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ABSTRACT

Paired-associate (PA) learning of children was investigated as a function of age, stimulus-type, and mode of elaboration. Sixty nursery school children (average age 53 months) and 60 first graders (average age 84 months) were selected as subjects. Each child studied nine pairs of objects, photographs, or drawings for two trials of PA learning by the recall method. In the visual elaboration conditions, the two items of the pair were presented in some visual relationship to each other during study trials (e.g., spoon holding a candle) as each item was named by the experimenter. In the corresponding verbal elaboration conditions, the items were presented visually, side-by-side, and accompanied by an orally presented sentence (e.g., "The spoon is holding the candle."). Five seconds were given for each item in test trials. The results indicated that photographs and objects were associated with more learning than drawings at both ages and with both types of mediational elaboration; but it was suggested that differences among the three types of pictorial stimuli decrease with age. A previously reported Age X Elaboration interaction suggesting a relative disadvantage of visual elaboration for younger children was not replicated. (WR)

STIMULUS CONCRETENESS AND MODE OF ELABORATION IN CHILDREN'S LEARNING

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Abstract

Paired-associate learning of children was investigated as a function of age (4 vs. 7 years), stimulus-type (line drawing, color photograph, or object) and mode of elaboration (visual or verbal). Photographs and objects were associated with more learning than drawings at both ages and with both types of mediational elaboration; but it was suggested that differences among the three types of pictorial stimuli decrease with age. A previously reported Age X Elaboration interaction suggesting a relative disadvantage of visual elaboration for the younger children was not replicated.

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Facilitation of associative learning with both adults and children has been demonstrated in studies of pictorial and verbal elaboration (e.g. Jensen and Rohwer, 1965; Wollen and Lowry, 1970). Verbal elaboration, when introduced by giving a verb or a sentence to relate a pair of objects, and pictorial elaboration, when introduced by a picture of the two objects in interaction, have been shown to produce approximately equal and parallel effects on paired-associate (PA) learning (e.g. Rohwer, Lynch, Suzuki, and Levin, 1967). Great theoretical interest was generated by several studies which suggested a developmental trend in the relative effectiveness of these two modes of elaboration, with verbal elaboration appearing relatively more effective with young children of around age 5 or less and losing its advantage with increasing age (Milgram, 1967; Reese, 1965; Rohwer, 1967). These data were described and several possible theoretical implications were discussed by Reese (1970a), Rohwer (1970), paivio (1970) and Palermo (1970). The present study like that of Holyoak, Hogeterp, and Yuille (1972) explored an hypothesis related to what Reese called the deficit of materials theory, which points out that stimuli typically used in PA learning are not rich in detail, and which suggests that older children are better able to generate extra details spontaneously than the younger children.

Many of the prior studies have used line drawings as stimuli, and it appears to have been widely assumed that such drawings, being pictorial, are es-

sentially concrete for the children; that they will be perceived and will evoke imagery in the same way that a photograph or a three-dimensional object will. We hypothesized that this assumption was less appropriate for young children than for older children or for adults, because the younger children may not yet have acquired the "visual literacy" required to process such graphical symbols. A continuum ranging from drawings to photographs to objects may be described in terms of increasing specificity of association to a particular referent, increasing perceptual similarity to the particular referent and decreasing variability or increasing restrictiveness in visual encoding (the SPR continuum). Perhaps with increasing age children learn to respond to drawings as functionally equivalent to corresponding photographs, and to photographs as functionally equivalent to corresponding objects and thus the SPR continuum becomes less important for them. Although it is similar, the SPR dimension is not seen as identical to Reese's deficit in materials dimension, because an elaborate detailed drawing might be less specific in reference, less similar to a referent, and greater in encoding variability than would be a simple unelaborated object. The proposed hypothesis may be more closely related to Reese's <u>failure to read</u> hypothesis, although it is not clear whether Reese is referring to drawings only or to all pictorial stimuli in his statement of this hypothesis.

The purpose of the present study, therefore, was to investigate visual and verbal elaboration in children with the use of objects and color photographs as well as line drawings as stimuli.

It was predicted that greater SPR or "pictorial concreteness" would be associated with greater learning, and that this relationship would be stronger with younger children than with older ones. The relative deficit for visual elaboration with younger children was hypothesized to result from the effective

"abstractness" of the drawings used for them; therefore, it was predicted that the interaction between mode of elaboration and age found in prior studies would be replicated only in the drawing condition. This interaction would be less in evidence with photographs and least so with objects.

Method

Subjects. Sixty nursery school children (average age, 53 months) were selected from several private nursery schools and 60 first graders (average age, 84 months) were selected from one middle-class public school in Austin, Texas.

Stimuli. Nine PA pairs were employed. The items of each pair were chosen from concrete objects which were familiar to both age groups (e.g. SPOON-CANDLE), provided some contrast when photographed in color, and could be handled easily by the experimenter on a 5½ by 9 inch cardboard rectangle. Pairing was random except that pairs of high association value were avoided. Objects were displayed in an interacting compound for the visual elaboration condition, or side-by-side for the verbal elaboration condition. These displays were also photographed in high quality color and mounted on white cardboard. Also black-and-white were produced on white cardboard in comparable size and orientation.

Design. Three stimulus types (drawing, photograph, and object), two modes of elaboration (visual and verbal), and two age groups (nursery and first grade) were used in a 3 X 2 X 2 between-subjects factorial design. There were 5 boys and 5 girls in each cell except for one which contained 4 boys and 6 girls.

Procedure. Each child studied the 9 pairs of objects, photographs, or drawings for two trials of PA learning by the recall method. In the visual elaboration conditions the two items of the pair were presented in some visual relationship to each other during study trials (e.g. a spoon holding a candle) as each item was named by the experimenter. In the corresponding verbal elaboration conditions,

the items were presented visually, side-by-side, accompanied by an orally presented sentence (e.g., "The spoon is holding the candle.").

Pairs were presented for 5 seconds each on an experimental apparatus which shielded all other pairs from view. Five seconds were given for each item in test trials. A new randomly determined order of presentation was used in each study and test trial. Children participated individually and responded orally; their responses were recorded by an assistant.

Children were tested in a separate room free from distraction. Data had to be discarded for four children because of interruptions during testing and for four others because they claimed not to understand the "game" they were to play even after instructions were presented a second time. Choice of timing and procedure had been based partially on a prior pilot study of three four-year old and three seven-year old children.

Results and Discussion

Table 1 presents the means and standard deviations for number of correct responses over two trials for each group of subjects. In a three-way analysis for stimulus type, mode of elaboration, and age there was a significant main effect for stimulus type ($F = 6.28$, $df = 2/108$, $p < .01$). Multiple comparisons using the Newman-Keuls procedure showed that objects and photographs both surpassed line drawings in terms of learning and that they did not differ significantly from each other. There was also an effect for age, with seven-year olds performing better than four-year olds ($F = 23.31$, $df = 1/108$, $p < .001$), but no other main effect or interaction was significant in this analysis. In particular, although the stimulus-type differences were somewhat smaller for seven-year olds than for four-year olds, the Stimulus Type X Age interaction failed of significance; thus the hypothesis that younger children would be more sensitive to

"picture-concreteness" or SPR differences was not directly supported. It receives some indirect support, however, if these results are compared to those of Wicker (1970) who found that color photographs were not superior to drawings as cues for paired-associate learning with adults. This comparison suggests that the interaction might have become significant if a wider age range had been employed. Future studies might explore the question of whether there is a gradual or a sudden decrease in drawing-photographs differences throughout the intervening age range, or whether the crucial difference between this and the Wicker study is the use of visual and verbal elaboration or some other procedural detail.

The importance of such procedural details is suggested by the fact that Holyoak, Hogeterp, and Yuille (1972), working with children only somewhat older than those employed here, found significantly better recall with line drawings than with color photographs. Several differences in procedure may account for this reversal in outcome, but the most likely critical difference is that they used line drawings as test-trial cues in all conditions, whereas photographs cues were used in the photographs conditions of this and the Wicker (1970) study. As Holyoak et al. point out, the reduced performance in their photograph condition may reflect the lesser similarity between the study-trial mediator and the test-trial stimulus in this condition.

The Age X Elaboration interaction discussed by Reese (1970a) et al. was not replicated in this study; in fact the interaction tended nonsignificantly to be in the opposite direction from that of the previous studies: visual elaboration was superior to verbal elaboration for nursery children and there was essentially no elaboration-mode difference for third-grade children. The interaction was significantly opposite when considering only the drawing and object conditions ($F = 3.92$, $df = 1/72$, $p < .05$). Because there was no good a priori reason for

omitting the photograph pairs from this analysis, however, one can conclude firmly only that relative verbal superiority with young children was not obtained. In this our data are consistent with other recent failures to replicate the interaction (Reese, 1970b; Holyoak, Hogeterp, and Yuille, 1972). Also Kee, Guy, and Rohwer (1971) reported among other data that mean number correct for visually separate pictures with preposition strings was 8.75 and for visually elaborated pictures was 11.79 in a four-year old sample, while the corresponding means in a seven-year old sample were 11.00 and 11.54. Although they used prepositions whereas the present study used complete sentences as connectors the outcome pattern is similar. The lack of overall inter-study consistency on the nature of the Age X Elaboration Mode interaction may reflect the importance of other factors, such as learning method, timing, instructions, list length, vividness or bizarreness of the elaborator, opportunity for warm-up, or the like, which themselves interact with the variables of concern. Another possibility worthy of future consideration is that children may differ simultaneously in two ways which have opposing implications for the type of Age X Elaboration interaction to be predicted. First, they might differ in their sensitivity to the two types of elaboration cue. In this case "visual" children would profit more from visual elaboration and "verbal" children would profit more from verbal elaboration. If, on the other hand, double encoding is more effective than any single encoding channel, then subjects may also differ in their need for elaboration such that "visual" children will profit more from verbal elaboration and "verbal" children will profit more from visual elaboration. If children may differ or develop in terms of both "sensitivity" and "need" factors, then independent measures of the two may be required before reliable relationships can be seen.

Although there was no overall recall difference between visual and verbal elaboration, when errors were classified as omissions, intralist intrusions,

or extralist intrusions, significantly more intralist intrusions were found with verbal elaboration than with visual ($F = 4.06$, $df = 1/108$, $p < .05$). This finding lends some support to those who theorize that the effect of visual mediation can be accounted for, at least partially, in terms of an increase in discrimination or distinctiveness of items (Paivio and Rowe, 1970).

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Table 1

Means and Standard Deviations of Number of Correct Responses in Two Trials

		Stimulus Modality					
		Objects		Photographs		Drawings	
		M	SD	M	SD	M	SD
Nursery							
	Visual	12.0	2.3	10.6	4.9	9.4	3.1
	Verbal	10.5	3.8	10.7	3.5	7.5	5.1
First Grade							
	Visual	13.7	3.4	13.9	2.0	11.7	2.5
	Verbal	14.8	2.7	12.7	2.4	11.9	3.1