An experimental evaluation of the pseudomediation hypothesis¹

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The chaining paradigm of mediation and the corresponding paradigm of pseudomediation were compared. Significant facilitation attributable to associative chaining was obtained in the mediation paradigm whereas the pseudomediation effect previously reported by Mandler & Earhard failed to appear. The adequacy of pseudomediation as an explanation of the apparent effects of associative chaining is questioned.

Present Status of Pseudomediation

A study by Mandler & Earhard (1964) suggested that the mediation effect observed in the three-stage paradigm of associative chaining may be an artifact resulting from the difference in the amount of test-stage interference between the experimental condition (A-B, B-C, A-C) and the control condition (A-B, D-C, A-C). This interpretation is based on the assumption that the first-list associations are unlearned during the acquisition of the second list in the experimental but not in the control condition. As a consequence, the acquisition of A-C in the test stage is subject to less interference from A-B under the experimental than the control treatment. To test this hypothesis, Mandler & Earhard used a design in which the first two stages of training were the same as in the conventional paradigm but mediation was precluded in the third stage by the use of entirely new response terms, i.e., A-B, B-C, A-E for the experimental condition and A-B, D-C, A-E for the control condition. As expected, the experimental group showed negative transfer in the second stage but was superior to the control group in the third stage. (The difference between the two groups was significant for trials to the criteria of one and two perfect recitations, but not for the number of correct responses on the first six trials.) The superior performance of the experimental group in the test stage was described as "pseudomediation." It was concluded that pseudomediation was probably responsible for the apparent facilitation produced by associative chains established in the laboratory.

Further experiments and theoretical discussions stimulated by the study of Mandler & Earhard have given rise to three questions: (a) Is the pseudomediation effect reproducible? An experiment by Jenkins & Foss (1965) yielded only marginal evidence for pseudomediation, whereas Schulz, Weaver, & Ginsberg (1965) led to replicate the effect altogether. In both these cases, however, the procedure differed from that of Mandler & Earhard. In the experiment of Jenkins & Foss a test of first-list recall was interpolated between the second and third stages; Schulz et al used different materials and multiple-choice learning in the second and third stages. A need for further replication is indicated, especially in view of the rather unusual finding of transfer effects which are maximal late rather than early in test-list learning. (b) Does the

interpolation of B-C in fact result in the unlearning of A-B, as the hypothesis of pseudomediation assumes? Since it is the backward first-list association B-A which must be assumed to be in competition with B-C, such an effect is to be expected only if unlearning is bidirectional. The available evidence on this question is equivocal. Goulet (in press) and Jenkins & Foss (1965) failed to find lower recall of A-B after interpolation of B-C than of D-C. On the other hand, Earhard & Mandler (1965) obtained the expected difference on a test of associative matching. The discrepancy can be reconciled only on the assumption that the greater loss of associations in the experimental than in the control condition is fully offset by an opposed difference in response availability. (c) If pseudomediation does occur, is the amount of facilitation large enough to provide an adequate explanation of the conventional mediation effect? This last question defines the central interpretative problem raised by the findings of Mandler & Earhard. In a direct comparison of the two paradigms Schulz, Weaver, & Ginsberg (1965) obtained a substantial amount of mediation but no pseudomediation. As already noted, however, there were important procedural differences between the latter and the original study. The use of a multiple-choice method of learning is interpreted by Earhard & Mandler (1965) as reducing task complexity and memory load so that mediational effects rather than interference have an opportunity to influence performance.

The present study addresses itself to the first and third of the above questions, i.e., the reproducibility of the pseudomediation effect and its adequacy as an explanation of the results obtained in conventional tests of mediation. A direct comparison was made between the paradigms of mediation and pseudomediation under conditions closely comparable to those of the study of Mandler & Earhard.

Method

The mediation and pseudomediation paradigms of associative chaining were used. In the mediation treatment the sequence of lists for the experimental condition (M-E) was A-B, B-C, A-C, and for the control condition (M-C) it was A-D, B-C, A-C. For the corresponding pseudomediation conditions (PM-E and PM-C) the sequences were A-B, B-E, A-C and A-D, B-E, A-C, respectively. Thus, the same test list was used for all groups, and within each paradigm the conditions of transfer were manipulated by appropriate variations in the first list. The use of a common second list within each paradigm makes it possible (a) to determine the amount of negative transfer in second-list learning, and (b) to assess the effects on test-list learning of prior familiarization with the response terms.

Lists of six paired associates were constructed from the pool of low-frequency words used by Mandler & Earhard (with substitution of *hutch* and *parle* for *prawn* and *llano*). There were three different pairings of the stimulus and response terms in each list which were used equally often. The lists were presented at a 2:2-sec. rate, with a 4-sec. intertrial interval. There were four different orders of presentation. The intervals between lists were approximately one min. All lists were learned by the anticipation method to a criterion of two successive perfect recitations.

The Ss were undergraduate students at the University of California who were not necessarily naive to rote learning experiments. There were 18 Ss per group. Assignment to conditions was in blocks of four, with ones per block from each condition.

Results and Discussion

The mean numbers of trials to a criterion of one perfect recitation on the first list were 11.3, 11.7, 11.8, and 12.0 for Conditions M-E, M-C, PM-E, and

PM-C, respectively. The corresponding scores for a criterion of two perfect recitations were 15.2, 15.2, 15.3, and 15.7. For both measures $F < 1$.

There is clear evidence for negative transfer in the experimental conditions during second-list learning. The mean numbers of correct responses on the first five trials, on which all Ss were represented, were as follows: M-E—10.7, M-C—15.6, PM-E—10.7, PM-C—14.2. The difference between the experimental and control conditions is highly significant, $F=18.48$, $df=1/68$, $p < .001$. There is no interaction of paradigms with conditions, $F < 1$. With the groups listed in the same order as above, the mean numbers of trials to a criterion of one perfect recitation were 10.4, 7.0, 11.2 and 8.4, and to a criterion of two perfect recitations 14.1, 9.8, 14.0, and 10.2. For both criterion measures, the difference between the experimental and control conditions remains highly significant, $F=8.86$, $df=1/68$, ($p < .005$) and 12.32 ($p < .001$), respectively. In both cases the F for interaction is less than 1.00.

Figure 1 shows the acquisition curves for the first five trials of the third stage (with all Ss represented). Condition M-E is clearly superior to the remaining three conditions; the variations among the latter are relatively small. The total numbers of correct responses in five trials are presented in Table 1. Analysis of variance yields only one significant effect, viz., for the interaction of paradigms with conditions, $F=3.98$, $df=1/68$, $p < .05$. For the difference between Conditions M-E and M-C, $t=2.49$, $df=68$, $p < .02$. Conditions PM-E and PM-C do not differ reliably, $t=.89$, $df=68$. The small difference that is present favors Condition PM-C. As Table 1 shows, the rank order of the conditions is maintained on the criterion scores. However, analysis of variance of the criterion measures does not yield statistically reliable effects.

Reference to Fig. 1 shows that on the first trial performance in Condition M-C is slightly better than in Condition PM-C, whereas on the second trial the difference is in the opposite direction. This interaction is significant, $F=4.77$, $df=1/34$, $p < .05$. Consequently, the slope of the learning curve is somewhat steeper for PM-C than for M-C. Prior familiarization with the response terms gives an advantage to Condition M-C; on the other hand, the relationship between the second and third lists conforms to the A-B, C-B paradigm for M-C, and to the A-B, C-D paradigm for PM-C. The former may be expected to yield negative

Fig. 1. Performance on the first five trials of the third stage.

associative transfer relative to the latter. The advantage of response familiarization appears to be offset by the negative transfer effects after the first trial. The equality of the two control conditions rules out the possibility that response familiarization contributes appreciably to the superiority of Condition M-E over Condition PM-E.

These results fully agree with those of Schulz et al in showing a significant amount of mediation and the absence of a pseudomediation effect. The reasons for the discrepancy between the findings of Mandler & Earhard and those of the present study are not apparent. Subtle differences in procedure or subject ability may be responsible. In any event, pseudomediation does not appear to be a strong effect which is readily reproducible. More important, however, clear evidence for mediation was obtained under conditions in which the pseudomediation effect failed to appear. The cumulative evidence available to-date makes it increasingly unlikely that chaining is an artifact attributable to pseudomediation.

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Notes

1. This research was carried out during the first author's tenure as an NIH postdoctoral fellow at the Institute of Human Learning, University of California, Berkeley.
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Table 1. Summary of Learning Measures for Third List

Cond.	Mean No. Correct	Trials to Criterion	
	Trials 1-5	One perfect	Two perfect
M-E	17.8	5.9	9.5
M-C	13.9	7.8	10.0
PM-E	14.2	9.7	12.6
PM-C	14.7	8.3	11.9