

Mediation in young children's paired-associate learning*

WILLARD E. MILLIS, JR. and KENNETH L. WITTE
University of Arkansas, Fayetteville, Arkansas 72701

The present study tested 4-, 6-, and 8-year-old children with a forward chaining (A-B, B-C, A-C) mediation paradigm. Each list was comprised of six pictorial stimulus-response pairs. All associations were acquired in the laboratory via a study-test method involving a recognition task on the test trials. The lists were constructed such that positive transfer was expected for two stimulus-response pairs on the third list (mediated facilitation), negative transfer was expected for two other pairs (mediated interference), and neither positive nor negative transfer was expected for the remaining two pairs (control). Analyses of correct responses during List III indicated: (1) positive, but not negative, transfer; and (2) no age differences in positive transfer.

Relatively few studies have employed the various three-stage mediation paradigms to examine mediation in children (Goulet, 1968). In these paradigms, either all of the associations which form a mediational link can be acquired in the laboratory, or natural language associations may be used for one or both of the first two stages. Goulet (1968) indicates that the former paradigm has greater utility for examining developmental processes in mediation, in that the latter paradigm involves a confounding of the effects of mediational ability and the strength of the natural language habits, both of which presumably increase with increasing age. Apparently, only six developmental studies have used the former paradigm (Boat & Clifton, 1968; Cook & Smothergill, 1971; Davis, 1966; Kausler & Deichmann, 1968; Norcross & Spiker, 1958; Palermo, 1962).

It is unfortunate that just four of the preceding six studies used children younger than 7 years, inasmuch as several writers (e.g., Reese & Lipsitt, 1970, p. 257) have suggested that the age period 5 to 7 years is a transitional stage in the development of mediational processes. In addition, only the Kausler and Deichmann, and Norcross and Spiker (Experiment I) studies included experimental controls for pseudomediation effects (Mandler & Earhard, 1964), and thus, mediation effects have not been unequivocally demonstrated in children younger than age 5 years. Furthermore, since the earlier studies each used only one age level, it is not possible to determine directly whether age differences in mediation exist.

Therefore, in order to examine for developmental trends in mediation, this study tested 4-, 6-, and

8-year-old children. The three-stage chaining paradigm was utilized, all associations were acquired in the laboratory, and List III contained mediated facilitation, mediated interference, and control stimulus-response pairs. The inclusion of the mediated interference pairs provides a control for pseudomediation (Jenkins, 1965) and thus, this study has the potential for providing an unequivocal demonstration of mediation effects as related to children's developmental level.

METHOD

Subjects

The Ss were 12 children from each of three age levels, 4, 6, and 8 years. Only children who had a birthday in the 4 months prior to the initiation of the experiment and who had an IQ within the 85-115 range were tested.

Experimental Design

Each S received three lists of stimulus-response pairs in a mixed list design. Each list consisted of six picture pairs representing words which were essentially unrelated (Entwisle, 1966; Palermo & Jenkins, 1964). Across the three lists there were two stimulus-response pairs designed to facilitate List III learning, two pairs designed to interfere with List III learning, and two control pairs. Four Ss from each age level were randomly assigned to each of three groups. These three groups were designed to control for possible differential difficulty of the stimulus-response pairs in List III. All groups received the same form of Lists I and III. The groups differed with respect to which of three forms of List II they received. These three forms were constructed so that for a given List III pair, facilitation was predicted for one group, interference for another, and neither mediated facilitation nor interference for the third group.

Apparatus and Materials

The pictures for the stimulus-response pairs consisted of slides of objects from the Peabody Picture Vocabulary Test. The pictures were projected upon a standard home projection screen by a Kodak Carousel projector. Three picture alternative cards, one for each list, contained copies of the six response pictures, with the pictures displayed in a random fashion.

Procedure

At the beginning of the testing, each 4-year-old child received a picture familiarization trial in which E presented each picture

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and asked S to name the object. The study-test method was used to train the Ss on the three paired associate lists. On the study trials the picture pairs were presented in a random order for 5 sec each. On the test trials, each of the six stimulus pictures were presented individually. The S was required to select, if possible, the correct response picture for each stimulus from the appropriate response alternative card. Test trials were self-paced and, for the first two lists, Ss were given full knowledge of results. For List III test trials, the Ss received only partial feedback, i.e., the E said "That's right" to correct responses and "That's wrong" to errors. For each list, six random orders of picture pairs in the study trials and six random orders of stimuli in the test trials were used to control for serial learning.

On Day 1 List I was presented until criterion was attained. Then List II was presented to criterion; the criterion for each list was that each stimulus picture in each pair be responded to correctly on three not necessarily successive trials. Following the learning of List II, training was terminated for Day 1. On Day 2, usually 1 week later, Lists I and II were relearned to the same criterion used on Day 1. Then List III was presented; this list was first presented in the form of a test trial in order to obtain an initial measure of mediation. Subsequently, the list was presented for six study-test trials.

RESULTS

Lists I and II

Day 1. Trials to criterion *increased* with increasing age, $F(2,27) = 4.38$, $p < .05$. The main effect of List II form was reliable, $F(2,27) = 3.87$, $p < .05$, reflecting fewer trials to criterion for Ss receiving Form B of List II than for the other two form groups. The Ss required more trials to learn List II than List I, $F(1,27) = 4.92$, $p < .05$. The List II Form by List interaction was significant, $F(2,27) = 3.37$, $p < .05$. This effect apparently resulted from the fact that only Ss given Forms A and C of List II showed negative transfer, i.e., numerically more trials to criterion on List II than List I. One additional interaction was reliable. Age by List II Form by List, $F(4,27) = 4.35$, $p < .01$. Follow-up analyses were conducted by examining the data for each list separately. For List I, the age and the List II form main effects were nonsignificant, as was the interaction between these two variables, indicating that Ss serving in

the various Age-List II form conditions may be regarded as comparable in ability,¹ inasmuch as List I was identical for all Ss. For List II, the Age by List II form interaction was significant, $F(4,27) = 5.45$, $p < .01$. The 8-year-old Ss given Form B of List II learned in fewer trials than Ss given either Form A or C.

Day 2. The List II Form by List interaction was significant, $F(2,27) = 3.47$, $p < .05$. Trials to criterion increased numerically from List I to List II for Ss given Forms A and C, and decreased for Ss given Form B. No other effects were significant.

List III

The mean number of correct responses for the mediated facilitation, mediated interference, and control pairs for the initial test trial and the subsequent six test trials are presented in Table 1. On the basis of a mediational analysis, it was expected that the ordering of the means, from greatest to least, would be facilitation, control, and interference. In addition, if mediational ability increases with increasing age, then the differences between successive means should increase with increasing age, thereby resulting in Age by Mediation interaction.

Initial Test Trial. Because of the marked skewness of these data, the scores were transformed, $\log(X + 1)$. The List II Form main effect was significant, $F(2,27) = 3.50$, $p < .05$, as was the mediation main effect, $F(2,54) = 3.40$, $p < .05$. Performance on the facilitation pairs was greater than that on interference pairs, $t(54) = 2.48$, $p < .02$, but not control pairs, $t(54) = 1.94$, $p < .06$, while performance on control and interference pairs did not differ, $t < 1$.

Test Trials 1-6. Inspection of Table 1 indicates that possible ceiling effects exist during the last three trials for all age levels. Therefore, only the data from the first three trials were analyzed.² This analysis resulted in a trials main effect, $F(2,54) = 18.38$, $p < .001$, and a mediation main effect, $F(2,54) = 5.60$, $p < .01$. Performance on the facilitation pairs was greater than

Table 1
Mean Number of Correct Responses on Initial Test Trial and on Six Trials of
List III Learning as Related to Age and Mediation Condition

Age	Mediation Condition	Trial						Mean (1-6)	
		Initial	1	2	3	4	5		6
4	Facilitation	.50	1.25	1.42	1.92	1.83	1.83	1.75	1.67
	Control	.42	.83	1.42	1.58	2.00	1.92	2.00	1.62
	Interference	.00	1.42	1.50	1.58	1.50	1.92	2.00	1.65
6	Facilitation	.58	1.33	1.58	1.75	1.67	1.83	1.92	1.68
	Control	.25	.92	1.42	1.25	1.67	1.50	1.67	1.40
	Interference	.42	.75	1.50	1.50	1.67	1.42	1.92	1.46
8	Facilitation	.50	1.67	1.67	1.75	1.75	2.00	1.92	1.79
	Control	.17	1.00	1.58	1.58	1.75	2.00	2.00	1.65
	Interference	.33	1.17	1.33	1.67	2.00	2.00	2.00	1.70
Mean	Facilitation	.53	1.42	1.56	1.81	1.75	1.89	1.86	
	Control	.28	.92	1.47	1.47	1.81	1.81	1.89	
	Interference	.25	1.11	1.44	1.58	1.72	1.78	1.97	

that on both control and interference pairs, $t(54) = 3.23$ and 2.26 , $p < .01$ and $.03$, respectively, while control and interference did not differ, $t < 1$.

DISCUSSION

The two major findings of the present study are: (1) the demonstration of positive, but not negative, transfer due to mediation; and (2) the amount of positive transfer was independent of the age levels utilized. There are two reasons for attributing the positive transfer to mediation rather than pseudomediation. First, according to a pseudomediation analysis, List III performance on the mediated facilitation and interference pairs should have been comparable, and superior to the level of performance for the control pairs (Jenkins, 1965). The present results do not conform to this pattern. Secondly, positive transfer effects were obtained for the first three trials. Performance differences due to mediation, but not pseudomediation, typically occur early in List III training (Jenkins, 1965).

The present failure to demonstrate both mediated facilitation and interference seems to be a rather common finding in developmental studies (e.g., Shapiro & Palermo, 1968). The lack of negative transfer may have resulted from the use of subject-paced test trials on List III, thus enabling the child to inhibit the mediated incorrect response and to respond with another, possibly correct, alternative. In addition, if mediated interference effects are generally weaker than mediated facilitation effects, then the successful demonstration of mediated interference may generally require the use of more than two stimulus-response pairs of each type (Norcross & Spiker, 1958).

The fact that age differences in positive transfer were not obtained is not necessarily inconsistent with positions that view the young child as "mediationally deficient." For example, Reese and Lipsitt (1971, p. 257) indicated that mediation rarely occurs *spontaneously* before the age of 5 years, while Reese (1962, p. 507) stated that with a well-learned concept, no necessary deficiency need exist. In the present study, as in the previous developmental studies using the three-stage mediation paradigms, the Ss were given extensive training on Lists I and II. The rationale for this procedure is that it produces well-established associative links and therefore maximizes the likelihood of demonstrating transfer effects. Such a practice, however, should also have the effect of minimizing the likelihood of demonstrating age-related differences in mediation, unless perhaps very young children are used.

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NOTES

1. Underwood and Schulz (1960) conceptualized paired-associate learning as consisting of two stages; the response learning stage in which the responses become integrated as functional units and thereby available for recall, and the associative or "hook-up" stage in which each response is associated with some aspect of its stimulus. The response-learning stage was presumably minimized or eliminated in this study. This is the case since (a) the responses were pictures of objects highly familiar to all Ss, and (b) the use of the recognition procedure on test trials minimized the need for response learning. Thus, the fact that the three age groups learned List I at approximately the same rate can be interpreted as indicating that the Ss were comparable with respect to associative learning.
2. An analysis for all six trials produced results essentially consistent with that for the first three trials only.

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