A STUDY OF RIGIDITY AND FLEXIBILITY IN PRESCHOOL CHILDREN

By

Janice Oehrlein Bowling

Bachelor of Science

Pepperdine College

Los Angeles, California

1964

Submitted to the faculty of the
Graduate College
of the Oklahoma State University
in partial fulfillment of the
requirements for the degree
of
MASTER OF SCIENCE
May, 1967

A STUDY OF RIGIDITY AND FLEXIBILITY IN PRESCHOOL CHILDREN

Thesis Approved:

Elizabeth K. Hardwerather
Thesis Adviser

Stanley E. Fowler

N N Durham
Dean of the Graduate College

TO THE GOOD DOCTOR

ACKNOWLEDGMENTS

Acknowledgment is given to Oklahoma State University Research Foundations for their interest in the research as a contribution to the study of creative ability in young children.

The writer wishes to express indebtedness and sincere thanks to Dr. Elizabeth K. Starkweather, whose insight and guidance made this study possible.

Appreciation is given to Dr. Stanley Fowler for his critical reading of the manuscript.

The writer is grateful for the cooperation of the nursery and kindergarten teachers. To each child who made this study so enjoyable go special thanks.

The writer wishes to express her sincere appreciation to her husband, David, whose faith and encouragement have been a continuous inspiration.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Purpose

The purpose of this research was to develop an instrument for the measurement of rigidity-flexibility in preschool children. Flexibility is considered essential for divergent thinking that is a part of creative expression; in view of this, the study of flexibility is seen as a contribution to the broad area of creativity research being done at Oklahoma State University.

Definition

Flexibility is the ability to vary activity within a considerable range to comply with the demands of the varying situation (Werner, 1948). The flexible person is able to adapt; he is adjustable to change; and he is marked by reflective as opposed to impulsive thinking (Kagan, 1964). Torrance (1965) states that adaptive flexibility requires that the conventional problem solving methods which have become unworkable be abandoned in favor of original solutions. Principles of reversal and changing position are especially useful in stimulating adaptive flexibility.

Problem

Educators have indicated their concern about the development of creative ability and have recognized it as an important aspect of intelligence. Cronbach (1963) states that even though we recognize the importance of flexibility, routine school methods build up rigid habits that inhibit insight and creative reorganization.

Early identification of creative talent, or potential, would facilitate identification of the environmental factors that nurture creative ability in children. Creative ability could then be permitted to develop to its fullest in all children.

The purpose of the present study is to develop a measurement of rigidity-flexibility. This research is seen as a contribution to the study of the nature and development of creative ability to the extent that it may be used in the early identification of creative potential.

Procedure

The following steps were involved in the development of an instrument for the measurement of rigidity-flexibility in preschool children.

1. A survey of the existing literature was made (a) to gain understanding of rigidity and flexibility as related to problem solving situations, to learning tasks, and to creative ability; and (b) to review methods which have been used to measure rigidity and flexibility in previous research.

2. The instrument for measurement of rigidity-flexibility was developed.

3. The Peabody Picture Vocabulary Test and the rigidity-flexibility instrument were administered to 54 preschool children.

4. The data were analyzed.

5. The results were interpreted and recommendations were made for future use of the instrument.

CHAPTER II

REVIEW OF LITERATURE

In the review of literature for this study rigidity and flexibility are discussed under the following sections; (1) flexibility and rigidity as an aspect of creativity; (2) measures of flexibility, a review of tests that have been developed; (3) rigidity in problem solving, a description of several studies in which rigidity hampered the individual's ability to learn; (4) discrimination learning, a definition and examples of several types of discrimination learning; (5) reversal shifts in learning situations, a definition and an example of reversal shift experiments.

Flexibility and Rigidity as an Aspect of Creativity

To identify creativity in preschool children, it is first necessary to identify the various aspects of creativity. Guilford (1956) has mentioned flexibility as one of the mental abilities involved in creative achievement. He listed fluency, flexibility, originality, elaboration, and sensitivity to problems as aspects of divergent thinking.

Taylor (1963) listed the intellectual characteristics of creative talent as originality, adaptive flexibility,

and the ability to sense problems. He listed the motivational-interest characteristics as freedom to be a nonconformist and willingness to try the difficult.

According to Kubie (1958), flexibility of symbolic imagery is essential if the symbolic process is to have creative potential.

Cronback (1963) described the creative thinker as characterized by an active approach to problem situations. He is independent, flexible, original, free to fail, and is marked by divergent (as opposed to convergent) thinking.

Measures of Flexibility

This section will review several ways of looking at flexibility. First is that of measuring flexibility as an aspect of creative ability in the normal individual. The work of Torrance (1965) and Guilford (1956) are examples of this type of flexibility. The second aspect of flexibility is that studied by Kounin (1943), where he compares normal and feebleminded individuals. In this context, he finds that the feebleminded are more rigid than younger (normal) subjects of equal mental ability.

The Circles Test and the Squares Test were instruments developed by Torrance (1965) to measure flexibility. The original format for the Circles Test consisted of a page filled with 42 circles, each one inch in diameter. The subjects were instructed to see how many objects they could sketch which had a circle as the main element

in their design. The test measured three aspects of divergent production: Fluency, flexibility, and originality. Flexibility was determined by the variety of the child's responses, that is, the number of different response categories.

In another test described by Torrance (1965), grade school children were asked to try to think of ideas for improving a stuffed toy dog so it would be more fun for a child to play with. The responses were scored for fluency, flexibility, and originality. Again, flexibility was determined by counting the number of different approaches used in making improvements. The categories used were as follows: (1) adaptation, (2) addition, (3) change of color, (4) change of shape, (5) combination, (6) division, (7) magnification, (8) minification, (9) motion, (10) multiplication, (11) position, (12) quality of material, (13) rearrangement, (14) reversal, (15) sensory appeal (ears), (16) sensory appeal (eyes), (17) sensory appeal (nose), (18) sensory appeal (touch), (19) substitution, and (20) subtraction.

Another measure of flexibility also relying on verbal ability, is the Brick Uses Test (Guilford, 1956). A score for flexibility is given for the number of runs of responses. In the test, the examinee is told to think of all the uses for a brick that he can think of in eight minutes. His spontaneous flexibility score reflects the number of classes of uses he gives. For example, bricks can be used as building material or missiles.

In a study of rigidity in feebleminded and normal individuals of equivalent mental age, Kounin (1943) measured the extent to which satiation in one simple task (repeatedly copying a simple line drawing of a cat) influenced the rapidity with which the subject became satiated with a similar task. He found a significant relationship between age and rigidity; the younger subjects were more quickly satiated with each succeeding task, whereas the older subjects approached each task as if it were a completely new experience. For the younger subjects, those who proved to be less rigid, these similar tasks were interdependent.

Rigidity in Problem Solving

Kagan (1963) enumerated the antecedents of analytic attitude as the ability to inhibit motor discharge, the ability to modulate behavior in the face of irrelevant stimulation, and the ability to reflect in situations that elicit alternate response tendencies.

Kounin (1943) found that rigidity made change more difficult, and that his more rigid subjects organized ambiguous situations in a less integrated manner. He concluded that rigidity hinders perception and reasoning when a change is indicated.

Kagan (1963) stated that there is a gradual establishment of reflective and impulsive attitudes and strategies developed to solve novel problem tasks. When

complex problems are involved, with alternate routes available for the solution, reflection on the validity of possible courses of action is critical for ease of success. For example, the child who does not reflect in such a situation is apt to act upon the first idea that occurs to him. He is, therefore, more apt to end in failure using this strategy than the child who first reflects on the various courses of action. Kagan (1964) found that the tendency toward reflection or impulsivity was stable over a period of time, and he concluded that this tendency is a basic component of a child's behavioral organization.

Discrimination Learning

Discrimination learning in problem solving is a frequently employed research method, and is suitable for use in the study of flexibility and rigidity. Spiker (1960) describes two methods of discrimination learning; simultaneous discrimination learning and successive or patterned discrimination learning.

In simultaneous discrimination learning, positive and negative stimuli are presented to the subject at the same time. The subject chooses between the two stimuli and can be scored according to the number of correct responses, the number of errors, or the total number of trials necessary for learning. An example of this type of discrimination learning is in an experiment by Kuenne (1946), in which a

large and a small plaque were placed in front of two goal compartments. The child was rewarded for selecting the small plaque.

Successive discrimination learning requires the subject to respond to a correct stimulus in one set and a different correct stimulus in a second set. The two correct stimuli never appear at the same time (Spiker, 1960). For example, the child learns that round is correct when round and square objects are presented to him, and that big is correct when big and little objects are presented.

Worell and Worell (1964) found a relationship between impulsive behavior and discrimination learning. Subjects trained in weak conflict situations as opposed to strong conflict situations tended to respond quickly in subsequent training, regardless of the strength of the conflict. Since these subjects tend to react to all situations as weak conflict situations, their behavior could be considered impulsive.

Reversal Shifts in Learning Situations

In reversal shift experiments, the subject learns to discriminate between two stimuli, and then the patterns are reversed, and the previously incorrect response is rewarded. (Theoretically, the rigid subject would have difficulty making this reversal shift.)

Kendler and Kendler (1959), in a study of kindergarten children, found no significant difference in rate of

learning reversal shifts and non-reversal shifts. However, when the subjects were divided into groups of fast and slow learners, he found that the fast learners were able to learn the reversal shift more quickly than they learned the non-reversal shift, whereas the slow learners were able to learn the non-reversal shift more quickly.

Implications for the Present Research

Flexibility has repeatedly been included as an aspect of creative ability. Measurement of flexibility in pre-school children is therefore important as a help in identification and in gaining an understanding of the development of creative ability.

Measures of flexibility have for the most part been dependent upon verbal ability. However, behavioral evidence of flexibility can be observed in situations which demand a shift from one activity to another.

Studies of impulsive behavior suggest another approach to the study of rigidity-flexibility. Impulsive behavior in problem solving situations has been interpreted as an indication of rigidity.

Discrimination learning is a type of problem-solving situation which may lead itself to the study of rigidity-flexibility in young children.

The findings of the studies in which reversal shift tasks were used suggest that there is a relationship between mental maturity and rigidity-flexibility.

In one study of satiation, the findings clearly suggest that there is a relationship between age and rigidity-flexibility, and that this relationship may be the inverse of the relationship between mental maturity and flexibility.

CHAPTER III

DEVELOPMENT OF THE INSTRUMENT

This chapter will include a description of the pilot work done to develop the instrument, a description of the instrument including directions for administration and scoring, a description of the subjects used in the study, the procedure used in testing the children, and recommendations for analysis of the data.

Pilot Work

Pilot work for the development of an instrument to measure rigidity-flexibility in preschool children began with a study of rigidity-flexibility in a problem solving situation (Geurkink, 1965).

Step 1. In the first step of the pilot work, Geurkink's Demonstration Matching Task was simplified. The four dimensions used in the study (color, form, size, and pattern) were presented to the child one at a time. This simplification facilitated easier understanding of the concepts involved. The dimensions of the styrofoam objects used in the instrument included many colors, three forms, two sizes, and three patterns.

Step 2. In Geurkink's Pretest Matching Task, the child held one object and was then shown three other objects from which he chose one that matched his. No control was provided, and a child who was simply picking up one of the objects was scored as though he understood the task, when in fact he had not.

Two methods of control were studied. First a "no match" object was presented to the child as one of the four objects from which he chose; and secondly, a "controlled no match" object was presented to him as one of the four objects. The "no match" object was different from the other objects on all dimensions; and the "controlled no match" object appeared to fit into the set since it was controlled on the same dimension as the rest of the set; for example, all four objects might be the same color. These revised tasks were administered to 17 children and it was determined that the "controlled no match" seemed to identify the children who did not understand the concepts involved.

The Pretest Matching Task was then reconstructed using the "controlled no match" objects.

This step in the pilot work seemed to indicate that the Pretest Matching Task could be used to measure a child's understanding of the concepts involved and then a sorting task might indicate his degree of flexibility.

Step 3. In this step, a sorting task was developed. A set of eight objects was made that could be sorted into

two groups on either one of two dimensions, for example, color or form. When the child sorted the objects according to his preference (e.g., color) he was given another set of eight objects which could only be sorted inadequately on color, but adequately on form. Similar sets were provided for various combinations of the dimensions, color, form, size, and pattern. The child who sorted inadequately on the dimension he originally chose rather than adapting to the more appropriate dimension, was considered rigid.

This sorting task was administered to approximately 20 children. The results indicated that the task did not differentiate among the children and the task was abandoned.

Step 4. In this step, the Pretest Matching Task was modified in that each child was asked to match his object with two of the objects from the set of four. Each set of four included one control object, and it was reasoned that rigidity would be indicated by frequent selection of this object as the second choice.

The modified matching task seemed to confuse the children, and was therefore split into two sessions. The child made one choice during the first session after which his chosen object was eliminated; and during the second session only three objects were presented.

Problems were still encountered with the matching task possibly because the children were at different levels of conceptual development. The matching task was abandoned as a possible measure of rigidity.

Step 5. In this step a training situation combined with a reversal shift was used as the measure of the degree of flexibility. The ability to adapt to new situations when a new form of behavior is more appropriate was accepted as an indication of flexibility.

Geurkink's Training Task was used to teach the concepts, shape (square and round), size (big and little), and brightness (black and white). A Reversal Shift Task involving these three concepts was then administered. The Reversal Shift Task caused some confusion; and it was therefore decided to teach each concept separately and immediately do the reversal shift for that concept alone.

The brightness concept seemed to be poorly represented by the black and white objects; therefore this part of the task was changed to include objects of many colors which were presented as light and dark, thereby providing greater variety for the objects in this category.

The success experienced in this step of the pilot work resulted in the retention of the training and reversal shift tasks as a measure of rigidity-flexibility.

The Research Instrument

The research instrument consisted of three training tasks and two reversal shifts. The order of presentation was; (1) the training task for shape, (2) the training task for size, (3) the reversal shift for size, (4) the training task for brightness, and (5) the reversal shift for brightness.

The purpose of each training task was to teach the child the correct response in a situation in which he was given two choices. Each concept (shape, size, and brightness) was taught to the criterion of learning which was 10 correct responses out of 12.

The concept of shape was taught in the demonstration task. The concepts of size and brightness were taught separately; and immediately after each was learned the reversal shift was done for that concept. Each reversal shift required adaptation to a new situation, and therefore, was assumed to measure the child's ability to change or his degree of flexibility.

The apparatus for the task was a green turntable one foot square divided into half by a partition five inches high. On each side of the partition were two holes in which a reward object (a beaded peg) could be placed. The holes, two inches square and three inches apart, were covered by lids on which the stimulus objects made of styrofoam were fastened. Thus, when the child made his choice between the two stimulus objects and uncovered one of the holes, he found a reward if he made a "correct" choice. If he made an "incorrect" choice, he found nothing.

The stimulus objects were 16 paired objects differing in shape (round and square), 16 paired objects differing in size (large and small), and 16 paired objects differing in brightness (light and dark). The round, large, and light objects of the pairs were the correct responses for

the training tasks. For the two reversal shifts, the correct responses were the small and the dark objects.

Administration

The rigidity-flexibility instrument was administered individually to each child. The child was brought into the testing room and seated at a low table with the experimenter. The green turntable, six boxes of different colored pegs, and a peg board were on the table. The child was asked to choose the color of the pegs he wanted to play with first. The experimenter then dropped one of these pegs into one of the turntable holes in the child's view and say, "Here is how we play the game. I will put a peg in one of these holes and then cover both the holes with these lids so that you cannot see the peg. You may then guess which hole the peg is in. You may take this peg and put it in the peg board and we will start the game".

Before each training task the child was asked to discriminate the two dimensions of the concept he was to learn in order to be sure that he understood them. For example, a round and a square object were placed before him and he was asked to point to the round one and then to point to the square one.

In the game a peg was hidden under one of the lids and the child was asked to guess which one he thought it was under. For each of the training tasks (but not for the reversal shift) the two dimensions were pointed to and named

as they were presented to the child. For example, the child was asked, "Is it under the round one or square one?". The correct dimension was always stated first, but was randomly presented on the right and left sides of the turntable.

When the child made the correct response, the experimenter said, "Yes, it was under the (round) one". If an incorrect response was made, the experimenter lifted the correct lid and said, "No. See, it is under the (round) one". In this way the correct response was always reinforced by the experimenter. At the beginning of each training task when the child has made two consecutive correct responses, the experimenter said, "It is always under the (round) one, isn't it?".

Each training task was taught to the criterion of learning, 10 correct responses out of 12. If a child had not learned the concept after 32 presentations, the game was stopped and that child was eliminated from the study. Each child who learned the training task was given the reversal shift for that task. To start the reversal shift, the child was asked to select a different colored peg for the "new game". The experimenter then carefully explained, "We are going to play a <u>new</u> game now with different colored pegs. It is not the same as the last game. You will have to think very hard. This is a different game."

Eight reversal shift pairs were used for each concept. The dimensions were named as in the training task, but none of the responses were verbally reinforced.

Scoring

In this study, three socres were derived from the data for each child. These were a score for the first two training sessions (Training 1-2), a score for the second two training sessions (Training 2-3), and a score for the two reversal shifts (Reversal Shift).

The scores for the test were figured from the following formula: Number of correct responses divided by the total number of responses. This formula yielded scores of from .125 to 1.000, a perfect score.

Subjects

The subjects participating in this study were 54 preschool children attending community nursery schools, day care centers, and kindergartens. The children ranged in age from 3 years 3 months to 5 years 11 months; all of them were of at least average mental ability as defined by the Peabody Picture Vocabulary Test (Dunn, 1965).

Table I in the Appendix gives the distribution of subjects by sex, age, and mental ability. Statistical analyses indicated that there were no significant sex differences in age or mental maturity of the children.

Table II in the Appendix gives the distribution of subjects by age and mental ability. Statistical analyses of these data indicated significant differences in the expected direction. The older children earned higher Peabody Picture Vocabulary Test (PPVT) raw scores than did

the younger children. However, the relationship between age and PPVT IQ was not significant. (See Table II for Kruskal-Wallis analyses.)

No child who participated in the pilot work was included in the final study.

Procedure

In the present study two tests were administered to each child. The PPVT was administered individually to each child in a first testing session. The rigidity-flexibility test, which was developed for this research, was administered individually in a second testing session.

The total testing time for each child was approximately 20 to 45 minutes.

Recommended Analysis

1. The verbal maturity as measured by the PPVT should be compared to the mental ability indicated by the child's ability to learn the concepts used in the present research.

2. The data should be examined to see if there is any relationship between a child's age and his ability to learn the concepts.

3. The training scores should be analyzed to see if the introduction of a reversal shift interferes with the child's ability to learn subsequent concepts.

4. The data should be analyzed to see if there is the expected positive relationship between age, mental maturity, and the ability to learn the concepts involved.

4. The data should be analyzed to see if there is the expected positive relationship between age, mental maturity, and the child's ability to adjust to the reversal shifts.

6. An analysis should be made of the characteristics of children who are exceptions to the above pattern, to support the current theories about rigidity-flexibility and to suggest hypotheses for future research.

CHAPTER IV

RESULTS

The purpose of this research was to develop a measure of rigidity-flexibility in preschool children. Three training tasks were used to teach the correct responses in two-choice problem-solving situations. When a child learned the concepts taught during a training task, he was given a reversal shift; and his ability to adapt to this change was assumed to indicate his rigidity-flexibility. The scores that were derived from the child's performance on these tasks were two training scores and one reversal shift score. These three scores, the ages of the children, and their mental ability as indicated by the PPVT scores comprised the data that was analyzed in the present study.

The data analyses presented in this chapter include: (1) a comparison of mental maturity and the ability to learn concepts; (2) a description of the Training Tasks and a comparison of the ages and mental ability of the children who scored high and low on each task; (3) a comparison of Training 1-2 and Training 2-3; and (4) a comparison of Training 2-3 and the Reversal Shift.

Mental Maturity and the Ability to Learn Concepts

PPVT raw scores were used as an indication of the children's mental maturity; and scores obtained on the first two training tasks (Training 1-2) were used as an indication of the children's ability to learn the concepts in this research. The possibility that these might be similar measures of mental maturity suggested the need to analyze the relationship between the two sets of scores.

A Chi-square analysis indicated no relationship between the PPVT scores and the Training 1-2 scores. (See Table III.) If, by definition, these scores are related to mental maturity, then the lack of relationship between the scores indicated that the two instruments are measuring different aspects of mental maturity.

Training Tasks

Training 1-2 consisted of two similar tasks presented in succession; and Training 2-3 consisted of two similar tasks which were separated by the presentation of a reversal shift task. The distribution of children according to high and low scores on these tasks is shown in Table IV, and as a help to the reader, this distribution is presented in Figure 1 as a four-cell diagram with appropriate cells shaded for each subsequent analysis.

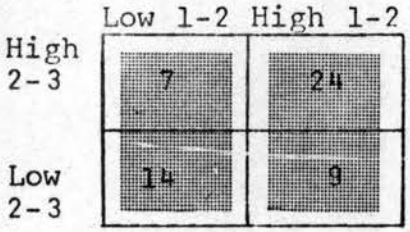
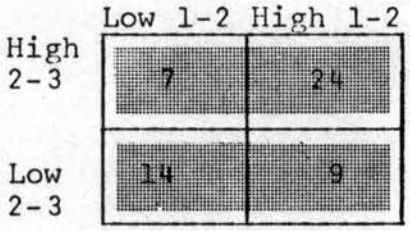
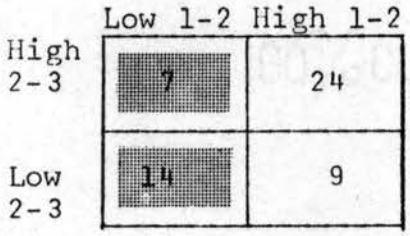
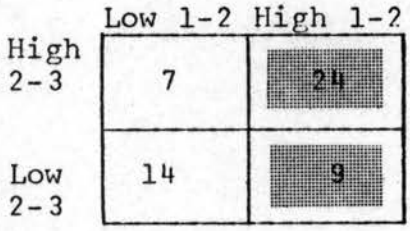
Diagrams	Mann-Whitney U Test
	Age: U = 217; p < .01 PPVT: U = 321; n.s. R.S.: U = 197; p < .005
Figure 1-a	
	Age: U = 194; p < .01 PPVT: U = 239; p < .02 R.S.: U = 131; p < .0001
Figure 1-b	
	Age: U = 17; p < .01 PPVT: U = 38; p < .20 R.S.: U = 10; p < .002
Figure 1-c	
	Age: U = 83; p < .20 PPVT: U = 59; p > .02 R.S.: U = 51; p < .02
Figure 1-d	

Figure 1. Diagrams identifying groups of children compared in the statistical analyses of Training 1-2 and Training 2-3.

Training 1-2

A comparison of the children who scored high and low on Training 1-2 (shown in Figure 1-a) indicated that the high-scoring children were significantly older but were not different in mental maturity from the low-scoring children. Median ages for these two groups were 4 years 10 months and 4 years 2 months; and the median PPVT scores were 50 and 52. (See Table V.)

Training 2-3

A comparison of the children who scored high and low on Training 2-3 (shown in Figure 1-b) indicated that the high-scoring children were significantly older and more mentally mature than the low-scoring children. Median ages for these two groups were 5 years 1 month and 4 years 3 months; and median PPVT scores were 53 and 49. (See Table V.)

Comparison of Training 1-2 and Training 2-3

A chi-square analysis indicated a significant relationship between the children's ability to learn the concepts in Training 1-2 and Training 2-3. (See Table IV.) Of the 33 children who scored high on Training 1-2, the majority also scored high on Training 2-3; and similarly, of the 21 children who scored low on Training 1-2, the majority also scored low on Training 2-3. The children who were exceptions to this pattern are of particular importance in the present study.

Seven children who scored low on Training 1-2 (shown in Figure 1-c) showed an improvement in their ability to learn the concepts, as indicated by high scores on Training 2-3. Apparently these children were unaffected by the introduction of the first reversal shift task. Compared to the children who scored low on Training 1-2 and Training 2-3, these seven children were significantly older, but were not significantly different in mental maturity. Median ages for these two groups were 4 years 8 months and 3 years 9 months; and median PPVT scores were 51 and 52. (See Table VI.)

Nine children who scored high on Training 1-2 (Figure 1-d) showed a decrease in their ability to learn the concepts as indicated by low scores on Training 2-3. Apparently these children were affected adversely by the introduction of the first reversal shift task. Compared to the children who scored high on Training 1-2 and Training 2-3, these nine children were significantly less mature mentally, but were not significantly different in age. Median ages for these two groups were 4 years 7 months and 5 years 1 month, and median PPVT scores were 47 and 54. (See Table VI.)

Comparison of Training 2-3 and the Reversal Shift

A chi-square analysis indicated a significant relationship between the children's ability to learn the

Diagrams

Mann-Whitney U Test

	Low 2-3	High 2-3
High R.S.	0	14
Low R.S.	23	17

Figure 2-a

Age: $U = 55$; $p < .001$

PPVT: $U = 87$; $p < .01$

	Low 2-3	High 2-3
High R.S.	0	14
Low R.S.	23	17

Figure 2-b

Age: $U = 59$; $p < .01$

PPVT: $U = 98$; $p < .20$

	Low 2-3	High 2-3
High R.S.	0	14
Low R.S.	23	17

Figure 2-c

Age: $U = 140$; $p > .05$

PPVT: $U = 149$; $p < .10$

Figure 2. Diagrams identifying groups of children compared in the statistical analyses of Training 2-3 and the Reversal Shift.

concepts in Training 2-3 and their ability to adapt to the Reversal Shift. (See Table VII.) All of the 23 children who scored low on Training 2-3, also scored low on the Reversal Shift; and 14 of the children who scored high on Training 2-3 also scored high on the Reversal Shift. A comparison of these two groups of children (shown in Figure 2-a) indicated that those who learned the concepts well and performed well on the Reversal Shift were significantly older ($U = 55$; $p < .001$), and were significantly more mature mentally ($U = 87$; $p < .01$). Median ages for the two groups were 5 years 2 months and 4 years 3 months; and median PPVT scores were 54 and 47. (See Table VIII.)

The children who were exceptions to the above pattern are of particular importance to the present study. Seventeen children who scored high on Training 2-3 (shown in Figures 2-b and 2-d) were unable to adapt to the Reversal Shift tasks. The 17 children were significantly younger than the 14 children who scored high on the Reversal Shift, ($U = 59$; $p < .01$); and they tended to be older than the 23 children who scored low on Training 2-3 and on the Reversal Shift, ($U = 140$; $p > .05$). A similar analysis of PPVT scores indicated no significant difference in the mental maturity of the two groups.

Summary

Analysis of the data gathered in this study revealed the following:

1. No relationship was found between the children's mental maturity (PPVT raw scores) and their ability to learn the concepts (Training 1-2). The two instruments can be accepted as measuring different aspects of mental maturity.

2. Children who scored high on Training 1-2, that is, who learned the concepts well, were older than those who scored low. The relationship between age and the ability to learn concepts was in the expected direction.

3. Children who scored high on Training 2-3 were older and more mature mentally than those who scored low. In view of the positive relationship between age and scores on Training 1-2, the relationship between age and scores on Training 2-3 was to be expected. The positive relationship between Training 2-3 scores and mental maturity suggests a relationship between flexibility and mental maturity inasmuch as a reversal shift was introduced between Training 2 and Training 3.

4. The relationship between Training 1-2 scores and Training 2-3 scores was in the expected direction. With few exceptions, the children who scored high on the one scored high on the other, and those who scored low on the one scored low on the other. Children who were exceptions to this pattern are of particular significance in the present study. (a) CHildren who did poorly on Training 1-2 and yet did well on Training 2-3 apparently were <u>not</u> affected by the introduction of a reversal shift task. These children were significantly older than those whose training scores

were low for 1-2 and 2-3, but they were not different in mental maturity. (b) Children who did well on Training 1-2 and yet did poorly on Training 2-3, apparently were adversely affected by the introduction of a reversal shift task. These children were less mature mentally than the children whose training scores were high for 1-2 and 2-3, but there were no age differences between these two groups.

5. The relationship between Training 2-3 scores and the Reversal Shift scores was in the expected direction. With few exceptions, the children who scored high on the one scored high on the other; and those who scored low on the one scored low on the other; and again, children who were exceptions to this pattern are of particular significance in the present study. (a) No children who did poorly on Training 2-3 were able to do well on the Reversal Shift. Children who did poorly on Training 2-3 and the Reversal Shift were younger and less mature mentally than those who did well on the training tasks and the reversal shifts. (b) Children who did well on Training 2-3 and yet did poorly on the Reversal Shift were younger than children who did well on the Reversal Shift and were older than the children who did poorly on both tasks, Training 2-3 and the Reversal Shift. The major differences between these groups were in age and not in mental maturity.

CHAPTER V

SUMMARY AND IMPLICATIONS

The purpose of this research was to develop a measure of rigidity-flexibility in preschool children. The ability to adapt to a new situation when a new form of behavior is more appropriate was accepted as behavioral evidence of flexibility; and in line with this definition, a research instrument consisting of three training tasks and two reversal shifts, was designed to measure the degree of a child's flexibility. The subjects were 54 children ranging in age from 3 years 3 months to 5 years 11 months. An understanding of the concepts shape, size, and brightness was necessary for a child to participate in the research.

The scoring of a child's behavior provided two measures of his ability to learn the concepts (training scores) and one measure of his ability to adapt to the reversal shifts. In addition, the Peabody Picture Vocabulary Test (PPVT) was administered to each child, and from this a measure of his mental maturity was obtained.

A comparison of PPVT scores and training task scores indicated that these two instruments were measuring different aspects of mental maturity. On the training task the older children learned the concepts more readily than

did the younger children; a comparison of the two sets of training scores suggested a relationship between flexibility and mental maturity. This relationship was also supported by a comparison of the second training scores and the reversal shift scores. Children who had difficulty learning the concepts, as indicated by low training scores, also had difficulty with the reversal shift. However, children who did well on the training tasks, were not necessarily able to do well on the reversal shift. Of these children, those who were younger seemed to have difficulty with the reversal shift, while those who were older were more able to adapt. The children who were both younger and less mature had difficulty on the training tasks and on the reversal shift.

Theoretical Implications

Theoretical implications can be drawn from the findings of the present research. The relationship which apparently exists between maturity and rigidity-flexibility suggests a pattern of development which is presented schematically in Figure 3. This figure can be used to illustrate the changes in the rigidity-flexibility of a single child as he matures. It can also be used to illustrate the differences in rigidity-flexibility that exist among children of the same age.

Theoretically, the development of a single child begins with behavior that is pseudo-flexibile (Section A in Figure 3). At this stage the immaturity of the child

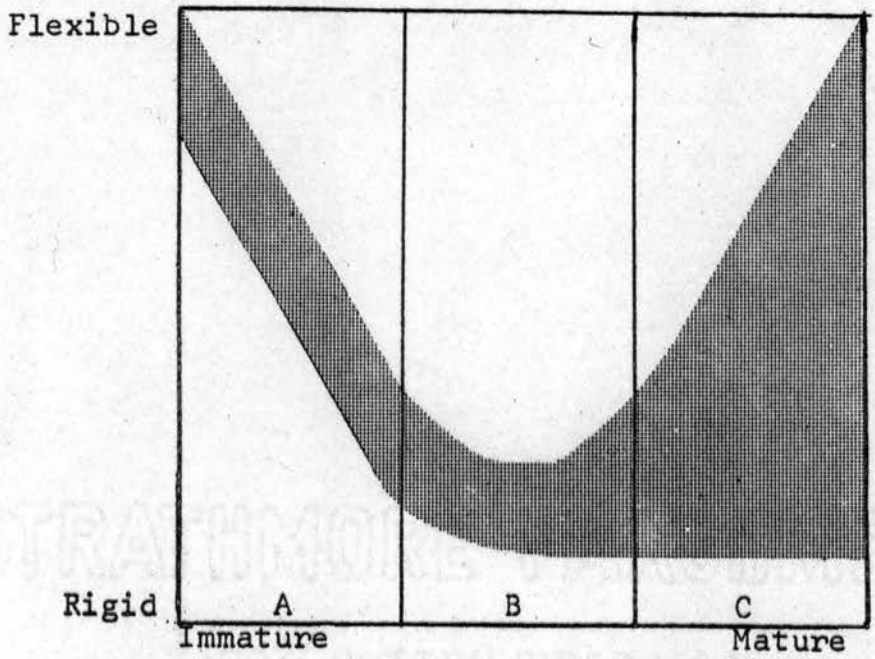


Figure 3. Schematic representations of the relationship between maturity and rigidity-flexibility.

prevents him from generalizing or from seeing the similarity between tasks; therefore, he approaches a training task and a reversal shift task as though they were unrelated, and he performs equally well or poorly on both. His behavior, which in reality is immature, suggests flexibility because of the ease with which he shifts from one task to the other.

As the child matures (Section B in Figure 3), his ability to generalize enables him to see the relationship between two similar tasks; but because of his egocentricity, he has difficulty shifting to a new point of view. He, therefore, responds to the reversal shift just as he had learned to respond to the training task. Thus, at this stage, the child's behavior suggests rigidity because he continues to respond in a manner which was appropriate in a previously learned similar task.

With increased maturity (Section C in Figure 3), the child has become less egocentric. He is able to generalize and he is able to view a problem from more than one point of view. True rigidity and true flexibility now appear, i.e., rigidity and flexibility which are not merely a reflection of the child's level of maturity. At this level, the rigid child continues to show the behavior he demonstrated when he was somewhat less mature (as in Section B). Rigidity has apparently become a complusive characteristic of his behavior and can no longer be simply explained as a sign of immaturity. The flexibile child on the other hand is able to respond readily and correctly

to the reversal shift. He recognizes the similarity of the tasks and is able to profit from his understanding of the concept he has learned and adapt readily to the reversal shift. Theoretically a group of children of the same age would show a similar range of behavior from rigid to flexible. In terms of Figure 3, the most immature children would behave in a rigid manner (Section B); and among the most mature children behavior would range from compulsively rigid to flexible (Section C).

Implications for Future Research

During the present study certain questions arose which suggest possibilities for future research.

1. A problem arose during the pilot work (Step 4) because of apparent differences in the children's ability to conceptualize. If children of the same age and mental ability do develop their conceptual abilities at different rates, a measure of this development would be of vital importance to both learning and creativity research.

2. Further research is needed in order to determine whether rigidity-flexibility is an independent characteristic. A comparison of individual intelligence test scores (e.g., Stanford Binet) and rigidity-flexibility scores is recommended.

3. Flexibility is a characteristic which is assumed to be important for creative expression; therefore, studies of rigidity-flexibility scores in relation to other

"creativity" scores should contribute to the general understanding of creative ability.

4. The relationship of rigidity-flexibility to other personality characteristics, such as anxiety, should also be studied.

5. The rigidity-flexibility instrument should be revised and simplified in order that it be easier to use in future research.

SELECTED BIBLIOGRAPHY

Cronback, L. J. Educational Psychology. New York: Harcourt, Brace and World, Inc., 1963.

Dunn, L. M. Expanded Manual for the Peabody Picture Vocabulary Test. Minneapolis: American Guidance Service, Inc., 1965.

Geurkink, L. S. "A Study of Rigidity and Flexibility in Preschool Children's Behavior in a Problem Solving Situation." Unpublished Master's Thesis, Oklahoma State University, 1965.

Guilford, J. P. "Structure of Intellect." Psychological Bulletin, LIII, (1965), pp. 267-293.

Kagan, J. "Information Processing in the Child: Significance of Analytic and Reflective Attitudes." Psychological Monographs, LXXVIII, (1964), pp. 1-37.

Kendler, H. H., and T. S. Kendler. "Reversal and Nonreversal Shifts in Kindergarten Children." Journal of Experimental Psychology, LVIII, (1959), pp. 56-60.

Kounin, J. S. "Intellectual Development and Rigidity," in Barker, Kounin, and Wright, Child Behavior and Development. New York: McGraw and Hill, (1943), pp. 179-197.

Kubie, L. S. Neurotic Distortion of the Creative Process. Lawrence: University of Kansas Press, 1958.

Kuenne, M. R. "Experimental Investigation of the Relation of Language to Transition Behavior in Young Children," Journal of Experimental Psychology, XXXVI, (1946), pp. 471-490.

Spiker, C. "Research Methods in Children's Learning," in Paul H. Mussen (ed.), Handbook of Research Methods in Child Development. New York: John Wiley and Sons, Inc., 1960, pp. 374-402.

Taylor, C. W. "Identifying the Creative Individual," in E. P. Torrance (ed.), Creativity: Second Minnesota Conference on Gifted Children. Minneapolis: Center for Continuation Study, University of Minnesota, 1959, pp. 3-21.

Torrance, E. P. Rewarding Creative Behavior. Englewood Cliffs, New Jersey: Prentice-Hall, 1965.

Werner, H. Comparative Psychology of Mental Development. Chicago: Follett Publishing Co., 1948.

Worell, L. and J. Worell. "Generalization of Conflict Tolerance," Psychological Reports, XIV, (1964), pp. 203-215.

APPENDIX

TABLE I

DISTRIBUTION OF SUBJECTS BY SEX, AGE,

AND MENTAL ABILITY

	Boys (N = 24)	Girls (N = 30)	Total (N = 54)
Age			
Median	4:7	4:8	4:7
Range	3:3 - 5:11	3:3 - 5:11	3:3 - 5:11
PPVT: Raw Score			
Median	52	49	51
Range	38 - 65	33 - 65	33 - 65
PPVT: I.Q.			
Median	111	105	108
Range	86 - 135	93 - 125	86 - 135
Trials 1-2			
Median	.875	.875	.875
Range	.586 - 1.000	.703 - 1.000	.586 - 1.000
Trials 2-3			
Median	.875	.875	.875
Range	.659 - 1.000	.613 - 1.000	.613 - 1.000
Reversal Shift			
Median	.687	.812	.750
Range	.125 - 1.000	.187 - 1.000	.125 - 1.000

TABLE II

DISTRIBUTION AF SUBJECTS BY AGE

AND MENTAL ABILITY

	Age (Expressed in Years and Months) 3:5 - 3:11	4:0 - 4:11	5:0 - 5:11	Kruskal-Wallis
	13	21	20	
PPVT: Raw Score				
Median	44	49	56	H = 14.85
Range	33-56	38-63	43-65	p < .001
PPVT: I.Q.				
Median	112	108	104	H = 5.28
Range	98-130	86-135	88-125	p < .10
Trials 1-2				
Median	.807	.875	.875	H = 6.7
Range	.586- .958	.750-1.000	.702-1.000	p < .05
Trials 2-3				
Median	.785	.875	.916	
Range	.674-1.000	.659- .958	.613-1.000	
Reversal Shift				
Median	.437	.750	.875	
Range	.125- .750	.375- .937	.375-1.000	

TABLE III

CHI-SQUARE ANALYSIS OF THE RELATIONSHIP BETWEEN MENTAL MATURITY (PPVT) AND THE ABILITY TO LEARN CONCEPTS (TRAINING 1-2)

Training 1-2	PPVT Scores 33-46	47-54	55-65	Total
0.875 - 1.000 (High)	10	12	11	33
0.125 - 0.874 (Low)	8	7	6	21
Total	18	19	17	54

Chi-square = 0.353; n.s.

TABLE IV

CHI-SQUARE ANALYSIS OF THE RELATIONSHIP BETWEEN THE CHILDREN'S PERFORMANCES ON TRAINING 1-2 AND TRAINING 2-3

Training 2-3	Training 1-2 0.125-0.874 (Low)	0.975-1.000 (High)	Total
0.875-1.000 (High)	7	24	31
0.125-0.875 (Low)	14	9	23
Total	21	33	54

Chi-square = 7.960; $p < .01$

TABLE V

PPVT SCORES AND AGES OF CHILDREN WHO SCORED HIGH AND LOW ON THE TRAINING TASKS

	N	Age (Yrs:Mos)	PPVT Scores
Training 1-2			
High-Scoring Children			
Median	33	4:10	50
Range		3:3 - 5:11	38 - 63
Low-Scoring Children			
Median	21	4:2	52
Range		3:3 - 5:11	33 - 65
Training 2-3			
High-Scoring Children			
Median	31	5:1	53
Range		3:6 - 5:11	42 - 65
Low-Scoring Children			
Median	23	4:3	49
Range		3:3 - 5:11	33 - 63

TABLE VI

PPVT SCORES AND AGES OF CHILDREN GROUPED ACCORDING TO PERFORMANCES OF TRAINING 1-2 AND TRAINING 2-3

	N	Age (Yrs:Mos)	PPVT Scores
Low Training 1-2 High Training 2-3			
Median	7	4:8	51
Range		4:2 - 4:8	42 - 65
Low Training 1-2 Low Training 2-3			
Median	14	3:9	52
Range		3:3 - 5:11	33 - 63
High Training 1-2 High Training 2-3			
Median	24	5:1	54
Range		3:6 - 5:11	42 - 63
High Training 1-2 Low Training 2-3			
Median	9	4:7	47
Range		3:3 - 5:5	38 - 56

TABLE VII

CHI-SQUARE ANALYSIS OF THE RELATIONSHIP BETWEEN THE CHILDREN'S PERFORMANCES ON TRAINING TASKS 2-3 AND THE REVERSAL SHIFT TASKS

Training 2-3	Reversal Shift Scores 0.125-0.874 (Low)	0.975-1.000 (High)	Total
0.975-1.000 (High)	0	14	14
0.125-0.874 (Low)	23	17	40
Total	23	31	54

Chi-square = 14.176; $p < .001$

TABLE VIII

PPVT SCORES AND AGES OF CHILDREN GROUPED ACCORDING TO PERFORMANCES ON TRAINING TASKS 2-3 AND THE REVERSAL SHIFT TASKS

	N	Age (Yrs:Mos)	PPVT Scores
Low Reversal Shift Low Training 2-3			
Median	23	4:3	47
Range		3:3 - 5:11	33 - 63
Low Reversal Shift High Training 2-3			
Median	17	4:7	50
Range		3:6 - 5:8	42 - 65
High Reversal Shift High Training 2-3			
Median	14	5:2	54
Range		4:1 - 5:11	42 - 63

TABLE VIII

DESCRIPTIVE DATA AND DERIVED SCORES FOR INDIVIDUAL CHILDREN PARTICIPATING IN A STUDY OF FLEXIBILITY AND RIGIDITY

(N=54)

Sex and Code No.	Age	Training Task Scores 1-2	Training Task Scores 2-3	Reversal Shift Score	PPVT Raw Score	PPVT IQ
F-1339	3:3	.807	.674	.500	33	106
M-1343	3:3	.875	.833	.562	42	111
F-1342	3:4	.833	.727	.625	34	98
M-1352	3:5	.807	.781	.125	43	112
F-1287	3:6	.703	.846	.187	49	122
F-1344	3:6	.958	1.000	.375	49	122
M-1341	3:7	.586	.735	.375	42	111
M-1346	3:8	.807	.704	.500	54	130
M-1345	3:8	.958	.958	.437	50	124
F-1309	3:9	.777	.821	.750	41	98
F-1310	3:10	.750	.785	.687	52	117
M-1347	3:11	.785	.781	.187	56	124
F-1338	3:11	.875	.916	.312	44	103
F-1307	4:0	.958	.875	.500	44	103
M-1277	4:1	.857	.805	.750	52	127
F-1308	4:1	1.000	.958	.875	42	100
M-1282	4:2	.875	.875	.812	50	114
M-1312	4:2	.875	.875	.812	49	112
M-1313	4:2	.777	.958	.750	42	100
M-1306	4:3	.958	.916	.375	50	110
F-1286	4:3	.958	.958	.937	45	105
M-1311	4:3	.875	.659	.500	38	86
M-1337	4:5	.846	.774	.687	63	135
F-1314	4:5	.750	.875	.875	49	108
F-1316	4:6	.958	.775	.500	45	100
M-1291	4:6	.875	.833	.812	53	119
M-1317	4:7	.916	.772	.500	43	96
M- 772	4:7	.827	.880	.812	44	100
M-1289	4:7	.916	.777	.625	49	108
F-1315	4:8	.750	.958	.750	51	112
M-1318	4:9	.916	.916	.812	57	114
M- 777	4:10	.775	.750	.625	63	125
F-1290	4:10	.916	.875	.937	63	125
F-1265	4:10	.875	.766	.750	47	95
F-1332	5:1	.958	1.000	.937	46	93
F-1321	5:1	.840	.916	.750	61	121
M-1322	5:1	.857	.711	.750	44	90
F-1335	5:2	.875	.916	1.000	56	112
M-1328	5:2	.812	.958	.812	57	104
M-1329	5:2	.958	.916	1.000	55	110
F-1330	5:2	.875	.613	.812	52	104
M-1336	5:4	.875	.875	.812	63	125
M-1324	5:5	1.000	.884	.812	43	88
M-1326	5:5	.875	.750	.500	56	112
F-1333	5:6	.958	1.000	.875	53	95
F-1325	5:7	.875	.875	.875	54	97
F-1319	5:7	.916	1.000	1.000	57	104
M-1348	5:8	.821	.958	.687	65	121
M-1334	5:8	.875	.916	.875	57	104
M-1323	5:8	.958	1.000	.687	56	102
F-1331	5:10	.916	.875	.937	57	104
M-1238	5:10	.916	1.000	.937	60	110
F-1327	5:11	.916	.875	.937	54	97
M- 395	5:11	.702	.696	.500	53	95

VITA

Janice Oehrlein Bowling

Candidate for the Degree of

Master of Science

Thesis: A STUDY OF FLEXIBILITY AND RIGIDITY IN PRESCHOOL CHILDREN

Major Field: Family Relations and Child Development

Biographical:

Personal Data: Born in Los Angeles, California, July 2, 1943, the daughter of William G. and Lucile Thompson Oehrlein. Married David I. Bowling, August 8, 1964.

Education: Attended grade school in Los Angeles, California; graduated from George Washington High School, Los Angeles, California, in January of 1961. Received a Bachelor of Science Degree from Pepperdine College, Los Angeles, California, with a major in Home Economics-Education, August 7, 1964. Completed requirements for the Master of Science Degree in May of 1967.

Professional Experience: Laboratory Technician, Oklahoma State University, 1964-1965; Graduate Research Assistant, Department of Family Relations and Child Development, Oklahoma State University, 1965-1967.

Professional Organizations: Kappa Omicron Phi, Phi Epsilon Omicron, American Home Economics Association, Society for Research in Child Development, Oklahoma Academy of Science.