REVERSAL AND NONREVERSAL SHIFTS IN CONCEPT LEARNING IN THREE LEVELS OF RETARDATES

THESIS

Presented to the Graduate Council of the North Texas State University in Partial Fulfillment of the Requirements For the Degree of

MASTER OF SCIENCE

By Cheryl Faye Scurlock, B.S.

Denton, Texas

June, 1968
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>LIST OF TABLES</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>iv</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LIST OF ILLUSTRATIONS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>v</td>
</tr>
</tbody>
</table>

## Chapter

I. INTRODUCTION

- Review of Literature
- Statement of Problem
- Statement of the Hypothesis

II. METHOD

- Subjects
- Task and Procedure

III. RESULTS AND DISCUSSION

- Results
- Discussion

IV. SUMMARY AND CONCLUSIONS

- Summary
- Conclusions

## BIBLIOGRAPHY Page

- 38
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Means of Matching Variables</td>
<td>20</td>
</tr>
<tr>
<td>II. Summary of Analysis of Variance with Three MA Levels, Color and Form Dimensions and Reversal and Nonreversal Shifts on a Concept Learning Task with Retardates</td>
<td>27</td>
</tr>
</tbody>
</table>
# LIST OF ILLUSTRATIONS

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>A Schematic Representation of the Mediational Hypothesis</td>
<td>2</td>
</tr>
<tr>
<td>2.</td>
<td>Examples of Reversal and Nonreversal Shifts</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>A Single Unit and Mediational S-R Analysis of Reversal and Nonreversal</td>
<td>9</td>
</tr>
<tr>
<td>4.</td>
<td>Experimental Procedure for Each Mental Age Level</td>
<td>23</td>
</tr>
</tbody>
</table>
REVERSAL AND NONREVERSAL SHIFTS IN CONCEPT LEARNING IN THREE LEVELS OF RETARDATES

APPROVED:

[Signature]
Jack A. Haynes
Major Professor

[Signature]
Ray Johnson
Minor Professor

[Signature]
Jesse T. Troup
Dean of the School of Education

[Signature]
Robert Toulouse
Dean of the Graduate School
CHAPTER I

INTRODUCTION

The formation of concepts is generally taken to imply the utilization of a common response to dissimilar stimuli. This ability to abstract is one of the most powerful instruments of man. In the past years of experimental psychology, one of the major topics of interest has been how this abstractive process evolves.

Studies in this field have been conducted utilizing white rats, children and college students. It has been suggested that there is a developmental process evident in concept learning, a transition stage somewhere between the white rat and the college student. The present study was designed to investigate further this transition point by analyzing the ability of mental retardates to form concepts and the ability of these retardates to shift dimension of cues by changing the response conditions.

Review of Literature

The mediation theory is a prevalent approach to concept formation and to the study of higher mental processes. The
focus is upon the internal process that mediates between the stimulus and the response. This mediational mechanism is required in addition to the single unit theory for concept learning. It assumes that the external stimulus evokes an implicit response which produces the implicit cue that is connected to the overt response. Figure 1, taken from a Kendler and Kendler (11) study, illustrates this process.

\[ S \rightarrow [R\quad--------\quad S] \rightarrow R \]

Fig. 1--A schematic representation of the mediational hypothesis.

In his book, Hunt (5, p. 72) explains that the mediating response theory begins with the assumption that responses produce stimuli, which may serve as cues for further responses. When a stimulus is presented, its image is said to evoke certain previously learned responses. These provide stimuli which evoke another response; and so on. In concept learning the chain is ended with the occurrence of a naming response.

The mediational theory is not new. In 1930, Hull, as stated by Kendler and Kendler (9), formulated the concept of the "pure stimulus act," a response with the sole function of providing the stimulus for other acts. The "pure stimulus
act," or, as it is more frequently called, the cue-producing response, includes any response that the organism is capable of making.

Hull's theory has been expanded by other learning theorists more concerned with complex mental behavior. The term "mediating response" is normally used instead of Hull's original "pure stimulus act."

One of the most important contributions of the mediating response hypothesis is in helping to explain the behavior of subjects in a reversal and nonreversal situation. In the reversal-nonreversal shift situation, the subject is required to solve two concept learning problems in which the stimuli have binary dimensions. The first problem is a simple two-choice dimension, using binary dimensions, only one of which is relevant. The second requires either a reversal or non-reversal shift.

Hunt (5, p. 74) states that in the reversal shift condition, the correct instances all contain the binary value of the dimension which was relevant in the first problem (simple two-choice dimension) and which was associated with the negative instances. In the nonreversal shift the discrimination is based on previously irrelevant dimensions.

Figure 2 characterizes each kind of shift by showing a simplified version of an experimental situation utilized by
Kendler and Kendler (11). The stimuli for the first discrimination differed simultaneously on two dimensions (size and brightness). The subject was rewarded for responses made to one dimension, (i.e., large is positive, small is negative). After learning the first discrimination, the subject is shifted to another response. In the reversal shift the subject is required to respond to the same dimension on which he was originally trained, but his overt choice has to be reversed. For example, he is shifted from large to small. For a nonreversal shift, the previously irrelevant dimension becomes relevant; for example, black becomes positive after large has been positive.

![Reversal and Nonreversal Shifts](image)

Fig. 2--Examples of reversal and nonreversal shifts
Utilizing a single S-R unit model, Hunt (5) reasoned that if concept learning stems from the attachment of a naming response (i.e., the development of habit strength) to the element most consistently associated with the response, the reversal condition should be more difficult since it would require attaching a naming response to stimulus elements never before paired with the response. The naming response tendency attached to the (now negative) instances must be extinguished also. In the nonreversal condition, the learned habit strength would not bear a perfect inverse correlation to the correct answer, so learning should not be as difficult.

It is important to note that for rats this is true. Kelleher (6) found that in a shift problem, the rats find a nonreversal shift easier than a reversal shift. They seemed to respond in an unmediated manner.

For human subjects the opposite is true. Buss (2) reported that college students executed a reversal shift more rapidly than a nonreversal shift. The experiment was a simple discrimination situation involving wood blocks which differed from each other in height, form, color or form. Group I learned a height discrimination and then a reverse height discrimination (reversal shift). Group II learned a
a form discrimination and then a height discrimination (non-reversal shift).

Buss attributed this result (easier attainment of the reversal shift) to the fact that in learning the second concept, Group II received fortuitous partial reinforcement of the form discrimination. For example, referring back to Figure 2, when the subject was making a nonreversal shift from the large positive to black positive, he would be reinforced when choosing the large black stimulus in preference to the small white stimulus. This chance reinforcement of the choice of the large stimulus helps to maintain the size discrimination and retards the learning of the brightness discrimination. If the subjects in Group II of Buss's study continued to respond to the form concept during the second discrimination problem in which height was the appropriate dimension, they would be correct 50 percent of the time. Group I, on the other hand, received no reinforcement of the discrimination learned previously while learning the second concept. Therefore, their responses were 100 percent non-reinforced.

Buss (2) did not incorporate the mediational mechanism in explaining his results. Kendler and Kendler (11) felt that this work was incomplete and that the adult human concept
could not be represented adequately by the single-unit S-R theory utilized in Buss's explanation.

Kendler and Vineburg (3) conducted a study to demonstrate this fact. Their experiment was designed to determine the influence the learning of a simple concept (one stimulus attribute, i.e. shape) had upon the learning of a compound concept (two stimulus attributes, size and shape). The experiment consisted of two similar studies, each involving three groups which were required to learn two simple concepts successively. Following this, each group was required to learn the test concept which was compound. In each study, one group learned both of the simple concepts; the second group learned only one simple concept; and a third group learned neither concept. The main difference between the two tests was the compound test concept. In the first experiment, size and shape constituted the compound test concept; part-whole and color were the concepts used in the second study.

The results of the first study indicated that the rate of learning the test concept was directly related to the number of simple concepts appropriate to the test concept which had been learned. The trend of the results of the second study was consistent with the first.
In an analysis of the data, the authors suggested that the advantage derived from the acquisition of the appropriate simple concepts did not stem from mere repetition of the correct sorting responses, but rather from the opportunity the initial training provided for the appropriate verbal responses to become dominant and thereby facilitate the acquisition of the test concept. From this study, they emphasized the need of a mediational mechanism.

Figure 3 characterizes reversal and nonreversal shifts in terms of both a single unit S-R analysis and a mediated one. It highlights the problem of what are the effective stimuli that are associated to the overt response in both a reversal and a nonreversal shift. Kendler and Kendler (11) suggest that in a single unit theory the habit to choose a large container might result from learning two separate habits (i.e., the choice of a large black container when presented with a small white one and the selection of a large white container when paired with a small black one). Another possibility is that the response is to the effective stimulus "large" since responses to the other features of the environment are not consistently reinforced. Similarly adult subjects might use the mediator "size" or "large" or both in the reversal shift.
Predicting by the single unit hypothesis, Kendler and Kendler (11) hypothesized that if fortuitous intermittent reinforcements were eliminated from a nonreversal shift, it would occur more rapidly than a reversal shift. They state that the reason for this is that at the time of the shift, the difference between the strength of the dominant incorrect habit and the to-be-correct habit is greater for the reversal, as compared to the nonreversal shift. More training would be required to make the correct habit dominant in a reversal shift.
According to the mediational theory, the situation is different. A reversal shift enables the subject to utilize the same mediated response. Only the overt response has to be changed. A nonreversal shift requires the development of a new mediated response. The cues have to be attached to a new overt response also. Because the old mediational sequence has to be discarded and a new one formed, the nonreversal shift should be executed more slowly.

The results of a series of experiments were consistent with the mediational formulation. Kendler and D'Amato (7) reported essentially the same findings as Buss (2). However, they incorporated the mediation mechanism.

In the Kendler and D'Amato study, three experiments were designed to evaluate an analysis of card-sorting behavior which assumed that such behavior on one trial consisted of a sequence of two successive S-R associations. The stimulus component of the first association represented test cards, while the response referred to implicit verbal or symbolic responses made to them. The second stimulus of the association represented the cue produced by the preceding implicit response, while the response was the overt card sorting behavior. In the reversal shift, the second concept learned was the reverse of the first response; for example, cards
were sorted in opposite fashion. In the nonreversal shift, the basis of card sorting was shifted from one stimulus dimension to a different one.

According to this study, the reversal shift occurred at a more rapid rate than a nonreversal shift, because at the completion of learning the first concept, the symbolic cues appropriate to the second concept would be present for the subjects in the reversal; i.e. they would be connected to the wrong sorting response. The superiority of a reversal shift over a nonreversal shift was discovered in this study to be independent of the presence or absence of any partial reinforcement effects from previously learned concepts and whether the concept shifted to was a reverse or direct concept.

In order to clarify the issue, Buss (1) conducted a further study in which the subjects first learned a simple, one-dimensional discrimination based on geometrical forms. Following this, the subjects were shown without warning a series of instances for which the experimenter's class identification was compatible with either a nonreversal or a reversal shift. Finally, subjects were asked to assign a third series of stimuli to different classes without being told whether or not they were correct. The class membership of instances in the third series varied, depending on whether
or not they were assigned to classes on the basis of the
reversal or nonreversal shift appropriate for the second
series. Eighteen of the twenty-five subjects classified the
third series in a manner consistent with the "reversal" con-
cept. Buss interpreted this study as unequivocal support
for the mediation theory of concept learning.

Further support for the mediation response position
was offered by Harrow and Friedman (3). Their experiment
eliminated partial reinforcement by using a different set of
sorting cards of the Wisconsin Card Sorting Task for each of
two stages of the experiment. The subjects were never re-
inforced during the reversal or nonreversal series for a
response they had previously learned during the first series.
Two types of concepts were used, a number and a color concept.
One set of reversal, nonreversal and control groups learned
a reverse number concept; and another set of reversal, non-
reversals, and controls learned a reverse color concept.

With partial reinforcement eliminated, the data indicated
the superiority of the reversal groups over the nonreversal
groups. Evidence was also found of negative transfer for the
nonreversal, when compared to control groups. The authors
interpreted this as indicating that partial reinforcement was
not a necessary condition for explaining the superiority of
The more recent studies offer evidence strongly in favor of the mediational theory in describing human concept formation. However, Kendler and Kendler (11) concluded that a single unit theory represented the behavior in rats, while the mediation S-R theory was required for the concept learning of adult humans. They felt that humans generated a mediated response that provided for his rapid reversal. The animal subjects gradually acquired an ability to respond appropriately to some response-produced cue resulting from nonreinforcement of a previously correct response.

The discontinuity between the behavior of white rats and college students suggested that there might be a developmental process of the mediation process. Between the rat and the college student there might be a point where a transition was made from a single unit to mediation control. This supposition led to studies of the behavior of children in which this transition was observed.

In a study by Kendler and Kendler (10), it was shown that kindergarten children executed a reversal and nonreversal shift at approximately the same rate. They state that the point (transition) in human development was discovered which was psychologically halfway between the white rat and the college student, since the children responded neither in
a single unit nor mediational manner, but in some compromise fashion. Another possibility offered was that the children had reached a transitional stage in development in which the task to which they were subjected led some to function on a single unit basis, and others to operate with a mediational mechanism.

The second alternative seemed to fit the data more appropriately. When the children were divided into fast and slow learners on the basis of their performance in the first problem. The slow learners responded in a manner consistent with the single unit theory; that is, they found the nonreversal shift easier. The fast learners performed according to the mediation theory. Like the college students they found the reversal shift easier to execute. The results were interpreted as demonstrating that the children were in the process of developing mediating responses, and some were further than others.

Kendler, Kendler and Wells (12) felt if this interpretation were true, then it would follow that nursery school children, since they were younger, should reflect an earlier stage of development. Their responses should be consistent with the single-unit theory; that is, the reversal shift would be slower than the nonreversal shift.
The experiment compared the performance of ninety-six nursery school children on three types of shifts, a control, a reversal shift, and a nonreversal shift. Half of each group was required to verbalize their choices for ten trials between the initial and test discrimination. The other half received no special instructions. The expectation was that such instruction would have an effect on the behavior during the reversal shift. The overt verbal (OV) group should have yielded positive transfer. The results showed a trend toward the possibility that the OV group should learn more quickly than the NOV group. The difference was small, however, and statistically unreliable.

In general, the results supported the prediction that children of this age would respond to the concepts employed in an unmediated fashion, since the reversal shift showed negative transfer, while the other two conditions showed positive transfer.

In a recent study by Kendler and Kendler (11), the experimental procedure was changed so after learning the initial discrimination of the children of 3, 4, 6, 8, and 10 years of age had a choice of either responding in a reversal or nonreversal manner. It was expected that the proportion of children who responded in a reversal manner would be expected
to increase with age. At age three, 37.5 percent chose a reversal shift over nonreversal, while at ten years of age 62.5 percent responded in a reversal manner.

Generalizing from all the studies of children in this field, the authors concluded that children tended to respond in a manner consistent with a single unit S-R theory in the earlier stages of development. With age, they tended to respond in a mediational manner.

Following up the studies with "normal" children, House and Zeaman (4) conducted a study with two groups of mentally retarded children. One group had an average MA of 4-6 years and the other an average MA of 6-8 years. In addition to the reversal and nonreversal shift conditions, an intra-dimensional shift was incorporated. The intra-dimensional shift kept form relevant but shifted to new form cues. Because color and form were not equally represented in the shift conditions for the 4-6 MA subjects, no conclusions could be drawn for the group. They did find that children in the 6-8 MA group executed the intra-dimensional and reversal shifts more easily than the nonreversal shift. They tended to respond in a mediated manner.
Statement of Problem

Previous studies on retardates regarding the formation of concepts have not demonstrated whether the developmental process evident in studies with "normal" children is in evidence in retardates. The primary objective of this experiment is to investigate the transition from single unit to mediation control in retardates and to compare their responses with those made by nursery, kindergarten and grammar school children. By utilizing three MA levels of retarded subjects, this transition point may be more specifically demonstrated.

Statement of the Hypothesis

The following hypotheses were formulated:

1. Under the nonreversal shift condition, the lowest MA level subjects should perform significantly better or shift more easily than the other two groups.

2. The highest MA level group should be expected to execute the reversal shift more easily than the nonreversal shift.

3. Subjects in the middle level group should respond at approximately the same rate under both the reversal and nonreversal shift conditions.


CHAPTER II

METHOD

Subjects

The subjects were twenty-four institutionalized, mentally retarded boys and girls enrolled at Denton State School. These subjects were divided into three major groups consisting of eight in each group. The groups were selected by mental age (MA) assessments obtained from previous Stanford-Binet and Weschler intelligence scales. Equivalent mental age scores were calculated for those subjects who had been administered the Weschler Intelligence Scale for Children (1). Table I gives a description of the three level groups.

<table>
<thead>
<tr>
<th>TABLE I</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEANS OF MATCHING VARIABLES</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>Number</th>
<th>Mean MA in Years</th>
<th>MA Range in Years</th>
<th>Mean CA in Years</th>
<th>IQ Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>8</td>
<td>4.5</td>
<td>3.0 to 4.11</td>
<td>11.2</td>
<td>39 to 65</td>
</tr>
<tr>
<td>Middle</td>
<td>8</td>
<td>5.8</td>
<td>5.0 to 6.11</td>
<td>13.2</td>
<td>48 to 55</td>
</tr>
<tr>
<td>Low</td>
<td>8</td>
<td>7.4</td>
<td>7.0 to 8.11</td>
<td>13.4</td>
<td>51 to 76</td>
</tr>
</tbody>
</table>
The low level group had a MA range from 3.0 to 4.11 years. The middle level group were students whose MA ranged from 5.0 to 6.11 years. The high level group was selected from subjects in the 7.0 to 8.11 MA range. The chronological age (CA) and IQ were not held constant. The etiology of all subjects was diagnosed as familial by the medical staff of Denton State School. Students who were extremely hyperactive were excluded from the study as well as those who had apparent sensory or motor impairments.

Task and Procedure

The task consisted of presenting four geometrical objects of two colors and two sizes to the subjects. The stimulus objects were one four-inch red square, one four-inch green triangle, one two-inch red triangle, and one two-inch green square.

A trial consisted of two of these geometric designs at a time being presented to each subject in a random order. If the subject's response was correct, he was given a piece of candy. This acted as the reinforcing agent in the experiment.

The apparatus utilized in the study was similar to the Wisconsin General Test Apparatus. Components were a sliding tray with depressed feeding cups upon which the geometric
forms were placed and a plywood screen separating the examiner from the subject.

The examiner baited the food cup behind the screen and pushed the tray directly in front of the subject to begin a trial. The subject's response was to lift the correct stimulus object revealing the reward in the food cup. The examiner responded with verbal reinforcement if the first response was correct or informed the subject if the response was wrong. Correction of the wrong response was allowed on the first trial. The subject could only make one response for each remaining presentation.

The subjects were trained with a single relevant dimension and tested under two shift conditions: (a) reversal, (b) non-reversal. The experimental design for each level is shown in Figure 4.

Each MA level was divided into two major groups. Four subjects in each group received color-relevant training. When a subject was being conditioned to color dimension, he was rewarded each time he responded to a specific color and not form. In form-dimension training, the subject was rewarded when he responded to a particular form instead of color. To control for individual preferences and tendencies, red was the positive cue for one half of the color relevant training.
Fig. 4—Experimental procedure for each MA level

The training groups were divided again into two shift conditions. One half received reversal shift trials; the other half were given nonreversal shift trials. In the reversal shift subjects trained in form dimension continued to be reinforced for a form discrimination but a different form
(i. e., training-square, shift-triangle). The color-relevant group was reinforced for responding to a new color (i. e., red to green). In a nonreversal shift the previously irrelevant cues became relevant. The subjects who originally responded to color were rewarded when responding to form. Those previously trained in form were reinforced when responding to color.

Twelve groups were eventually formed, each with different combinations of MA level, original training and shift conditions. The number of responses made by the subjects in all the groups was recorded. In order for the subject to reach criteria, he had to make seven correct responses in succession. This number had to be obtained on the original dimension before the shift condition was administered. Seven successive trials were required of each subject before concluding the experiment. There were no limits on time or number of trials required for the subject to reach criteria. Prior to the experiment, a pilot study was conducted to set the learning criteria. One subject within the lower MA group and one subject from the highest MA level were utilized. These individuals were not included in the experiment.
Results

In an attempt to measure the concept learning ability of mentally retarded subjects, twenty-four boys and girls were administered a discrimination learning task with two shift conditions, reversal and nonreversal. The chronological age and IQ of the subjects were not held constant. To establish whether an analysis of covariance was necessary to analyze the data, a Pearson's product-moment correlation was utilized to measure the degree of relationship between the chronological age of the subjects and the number of errors. The coefficient of -.38 was found to be nonsignificant. Therefore, a covariance analysis was not incorporated in the statistical procedure.

An analysis of variance was applied to measure the influence of factors such as mental age level (high vs. middle vs. low), color vs. form presentation and shift conditions (reversal vs. nonreversal) upon the ability of the subjects to form concepts. Only one of these F values was statistically
significant. A summary of this analysis of variance with transformed scores is shown in Table II.

TABLE II
SUMMARY OF ANALYSIS OF VARIANCE WITH THREE MA LEVELS, COLOR AND FORM DIMENSIONS AND REVERSAL AND NONREVERSAL SHIFTS ON A CONCEPT LEARNING TASK WITH RETARDATES

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA Levels</td>
<td>41.31</td>
<td>2</td>
<td>20.65</td>
<td>1.71</td>
</tr>
<tr>
<td>Color x Form</td>
<td>7.03</td>
<td>1</td>
<td>7.03</td>
<td>.58</td>
</tr>
<tr>
<td>Reversal vs. Nonreversal</td>
<td>82.17</td>
<td>1</td>
<td>82.17</td>
<td>6.81*</td>
</tr>
<tr>
<td>MA vs. Color and Form</td>
<td>7.04</td>
<td>2</td>
<td>3.52</td>
<td>.29</td>
</tr>
<tr>
<td>MA vs. Reversal and Nonreversal</td>
<td>76.37</td>
<td>2</td>
<td>38.18</td>
<td>3.16</td>
</tr>
<tr>
<td>Color-Form vs. Reversal-Nonreversal</td>
<td>37.13</td>
<td>1</td>
<td>37.13</td>
<td>3.08</td>
</tr>
<tr>
<td>MA vs. Color-Form vs. Reversal-Nonreversal</td>
<td>71.08</td>
<td>2</td>
<td>35.54</td>
<td>2.94</td>
</tr>
<tr>
<td>Within</td>
<td>144.71</td>
<td>12</td>
<td>12.05</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>466.84</td>
<td>23</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* $F$ (tab. .05) = 6.81 significant beyond the .05 level.

Homogeneity of variance was tested by the F-max test and found to be heterogeneous. Since the variances tended to be a function of the cell means, a square root transformation for small samples was utilized as suggested by Winer (5, p. 220).
The analysis reveals the difference between the two shift conditions to be significant beyond the .05 level. Each group was observed to have significantly greater capacity to execute the reversal shift rather than the nonreversal shift. This ability was evident in every case regardless of the mental (MA) level or the original dimension training, color or form. Interaction among these factors did not prove to be significant at the five per cent level.

Three subjects who were administered a nonreversal shift failed to reach the criteria, two in the low MA group and one in the middle MA group. An error score of seventy trials was given each of these subjects when the data was analyzed.

Discussion

The subjects in the present study were selected on the basis of their mental (MA) assessments. The three MA levels were comparable to the chronological ages of nursery school, kindergarten, and grammar school children, assuming that the latter groups were of normal or average intelligence. For example, the concept learning ability of retarded subjects within the MA range of 3.0 to 4.11 years with higher chronological ages was compared to the concept learning ability of nursery school children whose chronological ages fell within the mentioned range but whose intellectual functioning was
average. It was hypothesized that the performance of the three MA groups would be similar if not equivalent to the performance of the children in the Kendler and Kendler (2, 3) and Kendler, Kendler and Wells (4) studies, that is, the 3.0 to 4.11 MA group would find the nonreversal shift easier, the 5.0 to 6.11 group would be expected to execute a reversal and nonreversal shift at approximately the same rate, and the 7.0 to 8.11 MA group would respond in a reversal manner.

The results indicated that the reversal shift was easier to execute than the nonreversal shift regardless of the MA level or the original dimension training, color or form. This finding supported the prediction that the high MA group would shift more easily in the reversal shift condition. This is consistent with the results in a study by Kendler and Kendler (3) where the grammar school children, eight and ten years old, responded in a reversal manner. Therefore, this hypothesis was confirmed.

The low and middle MA groups also responded in a reversal manner. These results contradicted the present study's hypotheses concerning these groups and the findings in previous studies (2, 4). In the Kendler, Kendler and Wells study (4), nursery school children found the nonreversal shift easier than the reversal and in the Kendler and Kendler
study (2), kindergarten children executed both shift conditions at approximately the same rate.

There are several explanations for this discrepancy in results. The relatively small difference between the chronological ages of the subjects may have had some bearing on the results. There was approximately two years age difference between the low and high MA groups. It could be that the mediating response described by Hunt (1) and Kendler and Kendler (3) develops with chronological age and experience regardless of mental age. Perhaps as a child advances chronologically, he is involved in situations which would develop his concept learning ability. Through exposure, his ability to see relationships and abstract may be increased. Even though a retarded child functions at a lowered intellectual level, he may gain experience which would enable him to form concepts comparable to a child of the same chronological age but who is functioning at a higher intellectual level. Utilizing this explanation, it could be concluded that a retarded child, e.g., with a mental age of four years, does not conceptually function in the same manner as a nursery school child with a chronological age of four years. If chronological age is the major factor in the development of a mediating response, and since the difference in the chronological ages
of the retardates was small, it would follow that their performances would be similar. This similarity was found in the present study. It could be said that mediation was occurring in the groups involved in the experiment.

Many of the subjects did not have recent psychometric evaluations. There is the possibility that a number of the subjects were actually functioning on a higher level than stated in the experiment. This could account for some of the similarity in performance. If several students in the low or middle MA groups were performing at a point equivalent to subjects at a higher MA level, in the resulting performance would be a tendency to respond in a reversal manner.

As mentioned in the results, three subjects, two in the low MA group and one in the middle MA group, failed to reach the criteria under the nonreversal shift condition. They did reach the criteria in the original dimension training. Two of the subjects had color dimension training and one form dimension training. In statistically analyzing the data, a raw error score of seventy was given. Had these subjects been eliminated from the study and replaced by subjects able to reach the criteria, perhaps results more compatible with the hypotheses would have appeared.

The fact that these subjects were unable to complete a nonreversal shift may corroborate the theory of the mediating
response. The nonreversal shift is said to be more difficult because it requires the development of a new mediated response as well as a new overt response where the reversal shift only requires a new overt response. This increased difficulty on the nonreversal shift may be the reason the subjects failed to reach the criteria. This finding may substantiate the results in those studies where the nonreversal shift was harder to execute.

Results indicated that there was no difference in the performance of those subjects who received color dimension training and those receiving form dimension training. There did not appear to be any individual preferences or tendencies to choose a specific color or form.
CHAPTER III BIBLIOGRAPHY


CHAPTER IV

SUMMARY AND CONCLUSIONS

Summary

The present study was developed to investigate the developmental mediating response in mental retardates by analyzing the ability of these retardates to form concepts and shift dimensions of cues by changing the response conditions. The subjects were administered a learning discrimination task where they received training on a single relevant dimension and then were tested under two shift conditions: (a) reversal (b) nonreversal.

Twenty-four subjects from Denton State School were chosen on the basis of mental age (MA) evaluations obtained from previous Stanford-Binet and Weschler intelligence tests. Three groups were formed according to these MA assessments; low - 3.0 to 4.11, middle - 5.0 to 6.11 and high - 7.0 to 8.11. The chronological age and IQ of the subjects were not held constant.

Utilizing conclusions from previous studies with children of normal intelligence, (1, 2, 3) it was hypothesized that the low MA level subjects would execute a nonreversal shift.
more easily than a reversal, the middle MA level group would perform at approximately the same rate on both of the reversal and nonreversal shifts, and the high MA level group would perform more proficiently on the reversal shift.

Four geometric designs of two colors and two sizes were utilized in the experiment. A trial consisted of two of these geometric forms being presented to the subject and reinforced with a candy reward when the correct response was made. The MA groups of eight subjects each, equal numbers of boys and girls, were divided, one half receiving color dimension training, the other half receiving form dimension training. These groups were divided again into two shift condition groups. Four subjects were administered a reversal shift, the others a nonreversal shift.

The influence of MA level, original dimension training and reversal and nonreversal shift conditions upon concept formation ability was determined by an analysis of variance. The analysis indicated that all subjects had a greater capacity to execute a reversal shift regardless of mental age level or original dimension training. Therefore, only the hypothesis that the high MA group would execute a reversal shift more easily was confirmed.
Conclusions

Based on the results obtained from this study, the following conclusions were reached:

1. Regardless of the color or form dimension training or mental age level, mentally retarded subjects of approximately the same chronological age demonstrate a greater capacity to execute a reversal shift than a nonreversal shift.

2. The transitional stage hypothesized in studies with non-retarded subjects whose chronological ages ranged from three to ten years was not demonstrated in retarded subjects who had higher chronological ages than the non-retarded subjects but mental ages ranging from three to nine years. Performance on a discrimination task by a retarded subject with a certain mental age can not be expected to be similar or equivalent to the performance by a non-retarded subject with a corresponding chronological age.

3. The developmental process in the mediating response theory appears to be a function of increasing chronological age rather than increasing mental age.


BIBLIOGRAPHY

Books


Articles


**Standardized Tests**