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ABSTRACT

Two experiments were conducted with 80 college students to examine factors associated with the crossmodal facilitation of learning Braille symbols when the visual modality is utilized. In Experiment 1 subjects using the haptic mode were informed of both the structure of the braille cell and the range of dot numerosity of the symbols to be employed. Haptic subjects given this information did as well as subjects who studied the symbols visually. Experiment 2 attempted to determined which of the two kinds of information was the basis for the improv l learning effectiveness. This study found that both the general and specific types of information were important as was the interrelationship between the two. (DB)

Some Bases for Crossmodal Facilitation in Numerosity Judgments

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Abstract

Results from two experiments on the haptic judgment of dot numerosity in braille symbols suggest (1) that the bases for crossmodal facilitation (visual to haptic) may derive from either general or specific information about the symbols to be examined, and concomitantly (2) that such information may serve as bases for the greater "appropriateness" (Freides, 1974; Welch & Warren, 1980) of vision (as compared with active touch) as a study modality for this task, even when subjects are tested haptically.

Recent research has shown that crossmodal facilitation occurs both on tasks involving the perception of braille symbols (Newman, Hall, Coleman, Craig and Brugler, 1986, November) and the learning of their names (Hall and Newman, 1987; Newman, et al., 1982, Experiments 2 and 3). Thus visual (as compared with haptic) study of braille symbols has been found to facilitate performance on both kinds of tasks when subjects have been tested haptically. These results, are in accord with the modality appropriateness position proposed by Freides (1974) and by Welch and Warren (1980). The assumption is that for each of these tasks the visual modality is the more appropriate (Freides, personal communication, 25 May, 1981).

The two experiments described here provide some information about the basis for this facilitation and concomitantly for the presumably greater appropriateness of the visual (as compared with the haptic) modality. In both experiments the subject's task was to judge the dot numerosity of each of a set haptically-examined braille symbols (Myers, 1976; Newman, Craig & Hall, 1987; Newman & Hall, 1984, November).

Experiment 1 was done to determine whether visual superiority would be evidenced if haptic subjects were informed both about the structure of the braille cell (general information) and about the range in dot numerosity of the symbols to be employed (specific information). Since the haptic subjects who were given this information did as well as those who studied the symbols visually, Experiment 2 was done to determine which of these two kinds of information may have been the basis for the effect obtained in Experiment 1.

Experiment 1

The purpose of this experiment was to determine whether the superiority of visual (as compared with haptic) presentation on this task (Newman, et al., 1986, November) would still occur if subjects who studied the symbols haptically were provided with both general and specific information about the symbols they were to examine. A 2 x 2 between-subjects design was employed. The independent variables were study modality (visual or haptic) and prior information (some or none). Thus, prior to training, half of the subjects were informed about the structure of the braille cell (i.e. that it is a 2 x 3 matrix in which the dot(s) for any braille symbol are arrayed) and about the range in the number of dots contained in the set of symbols that they would be examining. The remaining subjects were not given this information. Results from previous research (Newman, et al., 1986, November) suggested that such information might be the basis for the crossmodal facilitation obtained in that study.

A study-test procedure was used. There were two study trials, each followed by a test trial. On study trials, half of the subjects in each treatment examined the items visually and the rest examined the items haptically. On test trials, all subjects examined the items haptically, and reported the number of dots each symbol contained. No feedback was provided on test trials. A 10-second rate was used on both study trials and on test trials. When examining the symbols haptically subjects used the index finger of the right hand and visual examination was precluded. The symbols were twenty-one of those previously found to be among the most difficult for subjects performing this task (Newman & Hall, 1984, November). Each contained 3, 4, 5 or 6 dots.

The subjects were 80 sighted undergraduates enrolled in the introductory psychology course at our university. All were right-handed. They were assigned to each of the four treatments through the use of a counterbalancing procedure.

Results

The means for percent correct for each condition on each test are presented in Table 1. A 2 (study modality) x 2 (prior information) x 2 (trials) repeated measures analysis of variance showed that all three main effects and the modality x prior information interaction were significant ($p < .01$). The haptic subjects who were given prior information did as well as the two visual groups. All three of these groups did significantly better than the uninformed haptic subjects. Finally, performance for each group was better on the second than on the first test trial ($p < .01$).

Experiment 2

This experiment was done to identify the basis for the facilitation in Experiment 1 for subjects who had examined the symbols haptically and were provided with both the general and specific information about the symbols they were to examine. A 2 x 2 between-subjects design was employed in which the independent variables were general information (yes or no) and specific information (yes or no). Thus, prior to training half of the subjects were told about the structure of the braille cell and the rest were not. In addition, half of those in each treatment were informed about the range in dot numerosity in the set of symbols to be examined and the rest were not so informed.

There were two other differences from Experiment 1: (1) since the effect of study modality was not to be examined, only test trials were employed, though again without feedback; (2) the symbols were those for the letters of the braille alphabet, for which there is a slightly greater range in dot numerosity (i.e. 1, 2, 3, 4, or 5 dots) than for those used in the first experiment.

Again the subjects were 80 sighted undergraduates enrolled in the introductory psychology course at our university. All were right handed. They were assigned to the four treatments through the use of a counterbalancing procedure.

Results and Discussion

Table 2 presents the means for percent correct for each treatment on each test. A 2 (general information) x 2 (specific information) x 2 (trials), repeated measures analysis of variance showed that all three main effects were significant ($p < .05$) as was the interaction between the two types of information. The means for all three groups which received information did not differ from one another but all were significantly higher than the mean for the group that received no information. (The difference between means for the group that received both kinds of information and the group that received no information replicates one of the findings of Experiment 1). Again, performance for each group improved from the first to the second test despite the absence of feedback.

In a previous experiment (Newman, et al., 1986, November) visual (as compared with haptic) study of braille symbols was found to facilitate the haptic judgment of dot numerosity in braille symbols. The results of the first experiment presented here showed that when subjects who studied the symbols haptically were provided information both about the structure of the braille cell and about the range in the number of dots in the set of symbols, their performance was as good as that of subjects who studied the items visually. Experiment 2 indicated that providing subjects with either type of information was equally facilitative. The results of these experiments suggest that the facilitation that occurs when subjects study the items visually (as compared with haptically) may derive from the greater provision of either type of information. Perhaps these are the bases for the greater "appropriateness" (Freides, 1974; Welch & Warren, 1980) of the visual (as compared with the haptic) study modality for performance on this task.

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Table 1

Mean Percent Correct for Each Treatment on Each Test: Experiment 1

	Test 1		Test 2	
	No Prior Information	Prior Information	No Prior Information	Prior Information
Haptic Modality	38.1	70.5	42.6	73.8
Visual Modality	64.3	61.7	70.7	75.0

Table 2

Mean Percent Correct for Each Treatment on Each Test: Experiment 2

	Test 1		Test 2	
	No Specific Information	Specific Information	No Specific Information	Specific Information
No General Information	54.6	71 7	61.7	77.5
General Information	74.4	76.2	81.3	81.5

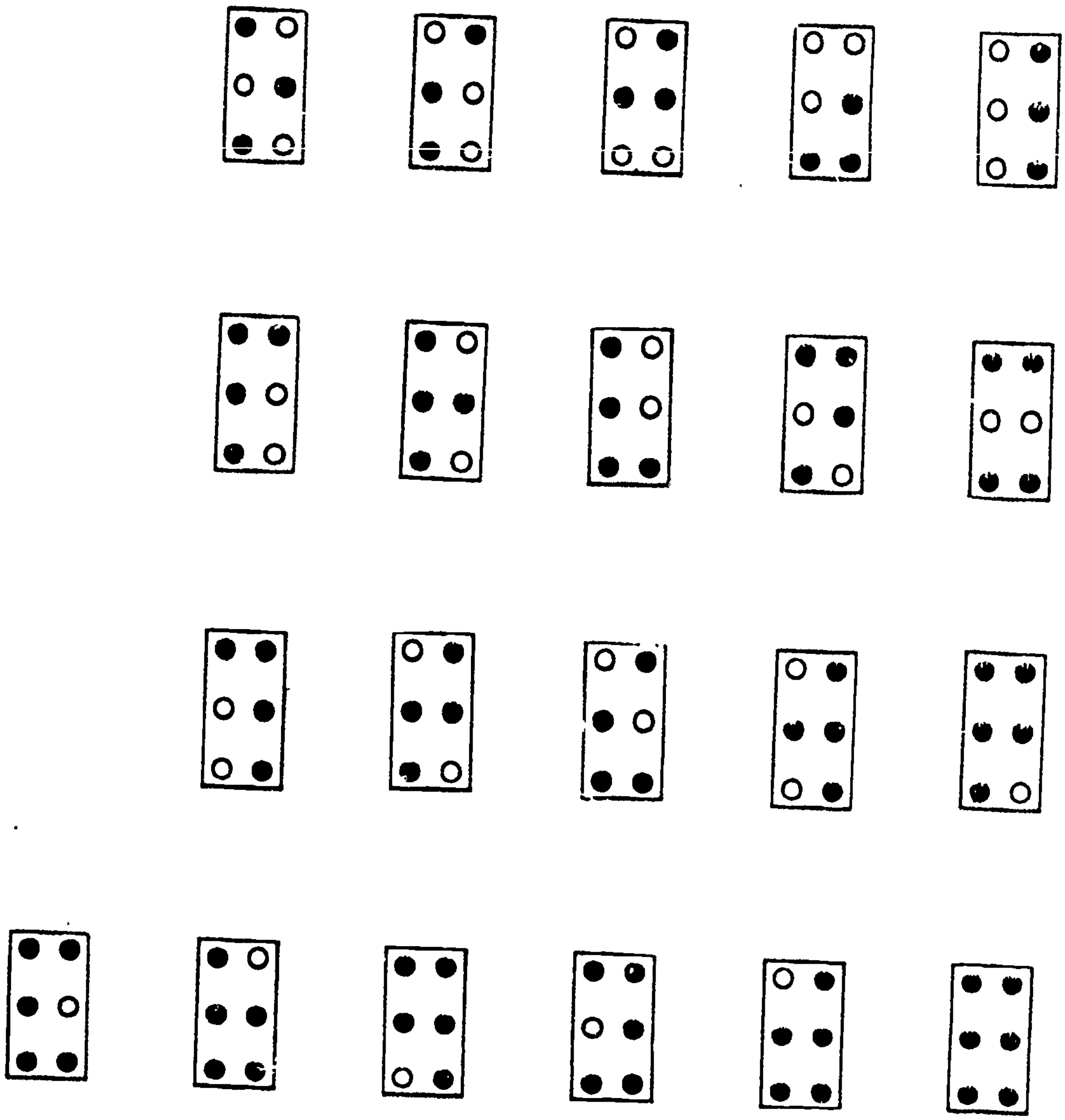

Figure 1. Braille Symbols Used in Both Experiments