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ABSTRACT

One-hundred and forty undergraduates were divided into seven equal groups; each group read five passages and then answered one of seven types of questions. However, after reading the sixth passage, all subjects received the same type of questions. Reading time for each passage was recorded, and students were encouraged to read faster. Significant group differences in reading speed did not occur for the first passage, but did occur for the last passage ($p<.01$) (these two passages were the same for all subjects). A second experiment replicated part of the first experiment under conditions in which subjects were encouraged to slow down and to answer questions correctly. Results from the two experiments were compared. It was found that experiment 1 subjects read significantly faster than comparable groups in experiment 2 ($p<.001$), but they also received significantly lower scores than the latter. No other effects were significant. References and figures are included. (AW)

EXPERIMENTAL MANIPULATION OF READING STRATEGIES[1,2]

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1. Paper presented at the annual meeting of the American Educational Research Association, April, 1972, at Chicago, Illinois.

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ABSTRACT

College undergraduates read a series of passages each followed by the same type of questions. Groups receiving different questions adopted different reading strategies, picking up different types of information. Factual and higher-order strategies were very similar. Payoff conditions influenced reading speed. For students reading for factual and higher-order information, reading speed affected the amount of incidental information gained, but had no effect on the types of information for which they were specifically reading.

EXPERIMENTAL MANIPULATION OF READING STRATEGIES

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It has long been recognized that people have some flexibility in the way they read a passage. In addition, it is generally accepted that the ability to be flexible in reading is a characteristic of better, more mature readers. Students are admonished to change their method of reading according to the material being read and their purposes in reading, in order to improve the efficiency of their reading. Developing this reading flexibility is a goal of many reading improvement programs (Hill, 1964; Carillo and Sheldon, 1952).

A number of studies have been aimed at assessing the degree to which students demonstrate flexibility in their reading. The dependent variable most commonly used as evidence for reading flexibility is change in reading rate. It is assumed that the efficient reader will modify his reading rate according to the difficulty of the material being read, the familiarity he has with the information being communicated, his purpose in reading (whether seeking to gain only an overview of the passage, or to understand and remember the factual details, for instance), etc. Studies investigating the effects of these variables have found surprisingly small changes in reading rate (for instance, Herculane, 1961; Hill, 1964; Levin, 1968; Letson, 1958, 1959; Rankin, 1970-71; Rankin and Hess, 1971). Most studies have found some change in rate resulting from the manipulations of passage difficulty or of instructions to the readers (generally instructing one

group to read only for main ideas and another to read carefully for specific details), but the change has usually been small. It seems generally accepted that readers, even those identified by tests as being good readers, are quite inflexible in their reading. (Hill, 1964; Rankin, 1970-71)

Besides being admonished to adjust their reading rate according to their purpose of reading and to the material being read, readers are also advised to focus on the reception of one kind of information from a passage rather than another, depending on their reading purpose (Harris, 1961; Tinker, 1965; Leedy, 1956). This aspect of reading flexibility has been studied very little. Postman and Senders (1946) instructed college students to read for different types of information (general comprehension, specific sequence of indifidual events, details of content, details of wording, and physical appearance) and found some differences among groups in their scores on different types of questions. Allen (1970) had two groups each read the same series of passages, receiving tests after each. One group received higher-order questions after each passage; the other received factual questions. Both groups received the same test after reading the last passage which contained both higher-order and factual questions. On that final test, the first group scored highest on the higher-order questions, and the second scored best on the factual questions. These two studies provide evidence that readers can make changes in the information they obtain from a passage when reading for different purposes.

If flexibility in reading, both in terms of changes in reading rate and of focus on different types of information, is as important to efficient reading as has been so often suggested, it is clear that this aspect of reading needs further research. It will be necessary, not only to assess the degree of flexibility readers typically exhibit, but also to have

some more specific information on the degree which is needed for efficient reading. Certainly this flexibility will not turn out to be unidimensional, resulting in the necessity of determining just what forms of flexibility are important. Having the ability to modify one's reading behavior, though perhaps important to efficient reading, is certainly but one aspect; it must be at least as important that one use his flexibility in an efficient manner. Thus, it will be necessary to specify the conditions under which various sorts of changes in reading behavior should take place if reading efficiency is to be achieved. Providing answers to such issues as these will require a much more thorough analysis of this aspect of reading behavior than has been exemplified in the research thus far. Among other things, means are required for more carefully controlling or monitoring the reader's purpose in reading, and for manipulating or measuring the other variables important to this investigation.

The present study is the second in a series designed to investigate a means of experimentally manipulating a subject's (S's) reading strategies in a more precise manner than has been used in the past. Essentially it is an attempt to provide a reading situation in which variables can be manipulated which will make it likely that a reader will modify his reading strategy in certain ways, both in terms of reading rate and in terms of the type of information sought during reading, and in which the effect of such variations can be studied. The method developed involves the use of a payoff system in which Ss are paid according to certain aspects of their performance. By manipulating the payoff structure, and the type of test used, different amounts of emphasis can be placed on reading speed, on number of questions answered correctly, and on different types of information which the S might try to acquire from the passage read. The particular conditions used for a particular study can be communicated to other researchers in a much more

specific manner than has generally been the case in reading studies.

The first study in this series (McConkie, Rayner, and Meyer, 1971) investigated the effects of task variables on reading speed. In it, each S read a series of seven passages under one of several experimental conditions. Some Ss were paid almost entirely on the basis of the number of questions they answered correctly (factual questions in one experiment, and higher-order questions in another), while others were paid a varying amount per correct answer, depending on the time they had taken to read the passage. This last condition placed a much heavier emphasis on reading quickly. Among other things, it was found that the group reading under conditions emphasizing retention took 50% more time (about 30% in a second experiment) to read than the group reading under conditions emphasizing fast reading. The former group was found to be almost identical to a control group reading without financial reward. These three groups did not differ in their performance on test questions.

Since the first study appeared successful in establishing this method as a means of experimentally manipulating reading strategies with regards to reading speed, the present studies were undertaken to see if the method could also be used to modify the type of information Ss acquire from the passages they read. The method used was somewhat similar to that of Allen (1970) and Postman and Senders (1946). Questions of several types were constructed for each of several passages. Each group of Ss received questions of a single type after each passage. After reading the final passage, all groups were given the same test, which included subsets of questions of all the different types used. It was assumed that if different groups of Ss were found to obtain different scores on the various types of questions, this would serve as evidence that the groups had employed different strategies in reading the passages. In addition, a payoff system was used in

which Ss received points according to their reading performance. In the first experiment, the payoff structure emphasized reading quickly; in the second, the structure was changed to place less emphasis on reading speed.

Experiment I

Method

Subjects - One hundred forty undergraduates from an introductory psychology class at Cornell University served as Ss as part of a course requirement.

Materials - Six passages of about 500 words each were extracted from articles in the Scientific American magazine for a previous study (McConkie, Rayner, and Meyer, 1971) and were used in this research as well. A Flesch count (Flesch, 1942) indicated that they were all of about equal readability. Each passage was a self-contained unit, and the topics were quite diverse, including set theory, the biosphere, abortion, and the Reconstruction Era. Five types of questions were written for each passage, all multiple-choice. Factual questions tested retention of facts clearly stated in the passage. Number questions tested retention of numerical information, or number facts. The set of factual questions included some number questions as well. For recognition questions, words and phrases were listed and Ss were asked to check which were in the passage just read. Higher-order questions asked which alternative served as the best title, what point the author was trying to make or what his purpose was, or asked Ss to solve analogies or to judge the relative importance of certain facts to the main idea of the passage. Structure questions asked about the order in which topics were discussed in the article, whether a particular idea was expressed in the early, middle, or late part of the passage, or about the amount of time devoted to a topic relative to certain other topics in the passage.

A booklet was prepared for each S, with each passage requiring 3, 4 or

5 pages, and with test questions on pages immediately following each passage.

Procedure - There were seven groups of 20 Ss each, defined by the type of questions they received after reading each of the first five passages. The Fact, Number, Structure (Struct), and Higher-Order-5 (HO-5) groups each received 5 questions of their designated type after each passage. The Recognition (Recog) group received twenty words or phrases, half of which were from the passage. The Higher-Order-2 (HO-2) group always received the same two higher-order questions after each passage, asking for the best title and the author's main point. Finally, the Combined (Comb) group received a question of each of the five question types after each passage.

Ss recorded the time required to read each passage, and their tests were scored after each passage. They were given complete feedback on the number of questions answered correctly and the number of points received before reading the next passage. Points were given for questions answered correctly, but the number of points per correct answer depended on the time taken to read the passage: if read in 80 seconds or less, Ss received 7 points for each correct answer; if 100 seconds, 6 points; if 120 seconds, 5 points; and so on in 20 second intervals. Any S spending more than 220 secs. reading a passage received no points for correct answers. This payoff system was carefully explained at the beginning of the experiment. At the end of the experiment, the points accumulated were exchanged for cash, averaging $1.25 per S.

After reading the sixth passage, all Ss received the same test, made up of five questions each of the factual, number, structure, and higher-order types, including the two questions the HO-2 group always received, plus twenty words and phrases for recognition. These five types of questions were counterbalanced over serial positions within groups of Ss.

Three to eight Ss were tested at a time. The first and last passages read were the same for all Ss, but the other four passages were counterbalanced within each group over presentation positions two through five.

Results

Reading speed - The reading times for the seven groups on the first and last passages were compared by means of one-way Analyses of Variance. There was no difference among the groups on the first passage ($F<1$), but there was a significant difference on the last passage ($F(6,133) = 3.09$, $p < .01$). A Newman-Keuls test (Winer, 1962) yielded the following pattern:

Condition	Number	Recog	Struct	HO-2	Fact	HO-5	Comb
Mean reading time (sec.)	98	105	111	113	116	126	128

Conditions with a common underline are not significantly different at the .05 level of significance.

Test performance - The analysis of greatest interest is that of performance on test questions after reading the final passage. Since the distributions of scores for the five types of questions on this passage were all quite normal but showed different standard deviations, they were first standardized with a mean of 5 and a standard deviation of 1. Fig. 1 and 2 show the average score received by each group on each type of question

Insert Fig. 1 & 2 about here

following this transformation. A two-way Analysis of Variance (seven groups by five types of questions) with repeated measures found the only significant effect to be the Group X Type of Question interaction ($F(24,532) = 2.10$, $p < .01$).

Discussion

The data from this experiment show that reading speed can be influenced by the type of test questions received following the passages. The group

which read fastest, the Number group, was the one tested on a type of information most easily identifiable in the passage. On the other hand, the slowest group, the Combined group, had the greatest variety of questions, and hence the greatest uncertainty as to just what information in the passage might be tested. It may be that reading speed is partly determined by the breadth of information in the passage on which the reader anticipates being tested. It should be noted, however, that in spite of these differences in reading speed there were no significant differences among groups in their overall performance on test questions.

Although the groups did not differ in overall performance, they did obtain different patterns of scores on the various types of questions used. This is evidence that the groups picked up different aspects of the information in the passage as they read it. By assuming that groups with similar profiles in Fig. 1 and 2 used similar reading strategies in determining what information to acquire from the passage, these data yield themselves to a hierarchical cluster analysis (Johnson, 1967). To obtain a measure of profile similarity, each possible pair of groups was compared by determining the absolute value of the difference between their scores on each type of test, and then summing these differences to obtain a profile similarity score for the two groups. Profile similarity scores were computed for all pairs of groups, and were then entered into a 7 by 7 half matrix. Johnson's minimum and maximum methods were employed to determine the hierarchical arrangement of the similarities among the groups, and the results are diagrammed in Fig. 3. The two methods yield almost identical hierarchial

Insert Fig. 3 about here

arrangements, which is evidence that the hierarchical structure is indeed inherent in the data.

The profiles and their pattern of similarities do not fall into an

easily interpretable pattern. However, a few generalizations can be made. (1) Similarities in test performance profiles for the different groups are not related to similarities in their reading speeds. Thus reading speeds and test performance profiles reflect different aspects of reading strategies, emphasizing the multideminsional nature of reading flexibility. (2) Groups do not necessarily excel in answering questions on the type of information for which they have been reading. Although the Fact, Structure, and Number groups were quite successful in answering questions of their respective types, the Recognition and Higher-Order groups were not. The HO-5 group scored at an average level on higher-order questions, and the HO-2 group, although always receiving the same two questions, scored poorest of all groups on these two questions after the final passage. These results suggest that it may not have been possible for these Ss to effectively read specifically for the kind of information necessary to answer higher-order questions. The Recognition group also scored lowest of all groups on recognition questions. Again, readers may not be able to adopt an effective strategy aimed specifically at being able to recognize words and phrases from a passage. (3) The two groups most similar in their profiles were the Fact and HO-5 groups. Apparently the strategies adopted by Ss attempting to read for factual and for higher-order information were very similar. This finding is not consistent with the common assumption that different strategies are needed to pick up these two types of information; that is, that a reader should modify his approach depending on whether reading for facts or for higher-order information. It is also at variance with the results reported by Allen (1970), which suggested differences in these reading strategies.

Experiment I has provided evidence that Ss can read for different types of information, and has demonstrated the effectiveness of a method of

manipulating this aspect of reading flexibility in the laboratory. It involved a payoff structure which encouraged Ss to read quickly. Experiment II replicated part of the previous study under conditions in which Ss were encouraged to read less quickly and with relatively greater emphasis on answering questions correctly, to see what effect this would have on the differences among the groups.

Experiment II

Method

Three groups of 15 Ss each were drawn from the same subject pool as in Experiment I, and the materials and procedures used were also the same except for a change in the payoff schedule. In Experiment II Ss were paid according to the number of questions they answered correctly, irrespective of the amount of time spent reading. In addition, they were given 1 bonus point if a passage was read in less than 240 seconds, and 2 if read in less than 200 seconds. This corresponded to the payoff schedule emphasizing retention as used by McConkie, Rayner, and Meyer (1971).

The three groups used in this experiment will be referred to as the slow-reading (S) groups. One group received factual questions after each passage (Fact-S group), one received higher-order questions (HO-S group), and the third received recognition questions (Recog-S group). All groups received all five types of questions after the last passage, as in Experiment I. The performance of these groups will be compared to that of comparable groups in Experiment I, termed the fast-reading (F) groups, and designated as Fact-F, HO-F, and Recog-F groups for this comparison.

Results

Reading speed - A 2 by 3 Analysis of Variance (fast vs slow reading groups by type of questions received on the first five passages) found no significant differences in reading speed on the first passage. A similar

analysis on the last passage yielded one significant main effect. Ss from Experiment I read significantly faster than those in Experiment II ($F(1,99) = 23.77$, $p < .001$). Mean reading times on the last passage for groups Fact-S HO-S and Recog-S were 141, 148, and 141 sec. respectively.

Test performance - Scores on the different types of questions administered after the last passage for all six groups were again standarized to yield a mean of 5 and a standard deviation of 1. A three-way Analysis of Variance (fast vs. slow readers, three groups, and five types of questions) indicated that the S groups received higher scores than the F groups ($F(1,99) = 24.55$, $p < .001$). No other effects were significant.

Discussion

Changing payoff conditions served to change Ss' reading speeds, as found by McConkie, Rayner, and Meyer (1971). However, there are two ways in which the present data differ from the results of that earlier study. First, the Fact-S group in the present study read much faster than the corresponding group in the earlier study. In that study, the slow reading group took 189 seconds to read a passage (averaged over all passages read), while the fast reading group took 128 seconds. In the present study these times for corresponding groups were 136 and 121 seconds. Both studies used the same passages and Ss from the same subject pool. This difference might be accounted for on the basis of the number and types of questions used in the two studies. In the earlier study, each passage was followed by 10 short-answer recall questions, whereas in the present study Ss received five multiple-choice questions after each passage. It appears that the extensiveness and perhaps difficulty level of testing after each passage influences Ss' reading speeds, especially under conditions emphasizing retention rather than speed of reading.

The second difference between the two studies concerns the relationship

between reading speed and test performance. In the previous study groups that read at different rates did not differ in their test performance; in the present study fast and slow reading groups differed in their test scores. This may be related to another difference between the tests in the two studies. In the earlier study, Ss in a group were always tested on the same type of questions: factual in the first experiment, and higher-order in the second. In the present study, Ss were tested on all types of questions after reading the last passage. This suggests a hypothesis which would reconcile the apparent discrepancy between the results of the two studies. It may be that reading speed, within the range represented here, is not related to performance on questions testing the type of information which Ss are directly seeking, but that it does affect performance on other types of questions, those testing incidental information which Ss are not directly seeking.

This hypothesis was tested in two ways. First, the test performance of the fast and slow reading groups in the present study was compared on the fifth passage, where they were tested only with the kind of questions they had received after previous passages. The fast and slow reading groups did not differ significantly in test performance ($t(33\ d.f.) = .25, .89$, and 1.84 for the Fact, HO, and Recog groups respectively), thus agreeing with results of the earlier experiments.

As a second test of the hypothesis, further analysis was carried out on test performance data after the sixth passage. This was justified in spite of the lack of a significant interaction on the Analysis of Variance because it was an attempt to test a specific hypothesis. Each S was assigned two scores, one being his score on the type of questions he had been receiving on earlier passages (Practice Question Score) and the other being an average of his scores on the four other types of questions (Other Questions Score). These scores were then subjected to a three-way Analysis of Variance with

factors being question groups (Recognition, Higher-Order and Factual), reading speed condition (fast vs slow reading groups), and type of score (Practice vs Other Question Score). The only significant main effect was due to reading speed group, showing the poorer performance of the fast reading groups. However, the three-way interaction was significant ($F(2,99) = 3.39$, $p < .05$) as well as the interaction between reading speed group and question group ($F(2,99) = 3.10$, $p < .05$). The two-way interaction is of little interest. It showed that, with the different types of questions weighted in the manner used here, there was a greater difference in test performance under the two reading speed conditions for the Recognition than for the other two groups. The three-way interaction bears on the hypothesis being considered, and is diagrammed in Fig. 4. For Fact and Higher-order

Insert Fig. 4 about here

groups, those similar to groups in the earlier study, reading speed had almost no effect on Practice Question Scores, but had a substantial effect on Other Question Scores. For these groups the hypothesis is supported: reading speed changes primarily influence the amount of incidental information acquired by the reader, but have little influence on the acquisition of information for which he is directly reading. However, the Recognition groups show a different pattern of results. For these groups, reading speed had a definite influence on Practice Question Scores, as seen in Fig. 4. This may be additional evidence that Ss are unable to adopt an effective strategy to read specifically for information necessary to recognize words and phrases in the same way that they are able to read specifically for, say, factual information. Further support for this suggestion comes from an examination of correlation coefficients indexing the relationship between reading speeds of groups in Experiment I, and their performance on different types of questions after the last passage. There is a strong relationship between reading

time of the different groups and their performance on recognition questions ($r = .75$, $p < .05$). Reading time was not significantly correlated with performance on any other kind of questions. It appears that performance on recognition questions primarily reflects the rate at which a person reads a passage, rather than the degree to which he adopts some specific information-acquisition strategy.

The following tentative picture of reading flexibility in skilled readers emerges from the studies completed so far. People are able to adjust both their reading speed and the type of information they acquire from passages according to the conditions under which they are reading. Reading speed is influenced by the payoff structure (the degree to which speed is important in maximizing payoff), as well as by the kind of test anticipated; that is, the type, number, and variability of questions expected. The type of information acquired changes according to readers' expectations of what information will be needed to answer the test questions. The students participating in these studies appear to have been unable to adopt a strategy successful in acquiring the type of information needed to answer higher-order questions. They appeared to adopt a strategy very similar to that adopted by readers seeking factual information. These students were also unsuccessful in adopting a strategy successful in specifically gaining information needed to recognize words and phrases in a passage. This type of test reflects primarily the rate at which a person chooses to read an article.

The effect which speeding up reading has on the acquisition of information depends on the type of information being tested. Increasing speed has little effect on amount of information retained of the type for which a person is specifically reading, but reduces the amount of incidental information he acquires.

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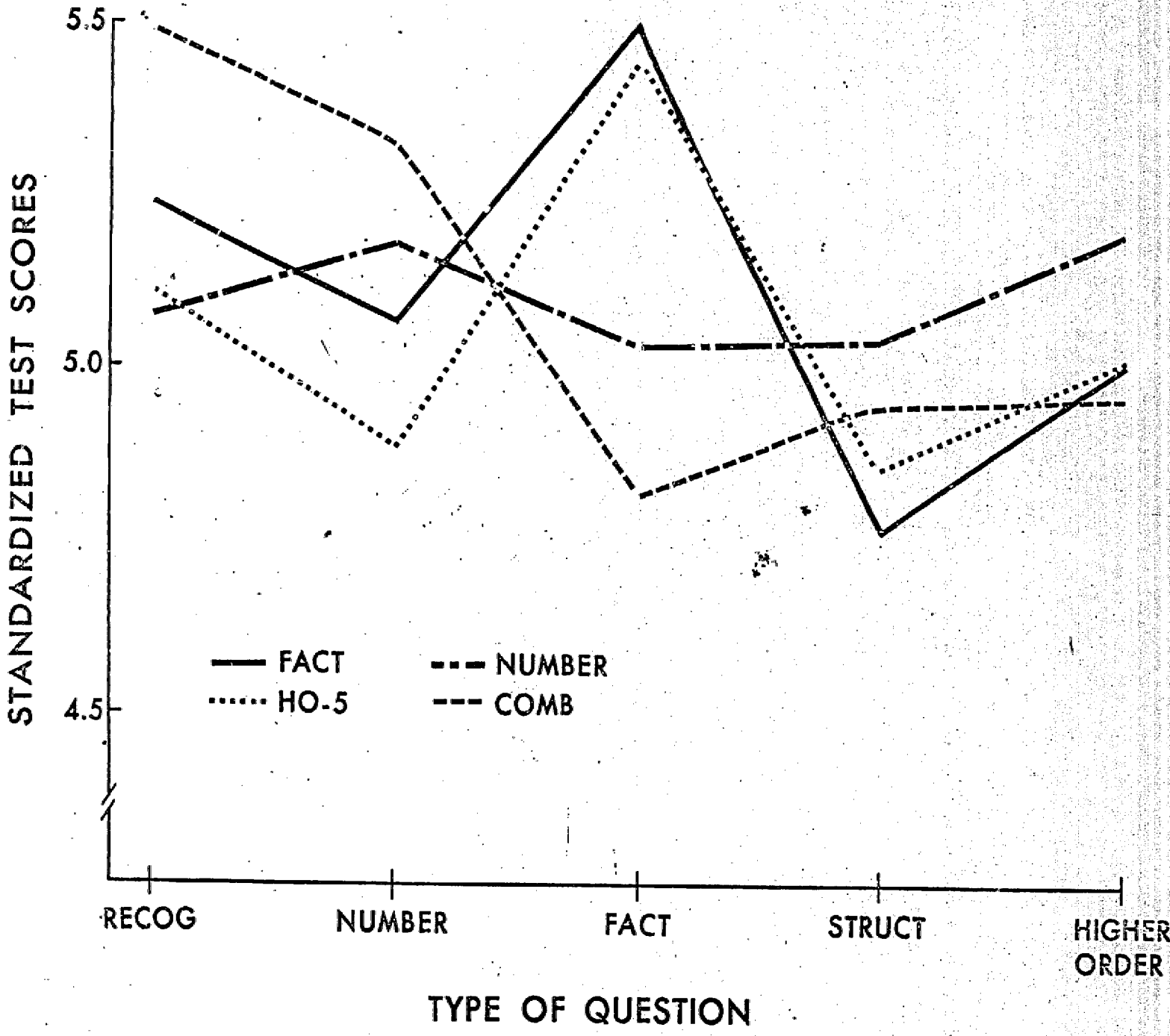
Figure Captions:

Fig. 1. Performance of four groups (Fact, HO-5, Number, Comb) on five types of questions included in the test following the reading of the sixth passage. Scores on each type of question were standardized to a mean of 5 and standard deviation of 1.

Fig. 2. Performance of three groups (HO-2, Recog, Struct) on five types of questions included in the test following the reading of the sixth passage. Scores on each type of question were standardized to a mean of 5 and a standard deviation of 1.

Fig. 3. Diagram of the hierarchical structure found in the profile similarity scores for the seven groups included in Experiment I. Results based on minimum and maximum methods of Johnson's (1967) hierarchical cluster analysis.

Fig. 4. Mean Practice Question Scores and Other Question Scores for fast and slow reading groups which received recognition, higher-order or factual questions on earlier passages.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STANDARDIZED TEST SCORES
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Figure 1

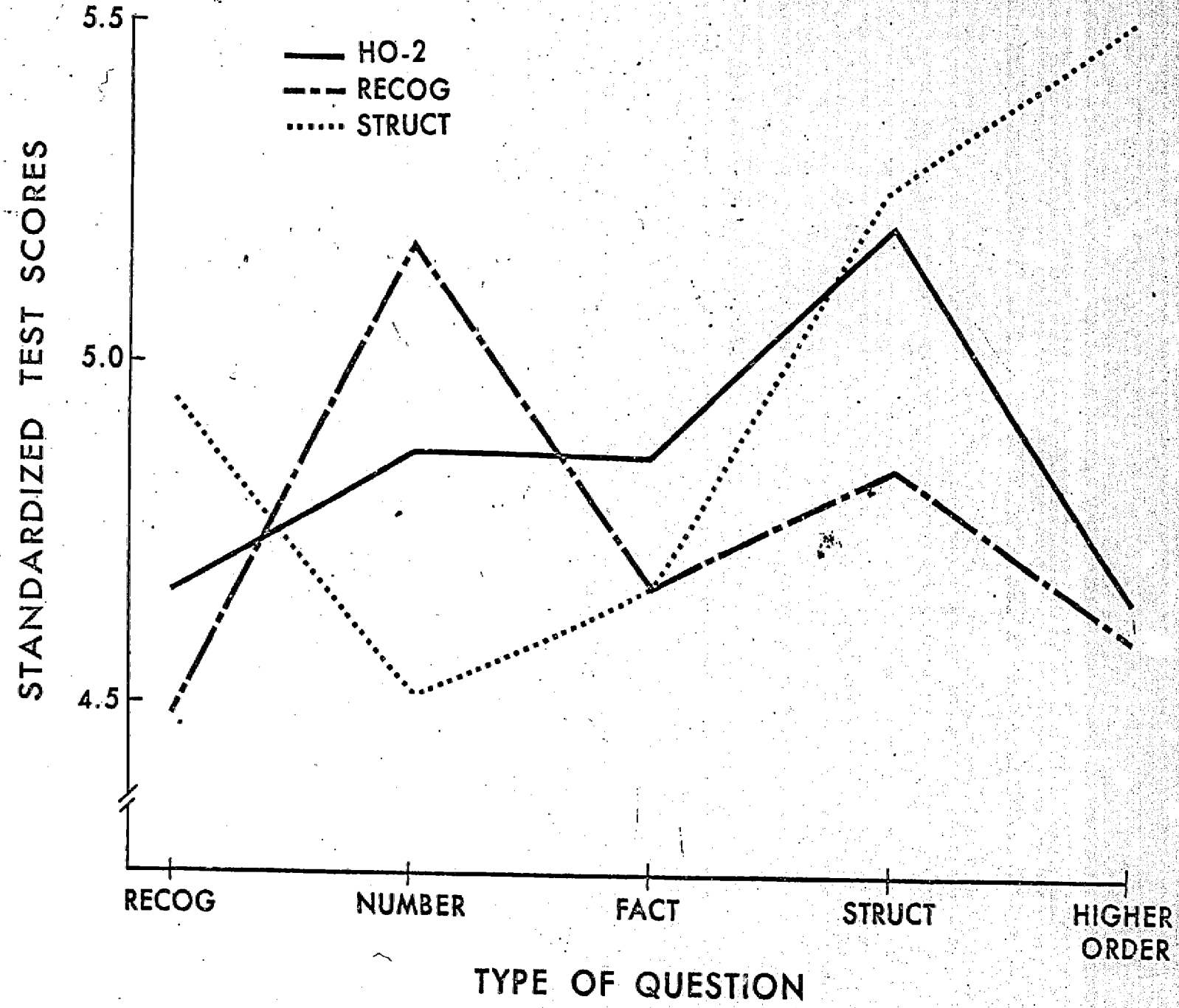
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Figure 2

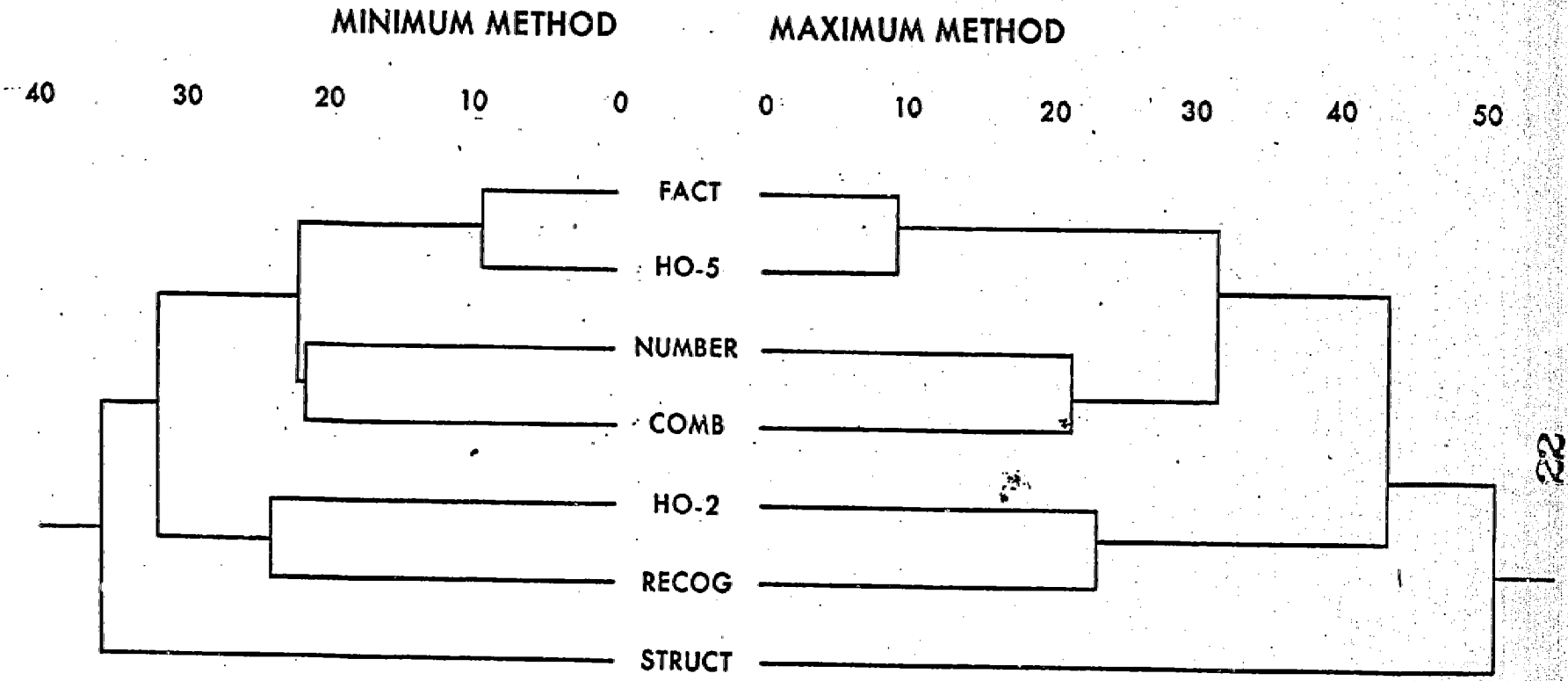
MINIMUM METHOD
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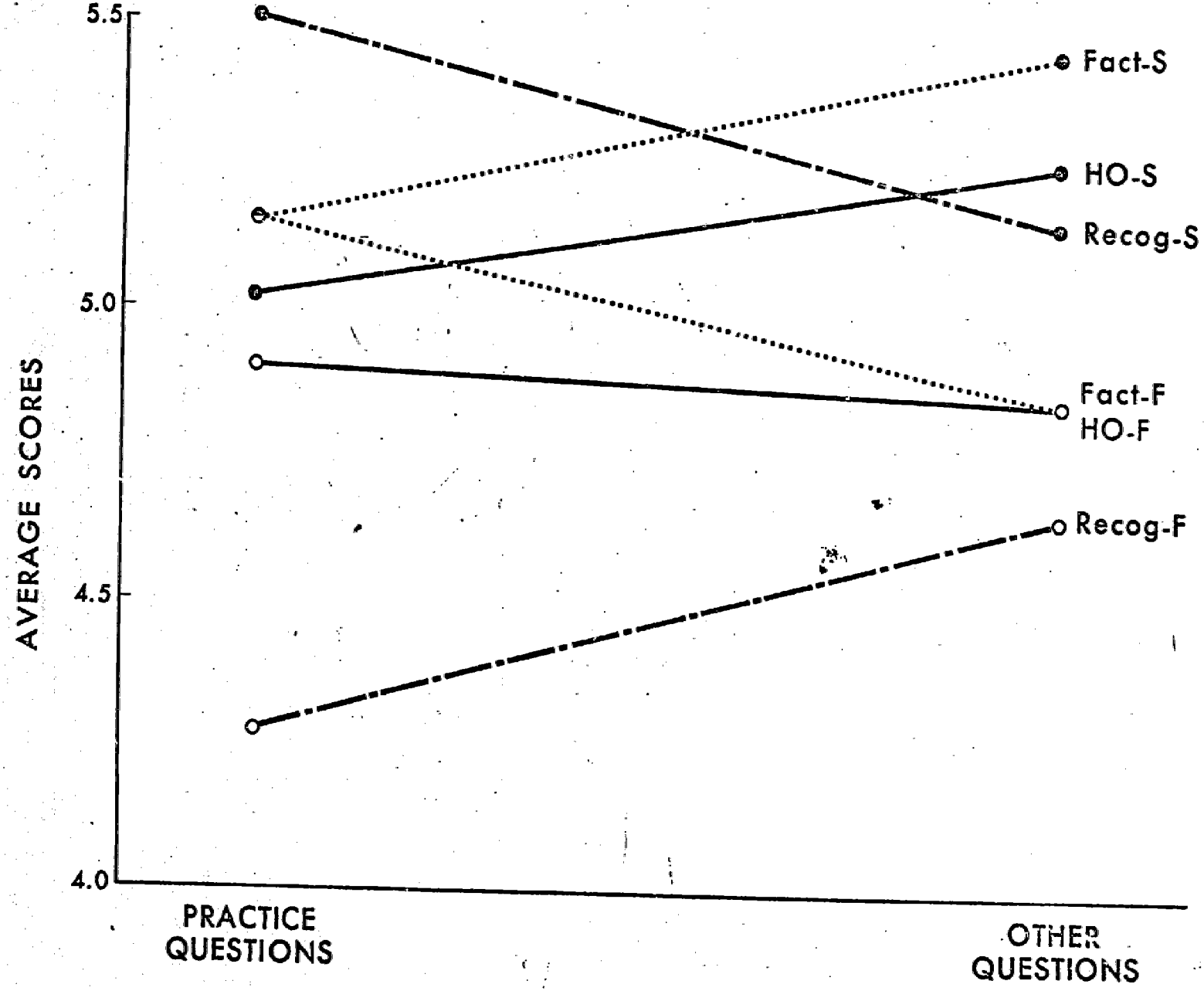
Figure 3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AVERAGE SCORES
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Recog-S
Fact-F
HO-F
Recog-F
PRACTICE QUESTIONS
OTHER QUESTIONS

Figure 4