

Table 2  
I.Q. of Solvers and Nonsolvers at Each Intelligence Level

I.Q. Group	Task A		Task B	
	Solvers	Non-solvers	Solvers	Non-solvers
Above Average	114.5	115.0	109.0	109.0
N	18	6	11	15
Below Average	90.0	93.5	95.5	93.5
N	16	10	4	20

IQ of solvers and nonsolvers is virtually identical at both IQ levels. In addition, Ss who solved, whether above or below average in IQ, required approximately the same number of trials to do so. The median number of trials required was 12.5 and 11.5, respectively, for above- and below-average Ss on Task A, and 16 and 19, respectively, on Task B. It does not appear that "given enough trials the low IQ child will gradually come to solve the concept."

#### DISCUSSION

The present data strongly suggest that, within the normal range (IQ 75-150), IQ is unrelated to speed of solution for children who solve. Intelligence appears to be more strongly related to likelihood of solution than to rate of solution. Perhaps solvers and nonsolvers among the lower-IQ children differ in some fundamental abilities. The work of Whitman (1966) on cognitive styles in concept attainment suggests this as a possibility. Whitman reports that compatibility between cognitive style and task are more critical than IQ in determining concept performance. On the other hand, the difference between solvers and nonsolvers may lie along dimensions which

permit remedial training. For example, some work suggests that lower-IQ children may be less likely to engage in hypothesis-testing behavior unless trained to do so (e.g., Osler & Weiss, 1962). Possibly, relevant hypotheses are less likely to be high in the hierarchy of lower-IQ children.

The present findings appear potentially important in suggesting that previous notions concerning the relationship between IQ and concept attainment may have been seriously in error.

#### REFERENCES

- OSLER, S., & FIVEL, M. Concept attainment: I. The role of age and intelligence in concept attainment by induction. *Journal of Experimental Psychology*, 1961, 62, 1-8.
- OSLER, S., & TRAUTMAN, G. Concept attainment: II. Effect of stimulus complexity upon concept attainment at two levels of intelligence. *Journal of Experimental Psychology*, 1961, 62, 9-13.
- OSLER, S., & WEISS, S. Studies in concept attainment: III. Effects of instructions at two levels of intelligence. *Journal of Experimental Psychology*, 1962, 63, 538-533.
- SALTZ, E., & HAMILTON, H. The role of intelligence in precriterion concept attainment by children. *Journal of Experimental Psychology*, 1969, 81, 191-192.
- WHITMAN, R. N. Concept attainment as a function of intelligence. *Dissertation Abstracts*, 1966.
- WOLFF, J. L. Concept attainment, intelligence and stimulus complexity: An attempt to replicate Osler and Trautman (1961). *Journal of Experimental Psychology*, 1967, 73, 488-490.
- NOTE
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transfer when using a generalization measure in the transfer stage of an AB, A'B paradigm, where A and A' were associated words, and B was a nonsense syllable. Palermo & Jenkins (1964) (using an AB, AC, AX paradigm, where AB words were either lowly or highly associated, AC words were not associated directly but only through mediated associations of either high or low strength, and AX words were not associated), with children as Ss, demonstrated that their association norms would predict not only the learning of pairs directly associated (AB), but also the learning of pairs which were associated indirectly via a mediated response (AC). Further, in an experiment by McGehee & Schultz (1961), conducted to determine how language habits inferred from free-association norms might mediate the learning of verbal paired associates, it was concluded that free-association norms were "critical" in defining associative chains.

The above studies have related the association value of pairs to mediation in varying manners. However, the present study attacked the problem by using a somewhat different procedure than had been attempted thus far. The purpose of this study was to more completely define the effect of association value of word pairs in the standard AB, BC, AC mediation paradigm by manipulating between-stage association value. The expectation was that manipulation of the associative strength of word pairs in different stages of the paradigm, while at the same time holding the association values of the word pairs in other stages constant, would modify the transfer and mediation which occurred in the paradigm. There was no test for mediation per se in the present study. By now, the mediation phenomenon in the AB, BC, AC paradigm is so well accepted by Es in the field that it seemed more efficacious for the purposes of the present study to accept as a basic premise that mediation would occur, and to direct the experimental procedure toward manipulating that mediation.

#### SUBJECTS

The 64 Ss (32 males, 32 females; median CA = 19) were undergraduates at the University of South Florida. Thirty-seven were enrolled in an introductory psychology course and received extra credit for their participation. Since not all Ss had participated in similar experiments, S assignment, while random, was done so that the Ss known to be naive were equally distributed across all conditions.

#### PROCEDURE

Subjects were run individually using the AB, BC, AC paradigm under standard paired-associate anticipation procedure.

Four lists of eight word-pairs each were constructed from Palermo & Jenkins's

## Mediation as a function of association value in the AB, BC, AC paradigm<sup>1</sup>

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Four experimental manipulations of association value (LLL, HLL, LHL, and LLH) were applied to the AB, BC, AC paradigm. High association value word pairs (H) facilitated list learning as well as mediation. It appeared that the mediation facilitation was greatest when the high associates were in Stages 1 and 3 of the paradigm, being minimally effective in Stage 2.

The study of transfer and mediation has long been a popular topic for research in the field of verbal learning. Such factors as contiguity, meaningfulness, and strength of connection of word pairs are generally accepted as being directly related to the magnitude and direction of transfer. [See Horton & Kjeldgaard (1961) or Kjeldgaard (1968) for a comprehensive review of these factors.]

The present concern was with the association value of word pairs and the resulting influence on mediation. Brown, Jenkins, & Lavik (1966) found moderate relationships between association value and

Table 1  
Mean Errors by Condition by Stage<sup>a</sup>

Condition	LLL	HLL	LHL	LLH
Stage 1 (AB)	L	H	L	L
$\bar{x}$ Errors	17.25	.81	15.81	9.44
Stage 2 (BC)	L	L	H	L
$\bar{x}$ Errors	9.38	10.63	3.94	15.00
Stage 3 (AC)	L	L	L	H
$\bar{x}$ Errors	17.50	6.75	10.44	.38

<sup>a</sup> Capital letters refer to the association value of the word pairs for particular stages; L = low, H = high.

(1964) norms to correspond to the four treatment conditions: LLL, HLL, LHL, LLH ("L" = low association value pairs; "H" = high association value pairs). Each capital letter indicated the association value of the pairs in that stage of the paradigm. For example, in the HLL group, AB pairs were highly associated (frequency of response  $\geq$  250 for the entire college sample), while BC and AC pairs were of low association value (frequency of response  $\leq$  10). All words used appeared in Palermo and Jenkins's norms, and no word appeared more than once in a given list.<sup>2</sup>

Four orders (O) of each of the four lists (1) were constructed for a total of 16 OIs. The four OIs for each treatment-condition-list were constructed as follows: (1) the pairs were randomly assigned to the numbers from 1 to 8, (2) four rows were randomly selected from a balanced 8 by 8 Latin Square, constructed so that each pair would follow every other pair only once and would appear in a given position only once (after Blount & Heal, 1966), and (3) one of the four randomly selected rows was randomly assigned to each stage of the paradigm with the restriction that no three-row sequence was repeated for any of the four OIs constructed for a given treatment condition. Four Ss (two male, two female) were assigned to each OI for a total of 16 Ss per treatment condition. Ss were randomly assigned to OIs as they became available for testing.

Lists were presented on a Lafayette memory drum (Model 303). Words were typed in black 1/8-in. capital letters on a white background. Presentation rate was 1 sec for the stimulus word, 1 sec for the pair, 1 sec between pairs, and 5 sec for the intertrial interval (ITI). One second of the ITI was consumed with a red dot which served as a ready signal. Ss were given two practice trials and criteria for each stage was three consecutive correct trials.

### RESULTS

Three one-way analyses of variance (one per stage) were done for each dependent variable (errors, trials to criterion). Trials-to-criterion data yielded results in agreement with those reported below for errors. For the error data, all three analyses

resulted in significant Fs (Stage 1,  $F = 11.55$ ,  $df = 3/60$ ,  $p < .01$ ; Stage 2,  $F = 3.68$ ,  $df = 3/60$ ,  $p < .05$ ; Stage 3,  $F = 8.28$ ,  $df = 3/60$ ,  $p < .01$ ). Table 1 presents the means for the error data.

Appropriate Tukey Ts (Winer, 1962) on Stage 1 indicated three expected significant differences corresponding to the three comparisons involving the high association value condition for Stage 1 and the low association value conditions: HLL-LLL (respective  $\bar{X}$ s = .81 and 17.25),  $T = 7.46$ ,  $p < .01$ ; HLL-LHL ( $\bar{X}$ s = .81 and 15.81),  $T = 6.81$ ;  $p < .01$ ; HLL-LLH ( $\bar{X}$ s = .81 and 9.44),  $T = 3.91$ ,  $p < .05$  ( $df = 3/60$  in all cases). Also as expected, there were no significant differences among the low association value conditions in Stage 1.

Tukey Ts applied to Stage 2 revealed only one significant difference: LHL-LLH (respective  $\bar{X}$ s = 3.94 and 15.00),  $T = 3.74$ ,  $p < .05$ ,  $df = 3/60$ .

Stage 3 results indicated three significant differences: LLH-LLL (respective  $\bar{X}$ s = .38 and 17.50),  $T = 6.89$ ,  $p < .01$ ; LLH-LHL ( $\bar{X}$ s = .38 and 10.44),  $T = 4.05$ ,  $p < .05$ ; HLL-LLL ( $\bar{X}$ s = 6.75 and 17.50),  $T = 4.32$ ,  $p < .01$  ( $df = 3/60$  in all cases).

### DISCUSSION

Stage 1 results were exactly as expected, indicating that (1) for first-learned lists, high association value significantly reduced learning time, and (2) there was no reason to suspect that one low association list was easier to learn than any other.

Stage 2 results were not as easy to interpret. One expected difference did occur (LHL-LLH), and the other means were in the direction an explanation based solely on association value would predict. The failure to obtain significant differences between Groups LHL and HLL in Stage 2 may have been due to a facilitative effect in Group HLL created by the relative ease of learning the first stage of that condition. The failure to find a significant difference between Groups LHL and LLL remains a mystery, a motivator for future research. A difference between Groups LLL and LLH for Stage 2 was not expected since these groups were identical in association value conditions up to this point, and indeed a difference did not occur.

Stage 3 revealed two of the three significant differences an association-value hypothesis would predict (LLH-LHL, LLH-LLL). The failure of the third difference such an hypothesis would predict (LLH-HLL) again indicated (as did similar failures in Stage 2) the inefficiency of such an hypothesis as the only explanation.

Assuming that mediation did in fact occur in each group used in the present study, the presence of a highly associated list in Stage 1 apparently facilitates mediation. This contention gains support from the

significant difference found in Stage 3 between Groups HLL and LLL. Additional evidence may be inferred from the lack of a significant difference between Groups HLL and LLH in Stage 3.

Again assuming mediation did occur, the failure of a difference to occur in Stage 3 between Groups HLL and LHL might indicate that a high associate list in Stage 2 is also facilitative of mediation. The "clincher" for this argument is unfortunately missing, since no significant difference was found between Groups LLL and LHL for the final stage of the paradigm, although the means were in the correct direction.

Thus, in addition to again demonstrating the effects of association value of word pairs on learning rate, the present results indicated that association value can influence mediation in the AB, BC, AC paradigm. It appeared that the effect was facilitative of mediation and that such facilitation was greatest in Stage 1 and Stage 3, being minimal in Stage 2. It should be noted that whatever facilitative effect high association value might have had in Stage 3 of the paradigm (Group LLH) was necessarily confounded in the present study with the fact of high association value.

### REFERENCES

- BLOUNT, W. R., & HEAL, L. W. Subject strategies and the effect of MA on learning rate and acquisition patterns of serial verbal material. *Psychonomic Science*, 1966, 6, 369-370.
- BROWN, L. K., JENKINS, J. J., & LAVIK, J. Response transfer as a function of verbal association strength. *Journal of Experimental Psychology*, 1966, 71, 138-142.
- HORTON, D. L., & KJELDERGAARD, P. M. An experimental analysis of associative factors in mediated generalization. *Psychological Monographs*, 1961, 75(11, Whole No. 515).
- KJELDERGAARD, P. M. Transfer and mediation in verbal learning. In T. R. Dixon and D. L. Horton (Eds.), *Verbal behavior and general behavior theory*. Englewood Cliffs, N.J.: Prentice-Hall, 1968.
- McGEHEE, N. E., & SCHULTZ, R. W. Mediation in paired-associate learning. *Journal of Experimental Psychology*, 1961, 62, 565-570.
- PALERMO, D. S., & JENKINS, J. J. Paired associate learning as a function of the strength of links in the associative chain. *Journal of Verbal Learning & Verbal Behavior*, 1964, 3, 406-412.
- PALERMO, D. S., & JENKINS, J. J. *Word association norms: Grade school through college*. Minneapolis: University of Minnesota Press, 1964.
- WINER, B. J. *Statistical principles in experimental design*. New York: McGraw-Hill, 1962.

### NOTES

1. This study was conducted as an undergraduate independent research project by the first author under the direction of the second author. Grateful acknowledgement is extended to the Department of Psychology, USF, for their cooperation re: Ss, apparatus, and space.

2. Due to the considerable (often extreme) difficulty of compiling lists like those used in the present study, mimeographed copies of the lists are available from the authors upon request.