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The effects of prompting and confirmation on automated presentation of materials in discrimination learning were studied. Eight pairs of words or pictures were presented to 48 mentally retarded subjects (mean IQ 63, mean chronological age 163.4 months, mean mental age 103.3 months). Each subject's correct responses advanced the program and, in the prompting condition, the correct response was always underlined. The number of errors in the original learning was less under prompting (p .001). Treatment by order interaction was also significant (p .01) with better performance for prompting from word-picture order and for confirmation from picture-word order. Seven days later, prompting subjects committed fewer errors in relearning (p .001) and were superior in recognition (p .01). Confirmation was further tested under two new conditions: in one, praise and candy reinforced all correct responses; in the other, they were given only upon correct first choices during practice trials. The first group had fewer errors (p .01) than the second or those in the analogous condition in the earlier experiment; and performance in the second experiment was not significantly different from that seen in prompting. (JD)

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Training Procedures and Automation: Effects on MR Performance

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September 1968

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Training Procedures and Automation: Effects on MR Performance[1]

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Abstract

Forty-eight MRs served as Ss in two experiments designed to study the effects of Prompting and Confirmation on automated presentation of materials in discrimination learning. Prompting produced superior performance in Experiment I. However, in Experiment II modification of the Confirmation procedure produced performance which was not significantly different from that seen in Prompting. Differences in discriminability of test and practice trials in these two treatments, and possible differences in motivation may account for these results.

Training Procedures and Automation: Effects on MR Performance

Stolurow (1961) observed that research in programmed instruction has been more provocative than definitive. This is hardly surprising since there is disagreement in the results of research dealing with the various parameters of presentation of programmed material. Before a meaningful consideration of the efficacy of programmed instructional material specifically for the mentally retarded can be entertained, some definitive work is needed to establish the most efficient method of presenting programmed material for this population. At present, no general statement can be made about the treatment variables of Prompting (so-called "errorless learning") and Confirmation (trial-and-error learning). Results of verbal learning studies vary according to the task, Ss, type of materials, and criterion which the experimenter utilizes for evaluation. Cook and his associates (Cook, 1958; Cook and Spitzer, 1960) report that prompting (P) produced faster learning in paired-associate (PA) tasks and superior retention in terms of "legitimate" responses.[2] Cook theorized that prompting was superior to confirmation (C) because of the shorter intervals between the stimulus and response pair than in confirmation and because overt practice of the response interfered with forming the proper S-R association. Cook's Ss were normal adults, and the method of presentation was film strip projector. Several authors reporting results of confirmation and prompting in PA

tasks failed to find prompting more effective (Hawker, 1964a, 1964b, 1964c, 1965a, 1965b, 1966a; Lockhead, 1962; and Silberman, Malaragno and Coulson, 1961). Stolurow & Lippert (1962) report prompting superior to confirmation in acquisition but not in retention. However, in similar studies Hawker (1964b, 1966b) and Blackman and Holden (1963) failed to find differences as a function of these treatments either in acquisition or retention of sight vocabulary. Better retention following confirmation was indicated by relearning data in a study showing no differences in the original learning of a PA task (Hawker & Keilman, 1966). Results are not directly comparable to other studies since mentally retarded (MR) Ss were used. That the type of task can influence results obtained with these two treatments is seen in three discrimination studies using MR Ss (Hawker, 1966c). Where either faster learning or greater retention was seen, prompting was the treatment indicated. The method of presentation was either by flash cards or slide projector. In a series of discrimination studies employing retarded subjects Fletcher and his associates also obtained better performance with prompting (Fletcher, 1965, 1966; Fletcher, Davis, Orr, and Ross, 1965). He attributes this to the occurrence of an implicit response in addition to the overt response, theorizing that these two responses accrue greater habit strength than the single correct response occuring in the trial and error procedure. His reasoning is in conflict with Cook's who assumes overt responses interfere with learning the correct responses. The present problem was designed to study the way in which prompting and confirmation affect per-

formance of educable MR Ss in a discrimination task in which the materials to be learned are presented in an automated, S-paced machine similar to those used in programmed teaching. In accordance with the results of most of the discrimination work, the hypothesis of this study was that prompting would produce better performance in original and relearning of a discrimination task.

Method

Subjects. Thirty-two mental retardates at the Austin State School served as Ss in this experiment. Eight Ss were randomly assigned to each of the four experimental conditions. Analysis of variance indicated that there were no significant differences in the mental age (MA), chronological age (CA), or IQ of these groups (see Table 1).

Insert Table 1 about here

Apparatus. The MTA SR-400 Scholar, an automated machine which enables the subject to advance the printed programs, was used to present the lists of paired stimuli. Eight pairs of either pictures or words were used according to the experimental conditions. The word pairs were: go, house; train, orange; book, and; paper, tree; hat, wind; play, shoe; ball, candy; two, red. The picture pairs were: table, gun; dog, lock; flower, cow; man, kite; pan, monkey; sock, balloon; car, rake; airplane, shirt. All materials were randomized for order of presentation in the list and for position.

Procedure. The four experimental groups were P-WP: prompting procedure, Order I, in which word discrimination preceded picture discrimination. P-PW: prompting, Order II, in which the picture task was presented first. C-WP: Confirmation, Order I presentation of tasks, and C-PW, Confirmation, Order II. The result is a 2 x 2 x 2 design with Prompting and Confirmation the major treatment variables for two lists of materials, delivered in two orders to control for practice.

The presentation of this material followed that used by Hawker (1966c) in his discrimination studies: eight pairs of words or pictures were presented for a practice trial, then these eight pairs were presented in a different order and position for a test trial. S was required to learn that one member of each pair was the "correct" response. Twenty test trials were interspersed with 20 practice trials. The performance was S-paced in that the S's responses advanced the program. In the prompting procedure, the correct choice was always underlined, so that the S could make a correct response and advance the list to the next pair by pressing the panel over the correct choice. The S was told that when he had made a correct choice he could know he was right because the paper would move forward and he could see a new pair of pictures (words). The conditions for both groups were the same for the test trials; in order to avoid feedback and turn the test trials into practice trials, either response panel would advance the program.

Retention and relearning data were collected seven days after original learning. Original learning for the second list

was begun the day after collection of retention data for the first list. Recall and recognition scores were obtained by the use of flash cards prior to relearning the task on the MTA Scholar. Recall data was collected before recognition. For recall, all cells of Ss were equally divided into two groups. Subjects in each group were asked to recall the missing member of the paired stimuli when shown either the correct (Group RI) or the incorrect (Group RC) member of the pair. All Ss were rewarded upon completion of each task with M & M's. Although they were told that the number of correct responses would determine the number of candy rewards, all Ss were rewarded equally.

Results

The hypothesis predicting that Prompting would produce superior performance in original learning and relearning was supported. The number of errors in original learning is significantly less under prompting than confirmation ($F = 751.40$; 1, 28 df, $p < .001$). The Treatment by Order interaction was significant at the .01 level. Better performance for Prompting was produced by Condition P-WP than P-PW with the reverse order effect for Confirmation.

Insert Table 2 about here

In order to provide conditions of equal exposure to the task (in terms of number of presentations) all Ss were given 20 test and 20 practice trials. A criterion of two perfect trials with no subsequent errors was adopted. As seen in Table

III, P Ss achieved criterion in significantly fewer trials than

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Insert Table 3 about here

C Ss, ($F = 173.59$; 1, 28 df, $p<.001$) P Ss performed better on the second list than on the first while C Ss were better on the first ($F = 11.94$; 1, 28 df, $p<.01$).

To compare trials to criterion in relearning with original learning the criterion of two errorless trials was compared to the first occurrence of two errorless trials in original learning. Again P was superior, ($F = 64.51$; 1, 30 df, $p<.001$). No

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Insert Table 4 about here

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significant differences were seen as a function of Order or Lists or their interactions with the major treatment variable. As would be expected, P Ss committed fewer errors in relearning (Table 5, $F = 427.29$; 1, 30 df, $p<.001$) making a significant

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Insert Table 5 about here

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reduction in the number of errors on the second list ($F = 8.76$, $p<.01$).

Recognition data also showed P to be superior to C, with significance at the .01 level (Table 6, $F = 24.44$, 1, 30 df).

Insert Table 6 about here

Recall results yielded insufficient data for statistical analysis. However, the raw data are presented in Table 7. The score

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Insert Table 7 about here

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is the number of different legitimate responses (using Cook's terminology) and the score in parentheses is the number of correct associations. The C Ss recalled 19 correct responses to the P Ss 10.

Discussion

The results of this study were surprising only in the magnitude of the differences between the treatment variables of Prompting and Confirmation. Since these differences were in excess of those reported by Hawker and the procedure was essentially the same, reason for this seemed to lie in the method of presentation. In Hawker's work as in other studies reviewed, the materials had been presented either remotely by projector or directly by the Experimenter (E). In this study the S presented the stimuli. This apparently slight change in procedure results in some important consequences for the Confirmation procedure. Here, knowledge of correct results, as shown by the forward progress of the program, is assumed to be rewarding and consequently motivating. However, the possibility exists that the S perceives this as frustrating and nonrewarding in that he advances the program to another problem to solve. For the MR, knowledge of results in an abstract task may result in accruing frustrative non-reward rather than in reward. Fur-

thermore, in the flash card method of presentation, the difference between test and practice trials in the Confirmation procedure is immediately apparent because the E reinforces correct responses only on the practice trials. In the automated procedure, the test and practice trials are distinctive only for the Prompting procedure. In Confirmation any response advances the program during the test trials. This may lead to reinforcing incorrect responses since the S has observed that only correct responses advance the program. Since the program advances with each response during test trials, the S may interpret this as meaning that each response is correct. Therefore a second experiment was devised to make the test trials more discriminable from practice trials and to see if this could narrow the differences between C and P.

Experiment II

In this experiment, two new conditions were compared with the original performance of eight Ss in C-PW, List I. Performance on this task will be considered Condition I. In Condition II reinforcement was provided by both the MTA Scholar machine and the E. As in Condition I, the machine automatically advanced the program to the next pair of pictures when the S made a correct response on a practice trial. In addition, the E rewarded the S with an M & M and said "that's right," but only when the S's first choice was the correct one. Again, during the test trials, the E offered no reinforcement, and the machine advanced the program after each response.

In Condition III, the E advanced the program with a remote control after each correct response and rewarded the S with an M & M and "that's right". In this condition, 20 practice trials also served as test trials, and correct responses were recorded whenever the S's first choice was correct.

Results

A one-way analysis of variance on the error scores on these three conditions showed a significant difference in favor of Condition III (Table 8), ($F = 68.97$, 2, 21 df, $p < .01$). A t-test

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Insert Table 8 about here

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between the Condition III and the analogous P Condition in the first experiment showed no significant differences between the P and C methods.

Discussion

The improvement in Confirmation performance under conditions of an E-advanced program and the elimination of test trials per se indicates that there is some danger in generalizing results from previous Prompting-Confirmation discrimination studies and concluding that prompting produces better or faster learning. First of all, performance differences may obscure underlying learning differences. In this case motivation is an important component and may be responsible for the poor performance under the Confirmation procedure in Experiment I, in which E observed alternation, banging on the equipment, and a reluctance to return

to learn List 2 on the part of the Ss. Confirmation Ss in Experiment I failed to show improvement on the second list, as did Prompting Ss.

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Footnotes

[1]The authors gratefully acknowledge the constructive criticism of Dr. Robert K. Young, The University of Texas.

[2]A legitimate response is any response term from the PA list regardless of whether it is paired with the proper stimulus term or not.

Table 1

Descriptive Data on CA, MA, and IQ

Group	CA		MA		IQ	
	Mean	SD	Mean	SD	Mean	SD
P-WP	163.4	13.26	103.3	22.64	63.0	11.74
P-PW	173.8	11.66	108.4	11.10	62.6	7.58
C-WP	166.1	12.33	103.5	10.77	62.6	8.02
C-PW	160.0	18.92	99.9	16.05	62.5	7.56

Table 2

Errors in Original Learning

Condition	List I		List II	
	Mean	SD	Mean	SD
P-WP	14.62	25.83	9.25	13.05
P-PW	19.75	22.56	10.25	12.34
C-WP	57.88	16.32	51.63	23.06
C-PW	53.00	23.27	45.13	24.83

Table 3

Original Learning: Trials to a Criterion of Two Errorless Trials with No Subsequent Errors

Condition	List I		List II	
	Mean	SD	Mean	SD
P-WP	12.50	6.26	13.25	8.26
P-PW	16.25	6.34	12.25	8.22
C-WP	19.38	1.77	19.00	2.83
C-PW	18.12	5.30	19.88	0.35

Table 4

Trials Saved on Relearning to a Criterion of Two Errorless Trials

Condition	List I		List II	
	Mean	SD	Mean	SD
Prompting	7.88	8.87	7.81	7.36
Confirmation	6.69	8.13	7.43	8.09

Table 5

Number of Errors in Relearning

Condition	List I		List II	
	Mean	SD	Mean	SD
Prompting	10.44	19.58	8.5	14.94
Confirmation	32.69	29.05	30.5	29.38

Table 6

Errors in Recognition

Condition	List I		List II	
	Mean	SD	Mean	SD
Prompting	2.19	2.51	2.38	1.89
Confirmation	2.62	1.86	3.44	2.19

Table 7

Responses to One Stimulus in Discrimination Pairs

	Correct Stimulus	Incorrect Stimulus
P	38 DLR (7C)	44 DLR (3C)
C	44 DLR (13C)	33 DLR (6C)

Responses given to either the word or picture to be learned (Correct Stimulus) or to the member of the pair which was not to be learned. DLR = Different Legitimate Responses; C = Correct Responses.

Table 8

Errors Under Three Confirmation Conditions

	I	II	III
Mean	53.00	63.50	28.88
SD	23.27	23.62	12.67