Language and thinking: The interaction of naming with relevance and concreteness[1]

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Abstract

Ss solved a "mental jigsaw puzzle" following training either with names that were relevant to the problem, with irrelevant names, or without names. The jigsaw problem was presented either concretely or symbolically. At the symbolic level, relevant names facilitated and irrelevant names hindered problem solution, relative to the unnamed condition. Naming had no reliable effects at the concrete level.

Problem

Saltz & Newman (1960) found that learning the names of the parts of a mechanical device to a high criterion hindered subsequent assembly of the device. Ranken (1963) obtained a similar negative effect of naming on solution of a "mental jigsaw puzzle." The effect of pretraining on other transfer tasks is known to depend on whether the stimulus attribute that is relevant in the training task is relevant or irrelevant in the transfer task (Kurtz, 1955; Kendler & Kendler, 1961; Rasmussen & Archer, 1961). The names used by Saltz and Newman and by Ranken did not specifically encode the information required for problem solution, and the detrimental effects obtained may have been due to this lack of relevance. It is proposed that the effect of naming on problem solving will be positive when the names are relevant to the problem and negative when they are irrelevant. It is further proposed that these effects will be greater when S must solve the problem symbolically ("in his head") than when the problem is presented concretely.

Method

The stimulus shapes are shown in Fig. 1. Ss either received training with numerical labels for the 18 shapes (Named condition) or equivalent recognition training without names (Unnamed). All Ss then learned to associate each of the nine circled shapes with a different position in a circular array (the inner ring in Fig. 1). Finally, all Ss were given jigsaw problems, in which S indicated in what order the nine shapes could be fitted together to form a horizontal row or vertical column. Problems were presented at either the Concrete or Symbolic level.

The labels consisted of two digits, which encoded respectively the left and right sides of the shapes (or, for half the Ss in the Named condition, the top and bottom contours, or "ends"), as follows: "1" = "points to the left," "2" = "straight," "3" = "points to the right." Since the 18 shapes could be paired on the basis of their sides (or, differently, on the basis of their ends), each label applied to two shapes, and Ss could, by attending only to the labeled contours, reduce the effective number of stimuli from 18 to 9. The labeling code and the pairing of the shapes were explained to Ss in the Named condition, while Ss in the Unnamed condition were instructed not to use words and were not told of the pairing.

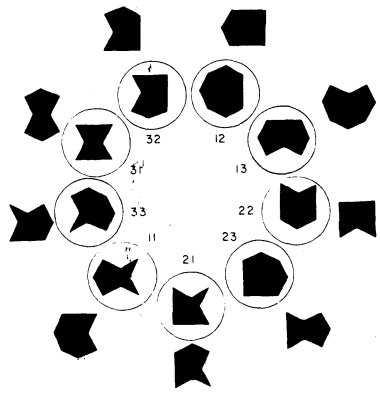

Fig. 1. Stimulus shapes, paired and labeled on the basis of left and right sides. The two shapes on any radius have the same side contours, and, for half the Ss in the Named condition, were both assigned the label shown, which encodes the sides. For the remaining Ss in the Named condition, the labels encoded the top and bottom contours. The inner ring shows the shapes used in position learning and problem solving, in their assigned positions in the ring.

Following a presentation trial during which each shape was shown for 10 sec., and the names explained to Ss in the Named condition, recognition training was given to all Ss. A shape was presented for 2 sec.; after a 2-sec. pause, S pointed to the same shape when presented with eight other shapes (each of which differed from the test shape both in sides and in ends). Ss in the Named condition gave the label for each test shape, with correction, before making the recognition response. Training for all Ss continued to a criterion of five consecutive errorless trials on the nonverbal recognition response.

Ss then learned the positions of the nine circled shapes in the ring. Following a demonstration trial, a paired-associate procedure was used. E pointed to a position in the blank ring; after a 2-sec. pause, all nine shapes were shown, and S pointed to the shape belonging in the indicated position. Ss in the Named condition were told to give the label of the appropriate shape before the shapes were shown, but only the pointing response was corrected. Training continued to a criterion of five consecutive errorless trials on the pointing response.

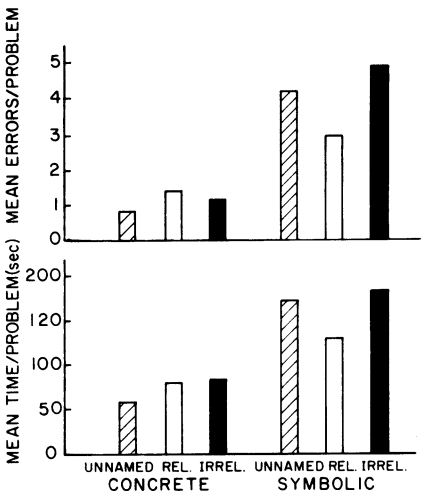

Fig. 2. Mean errors and mean solution time for different naming conditions and levels of concreteness. The data for relevant and irrelevant names within each level of concreteness come from the same Ss.

In the jigsaw problems, E designated one of the shapes and S indicated how the shapes could be fitted together, starting with the designated shape, to form either a horizontal row or a vertical column. E indicated the starting shape, and S indicated his choices, by marking the corresponding positions on an answer sheet showing the ring. In the Concrete condition, the shapes were shown in their appropriate positions on the answer sheet. In the Symbolic condition, the positions were blank. Each S did two horizontal problems, left to right and right to left, and two vertical problems, one working down and one up. For Ss in the Named condition, the labels were relevant to two of the problems (those requiring S to fit together the contours encoded in the labels) and irrelevant to the other two problems. An error was scored for each instance in which two non-matching contours were juxtaposed in S's ordering of the shapes. Twelve undergraduate Ss were run in the Named-Concrete condition, and 14 in each of the other three combinations of Naming and Concreteness.

Results

Figure 2 shows errors and solution times for the jigsaw problems. In the Named conditions, results for problems to which the names were relevant and irrelevant are given separately. With Symbolic problems, relevant names reliably facilitated problem solving relative to the Unnamed condition, as shown both by error scores ($F(1,50) = 12.84$, $p < .001$) and time scores ($F(1,50) = 9.07$, $p < .01$). Irrelevant names hindered performance as reflected in error scores ($F(1,50) = 4.47$, $p < .05$), but did not reliably affect time scores. With Concrete problems, no reliable effects of naming were obtained with either error or time scores. Concrete problems were reliably easier than Symbolic, on both error and time scores ($F(1,50) = 100.70$ and 41.00, respectively).

Discussion

The results support the propositions that relevant names facilitate problem solving and irrelevant names hinder, and that these effects are more pronounced for symbolic than for concrete problems. The effects of naming might be due to one or more of three processes: naming may induce selective attention to the stimulus attributes which serve as cues for the names; naming may favor the retention of information about these attributes; naming may facilitate the symbolic manipulation of this information in solving the jigsaw problems. The present data do not permit an analysis of the relative contributions of these three factors. However, the interference produced by irrelevant names suggests that stimulus selection, resulting in failure to take in information about the unnamed attributes, plays at least some part, since there is no obvious reason why the possible facilitating effects of naming on retention and symbolic manipulation should make retention and manipulation of the unnamed attributes more difficult in the Named condition than in the Unnamed. The fact that the effects of naming appear only at the symbolic level is consistent with an interpretation in terms of any of the three factors. Retention would not be a factor when the shapes are present; stimulus selection would be of less importance when the problem instructions specify the required information and that information is perceptually available; and the part played by symbolic manipulation is presumably less when the problem can be solved largely on the basis of perceptual judgments of similarity of contour.

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Note

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