahill & Hovland called for further research to discover if efficiency on the positive series would increase when memory demands were lessened.

Kates & Yudin (1964) found that the successive condition was inferior to the simultaneous condition on a positive series of concept problems. These findings are in agreement with those of Cahill & Hovland (1960) and Hovland & Weiss (1953) who found less efficiency of conceptual performance in the successive than in the simultaneous condition on negative series of concept problems.

Little additional research, however, has been conducted to either confirm or weaken the findings of Kates & Yudin (1964). The purpose of this experiment, therefore, is to replicate in part the study conducted by Kates & Yudin. Accordingly, the problem is: In a positive series of concept problems, is performance improved by increasing the availability of previous stimulus information?

Since most experimental attempts to demonstrate improved performance with decreased memory requirements have been successful, the hypothesis of this experiment is as follows: On a positive series of concept problems, the simultaneous condition, which places a decreased demand upon memory, will be superior to the successive condition, in terms of the number of problems solved.

Method

Subjects. Four students from Austin Peay State University volunteered to participate in a pilot study which was conducted two days before the actual experiment. The purposes of the pilot study were to give the experimenter practice in manipulating the materials to be used in the experiment, and to determine whether or not the directions to the subjects were clear. In their evaluation of the experiment, the four subjects offered several suggestions which aided the experimenter in improving both his presentation and the directions to the subjects.

The 26 subjects used in the actual experiment were students attending Austin Peay State University, taking the elementary statistics course. These subjects were divided randomly into two groups of 13 subjects. Group 1 was administered the successive memory condition, while Group 2 was administered the simultaneous memory condition. The average age of the subjects in Group 1 was 26 years and 6 months, as compared with an average age of 26 years and 2 months for the subjects in Group 2.

Test Materials. One practice problem and five experimental problems were presented, all showing positive instances of the concept. Each problem consisted of 12 pictures drawn on seven-inch squares of posterboard. After each picture was presented, the subject offered his best guess as to the correct value, 12 guesses for each problem. Responses were scored as correct from the point the correct value was guessed and not changed thereafter.

The correct answer to each problem was a single value. The single

value "one form" was the answer for the first experimental problem; similarly, the single value "square" was the correct answer for the second problem. Responses containing two or more values, such as "two red circles" or responses containing an attribute instead of a value, such as "number of borders" were incorrect.

Each picture of a problem contained the four attributes: form, color, number of forms, and number of borders. In any one picture there was included one of the following values of the four attributes: (a) one of the three forms (circle, triangle, or square), (b) one of the three colors for the forms (red, green, or black), (c) one of the three numbers of forms (one, two, or three), and (d) one of three borders (one, two, or three borders surrounding the forms). Two examples of the pictures used are: two red circles with three borders, and three green squares with one border.

In both conditions of the memory experiment only positive instances of the concept were used. Each condition had the same practice and experimental problems. The pictures were the same for the corresponding problems in both memory conditions. However, the 12 pictures of any problem were presented in differing fashion as defined by the memory condition.

In each problem of the successive condition, the first picture was shown for 15 seconds and then removed from view. The remaining pictures were presented in like manner. In each problem of the simultaneous condition, the first picture was shown for 15 seconds. The second picture was then presented for 15 seconds while the first picture remained in view, and so on for the remaining pictures. For

example, the fourth picture of the third problem showed (a) in the successive condition three black squares with two borders, and (b) in the simultaneous condition two red squares with one border, three red squares with one border, two green squares with one border, and three black squares with two borders.

Procedure. In each memory condition 13 subjects were tested on the same one practice and five experimental problems. The terms "concept", "attribute", and "value" were defined, and a chart showing the four attributes and three values of each attribute was explained. Two examples of the pictures to be used in the experiment were shown. The instructions stated that the correct answer for each problem was one of 12 possible values. The subjects were advised, further, that each picture of a problem would contain the correct value. The practice problem was presented in the same form as the experimental problems. Subjects recorded their best guesses as to the correct value of a problem during each 15-second exposure period, making a total of 12 guesses for each problem. Previous guesses were covered with a sheet of paper provided by the experimenter. Subjects were asked not to change their previous answers.

Results

The null hypothesis for this experiment was: On a positive series of concept problems, there will be no difference between the successive and simultaneous conditions, in terms of the number of problems solved. The Mean of Group 1 (the successive condition) was 32.08, as compared with a Mean of 30.85 for Group 2 (the simultaneous condition). The t test yielded a value of .122. With 24 degrees of freedom, this value

is not significant at the 5 per cent level. Therefore, it is not possible to reject the null hypothesis. Since this finding is not in accord with the empirical hypothesis, it may be concluded that the hypothesis was not confirmed.

Discussion

In view of previous research on the role of memory in concept learning, the failure to obtain a significant difference between the successive and simultaneous conditions on a positive series of concept problems is most interesting. This finding would appear to be inconsistent with the findings of Bruner, et al. (1956), Cahill & Hovland (1960), and Kates & Yudin (1964). A few studies have been reported, however, which have not found performance to be depressed by increased memory requirements.

Sechrest & Wallace (1962) employed a board containing all stimulus cards from which a subject could choose instances. The subject was allowed to guess what the correct concept might be after receiving information on each card selected. Groups were differentiated in terms of the kind of aid given them to help remember what information had been transmitted by the first instance shown. There were no differences between groups on the measure of card choices to solution. It could not be determined to what degree the aids had been used. Comparison of expected performance with actual performance, however, suggested that the subjects as a group did not make full use of the objectively available information.

It is possible that a number of subjects in both groups of the present study also failed to make full use of the objectively available

information. After the experimental treatment had been administered, several subjects from both the successive and simultaneous groups expressed to the experimenter their difficulty in remembering portions of the information which had been presented in the instructions. Not surprisingly, there were a number of subjects in both groups who scored poorly on the concept identification problems. The inability of certain subjects in both groups to remember portions of the information presented in the instructions may account in part for the lack of difference between the successive and simultaneous conditions. In future experimentation it is suggested that important portions of the instructions be repeated or that instruction sheets be provided for the subjects.

Several subjects in both groups, however, solved all the concept identification problems. Hovland & Weiss (1953) reported a similar occurrence in which the number of solvers in one experiment was so high in both the successive and simultaneous conditions for a positive series of concept problems that there was no opportunity for type of presentation to have any effect.

In the present experiment, it is likely that the type of presentation had no effect on those subjects in both the simultaneous and successive groups who correctly solved all the concept identification problems. This condition may account in part for the lack of difference found between the two groups. In the future, positive series of concept problems of varying difficulty levels must be designed which can be adapted to the age level of the subjects used in an experiment.

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