RETARDATE DISCRIMINATION LEARNING AS A FUNCTION OF CORRECTION AND NON-CORRECTION TECHNIQUES

By

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PREFACE

This study was planned and carried out with the valuable assistance of Drs. Jerome Smith (Chairman), Donald Tyrrell, and Larry Brown of the Oklahoma State University Department of Psychology who served on the author's Master's thesis committee. It was conducted at the Hissom Memorial Center, Sand Springs, Oklahoma.

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CHAPTER I

INTRODUCTION AND REVIEW OF THE LITERATURE

When an investigator studies performance in a two-choice discrimination learning task, he may employ one of two methods of reward and non-reward; the correction method or the non-correction method. As typically employed in discrimination learning situations, both the correction and non-correction methods are identical when the subject makes a correct response. If the subject makes an incorrect choice, however, the two methods differ. Under the correction method the subject makes an instrumental response to one of the two stimuli presented with one of two possible outcomes: (1) If he makes the correct choice, the trial is rewarded and counted as a correct response. (2) If he makes the incorrect choice, the trial is counted as incorrect and the subject is allowed to correct his mistake and secure the reward. With the correction procedure a trial is always terminated with a response to the positive stimulus and attainment of reward. With the non-correction procedure the subject makes one and only one response to the two stimuli presented and the response is counted as either correct or incorrect. Correct responses are rewarded and incorrect responses non-rewarded.

In view of the difference between the two methods when a subject makes an incorrect response, one could possibly speculate that groups of subjects trained under the correction method may perform differently

during acquisition and/or shifts than subjects trained under the non-correction method in a discrimination task. Seward (1942), for example, offered an explanation for differential performance of rats in a maze learning task. In short, Seward maintained that part of the problem in maze learning is to select differential cues. The correction method, which rewards both right and wrong choices, possibly retards the process of selecting differential cues. Under the correction procedure response to common aspects of the stimuli is less completely blocked, while distinguishing aspects are less distinct in their consequences, than in the non-correction method. Hence, early in learning, the chief effect of delayed reward (incorrect responses with the correction method), is not to strengthen the correct response but to prolong confusion for the learner. This type of interpretation would lead one to predict faster learning for a group trained with the non-correction method.

On the other hand, the failure to obtain a reward for making an incorrect response under the non-correction procedure could lead to an interfering emotional response (House and Zeaman, 1963) consequently retarding solution of the problem for subjects trained with the non-correction method. Given these possibilities for differential performance, depending upon the method used, study of the correction/non-correction difference would appear important in any discrimination situation.

According to Hull and Spence (1938), the contrast between the two methods (correction and non-correction) is most apparent when for some reason, such as previous training, the subject has at the outset a strong tendency to respond incorrectly. This situation occurs in a

discrimination reversal. That is, a previously reinforced stimulus is now non-reinforced and a previously non-reinforced stimulus is now reinforced. Hull and Spence predicted earlier reversal by the correction method on the ground that this method provided both extinction of the original habit and reinforcement of a new one, while the non-correction method at first provided only extinction of the original habit.

Purpose of the Study

The main purpose of the present study is the comparison of acquisition and reversal performance of a group of institutionalized mentally retarded subjects under a correction and non-correction procedure.

Of secondary importance are: (1) Performance of the two groups when shifted to the opposite condition (from correction to non-correction or vice versa) after three problems (acquisition and reversal), and (2) Examination of the tenability, using retardates rather than rats, of the Hull and Spence (1938) prediction concerning reversal performance. Hull and Spence predicted that reversal performance should be superior for subjects run under the correction procedure when compared to performance of subjects run under the non-correction procedure.

Review of the Literature

Most of the research conducted comparing the effects of the correction and non-correction techniques of training upon performance has revealed a correction/non-correction difference, with the exception of

a series of studies by House and Zeaman (1958a, 1958b, and 1958c; Zeaman and House, 1962). Furthermore, such comparisons have usually been made as a subsidiary part of another study (House and Zeaman, 1958a, 1958b, 1958c; Kalish, 1946; Seward, 1943; and Zeaman and House, 1962). Hull and Spence (1938), however, compared directly the discrimination performance of rats in a T-maze using the correction and non-correction procedures. They found no differences between the two methods in the original learning of a position discrimination; in reversing the habit, however, the correction group was superior to the non-correction group. The advantage of the correction group gradually disappeared on the later days of reversed training.

Three studies, which included a correction/non-correction comparison as a minor part of their investigation, have found a non-correction superiority in various facets of performance. Seward, for example, in 1943 ran rats in a single alley maze which permitted comparison of the effects of varying the length of the true path and blind from three to twelve feet, separately or together. Half of the rats were trained by the correction method, half by the non-correction method. With the correction method, increase of either path or blind alley tended to increase the difficulty of learning, but not significantly. With the non-correction method, differences between maze-lengths were insignificant, and more importantly, the non-correction method gave clearly and consistently better learning scores than the correction method.

In another related study, Kalish (1946) attempted to test the Blodgett and McCutchan (1944) finding that a rat is unable to learn to make spatially opposed responses at the same place in the absence

of differential cues at that place. Animals trained by the non-correction method of six trials a day on an H-shaped maze similar to Blodgett and McCutchan's, provided unambiguous evidence that the rats were able to learn to make spatially opposed responses at the same place in the absence of differential cues at that place.

In a number of visual discrimination learning studies using retardates as subjects, House and Zeaman have often included a correction and non-correction group for comparison. In one study (1963), investigating learning sets from minimum stimuli, interproblem improvement was found for the non-correction group but not for the correction group, despite the fact that errors in the non-correction group were not significantly lower at the end of training.

In one of the first studies related to their "Attention Theory" of retardate discrimination learning, House and Zeaman (1958a) investigated the visual discrimination learning of defectives of low mental age on both a color-form object problem and a subsequent pattern problem. Subjects MA's ranged between two and six years. Some of the subjects were run under a correction and others under a non-correction procedure. No differences were found in performance between these two procedures. Subsequent studies (House and Zeaman, 1958b, 1958c, 1963; and Zeaman and House, 1962), with the exception of the data reported in the last paragraph, also failed to show any significant correction/non-correction differences.

There appears, then, an unresolved conflict in the literature regarding the effects of the correction and non-correction methods of training upon performance and learning. Munn (1950, p. 327) states, ..."it is apparent that no general conclusion can be reached concerning

the relative advantages of the correction and non-correction method. Whether one will produce more efficient learning than the other, and if so, which will be better, appears to depend upon the nature of the problem to be learned." Also, Stevens (1951, p. 597) says, "Comparison of the two methods have resulted either in no difference or in a more rapid acquisition with the non-correction method."

In summary, the conflicting data already reported concerning a correction/non-correction comparison appears to point up the need for further investigation of this problem.

CHAPTER II

METHOD

Subjects

Thirty-one (twenty-two males and nine females) institutionalized mentally retarded individuals from the Hissom Memorial Center in Sand Springs, Oklahoma, served as Ss for this study. All Ss were chosen from a population of children who had previously demonstrated ability to learn a standard (e.g., color, form, or junk) visual discrimination task (within 250 trials) different from the color-form object problems employed in the present study.

Fifteen Ss were assigned to a Group I and thirteen assigned to a Group II. Groups were matched on MA levels (MA's were obtained by performance on the Stanford-Binet test (1960 revision) between 3-2 and 5-10 years (characteristics of the subjects are given in Table I), all Ss were free from gross physical anomalies, and ambulatory.

Apparatus

A modified Wisconsin General Test Apparatus was used for all learning tasks. This type of apparatus is described in detail elsewhere (Zeaman and House, 1963, p. 160). The basic characteristics of the apparatus were a table with a sliding stimulus tray 30 inches by 12 inches with two circular food wells two inches in diameter

TABLE I

CHARACTERISTICS OF THE SUBJECTS

Group	N	MA Range	Mean MA	CA Range	Mean CA
I	15	3-2 to 5-10	53.8 Mo.	7-6 to 20-0	144.1 Mo.
II	13	3-5 to 5-4	54.5 Mo.	7-8 to 19-3	142.1 Mo.
Total	28	3-2 to 5-10	54.1 Mo.	7-6 to 20-0	143.1 Mo.

centered 12 inches apart. In the center of the table, separating the subject from the experimenter, was a one-way mylar screen. The sliding tray, when pulled back by the experimenter, was invisible to the subject.

Stimuli

Stimuli were three dimension forms cut out of ¼ inch Masonite and mounted vertically on four inch by four inch gray Masonite bases. Five forms were used (circle, cross, square, T and triangle) each having a maximum height and width of two inches. Each form was repeated in six colors (black, blue, green, red, white, and yellow) making a total of 30 stimuli in all. For each problem (acquisition and reversal) S was assigned two stimuli selected from among these 30 (with the restriction that the two stimuli should differ in both color and form, for example, a red cross and green square). The number of problems (acquisition and reversal) made it necessary to duplicate some of the colors and forms for each S. However, none of the same specific color-form combinations were repeated for any one S.

Procedure

General: The procedure consisted of pretraining, three problems (acquisition and reversal) under one condition, and three problems under the opposite condition. All Ss received the same discrimination training with the exception that one-half (Group I) were initially (first three problems) run under the Correction procedure and one-half (Group II) were initially run under the Non-correction procedure. Instructions differed in that the Ss run under the non-correction condition were told that they could make one choice only on each trial

whereas under the correction procedure Ss were allowed to correct any error made on each presentation of the stimulus tray.

Pretraining: The procedure used for pretraining was essentially the same as that suggested by House and Zeaman (1958a). S was brought into the experimental room, told he was going to play "the candy game," and asked to sit at the apparatus. On the first presentation of the stimulus tray, both food cups were left uncovered with candy (M&M) placed in one of them. The E asked "can you find the candy?" and pointed if the S failed to pick it up. On the next trial, a plastic wedge (three and one-fourth inches by four inches plexaglass wedge) was placed over one of the food cups containing candy, with the other cup left uncovered. Again, the S was asked to find the candy and was aided by the E if he failed. When the S was able to pick up the plastic wedge and secure the candy without prompting, discrimination acquisition trials for the first problem began. Under both Correction and Non-Correction the E said "good" for correct responses and "no" for incorrect responses.

Discrimination acquisition trials: For the discrimination trials, the E pushed forward the stimulus tray with two stimuli (color-form objects) covering the food cups so that it would be directly in front of the S. The two stimuli for any S remained the same on every trial for each problem (acquisition and reversal) with one and only one always correct. The position of the positive stimulus was varied irregularly from left to right according to a Gellermann (1933) series. During the acquisition phase of each problem 25 trials, with approximately a 5 sec. inter-trial interval, were given per day until a criterion of 20 out of 25 correct responses was reached during a

single daily session. Ss failing to meet this criterion in 100 trials were dropped from the study.

Reversals: Once a S had met the acquisition criterion for one problem the positive stimulus and negative stimulus were reversed on the following session. When reversed S was rewarded for responding to the previously negative stimulus and non-rewarded for a response to the previously positive stimulus. S was run under this condition until he was able to complete one reversal (20 out of 25 correct responses in a single session). Ss failing to complete one reversal in 200 trials were excluded from the study.

After S had completed one problem (acquisition and reversal) two new color-form objects were introduced (during the next daily session) for another problem. Ss were run on the first three problems (acquisition and reversal) under either the correction or non-correction procedure.

Condition shift: Once a S had completed three problems (acquisition and reversal) under one condition he was shifted to the opposite condition (either correction or non-correction) for an additional three problems. An example of the conditions for a single S is given below.

	CORRECTION				NON-CORRECTION			
	Acquisition		Reversal		Acquisition		Reversal	
	+	-	+	-	+	-	+	-
Problem 1	F_1C_2	F_2C_1	F_2C_1	F_1C_2	F_1C_1	F_4C_4	F_4C_4	F_1C_1
Problem 2	F_3C_4	F_4C_5	F_4C_5	F_3C_4	F_3C_5	F_5C_2	F_5C_2	F_3C_5
Problem 3	F_5C_6	F_2C_3	F_2C_3	F_5C_6	F_2C_3	F_1C_6	F_1C_6	F_2C_3

CHAPTER III

RESULTS

Twenty-eight Ss (15 in Group I and 13 in Group II) completed the experiment; three were dropped from Group II (two for failure to meet the initial acquisition criterion and one for failure to meet the criterion for the first reversal). Each phase (Acquisition and Reversal), of all problems (one, two, and three), under each condition (Correction and Non-correction), was learned in a median of 25 trials by all Ss with the exception of the acquisition phase of problem one for Group II with the Non-correction training. This particular phase took a median of 50 trials to learn.

The assumption of homogeneity of variance proved untenable (by the Hartley's test), therefore, for the purpose of statistical analysis, error scores were transformed into log (errors + 1) values. The transformed scores were then entered into a Split-Plot design analysis of variance with one factor (Groups) corresponding to the main plots, one factor (Conditions) corresponding to the sub-plots, and one factor (Phases) corresponding to the sub-sub-plots. Problems were treated as replications in order to obtain a measure of error. The design of the experiment is illustrated in Figure 1.

On the basis of this analysis (see Table II) no significant (at the .05 level of confidence) effects or interactions were evident. Means and standard deviations of the log (errors + 1) values are

FIGURE 1

SUMMARY OF THE EXPERIMENTAL DESIGN

Group I (n = 15) Main Plot

	Correction		Non-Correction		Sub-plot
	Acquisition	Reversal	Acquisition	Reversal	Sub-sub-plot
Problem 1	---	---	---	---	
Problem 2	---	---	---	---	
Problem 3	---	---	---	---	

Group II (n = 13) Main Plot

	Correction		Non-Correction		Sub-plot
	Acquisition	Reversal	Acquisition	Reversal	Sub-sub-plot
Problem 1	---	---	---	---	
Problem 2	---	---	---	---	
Problem 3	---	---	---	---	

TABLE II

SUMMARY TABLE OF ANALYSIS OF VARIANCE OF
LOG (ERRORS + 1) TO CRITERIA

SOURCE	df	SS	MS	F	
Total	335	35.09339			
Main Plot Analysis	5	1.90412	.38082		
Problems (P)	2	1.48870	.74435	3.95195	NS
Groups (A)	1	.03873	.03873	.20563	NS
Error (a)	2	.37669	.18835		
Sub-Plot Analysis	6	3.52864	.58811		
Conditions (B)	1	.06833	.06833	.11871	NS
Groups x Conditions (AB)	1	1.15783	1.15783	2.01145	NS
Error (b)	4	2.30248	.57562		
Sub-Sub-Plot Analysis	12	1.81447	.15121		
Phase (C)	1	.21995	.21995	1.38134	NS
Groups x Phase (AC)	1	.11030	.11030	.69271	NS
Conditions x Phase (BC)	1	.14765	.14765	.92728	NS
Groups x Conditions x Phase (ABC)	1	.06276	.06276	.39415	NS
Error (c)	8	1.27381	.15923		
Sampling Error	312	27.84616			

F values read from table at .01 level of significance.

reported in Table III. In short, S's performance was not contingent upon the method of training received, acquisition and reversal performance was not significantly different, and errors did not decrease significantly over total problems. Ss trained first with the Correction procedure and then with the Non-correction procedure performed as well as Ss trained the opposite way.

In the analysis of variance Problems x Conditions, Problems x Phases, and Problems x Conditions x Phases were used as an estimate of error. Therefore, no F values for the interactions involving Problems were obtained. In order to compare the individual phases of each problem t-tests were made between the various combinations of data. These results are reported in Table IV. The findings were that:

1) Acquisition performance during the first problem for the group receiving Non-correction training first (i.e., Group II) was significantly ($<.05$) poorer than that of the group receiving the Correction training first (i.e., Group I). This difference disappeared after the first problem.
2) Both groups improved significantly ($<.05$) over problems (i.e., showed a decrease in the number of errors to criterion) from problem one of the initial condition to problem three of the second condition. Inspection of Table IV, however, reveals that this improvement took place only during the first three problems.
3) The significant improvement in acquisition performance took place after only one problem. Acquisition performance on problem two (under the first condition) was significantly ($<.05$) superior to performance during problem one for both

TABLE III

MEANS AND STANDARD DEVIATIONS OF LOG (ERRORS + 1)
TO CRITERION X PROBLEMS

Group	Condition		Problem 1	Problem 2	Problem 3
I	Correction	Mean	1.05340	.76723	.49152
		SD	.55836	.36778	.35599
I	Non-Correction	Mean	.60701	.71382	.50668
		SD	.25801	.38100	.36425
II	Non-Correction	Mean	1.40633	.53085	.72571
		SD	.90044	.34398	.45291
II	Correction	Mean	.50479	.65761	.57270
		SD	.46099	.68312	.36609

TABLE IV

INDIVIDUAL t-TEST COMPARISONS

Group	Condition	Phase	Problem	t Value
I	Correction	Acquisition	1	2.37180*
	vs			
II	Non-Correction	Acquisition	1	
I	Correction	Reversal	1	.19689 NS
	vs			
II	Non-Correction	Reversal	1	
I	Correction	Acquisition	1	3.73239**
	vs			
I	Correction	Acquisition	2	
II	Non-Correction	Acquisition	1	4.36373***
	vs			
II	Non-Correction	Acquisition	2	
I	Correction		1	4.95732***
	vs			
I	Correction		3	
II	Non-Correction		1	3.44880**
	vs			
II	Non-Correction		3	
I	Correction		1	3.92992**
	vs			
I	Non-Correction		3	
II	Non-Correction		1	3.73239**
	vs			
II	Correction		3	
I	Correction		3	1.14483 NS
	vs			
I	Non-Correction		1	
II	Non-Correction		3	1.62054 NS
	vs			
II	Correction		1	

*<.025
**<.01
***<.001

Groups.

4) No significant differences were found between Groups during the first reversal of the first condition. This particular finding does not correspond to the prediction of Hull and Spence (1938). They predicted that reversal performance should be superior for subjects trained with the correction procedure.

CHAPTER IV

DISCUSSION

In general the results of this experiment tend to corroborate those of House and Zeaman (1958a, 1958b, 1958c, 1963; and Zeaman and House, 1962) in that the analysis of variance failed to show any effect of method (Correction and Non-correction) on overall performance. The t-tests comparisons, however, as pointed out above, did show an initial difference in the acquisition performance of the two groups during the first problem.

House and Zeaman (1963) reported interproblem improvement for their non-correction group but not for their correction group. The present investigation showed interproblem improvement for both Groups during the three problems of the first condition. That is, for Group I there was a significant decrease in errors from problem one to problem three under the Correction method but not for problem one to problem three under the Non-correction method. For Group II there was a significant decrease in errors from problem one to problem three under the Non-correction method of training, but not from problem one to problem three of the Correction method of training. It appears, then, that subjects reach a ceiling in performance in just three problems regardless of the method of training they are exposed to.

In the House and Zeaman (1963) study, however, stimulus pairs were selected from a single set of four objects (junk stimuli) appearing

repetitively throughout training in all possible combinations. In addition, as opposed to the present study of a 20/25 criterion, House and Zeaman used a criterion of five successive correct responses. Therefore, any comparison made should point out that the House and Zeaman problems differed from and the criterion appeared to be less stringent than the ones employed in the present investigation.

In the present study no significant differences were observed on the problem immediately following a condition shift. That is, Ss from both Groups performed equally well during the last problem of the first condition as during the first problem of the second condition. Furthermore, both Groups were performing equally at the termination of the experiment (the reversal phase of problem three in the second condition). Hence, on the basis of these data, one could conclude that switching the method of training had no effect on performance once the problem had been learned. In the words of Attention Theory, once the subject has begun attending to the relevant dimensions of the problem, switching training techniques has no effect.

Probably the most feasible hypothesis to make in explanation of the initial effect of method of training upon performance during acquisition, is the one offered by House and Zeaman (1963). They state that failure to obtain a reward for making the incorrect response under the non-correction procedure may lead to an interfering emotional response and possibly retard solution of the problem. Moreover, it should be pointed out that all Ss in the present experiment had previously experienced training with the correction procedure, that is, trials of previous problems had always ended with reward. The failure, during the acquisition phase of the first problem under Non-correction,

to obtain reward when making an incorrect response, could have resulted in something akin to an emotional response as House and Zeaman (1963) speculate.

Of secondary importance was the failure of the results of this study to support the Hull and Spence notion regarding reversal performance. Briefly, they predicted earlier reversal by the correction method on the ground that this method provided both extinction of the original habit and reinforcement of a new one, while the non-correction method at first provided only extinction of the original habit.

There were, however, a number of differences between the present study and the Hull and Spence (1938) study of the effects of the correction and non-correction training techniques upon performance: (a) The study reported in this paper used retardates rather than rats as Hull and Spence did, (b) the task employed by Hull and Spence was a simple T-maze discrimination whereas this investigation employed a two-choice visual discrimination task, (c) Hull and Spence used a set number of trials as "original" training prior to reversal and in the present study a "block" criterion of 20/25 correct responses to acquisition during any daily session was used.

A failure to find a correction/non-correction difference is not surprising when one takes into account the relative ease in which the problems were learned. If the majority of trials are responded to correctly, one would not expect any differences or differential effects of training since the two training methods are identical in this case. Only when responses are incorrect does a difference in method appear. It would appear that it may be necessary to utilize more difficult problems before a definite Correction/Non-correction, difference, if

any, will be found.

CHAPTER V

SUMMARY AND CONCLUSIONS

In a two-choice visual discrimination learning problem two methods of reward and non-reward may be employed; the correction method or the non-correction method. The available literature indicates an unresolved conflict regarding the effects of the correction and non-correction methods of training upon performance and learning.

An attempt was made in the present study to examine the discrimination performance of mentally retarded subjects trained with the correction or non-correction procedure. Of secondary importance was the performance of these subjects when shifted to the opposite condition (from correction to non-correction or vice versa), and the examination of the Hull and Spence (1938) prediction that reversal performance of subjects trained with the correction procedure should be superior to subjects trained with the non-correction method.

Subjects for the present study were 28 institutionalized mentally retarded children (MA levels from 3-2 to 5-10 years). Group I ($n = 15$) was initially trained, using the correction technique, to reach criterion on three color-form object problems (Acquisition and Reversal). After meeting criterion on these three problems they were then shifted to the opposite condition for an additional three problems. Group II was treated in an identical manner only that they were first trained using the non-correction method and then shifted to the correction

procedure.

Results were analyzed using a Split-Plot analysis of variance. This analysis revealed no significant effects or interactions. In brief, subjects trained first with the correction procedure and then switched to the non-correction method performed equally as well as subjects trained in the opposite manner.

Individual t-tests comparisons, did, however, reveal the following: (1) correction/non-correction differences on acquisition of the first problem only, (2) evidence of learning set, and (3) that the Hull and Spence prediction was not supported.

An interfering emotional response was hypothesized to account for the initial acquisition difference during the first problem. The ease in which the problems were learned was suggested as a possible explanation of the failure to find a correction/non-correction difference.

More difficult problems may be necessary before a correction/non-correction difference may be found.

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