

MEDIATED GENERALIZATION AND THE INTERPRETATION OF VERBAL BEHAVIOR: III. EXPERIMENTAL STUDY OF ANTONYM GRADIENTS¹

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In the previous discussion of mediated and non-mediated generalization (1), it was suggested that the former type of generalization might occur along a number of different gradients in addition to those involving synonyms. One of the possible other gradients suggested was that involving antonyms. The present paper reports an experiment designed to determine experimentally whether generalization does occur to antonyms.

In the previous paper, we described the mechanism which, it is assumed, mediates generalization in the case of synonymous words (1, Fig. 1; see also 3, pp. 27-28). In the case of antonyms it is possible that the mediating mechanism is somewhat more complex than is the case with synonyms. To explore this theoretical possibility would require a great deal of discussion, and we merely mention the point here, reserving until a later time the examination of this question.

A previous study by Riess (4) showed that generalization to antonyms does occur. He used the galvanic skin reaction to a bell as the response to be conditioned. The present experiment employed a larger number of antonyms than Riess used, and the method was essentially the same as that used in a previous investigation of homophone and synonym generalization (2).

METHOD

1. *Materials.*—A list of 10 unrelated familiar words (presentation or P-list) was assembled such that from each word an antonym could be derived. Other complicating semantic or homophonic relationships were minimized. According to our hypothesis, the repetition (reinforcement) of these antonyms should increase the reaction potentials of the words in the original (P) list more than would the repetition of an unrelated list (control), and hence recall of the P-list should reflect this difference. Two reinforcement lists were accordingly constructed: (1) the A-R list was composed of 10 words each one of which was an antonym of one word in the P-list; (2) the C-R₁ list was composed of 10 words which were not related to any words in the P-list in any evident or formal way, directly or indirectly. These two lists, along with the

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P-list, may be found in Table 1. In addition a 'Buffer' or practice list (B) and an Equation List (E. L.) were utilized; these two lists were the same as those used previously and may be found in Table 1 of the previous paper (2).

TABLE 1
LISTS OF WORDS USED IN THE EXPERIMENT

The word order (top to bottom) shown is that of the first presentation of each list throughout the experiment. Only the R-lists were changed in order at any time, as described in the previous paper (2). Numbers in parentheses indicate the relationship between words in the A-R list and words in the P-list.

P	A-R	C-R ₁
(1) light	(3) early	each
(2) hard	(4) praise	print
(3) late	(7) timid	tepid
(4) blame	(2) soft	sold
(5) dirty	(8) top	tuck
(6) dead	(9) subtract	suppose
(7) brave	(10) deny	deer
(8) bottom	(6) alive	also
(9) add	(5) clean	cleat
(10) affirm	(1) heavy	hedge
Mean no. letters per word	5.0	4.7
Range in no. let- ters per word	3-8	4-7

2. *Procedure and Scoring.*—The procedure and scoring used in this experiment were the same as in the previous study (2). Briefly, the procedure was as follows: Every S first learned the Buffer List and then the E. L. list. On the basis of E. L. score (used to equate the reinforcement sub-groups for 'learning ability'), the S was assigned to a reinforcement procedure. In the A-R sub-group, this consisted of four presentations of the A-R list; in the C-R₁ sub-group, this consisted of four presentations of the C-R₁ list. In both groups, the reinforcement list was presented immediately after S wrote his recall of the E. L. list, and the reinforcement list presentations were followed immediately by the presentation of the P-list. The C-R₂ sub-group was an additional control, introduced to determine the effect of the omission of the reinforcement list on the recall of the P-list; it is to be compared with the C-R₁ sub-group. In all respects it was treated the same as the other two sub-groups except that no reinforcement list was presented between the E. L. and the P lists. All other aspects of the procedure and scoring, such as the method of presentation of material, exposure interval, instructions (modified slightly to suit the needs of this study), and general conditions were the same as those previously described (2). That the three sub-groups were adequately equated in terms of E. L. score may be seen from Table 2.

3. *Subjects.*—84 Ss were used in this experiment, 54 male and 30 female. They were all enrolled in the first course in psychology and were naive with respect to the purpose of the experi-

TABLE 2
DATA CONCERNING THE EQUIVALENCE IN 'LEARNING ABILITY' OF THE THREE SUB-GROUPS AS EVIDENCED BY EQUATION LIST SCORE

Sub-group	N	'Equation List' Performance			
		No. Correct	No. Incorrect	Range in no. Correct	Mean no. Correct
A-R	28	179	9	4-9	6.39
C-R ₁	28	179	9	4-8	6.39
C-R ₂	28	177	0	4-9	6.32

ment. Each sub-group included 28 Ss, and the sex ratio, age, and years spent in college were approximately the same for the Ss in each sub-group.

RESULTS

The major results of the experiment are presented in Table 3. The only comparison relevant to the problem of mediated generalization is that between the means of the A-R sub-group and of the C-R₁ sub-group. The average recall score for the P-list is 0.61 words greater for the A-R sub-group than for the C-R₁ sub-group. This difference is in accordance with what would be expected if mediated generalization occurs. The significance ratio of this difference is 1.68, indicating that there are 95 chances in 100 that such a difference could not have arisen as a sampling error from a true difference of zero. Although this critical ratio is somewhat below the value ori-

TABLE 3
ANALYSIS OF PERFORMANCE OF THE 3 SUB-GROUPS IN THE RECALL OF THE PRESENTATION (P)
LIST. *N* IS 28 FOR EACH GROUP

Sub-group	No. Correct	No. Incorrect	Range Correct	Mean Correct	σ Mean	Diff. from C-R ₁ Mean	σ diff.	Significance ratio	P-value
A-R	168	19	4-9	6.00	.247	.61	.363	1.68	95
C-R ₁	151	15	3-8	5.39	.249	—	—	—	—
C-R ₂	159	7	4-9	5.68	.236	.29	.355	0.82	79
Diff. between A-R and C-R ₂ means: 0.32							.342	0.94	83

narily accepted for statistical certainty, it allows a reasonable degree of confidence that the obtained difference is a real one.^{2,8} Thus, Riess' finding (4) of generalization to antonyms would seem to be confirmed by a different method.

The difference between the average number of words recalled from the P-list by the two control sub-groups is 0.29, with the C-R₂ sub-group having the higher mean. This slight difference indicates, if anything, only that the four presentations of the reinforcement list caused a small amount of interference with recall of the P-list in the case of the C-R₁ sub-group. (The medians for these two groups are practically identical.)

² At the end of the experiment, the Ss were questioned to determine whether they had observed the relationship of antonymity in the words. Three Ss gave no evidence of having discerned it, four others apparently saw it in only a few words, and two apparently saw it as an 'after-thought,' *i.e.*, after their recalls had been completed. The other 19 cases apparently knew of the relationship without question. If the 9 Ss who did not clearly see the relationship are excluded from the A-R sub-group and 9 Ss equivalent to them in E. L. score are also removed from the C-R₁ sub-group, the difference between the two means is increased by a small amount.

³ The medians for the 3 sub-groups show somewhat smaller differences than the means. The medians for the A-R, C-R₁, and C-R₂ sub-groups, respectively, are: 6.0, 5.71, and 5.70.

We tabulated, for each sub-group, the number of correct responses for each word in the P-list. The resulting distributions showed no consistent differences among the groups.

Incorrect recalls for each sub-group were likewise tabulated and analyzed. Of the 19 incorrect words in the A-R sub-group, 17 were repetitions of words in the reinforcement list. The two other incorrect words were (1) *divide*, which is in the same class (arithmetic operations) with *subtract* (A-R) and *add* (P); (2) *loud*, which is an antonym of *soft*, found in the A-R list. Only one of the 15 incorrect recalls in the C-R₁ sub-group was a word from the reinforcement list (C-R₁). The other incorrect words were antonyms of words in the P-list or possible synonyms or quasi-homophones of words in the reinforcement and P lists. A similar statement may be made about the 7 incorrect recalls of the C-R₂ sub-group, although all of them of necessity were related to words in the P-list.

SUMMARY

An experiment was designed to test the hypothesis that mediated generalization may occur to antonyms of reinforced words. The results tend to suggest that generalization may occur in this way.

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