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ABSTRACT

Two experiments, each involving 96 sighted undergraduates, investigated the effects on braille learning of presenting information about the number of dots a symbol contains at the beginning of the study interval (prompting condition). In study 1, prompting was compared with presenting no information during the study interval. In experiment 2, prompting was compared with presenting such information at the end of the study interval (confirmation condition). Effects of length of the study and test interval were also analyzed. Results revealed that presenting information at the beginning of a study interval about the number of dots a symbol contains led to better performance than either presenting such information at the end or not presenting such information at all. Underestimations were more prevalent than overestimations when dot numerosity was presented at any time during the study interval. Finally, item difficulty was directly related to the number of dots an item contained. (CL)

Judging Dot Numerosity In Haptically-Examined Braille Symbols: Further Experiments

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ABSTRACT

In two experiments, subjects haptically examined braille symbols and judged the number of dots each contained. Subjects who were informed as each symbol was presented during the study interval about the number of dots it contained (Prompting Condition) were more accurate (in Experiment 1) than subjects given no such information (No Information Condition) and were more accurate (in Experiment 2) than subjects who were given such information later during the study interval (Confirmation Condition). In each experiment, the superiority of prompting was found to be independent of both the length of the study interval and of the test interval. Several bases for the superiority of prompting are proposed.

INTRODUCTION

Results from previous research on identification (Millar, 1977; Nolan & Kederis, 1969) and immediate memory (Newman, Hall, & Gupta, 1983, November) of braille symbols suggest that many errors derive from incorrect judgment of the number of dots contained in the symbols. These results suggest also that identifying the number of dots in a braille symbol may be an important source of difficulty in encoding braille symbols and, concomitantly, in the learning of braille In each of the above experiments, however, the subject had to consider both the number of dots comprising each symbol and the arrangement of these dots. It is possible that many of the errors in identifying the number of dots in these experiments were due to the subject's having had to consider both of these types of information. Therefore, in the two experiments reported here, the subject's only task was to judge the number of dots comprising each braille symbol.

Very little information exists about the judgment of numerosity of haptically-examined stimuli. Most relevant is a series of experiments by Myers (1976). He reported that subjects were correct about 65% of the time in identifying the number of dots contained in haptically-examined braille symbols. However, he used only five symbols, three of which were among the easiest for their respective levels of numerosity (2, 3, or 4 dots). In the present experiments, we used 21 braille symbols previously shown (Newman & Hall, 1984, November) to be among the most difficult for that task. Each of the symbols had 3, 4, 5, or 6 dots.

Two experiments are reported here. In each experiment, the effects of presenting information about the number of dots a symbol contains at the beginning of the study interval (Prompting Condition) were determined. In Experiment 1, prompting was compared with presenting no information during the study interval (No Information Condition), and in Experiment 2, prompting was compared with presenting such information at the end of the study interval (Confirmation Condition). In both experiments, the effects of length of both the study interval and the test interval were also investigated.

EXPERIMENT 1

Method

Procedure

Subjects were given two study trials, each followed by a test trial. On study trials, the subject haptically examined each of the 21 braille symbols for 5 or 10 seconds and, in addition, reported the number of dots each symbol contained. On the study trials, half of the subjects in each treatment were told the number of dots an item contained as the item was presented (Prompting Condition); the remaining subjects were given no information on study trials about dot numerosity (No Information Condition). For all subjects, there was no feedback on test trials. In

examining the braille symbols, subjects used the index finger of the right hand. Visual examination of the symbols was precluded.

Subjects

Subjects were 48 female and 48 male undergraduates enrolled in the introductory course in psychology at our university. All were right-handed and had no previous experience with braille. Six males and six females were assigned to each of the eight treatments through the use of a counterbalancing procedure.

Results

A 2 (information) x 2 (study interval) x 2 (test interval) x 2 (trials) repeated measures analysis of variance was applied to the data for number correct on each trial. Table 1 contains the means for percent correct for each treatment. Four effects were significant -- information ($p < .01$), trials ($p < .05$), information x trials ($p < .05$), and study time x test time ($p < .01$). Examination of the means showed that subjects in the Prompting Condition did better than subjects in the No Information Condition, particularly on the first trial; however, Prompting subjects did not improve from the first to the second trial whereas subjects in the No Information Condition did. Finally, subjects did better when the length of the test interval matched that of the study interval than when the length of the two intervals did not match.

There were two other findings of interest -- (a) subjects in the Prompting Condition (but not in the No Information Condition) were more likely to underestimate than to overestimate the number of dots in a symbol ($p < .01$) and (b) among all eight treatments of the experiment, the percent correct for an item was inversely related to the number of dots it contains. Rank-order correlations ($df = 19$) between percent correct and number of dots ranged from -.46 ($p < .05$) to -.65 ($p < .01$).

EXPERIMENT 2

Experiment 1 showed that providing information at the beginning of each interval about the number of dots a symbol contains was accompanied by better performance than providing no such information. Experiment 2 was done to determine whether the time during the study interval at which the information was presented would affect performance on this task.

Method

Procedure

For half of the subjects, the information was presented at the beginning of the study interval (Prompting Condition, as in Experiment 1) and for the remaining subjects, the information was presented at the end of the study interval (Confirmation Condition). In all other respects, the procedure for Experiment 2 was the same as for Experiment 1.

Subjects

Again, 48 males and 48 females enrolled in the introductory course in psychology at our university participated as subjects. All were right-handed and had no previous experience with braille.

Results

A 2 (information) x 2 (study interval) x 2 (test interval) x 2 (trials) repeated measures analysis of variance for number correct on each trial showed that only the effect of information was significant ($p < .05$). The means for percent correct for each treatment are presented in Table 2. Examination of the means shows that subjects did better under the Prompting Condition than under the Confirmation Condition.

Again, for subjects in the Prompting Condition, underestimations exceeded overestimations ($p < .01$); similar findings were obtained in the Confirmation Condition. Again, too, the percent correct for an item was found to be inversely related to the number of dots the item contains. Rank-order correlations ($df = 19$) between percent correct and number of dots ranged from -.53 ($p < .05$) to -.80 ($p < .01$).

CONCLUSIONS AND DISCUSSION

The following conclusions appear warranted:

- Presenting information at the beginning of a study interval about the number of dots a symbol contains leads to better performance on this task than either presenting such information at the end of the study interval or not presenting such information. These effects are independent of the length of both the study interval and the test interval. A superiority of prompting over confirmation has been the usual finding, also, in studies of paired-associate learning (Hall, 1971). In those studies, however, subjects usually responded overtly during the study interval; in the prompting condition the response would follow the information, and in the confirmation condition the information would follow the response.

- Underestimations are more prevalent than overestimations when information about dot numerosity is presented at any time during the study interval. When no such information is presented, the number of underestimations and overestimations do not differ. The prevalence of underestimations replicates our finding in a previous numerosity-judgment experiment (Newman & Hall, 1984, November).

- Item difficulty on this task is directly related to the number of dots an item contains. A similar finding has been reported for identification (Loomis, 1982), discrimination (Newman, Hall, Foster & Gupta, 1984), and memory (Newman, Hall & Gupta, 1983, November) tasks in which braille symbols have been used.

We have suggested elsewhere (Newman, Craig & Hall, 1986, March) that training in judging the number of dots contained in braille symbols might facilitate learning their names. One implication of the findings from the present experiments is that training time on the numerosity task can be shortened if the learner is informed, particularly early during the study interval (as in the Prompting Condition), about the number of dots the symbol contains.

Providing such information during the study trial may have these effects:

- Enhancing effectiveness in searching the symbols,
- Fostering learning of the number of dots each symbol contains,
- Familiarizing subjects with the range (i.e., 3-6) for the number of dots contained in the symbols of the set, and
- Familiarizing subjects with the number of symbols in the set that contain 3, 4, 5, and 6 dots.

Although the better performance of the Prompting Condition as compared with the No Information Condition may derive from any one or or a combination of the above four factors, the superiority of the Prompting Condition as compared with the Confirmation Condition probably derives from differences in the first two factors. Further research is required to assess the adequacy of this analysis.

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TABLE 1

Mean Percent Correct For Each Treatment On Each Trial:

Experiment 1

Information	Study Interval (Sec)	Test Interval (Sec)	Test 1	Test 2
Prompting	5	5	60.7	62.7
		10	61.1	56.0
	10	5	59.9	59.9
		10	68.2	71.1
No Information	5	5	52.8	54.0
		10	39.3	48.0
	10	5	36.1	46.8
		10	58.2	64.7

TABLE 2

Mean Percent Correct For Each Treatment On Each Trial:

Experiment 2

Information	Study Interval (Sec)	Test Interval (Sec)	Test 1	Test 2
Prompting	5	5	57.5	59.9
		10	70.6	71.8
	10	5	65.9	67.0
		10	69.0	67.5
Confirmation	5	5	56.8	58.0
		10	58.7	58.7
	10	5	56 8	62.3
		10	57.5	65 9