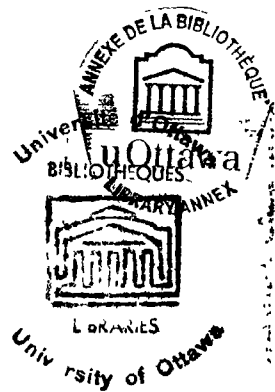


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ROTATIONAL TENDENCIES OF THE HIGH-GRADE MENTALLY
RETARDED AND OF CHILDREN WITH AVERAGE
INTELLIGENCE

by Pauline P.T. Tsui

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Psychology and Education of the
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fulfillment of the requirements
for the degree of Master of Arts



*R. H. Shewell on
day*

Toronto, Canada, 1967

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CURRICULUM STUDIORUM

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INTRODUCTION

The development of the visual-motor function of the retarded and non-retarded children has drawn much attention in recent years, as it has been found to be related to a child's adaptability to his environment, particularly his achievement in schools. It is important to educational planning and clinical diagnosis to study the retarded children's development in this area as compared to the non-retarded.

To account for this development, Bender postulated that the visual-motor gestalt production of the retarded children is generally at a lower level, though she did not specify clearly whether it would be commensurate with, above or below their mental age, when these children are considered as a group. Secondly, she postulated that there is greater variation in their production, even in cases of high-grade mental retardation, than among the non-retarded children of the same mental age.¹ Studies are needed to verify these postulations.

The present thesis focuses on one aspect of the visual-motor gestalt function, i.e., rotation which indicates the inability to reproduce graphically a design according to its

¹ Lauretta Bender, A Visual-Motor Gestalt Test and Its Clinical Use, American Orthopsychiatric Association, Research Monograph, No. 3, 1938, p. 137-149; and Child Psychiatric Techniques, Springfield, Thomas, 1952, p. 78-103.

proper spatial orientation. Griffith and Taylor,² Silverstein and Mohan,³ and Fred⁴ found that a high percentage of institutionalized mental retardates made rotation on the Bender-Gestalt Test, but they did not compare them to the normal non-retarded as to indicate to what extent rotation occurred more often among them. Burnett and Fuller⁵ were the only ones who attempted to compare the rotational tendency of the retarded children with the so-called normal children, but not at the same mental age level. The results showed that the retarded children rotated far more on the Minnesota Percepto-Diagnostic Test than the normal children. However, the subjects in these studies were all taken from a hospital and therefore could not be considered representative of the retarded. To give a fair representation of the retarded, the subjects should be taken from public schools. These children should also be compared to the non-retarded at the same mental age level, so as to indicate to what extent they are retarded in this function.

2 R.M. Griffith and V.H. Taylor, "Incidence of Bender-Gestalt Figure Rotations," Journal of Consulting Psychology, Vol. 24, No. 2, April 1960, p. 189-190.

3 A.B. Silverstein and P.J. Mohan, "Bender-Gestalt Figure Rotations in the Mentally Retarded," Journal of Consulting Psychology, Vol. 26, No. 4, August 1962, p. 386-388.

4 Earl X. Fred, "Incidence of Bender-Gestalt Figure Rotations among Mentally Defective Psychiatric Patients," American Journal of Mental Deficiency, Vol. 69, No. 4, January 1965, p. 514.

5 A. Burnett and G.B. Fuller, "Minnesota Percepto-Diagnostic Test Performance in Educable Mentally Retarded Children: Standardization, Normative Data; Comparison with Other Diagnostic Groups and Detection of Organic Brain Damage," not published.

As for variability in the quantity of rotation, Burnett and Fuller's study⁶ was the only one that reported of the standard deviation in the rotation made by the retarded children, but it was not compared with that of the normal.

This study attempted to compare at one mental age level the high-grade mentally retarded children with those of average intelligence on the amount of rotation and variability in the group. The samples were drawn from public schools and it also attempted to control other variables that could affect rotation. The problem under investigation can be worded as follows: Do the retarded children make about the same amount of rotation as those with average intelligence, and is there about the same amount of variability of production in the two groups?

The first chapter gives further explanation of Bender's theory on which the thesis is based. It then reviews the literature on the rotational tendency of the retarded and non-retarded children, pointing out the factors which could affect rotation and the importance in defining the population studied. It also attempts to compare the retarded with the non-retarded in the light of the results of separate studies on the two. The purpose of this thesis and the general hypothesis are then stated.

⁶ Ibid.

The second chapter describes the experimental design of the project, emphasizing the selection of samples to make the two groups as comparable as possible. The rationale and validity of the tool is also described. The specific hypotheses are then formulated and the methods of statistical analysis are explained.

The results of the study are presented in Chapter III and discussed in Chapter IV, with regard to the hypotheses, Bender's speculation, and the results of the previous studies. The limitations of the findings due to the IQ and mental age of the subjects and due to the tool are pointed out and suggestions for further studies are given. The last section presents a summary and conclusion of the findings.

CHAPTER I

REVIEW OF THE LITERATURE

When reviewing the literature of the visual-motor gestalt function of the retarded children, one would go back to Laretta Bender, who constructed the Visual-Motor Gestalt Test with designs adapted from Wertheimer's and attempted to give a theoretical explanation of its genesis and maturation. She observed that the gestalt function of children goes through a developmental process and gradually matures. In the case of mental deficiency, the process is slower. In her earliest work on this topic, she stressed the similarity of the genesis and maturation of this function between the young and the retarded children.¹ Later she observed that mental deficiency is not an entity and there is great variation among them as affected by different developmental disorders associated with mental deficiency.² She stated that:

¹ Laretta Bender, "Principles of Gestalt in Copied Form in Mentally Defective and Schizophrenic Persons," Archives of Neurology and Psychiatry, Vol. 27, No. 3, March 1932, p. 661-686.

² -----, A Visual-Motor Gestalt Test and Its Clinical Use, American Orthopsychiatric Association, Research Monograph No. 3, 1938, p. 137-149; and Child Psychiatric Techniques, Springfield, Thomas, 1952, p. 78-103.

There is not simply a lower level of the integrated gestalt production commensurate with the mental level determined by the other standardized psychometric tests. There is a much greater variety of productions among mental defectives of a given age level than among normal children of the same mental age. There is, of course, retardation in some one or all of the various maturational processes but this retardation may be more in one field than in another.³

In other words, the overall visual-motor performance of the retarded children when considered individually may be commensurate with, above or below their mental age, and also it may be stronger or weaker in certain areas. She felt that the discrepancy might be related to the developmental disorder associated with mental retardation. For example, she observed that children of congenital word blindness often show directional disturbance and epileptic children have difficulty in spatial orientation of configuration on the ground. Among the high-grade mentally retarded one finds more cases of the hereditary constitutional type, whose visual-motor gestalt function resembles more that of the younger children as their maturational process is slower. They would show less discrepancy than the retarded of other types, but still "even in these cases, a simple retardation is not found in all of the principles of the integrated visual-motor gestalt function."⁴

³ Bender, Child Psychiatric Techniques, p. 80-81.

⁴ Ibid., p. 86.

To sum up, Bender felt that the visual-motor gestalt production of the retarded children is generally at a lower level and there is more variation among them, even in cases of high-grade mental retardation. In regard to the first part, she did not speculate to what extent this function is retarded when these children are considered as a group, i.e., whether it is commensurate with, above or below their mental age level. It also has to be pointed out that Bender made these observations in the hospital or clinic setting where, generally speaking, the children presented greater adjustment problems.

This study singled out rotation, i.e., the inability to reproduce graphically a design according to its proper spatial orientation. It attempted to find out if the high-grade mentally retarded children make more or less rotation and show more or less variability when compared to the children with average intelligence at the same mental age level.

There has not been any study comparing the children with average intelligence and the retarded at the same mental age levels on rotation. However, there are some separate studies on the two groups, which could shed some light on the topic.

REVIEW OF THE LITERATURE

4

1. Rotational Tendency in Children with Normal Intelligence.

Normal children go through a period of instability in spatial orientation. Stern, one of the earliest to study the perceptual development of children, observed that to a child a form is much more independent of its absolute spatial position than to an adult, and that "the idea of form and the idea of position are two distinct psychic functions, the second of which is only developed by a somewhat slow process of learning."⁵ Koffka followed the same line of thought. He stated that:

The varying possibilities of formulating the perceptual world of an adult, according to form, magnitude, position and color, all entering into one configuration which is determined in many ways, are to a child still more or less independent of one another.⁶

⁵ W. Stern, Psychology of Early Childhood, up to the Sixth Year of Age, translated by Anna Barwell, 3rd edition, London, Allan and Unwin, 1924, p. 113-123.

⁶ K. Koffka, The Growth of the Mind, New York, Harcourt, 1925, p. 314-315.

Smith,⁷ Hildreth,⁸ Davidson,⁹ and Feldmann,¹⁰ who studied the visual-perceptual development of young children found that they frequently make reversals and the incidence decreases with age, and that letters similar in form but different in position, like b, p, q, and d are by far the most difficult to differentiate. Fabian¹¹ did a series of experiments to show that the tendency to rotate horizontally-directed configurations to the vertical position is a developmental phenomenon. He concluded that vertical rotation is common in normal children of pre-school and beginning-school age and is gradually corrected as they mature, but it does not disappear until seven or eight years of age. Children who make reversals in reading rotate more often. Gillespie attempted to verify Fabian's findings using tachistoscopically

7 N.B. Smith, "Matching Ability as a Factor in First-Grade Reading," Journal of Educational Psychology, Vol. 19, No. 8, November 1928, p. 1-20.

8 G. Hildreth, "Reversals in Reading and Writing," Journal of Educational Psychology, Vol. 25, No. 1, January 1934, p. 1-20.

9 Helen P. Davidson, "A Study of Reversals in Young Children," Journal of Genetic Psychology, Vol. 45, No. 2, December 1934, p. 452.

10 Shirley C. Feldman, "Visual Perceptual Skills of Children and Their Relation to Reading," doctoral thesis presented to Columbia University, 1961, in Dissertation Abstracts, Vol. 22, 1961, p. 1084-1085.

11 A.A. Fabian, "Vertical Rotation in Visual-Motor Performance--Its Relationship to Reading Reversals," Journal of Educational Psychology, Vol. 36, No. 3, March 1945, p. 129-154.

exposed Minnesota Percepto-Diagnostic Test designs and found that age is still a factor of rotation from eight to at least fourteen.¹² Although Fuller and his associates, in their earlier studies with the MPD, found age unrelated to rotation at and above age eight,¹³ some low correlation coefficients were reported in later studies.¹⁴

Studies report of the averages of the performance of groups of children. In actuality, there is considerable difference in the speed of maturation among them. Gillespie found in her study that when exposure time is reduced, the variability in rotation scores increases.¹⁵ In other words, when less time is given for the children weak in visual perception to compensate by paying more attention, the variation in the groups becomes more apparent.

12 Margaret E. Gillespie, The Effect of Age of Children and Exposure Time of Stimulus on Rotation in a Visual-Motor Task, unpublished Master's thesis presented to the Faculty of Psychology and Education of the University of Ottawa, Ontario, 1966.

13 G.B. Fuller and J.T. Laird, "The Minnesota Percepto-Diagnostic Test," Journal of Clinical Psychology, Monograph Supplement No. 16, January 1963, p. 19.

14 G.B. Fuller and G.H. Lunney, "The Relationship Between Perception and Body Image among Emotionally Disturbed Children," Perceptual and Motor Skills, Vol. 21, No. 2, October 1965, p. 530; G.B. Fuller, "A Comparison of Intelligence and Perception in Emotionally Disturbed Children," Journal of Clinical Psychology, Vol. 22, No. 2, April 1966, p. 193-195; D.H. Harrison and J.G. Chagnon, "The Effect of Age, Sex and Language on the Minnesota Percepto-Diagnostic Test," Journal of Clinical Psychology, Vol. 22, No. 3, July 1966, p. 302-303.

15 Gillespie, Op. Cit.

With children who are not retarded, the reported relationships between IQ and MPD rotation are rather controversial, varying from no relationship to a low but significant one.¹⁶ Fuller felt that there might be a negative correlation in the above-average IQ group.¹⁷ Sex has consistently been found not to affect the amount of rotation on the MPD.¹⁸

It has been said previously that children become increasingly capable of recognizing spatial position throughout kindergarten and the primary grades. Besides the effect of maturation, the improvement can also be attributed to experience and training acquired in daily life and school work. In recent years perceptual training has been much emphasized in kindergarten and grade I as part of the readiness work. Similar to this point, cultural background has been found related to visual perception. Gredler, who studied the MPD performance of eleven white and nineteen Negro children from very disadvantaged background, found that they rotated far more than the normal and emotionally-disturbed children in Fuller's studies.¹⁹

¹⁶ Fuller and Laird, Op. Cit.; Fuller, Op. Cit.; Harrison and Chagnon, Op. Cit.

¹⁷ Fuller and Laird, Op. Cit.

¹⁸ Fuller and Laird, Op. Cit.; Harrison and Chagnon, Op. Cit.

¹⁹ G. Gredler, "Performance on the MPD Test: Educational and Diagnostic Validity for Children from Culturally Disadvantaged Background," Temple University, not yet published.

Visual perception has also been observed to be related to the health of the organism, and large amount of rotation considered suggestive of brain damage in adults and older children who have normal intelligence. After reviewing Griffith and Taylor's study on Bender rotation in relation to various adult diagnostic groups and Hanvic, Anderson, Chorost, Spivack and Levin's studies on the relationship between Bender rotation and EEG abnormalities in children, Tolor and Schulberg concluded that:

[...] except for mentally defective groups, it is generally possible to differentiate groups of organic and non-organic subjects in terms of the incidents of Bender rotations, with brain-injured individuals tending to produce a greater number of rotations than others.²⁰

Koppitz' study also supported this conclusion.²¹ Fuller studied the MPD Test with a large sample of children aged eight to fifteen and found that children with organic reading disability rotated more than the good readers and the children with primary or secondary reading disability.²² Kreitman's study with much smaller samples supported Fuller's

²⁰ A. Tolor and H.C. Schulberg, An Evaluation of the Bender-Gestalt Test, Springfield, Thomas, 1963, p. 123.

²¹ Elizabeth M. Koppitz, The Bender Gestalt Test for Young Children, New York, Grune and Stratton, 1964, p. 73-83, 139.

²² G.B. Fuller, "Perceptual Considerations in Children with a Reading Disability," Psychology in Schools, Vol. 1, No. 3, July 1964, p. 314-317.

finding.²³ For the convenience of comparison and later discussion the MPD norms from the more important studies are listed in Table I.

It has often been assumed that visual perception is negatively affected when a person is under stress or when the personality is poorly integrated such as in the neurotic or psychotic conditions, but that the distortion would not be as great as in the case of brain damage. This view is supported by a few studies. Byrd²⁴ and Clawson²⁵ in their fairly similar studies found that the performance of the maladjusted children on the Bender-Gestalt Test was inferior to that of the well-adjusted, and rotation was one of the several deviations which differentiate significantly the two groups. Fuller found that children whose low reading achievement was considered to be due to emotional problems rotated more on the MPD than the good readers but not as much as those with organic impairment.²⁶

23 L. Kreitsman, "A Note on the Use of the Minnesota Percepto-Diagnostic Test," Journal of Clinical Psychology, Vol. 22, No. 2, April 1960, p. 196.

24 E. Byrd, "The Clinical Validity of the Bender-Gestalt Test with Children: a Developmental Comparison of Children in Need of Psychotherapy and Children Judged Well-Adjusted," Journal of Projective Techniques, Vol. 20, No. 2, June 1956, p. 127-136.

25 A. Clawson, "The Bender Visual-Motor Gestalt Test as an Index of Emotional Disturbance in Children," Journal of Projective Techniques, Vol. 23, No. 2, June 1959, p. 198-206.

26 Fuller, "Perceptual Considerations in Children with a Reading Disability," Op. Cit.

Table I.-
Normative Data of Normal, Retarded and Psychiatric
Children on MPD.

Categories	N	Age		IQ	MA	Rotation	
		Mean	SD			Mean	SD
Normals ^a	220	Mean 13.22	SD 2.00	Mean 109.6		14.39	5.62
Normals ^b	169	Mean 13.72	SD 2.11		Mean 14.60	21.80	9.1
Normal eight-year olds ^c	58	8				44.10	22.56
Emotional Disturbance ^a	194	Mean 12.00	SD 2.14	Mean 101.2		34.97	15.30
Schizophrenic ^a	100	Mean 12.50	SD 2.18	Mean 96.1		65.73	19.30
Organic reading disability ^a	60	Mean 11.50	SD 1.96	Mean 92.9		75.11	19.60
Secondary reading disability ^a	48	Mean 10.70	SD 1.94	Mean 93.2		46.02	10.24
Good readers ^a	90	Mean 10.34	SD 2.03	Mean 110.8		13.64	4.02
Educable mentally retarded ^b	149	8-21		50-84	Mean 11.07	71.36	33.09
					SD 2.16		

^a G.E. Fuller and J.T. Laird, "The Minnesota Percepto-Diagnostic Test," Journal of Clinical Psychology, Monograph Supplement No. 16, January 1963, p. 17.

^b A. Burnett and G.E. Fuller, "Minnesota Percepto-Diagnostic Test Performance in Educable Mentally Retarded Children: Standardization, Normative Data, Comparison with Other Diagnostic Groups and Detection of Organic Brain Damage," unpublished.

^c Preliminary age norm derived by G.E. Fuller, unpublished.

In another study with children who were referred to a clinic primarily because of personality disturbance, the schizophrenic and emotionally disturbed children rotated more than the normal.²⁷ Kreitman's finding with smaller samples was close to Fuller's.²⁸ These studies point to the relationship between emotional disturbance and rotation. There is still the question whether they are concurrent or one is the cause of the other.

In conclusion, with children of normal intelligence, rotational tendency is a maturational phenomenon, which decreases sharply from four to eight years and continues to decrease further with age. It occurs in greater amount in cases of maturational lag, cultural deprivation, personality disturbance and especially in cases of brain damage.

Because of the many factors that could affect rotational tendency, the amount of rotation made by the so-called normal children varies considerably according to how the group is defined. For example, Fuller's normal groups reported in the studies done by him and his associates²⁵ are fairly

²⁷ G.B. Fuller, "The Objective Measurement of Perception in Determining Personality Disorganization among Children," Journal of Clinical Psychology, Vol. 21, No. 3, July 1965, p. 305-307.

²⁸ Kreitman, Op. Cit.

²⁹ Fuller and Laird, Op. Cit.; Fuller, "Perceptual Considerations in Children with a Reading Disability," Op. Cit.; Fuller, "The Objective Measurement of Perception in Determining Personality Disorganization among Children," Op. Cit.

selected and rotated far less than the general school population from whom he derived his age norms.³⁰

The variability of the amount of rotation among children with normal intelligence has sometimes been reported in the form of standard deviations but has never been specially studied. Like the mean, it depends very much on how the group is defined and how inclusive it is. For example, there is very little variability in Fuller's groups of normal children and good readers reported in the manual for the MPD, while the variability in his different age groups is far greater.³¹

2. The Rotational Tendency of Retarded Children.

With the retarded children, there has been far less investigation on the factors which could affect rotation. A few studies grouped together retarded children and adults of wide ranges of IQ and age, and compared them with the normals or some kind of psychiatric patients. Others compared the rotational tendency of the exogenous and endogenous retardates. Some additional information such as the relationship between rotational tendency and IQ or mental age, and the variation within the groups were reported.

³⁰ Preliminary age norms derived by Fuller, unpublished.

³¹ See Table I, p. 10.

The development of visual-motor function in retarded children is usually thought of in relation to mental age and IQ rather than chronological age. As said previously, Bender speculated that in cases of hereditary or culturally-caused mental deficiency there is a slowing down of the maturational process and the visual-motor performance is sometimes commensurate with mental age. In other types of mental deficiency, such as brain damage and language disability, there is more discrepancy in the different areas of the visual-motor function. Some studies reported of rather high correlations between mental age or IQ and the overall performance on the Bender-Gestalt Test.³² There has been only a few studies which reported of the relationship between rotational tendency and the mental age or IQ of the retarded. Silverstein and Mohan found some significant correlation between Bender figure rotation and IQ in part of their study.³³ Halpin and Patterson reported of a correlation of .46 between the correct responses on the Goldstein-Scheerer

32 J. Keller, "The Use of a Bender-Gestalt Maturation Level Scoring System with Mentally Handicapped Children," American Journal of Orthopsychiatry, Vol. 25, No. 3, July 1955, p. 563; F.H. Goldberg, "The Performance of Schizophrenic, Retarded and Normal Children on the Bender-Gestalt Test," American Journal of Mental Deficiency, Vol. 61, No. 3, January 1957, p. 548-555; Koppitz, Op. Cit., p. 110-111.

33 A.B. Silverstein and P.J. Mohan, "Bender-Gestalt Figure Rotations in the Mentally Retarded," Journal of Consulting Psychology, Vol. 26, No. 4, August 1962, p. 386-388.

Tests and mental age.³⁴ Burnett and Fuller found a correlation of $-.22$ between MPD rotation and mental age on the Peabody Picture Vocabulary Test.³⁵ All these indicate that with the mentally retarded spatial perception including rotation becomes somewhat more accurate with increase in mental age.

The studies which compared the retarded with the normal or patients of some psychiatric categories, usually did not compare them at the same mental age level. The retarded subjects were often of lower mental age and very often taken from residential institutions. They were found to make more rotation.

Griffith and Taylor who studied the Bender records of 1,003 patients of various diagnostic categories found that 55.9 per cent of the mental defectives made one or more rotations of 45 degrees or more, which was more than the 40.3 per cent of the organic and the 22.3 per cent of the schizophrenic, neurotic, organic, character disorder, and "other" types.³⁶

³⁴ Virginia G. Halpin and Ruth M. Patterson, "The Performance of Brain-Injured Children on the Goldstein-Scheerer Tests," American Journal of Mental Deficiency, Vol. 59, No. 1, July 1954, p. 91-99.

³⁵ A. Burnett and G.B. Fuller, "Minnesota Percepto-Diagnostic Test Performance in Educable Mentally Retarded Children: Standardization, Normative Data, Comparison with Other Diagnostic Groups and Detection of Organic Brain Damage," not published.

³⁶ R.M. Griffith and V.H. Taylor, "Incidence of Bender-Gestalt Figure Rotations," Journal of Consulting Psychology, Vol. 24, No. 2, April 1960, p. 189-190.

Silverstein and Mohan studied the Bender record of four hundred patients in a hospital for the mentally retarded. The mean IQ was around 56 to 61, and the mean chronological age around eighteen. Approximately forty to fifty per cent of the patients made at least one rotation.³⁷

Fred studied sixty-six psychiatric patients, with a mean chronological age of 35.5 and mean Wechsler IQ of 63.6. These patients had a variety of psychiatric diagnoses not necessarily including mental deficiency. He found that 39.4 per cent of them produced one or more rotations of at least 45 degrees, 45.5 per cent produced one or more rotations as defined by Pascal-Suttell, and a total of 68.2 per cent produced at least one rotation of either type.³⁸

Goldberg compared the Bender records of three groups of children; the schizophrenic, the retarded of the familial type, and the normal, aged eleven to sixteen, with mean IQ of 71.4, 69.1 and 100.7 respectively. There were fifteen in each group. The overall performance of the first two groups was inferior to the normal. Rotation was considered characteristic of the

37 Silverstein and Mohan, Op.Cit., p. 386-388.

38 Earl X. Fred, "Incidence of Bender-Gestalt Figure Rotations among Mentally Defective Psychiatric Patients," American Journal of Mental Deficiency, Vol. 63, No. 4, January 1957, p. 548-555.

schizophrenic but not the retarded.³⁹ However, it should be noted that the mean IQ of the schizophrenic group was very low, and also that the retarded group was of the familial type.

Burnett and Fuller have derived some preliminary MPD norms for the mentally retarded from 149 residents in an institution, aged eight to twenty-one, with IQ from 50 to 84 and mean mental age of 11 according to the Peabody Picture Vocabulary Test. The mean MPD score was far higher than that of the normal and emotionally disturbed in Fuller's previous studies.⁴⁰

These studies show that the institutionalized retardates, whether children or adults, rotate more than the normal and the emotionally disturbed when compared in groups. Burnett and Fuller's study suggests that they might perform below the level of the normal children with the same mental age. However, the subjects of these studies were all from institutions. As Burnett and Fuller pointed out that with the increasing facilities to accommodate the retarded in their home communities, those who are sent to residential institutions tend to be more maladjusted.⁴¹

³⁹ F.H. Goldberg, "The Performance of Schizophrenic, Retarded and Normal Children on the Bender-Gestalt Test," American Journal of Mental Deficiency, Vol. 52, No. 3, January 1957, p. 548-555.

⁴⁰ Burnett and Fuller, Op. Cit.

⁴¹ Ibid.

The retarded with an organic origin have been observed to perform more poorly on visual-motor tests than the retarded of the cultural-familial type. However, so far rotation has not been consistently found to occur more often in the exogenous. Tolor and Schulberg, after reviewing the studies by Bensberg, Feldman, Baroff and Halpin, concluded that:

[...] certain measures on the Bender-Gestalt Test can be used successfully to make group differentiations between endogenous and exogenous mental defectives [...]. The main exception appears to be the frequency of rotation which may be a poor discriminator between organic and non-organically involved defectives.⁴²

It has often been mentioned in the literature that the Bender-Gestalt Test lacks uniform means of scoring and also lacks control of conditions which might cause rotation. The MPD, in this respect, is a more adequate tool. Burnett and Fuller, after deriving the MPD norms for the educable mentally retarded, compared the performance of the brain-damaged retardates with that of the cultural-familial. There were thirty-six in a group, matched individually by mental age. The brain-damaged rotated on average 82.14 degrees, which was significantly more than the cultural-familial who rotated 68.19 degrees. However, the variation was so great that it was not possible to consistently differentiate the

⁴² Tolor and Schulberg, Op. Cit., p. 120.

two groups.⁴³ In other words, brain damage has not been found to be as significant a variable of rotation in mentally retarded children as in the non-retarded.

Burnett and Fuller's study was the only one that reported the standard deviation in the retarded group. The IQ of their group ranged from 50 to 84, and the mean mental age was eleven according to the Peabody Picture Vocabulary Test which Burnett found to rate higher than the Binet and the WISC. The standard deviation of the MPD scores was 38 degrees, which is far greater than that of any of Fuller's normal and psychiatric groups in terms of absolute variance.⁴⁴ As in the case of the comparison of means, it cannot be concluded that there is greater variability among the retarded, as the subjects were all from a residential institution.

3. Summary and Basic Hypothesis.

To sum up Bender's postulation, the visual-motor gestalt production of the mentally-retarded children is at a lower level, and there is more variation among them, even in cases of high-grade mental retardation. The gestalt production of a retarded child might be commensurate with, above or below his mental age level, and he might be stronger or weaker in

⁴³ Burnett and Fuller, Op. Cit.

⁴⁴ Ibid.

certain areas. However, Bender did not speculate to what extent these children are retarded in this function or in certain areas of this function if considered as a group, i.e., whether they would be at their mental age level, above or below. The present thesis attempted to study this problem and focused on rotational tendency, one aspect of the visual-motor function.

As seen from the review of the literature, many factors could affect rotational tendency and therefore no meaningful study can be done unless the groups are well defined. With those of normal intelligence, age and maturation are chief factors. Cultural stimulation and training, personality integration, and especially neurological condition are important factors. Intelligence might affect spatial perception to some small extent. Sex has not been found to be a factor. With the mentally retarded, there is some relationship between mental age and rotation. Rotational tendency might also be somewhat greater among the brain-damaged. The other possible factors have not really been studied. The data collected from these two kinds of children vary considerably, depending on how the groups are defined. The studies on the retarded children used almost exclusively subjects from residential institutions who could not be considered representative of the retarded. The result suggests that L.S. might

make more rotation than the non-retarded children of equivalent mental age and there might be greater variability among them.

The present study attempted to compare the rotational tendency of the high-grade mentally retarded children with that of the children of average intelligence at the same mental age level, and attempted to control as many variables as possible. The null hypothesis was that there is no significant difference between the two groups in either the mean amount of rotation or in the variability among them. If the rotational tendency of retarded children is commensurate with mental age, no significant difference in mean amounts of rotation would be found between the two groups. If, as Bender postulated, there is more variation among the retarded even of the high-grade type, a significant difference would be found in the variability.

The next chapter describes the experimental design. The specific hypotheses will then be given.

CHAPTER II

EXPERIMENTAL DESIGN

This chapter presents the design of the study to test the general hypothesis proposed in the preceding chapter. After the tool, the sampling and procedure are discussed, the hypothesis is restated in detail and the statistical operation explained.

1. The Tool.

The most popular tool used for the study of rotation is the Bender-Gestalt and more recently the MPD. For this study, the MPD was used because of its definite scoring system and the control on card and paper rotation.

The MPD was developed by Fuller and Laird out of two of Bender's designs, placed in three different shapes on ground. The subjects are asked to copy the figures on the six cards one at a time. The reproduced designs are scored for degrees of rotation.

The rationale is that rotation, as a perceptual distortion, comes from the innate property of the perceived object and the perceiver. As for the property of the perceived object, Fuller cited the perceptual principles formulated by the Gestalt psychologists, namely, principles of inhomogeneity,

interaction of figure and ground, laws of grouping and pragnanz.¹ For the MPD, the principle of interaction of figure and ground is especially important. Fuller made the two Bender designs less stable by placing them on incongruent ground.

Perception also depends on the ability, health and personality integration of the perceiver. The person with organic brain damage is confused by the ambiguity of the figure-ground relationship and makes a lot of rotation, while a normal person is able to master it. The emotionally disturbed person, who is presumably under greater strain than the normal but with a more intact nervous system than the brain-damaged, is between the two. Studies show that the MPD has promise in differentiating between the normal, emotionally disturbed and schizophrenic among children and adults. It can also help to determine if organic factors are involved in reading disorders in children.² With the retarded, visual perception is one of the most frequently mentioned deficits. Using a group of retarded children and youths in a residential institution, Burnett and Fuller found that they rotated more

1 G.B. Fuller and J.T. Laird, "The Minnesota Percepto-Diagnostic Test," Journal of Clinical Psychology, Monograph Supplement No. 16, January 1963, p. 3.

2 Ibid., p. 11-18.

than the normal, the emotionally disturbed and the schizophrenic children of normal intelligence.³

Besides using the converted scores of the total rotation on the MPD, this study attempted to make a more refined comparison by singling out verticalization of horizontal designs on cards 1, 3, 4 and 6. Fabian found that young children have the tendency to reproduce horizontal designs in the vertical position.⁴ Hence, verticalization seems to show a lack of awareness of spatial orientation characteristic of immature perception while a milder one suggests awareness of orientation but inability to reproduce it correctly. For this study, verticalization is defined as the turning of a horizontal design by 70 to 110 degrees to the vertical position.

2. The Subjects.

There were thirty-five subjects in each of the two groups, i.e., the retarded and that of average intelligence. The subjects were selected in a way as to control the variables

³ A. Burnett and G.B. Fuller, "Minnesota Percepto-Diagnostic Test Performance in Educable Mentally Retarded Children: Standardization, Normative Data, Comparison with Other Diagnostic Groups and Detection of Organic Brain Damage," unpublished.

⁴ A.A. Fabian, "Vertical Rotation in Visual-Motor Performance--Its Relationship to Reading Reversals," Journal of Educational Psychology, Vol. 36, No. 3, March 1945, p. 129-154.

that could affect rotation, namely age, IQ, mental age, sex, cultural background, achievement, emotional adjustment, and whether organic factor was involved.

The mental age level at which the retarded children were compared with those of normal intelligence was set at eight for three main reasons. First, the MPD is meant for use with children of eight and above. Before age eight, some children are still not able to reproduce the shapes correctly enough for scoring. Secondly, as most studies show that age still affects MPD performance to a mild degree after eight,⁵ for the simplicity of design, the study limited the mental age to the range from 8/0 to 8/11. Lastly, the mental age was set at eight instead of a higher level, because with the improvement of spatial perception with age the MPD would be less discriminative at the higher age level and hence there would be less variability within an age group.

All the subtests in the WISC, except for Digit Span and Maze, were included in the calculation of IQ. The mental age of the subjects were counted up to the date when the MPD was first administered.

The studies on the retarded children described previously included subjects with IQ's varying from 40 or 50 to 75 or 85. This study limited the range to WISC IQ of 60 to 79,

⁵ See p. 6.

which would include only the cases of high-grade mental retardation if one considers only the intelligence rating. Bender postulated that as more of the high-grade mentally retarded are of the hereditary-constitutional type there will be less variation among them than among those who are more retarded.

For the control group, to eliminate the effect of intelligence on rotation, the IQ range was limited to WISC IQ of 90 to 109, which the author of the test designated as average. And also to eliminate the possible mild effect of chronological age on rotation, the range was set at 8/0 to 8/11.

The data of the retarded group were collected first. The files of the retarded children tested by the Child Adjustment Services of the Toronto Board of Education earlier in the school year were checked, and those from English-speaking families and with IQ and mental age within the required range were selected. As the number of children thus collected was less than thirty-five set as the minimum size of the samples, a few more were tested with the WISC by the writer and included when found suitable. The final sample consisted of twenty-one boys and fourteen girls, located in thirteen public schools and mostly placed in Opportunity Classes with only a few in regular classes.

Burnett and Fuller's study suggests that the brain-damaged retardates tend to rotate more than the non-brain-damaged.⁶ These two kinds of retarded children were not differentiated in the present study, as the Child Adjustment Services usually does not go to the length to spot brain injury in cases of mental retardation unless the child presents marked adjustment problems. The retarded children in this study were randomly sampled. It turned out that extensive diagnostic work was done on only two of the children and both were suspected of brain damage and schizophrenia. For the rest of the children, signs of brain damage, if any, were at least not pronounced.

This retarded group is quite representative in the sense that it included children of all levels of adjustment. Exclusion from the Toronto public schools on psychiatric grounds is infinitesimal as at other IQ levels above 50.

When the retarded children were selected from the files, it was found that they were all located in the southern part of the city which is generally a low socio-economic district. Gredler's study of the MPD performance of the culturally disadvantaged children indicated that they rotated far more than the normal children in Fuller's studies, who were

⁶ Burnett and Fuller, Op. Cit.

presumably less disadvantaged.⁷ To eliminate the cultural factor, the control group was drawn from three schools also in the southern part of the city.

As seen from the review of the literature, children with personality disturbance or low achievement tend to rotate more on the MPD. The children with these problems were not excluded from the control group, as these problems were not eliminated from the retarded group either. However, with the control group, the children previously investigated by a clinic and diagnosed or suspected to be brain-damaged were excluded, as the visual-motor performance of these children is often markedly inferior to the non-brain-damaged.⁸ Hearing and peripheral visual problems were excluded from both groups as they might affect the WISC, and also the MPD result as in the case of visual problems.

To help select children for the control group, the IQ on the Otis Test given by the schools a year earlier were used. Those children with Otis IQ and mental age within the required range were picked out at random, checked with the WISC, and included in the study if found suitable.

7 G. Credler, "Performance on the MPD Test: Educational and Diagnostic Validity for Children from Culturally Disadvantaged Background," Temple University, unpublished.

8 See p. 8.

Although sex has not been found a factor affecting MPD rotation among children of normal intelligence, this element has not been studied with the retarded children. To eliminate any possible influence of sex, the proportion of boys and hence girls in the control group was made the same as in the retarded sample.

The range and mean of the IQ, mental age and chronological age of the two groups finally selected are presented in Table II.

3. The Procedure.

Both the retarded and control groups were administered the MPD and retested for reliability check two to five weeks later.

The children were tested in their own school, in the Health Office, the library, a classroom or in the staffroom when the teachers were not there. Lights were turned on if it happened to be dim in the room. A large desk was preferred and unnecessary paper and objects were removed as much as possible to eliminate distraction in the background. The first test was administered according to the instructions stated in the manual. There was some modification in the instruction for the retest. The child was told, "I want you to do the same thing you did last time. I am going to show you the six

Table II.-

Mean and Range of IQ, M.A. and C.A. of the Experimental and Control Groups.

Group	N	IQ		M.A.		C.A.	
		Mean	Range	Mean	Range	Mean	Range
Experimental	35	71	61-79	8/5	8/0-8/11	11/10	10/8-13/1
Control	35	98	90-100	8/5	8/0-8/11	8/7	8/1-8/11

cards, one at a time. You remember, each card contains a figure [...]."

The reproductions were scored according to the instructions in the manual and the converted scores were used for computation of the mean and standard deviations. The results of the first MPD test were used for comparison between the two groups.

4. The Specific Hypotheses and Statistical Analysis.

The specific hypotheses are as follows:

1. There is no significant difference between the mean MPD converted scores obtained by the mentally retarded group and that of the control group.

2. There is no significant difference between the standard deviation of the MPD converted scores obtained by the mentally retarded group and that of the control group.

3. There is no significant difference between the mean number of verticalizations made by the mentally retarded group and that of the control group.

The test-retest reliability of the MPD was obtained by calculating the Pearson r of the MPD converted scores of the first and second testing. Same test of reliability was meant to be done with the number of verticalizations.

The t test was used to check the significance of difference between the mean MPD converted scores of the two

groups. The significance of difference between the standard deviations of the MPD converted scores of the two groups was checked with the F test. The significance of difference between the mean numbers of verticalizations made by the two groups was meant to be checked with the t test.

The results of the study are presented in the following chapter.

CHAPTER III

PRESENTATION OF RESULTS

This chapter presents the MPD reliability test results and the comparison of the performance of the retarded and control groups in the order of the hypotheses.

The mean MPD converted scores of the first and second testing and the Pearson correlations are presented in Table III. The correlation of .80 for the control group is lower than the .89 for the normal children reported in the manual.¹ The correlation of .64 for the retarded group is somewhat low. There is no other MPD reliability score reported in the literature on retarded children for comparison.

As said previously, the MPD results of the first testing were used for comparison of the two groups. They are presented in Table IV. The mean rotation of the retarded group was 49.83 degrees and that of the control group was 51.17. The two were very close, and the obtained t was .25, which was far below the t limit significant at the .05 level of significance. Therefore, the first null hypothesis that there is no significant difference between the mean MPD rotation of the two groups could not be rejected.

¹ G.B. Fuller and J.T. Laird, "The Minnesota Percepto-Diagnostic Test," Journal of Clinical Psychology, Monograph Supplement No. 16, January 1963.

Table III.-

MPD Test-Retest Reliability for the Retarded and Control Groups.

Groups	N	First Mean Rotation	Retest Mean Rotation	Pearson r
Retarded	35	49.38°	52.17°	.64
Control	35	51.17°	52.40°	.80

Table IV.-

Comparison of the Retarded and Control Groups in MPD Mean Rotation and Standard Deviation.

	Retarded vs. Control	Statistical Analysis	Significance
Mean Rotation	49.83°-51.17°	t = .25	p > .05
S.D.	21.27°-22.42°	F = 1.10	p > .05

The standard deviation of the MPD rotation of the retarded group was 21.27 degrees and that of the control group was 22.42, which were also very close. The obtained F was 1.10 which was far below the F limit significant at the .05 level. Therefore, the null hypothesis that there is no significant difference between the standard deviations of the MPD rotation of the two groups could not be rejected.

A further analysis was made by comparing the retarded children with IQ between 70 and 79 and those with IQ between 61 and 69. Details are shown in Table V. The MPD mean rotation of the higher IQ group was 46.53 degrees and that of the lower IQ group was 55.15. There was a difference of 8.62 degrees between the means but the obtained t of 1.13 was still considerably below the .05 level of significance. The standard deviations within the two groups were very close, with 21.35 degrees for the higher IQ group and 20.04 for the lower IQ group. The F was 1.10 which was far below the .05 level of significance.

The turning of horizontal designs to the vertical position occurred infrequently. It was also found that though verticalization was the most common kind of gross rotation, there were other kinds of rotation of more than 70 degrees. Card 2 which is a vertical design could be reproduced upside-down, and Card 5 which is also vertical could be

Table V.-

Comparison of Two Retarded Groups in MPD Mean Rotation and Standard Deviations.

Retarded Groups	N	Mean Rotation	SD
I (IQ 70-79)	22	46.68°	21.35°
II (IQ 61-69)	13	55.15°	20.04°

reproduced in the horizontal position--probably a carry-over from the preceding horizontal designs.

The number of gross rotations and the number of subjects who made them upon the first and second testings are presented in Table VI. The raw scores showed that the retarded group made more verticalizations, but the incidents were too few for any meaningful statistical analysis. None in the control group made any kind of gross rotations upon retest. Only the two subjects in the retarded group suspected of both brain damage and schizophrenia continued to make them.

A check on sex difference in the two groups was made. Details are given in Tables VII and VIII. The boys and girls of both groups were comparable in chronological age, IQ and mental age. The mean MPD rotation made by the boys and by the girls in the retarded group was very close, while a difference significant at the .05 level was found between the boys and girls in the control group, with the girls being superior.

The results of the study indicated that there was no significant difference between the retarded and control groups in the mean amount of MPD rotation and the variation within the groups. The incidents of verticalizations were too few in both groups for statistical comparison. The results of both groups were fairly different from those of the

Table VI.-

Number of Gross Rotations and Number of Subjects Making Them
in the Retarded and Control Groups upon First and Second
Testings.

Groups	N	Testing	No. of Subjects	No. of Rotations ^a	
				Vertical- isations	Others
Retarded	35	First	4	3	0
		Second	2	5	3
Control	35	First	2	4	1
		Second	0	0	0

^a Including the turning of vertical designs upside-down or into the horizontal position.

Table VII.-

Mean C.A., IQ and M.A. of Boys and Girls in the Retarded and Control Groups.

Groups	N	Mean C.A.	Mean IQ	Mean M.A.
Retarded				
Boys	21	12/0	70	8/5
Girls	14	11/8	72	8/5
Control				
Boys	21	8/8	97	8/5
Girls	14	8/5	99	8/4

Table VIII.-

Sex Difference in Mean MPD Rotation in the Retarded and Control Groups.

Groups	<u>Mean MPD Rotation</u> Boys vs. Girls	t	Significance
Retarded	50.76° - 48.43°	.3087	p > .05
Control	57.57° - 41.57°	2.1439	p < .05

retarded or normal children reported in the previous studies. A sex difference was found in the control group which is also contradictory to the previous findings.

The results will be discussed in the next chapter.

CHAPTER IV

DISCUSSION OF RESULTS

The results of the study will be discussed in the order of the hypotheses. The means and variation in the retarded and control groups will also be compared with the results derived by previous investigators, as there is considerable difference.

1. Comparison of Mean MPD Rotation Made by the Two Groups.

Bender speculated that the visual-motor gestalt function of the retarded children is at a lower level, and there is much variation among them. In terms of individual cases, the gestalt production of a retarded child could be commensurate with, above or below his mental age, and he could also be stronger or weaker in certain areas. However, Bender did not speculate to what extent these children are retarded in this function or in certain areas of this function when considered as a group. The first part of the study attempted to find out if the retarded children rotate as much as the average children of the same mental age. The null hypothesis of no significant difference between the mean MPD rotation of the retarded and that of the control group was upheld. The retarded group made the same amount of rotation as the control group.

The generalization of the finding is, of course, limited by the tool and population from whom the samples were drawn. The MPD measures only rotation. The accuracy of shape, integration of parts and perseveration, as measured by the Bender-Gestalt Test, are not included.

As for the population, the range of IQ and mental age were rather limited for both groups. The retarded group included only the high-grade mentally retarded, and the control group was of average intelligence. As seen in the review of the literature, there could be some low but significant correlation between intelligence and rotation in both retarded and normal children.¹ It is uncertain if similar results would be obtained if the IQ levels chosen were different. The comparison of the MPD performance of the retarded with IQ in the 70's and those in the 60's showed that the latter made more rotation although the difference did not reach statistical significance. This suggests the possibility of a trend with the more retarded children making more rotation. In this study the mental age level at which the two groups were compared was also limited to eight. Further studies are needed to compare them at other levels.

It also has to be pointed out that the variabilities in both groups were great. Therefore, the finding that the

¹ See p. 7, 13-14.

retarded children with IQ and mental age as set in this study rotate as much as a comparable average group, has little meaning in individual cases.

As seen in the review of the literature, some previous studies suggest that the retarded group might make more rotation than the normal group of the same mental age.² The present study found the two groups function at the same level on the MPD. This is probably due to difference in the populations from which the samples were drawn.

Burnett and Fuller's sample of 149 students from a residential institution made an average 71.86 degrees of rotation on the MPD, which is considerably more than what one would expect of a group of children with an average mental age of eleven and IQ between 50 and 85 on the Peabody Picture Vocabulary Test, and which is also considerably more than the mean rotation of 49.83 degrees made by the retarded group in this study. Burnett and Fuller pointed out that because of the increased facilities to accommodate the retarded children in their home communities, those admitted into residential institutions tend to be more maladjusted.³ The sample of the

² See p. 14-16.

³ A. Burnett and G.B. Fuller, "Minnesota Percepto-Diagnostic Test Performance in Educable Mentally Retarded Children: Standardization, Normative Data, Comparison with Other Diagnostic Groups and Detection of Organic Brain Damage," not yet published.

present study was drawn from the Toronto public schools, and it is more representative of the retarded children as exclusion from the public schools on psychiatric grounds is infinitesimal at all mental levels above IQ 50. This finding makes questionable some studies on the mentally retarded using subjects from residential institutions.

The mean MPD rotation of 51.17 degrees made by the children of average intelligence in this study is, on the other hand, much more than the mean rotation of 14.89 degrees made by Fuller's "normal" group aged eight to fifteen.⁴ The difference could be due to various factors which could affect rotation, such as age, IQ, cultural background, personality integration and level of achievement. Fuller's sample included children aged eight and above, reasonably well-adjusted, with at least average achievement, and with higher mean IQ and probably better cultural background, all of which are in favor of good MPD performance. The control group in the present study was sampled from three Toronto schools in the relatively low socio-economic district. The underachieving and maladjusted children were not excluded. They were a relatively fair comparison to the retarded group, as the latter included also the underachieving and maladjusted

⁴ G.B. Fuller and J.T. Laird, "The Minnesota Percepto-Diagnostic Test," Journal of Clinical Psychology, Monograph Supplement No. 16, January 1963, p. 17.

children and they came from the same low socio-economic district.

Compared to Gredler's study of the culturally disadvantaged children in Atlanta, the control group of the present study rotated about as much as Gredler's eleven white children who made an average 58.9 degrees of rotation but less than the nineteen Negro children who rotated 91.58 degrees.⁵

Fuller designated a total MPD rotation of 30 degrees or less as normal perception. If the same cutting score were used, only four out of the thirty-five children in the control group would be in the "normal" category, while the rest would fall into the "emotionally disturbed," "schizophrenic" or "organic" categories. It is not likely that so few children in this group are really normal, which makes doubtful the applicability of Fuller's norms on the population from which the control group was drawn.

A sex difference significant at the .05 level was found in the control group. The previous literature reported of no sex difference in MPD performance in the non-retarded children aged eight and above.⁶ A possible explanation for

⁵ G. Gredler, "Performance on the MPD Test: Educational and Diagnostic Validity for Children from Culturally Disadvantaged Background," Temple University, unpublished.

⁶ See p. 7.

the finding in the present study is that with the culturally-disadvantaged children being more backward in spatial perception, at the age of eight, girls are superior to boys.

2. Comparison of MPD Variabilities in the Two Groups.

The second hypothesis which states that there is no significant difference between the variability in the retarded group and that in the control group, can be maintained. This is not in line with Bender's observation that even among the high-grade mentally retarded the variation in visual-motor gestalt production may be greater than among the non-retarded of the same mental age. The result of this study showed that the variabilities in rotation made by the two groups were just as great--more than forty per cent of the mean. This might be due to difference in sampling. The control group was a random sample of the eight-year-olds in three schools in a low socio-economic district, whose performance was different from the "normal" groups reported in other studies. The retarded group was drawn from the public schools in the same district, whose performance was better than those drawn from the hospital or clinic. The finding does not in any way repudiate Bender's observation that some retarded children show great discrepancy in the visual-motor gestalt function, which might be related to the developmental disorder

associated with mental retardation. This postulation has to be tested by comparing the performance of different diagnostic groups.

The generalization of the finding that there is as much variability in rotational tendency among the high-grade mentally retarded children as among average children with the same mental age, is again limited by the tool and the samples used, especially the mental age and IQ range set for the study.

The comparison of the children with IQ in the 70's and those with IQ in the 60's showed that the variabilities in the two groups were about the same. It needs further study to see if there would be more variation in children more retarded than those included in this study. Many of the subjects Bender reported had IQ and mental age below those in the present study.⁷

The standard deviations of the MPD rotation of the two groups in this study were fairly different from those reported in other studies. As the mean MPD rotations of the different groups in the present and previous studies vary so greatly, the relative variabilities rather than the absolute ones should be used for comparison. They are presented in Table IX.

⁷ Lauretta Bender, A Visual-Motor Gestalt Test and Its Clinical Use, American Orthopsychiatric Association, Research Monograph No. 3, 1938, p. 137-149; and Child Psychiatric Techniques, Springfield, Thomas, 1952, p. 78-103.

Table IX.-

Comparison of the Relative Variabilities in the Retarded and Non-retarded Groups in the Present and Previous Studies.

Groups	N	Mean	SD	CV
Retarded (present study)	35	49.83	21.27	42.68
Retarded (Burnett & Fuller) ^a	149	71.86	30.09	54.40
Control (present study)	35	51.17	22.42	43.81
Normal (Fuller and Laird) ^b	220	14.89	5.62	37.70
Normal (Fuller) ^a	169	21.80	9.1	41.74
Normal eight-year-olds (Fuller) ^c	58	44.00	22.56	51.27

a A. Burnett and G.B. Fuller, "Minnesota Percepto-Diagnostic Test Performance in Educable Mentally Retarded Children: Standardization, Normative Data, Comparison with Other Diagnostic Groups and Detection of Organic Brain Damage," not yet published.

b G.B. Fuller and J.T. Laird, "The Minnesota Percepto-Diagnostic Test," Journal of Clinical Psychology, Monograph Supplement No. 16, January 1963.

c Preliminary age norm derived by G.B. Fuller.

The standard deviation of the retarded group in the present study is less in relation to the mean than that of Burnett and Fuller's retarded group. This could be attributed to the fact that the latter is a more maladjusted group as explained previously.

The standard deviation in relation to the mean of the control group in the present study is fairly close to those of Fuller's normal groups.

3. Comparison of Number of Verticalizations Made by the Two Groups.

The third hypothesis which states that there is no significant difference between the mean number of verticalizations made by the retarded group and that made by the control group, cannot be tested as they occurred infrequently in both groups. Verticalization was found to be not the only kind of gross rotation that occurred, though more frequent than others. In two cases, the vertical design on Card 2 was turned upside-down, and in two others the vertical design on Card 5 was turned into the horizontal position. All these gross rotations are probably indicative of a lack of awareness of spatial position.

The fact that only the two retarded children suspected of both brain damage and schizophrenia continued to make gross rotation upon retest suggests that gross rotation upon retest is a malignant sign. It might be indicative of brain injury or

serious personality disturbance, while that appearing only on the first test might be due to various other reasons such as lack of concentration, emotional disturbance or mild perceptual problem. Winifred felt that children who make rotation on the Bender-Gestalt Test should be asked to try again as neurotic children are often able to find out mistakes then.⁸

The findings of the study are summarized in the following section.

⁸ Winifred's comment in J. Keller's "The Use of a Bender-Gestalt Maturation Level Scoring System with Mentally Handicapped Children," American Journal of Orthopsychiatry, Vol. 25, No. 3, July 1955, p. 573.

SUMMARY AND CONCLUSIONS

The results of the study showed that when compared in groups there was much similarity between the rotational tendency of the high-grade mentally retarded children and those of average intelligence at the mental age of eight.

The first hypothesis of no significant difference between the mean MPD rotation of the two groups was upheld. While stating that the gestalt productions of the retarded children are generally at a lower level, Bender did not speculate to what extent they are retarded in this function or in certain areas of this function. The result of the present study shows that at mental age of eight they rotate as much as the average children with the same mental age. However, the finding has little meaning in individual cases, as the standard deviations in both groups were so great--more than forty per cent of the mean. Another point is that as the retarded children with IQ in the 60's made more rotation in raw scores than those with IQ in the 70's though the difference did not reach statistical significance, there is some doubt as to whether there would still be no difference in mean rotation if a much more retarded group is compared with the average. Further study is needed to clarify this point.

The second hypothesis of no significant difference between the standard deviations of the MPD rotation made by

the two groups was also upheld. There was just as much variability in the average group as in the retarded, which is not in line with Bender's speculation of greater variability even among the high-grade mentally retarded. This is probably due to the fact that Bender made her observation in the hospital or clinic setting, where there were more retarded children with severe adjustment problems. There was also no significant difference between the retarded group with IQ between 70 and 79 and that between 61 and 69. Further study is needed to find out if there would be greater variability in a group more retarded than the experimental group in the present study.

The finding about the variability does not in any way repudiate Bender's observation that some retarded children show great discrepancy in their visual-motor gestalt function, which might be related to the developmental disorder associated with mental retardation. This point has to be tested by comparing the performance of different diagnostic groups.

In raw scores, the retarded group made a few more verticalizations, but the incidents in both groups were too few for statistical analysis. Therefore, the third hypothesis of no significant difference in the mean frequency of verticalizations between the two groups could not be tested. Verticalization was found to be the most common gross rotation, but

occasionally a vertical design could be turned upside-down or into the horizontal position. The fact that only the two retarded children suspected of both brain damage and schizophrenia continued to make gross rotation upon retest suggests that this phenomenon is a malignant sign. Further research is needed to test this point.

Compared to Burnett and Fuller's study, the present retarded group made less rotation on the MPD and there was less variation in it. The possible explanation is that the sample was drawn from public schools rather than from residential institutions as in Burnett and Fuller's study. The average group in this study, on the other hand, made far more rotation than the normal groups in Fuller's studies, probably because they were randomly sampled from schools in the relatively low socio-economic district while the latter were relatively more selected and possessed qualities in favor of good MPL performance.

The generalization of the finding is limited by the tool which measures only rotation, and the population from which the samples were drawn. Further studies are needed, using other tests of spatial perception, and using subjects of different IQ ranges, and maybe comparing the retarded with the non-retarded at different mental age levels.

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-----, A Visual-Motor Gestalt Test and Its Clinical Use, American Orthopsychiatric Association, Research Monograph No. 3, 1936, p. 7-25, 137-149.

Presents the theoretical explanation of the genesis and maturation of the visual-motor gestalt function. There is a chapter on mental defectiveness.

-----, Child Psychiatric Techniques, Springfield Charles C. Thomas, 1952, p. 3-6, 50-77, 78-103.

The chapter on the visual-motor gestalt function of the mentally deficient is largely similar to that in the preceding monograph. This study attempts to verify her speculation on the performance level and variation among the mentally deficient.

Burnett, A. and G.B. Fuller, "MPD Test Performance in Educable Mentally Retarded Children: Standardization, Normative Data, Comparison with Other Diagnostic Groups and Detection of Organic Brain Damage," not yet published.

The only significant study on the MPD in use with the retarded youngsters. The norms reported are important for comparison with the results of this study. It also deals with the effect of brain damage on the rotation of the retarded.

Fabian, A.A., "Vertical Rotation in Visual-Motor Performance--Its Relationship to Reading Reversals," Journal of Educational Psychology, Vol. 36, No. 3, March 1945, p. 129-154.

The earliest experimental study on the developmental aspect of vertical rotation and its relationship to reading problems. It shows the relationship between rotation and age, and suggests that vertical is characteristic of immature perception.

Fred, Earl K., "Incidence of Bender-Gestalt Figure Rotations among Mentally Defective Psychiatric Patients," American Journal of Mental Deficiency, Vol. 69, No. 4, January 1965, p. 514.

The actuarial data are of interest to this study.

Fuller, G.B. and J.T. Laird, "The Minnesota Percepto-Diagnostic Test," Journal of Clinical Psychology, Monograph Supplement No. 16, January 1963.

The manual for the tool of this study. Gives the rationale and evidence of the effect of personality integration and neurological condition on the rotational tendency of non-retarded children. The norms for the normal children and those of different diagnostic categories are of much importance for consideration of the results of this study.

Gillespie, Margaret E., The Effect of Age of Children and Exposure Time of Stimulus on Rotation in a Visual-Motor Task, unpublished Master's thesis presented to the Faculty of Psychology and Education of the University of Ottawa, Ontario, 1966, 39 p.

A verification of Fabian's findings. The effect of age on rotation of non-retarded children is of special interest to this study.

Gredler, G., "Performance on the MPD Test: Educational and Diagnostic Validity for Children from Culturally Disadvantaged Background," not published.

Samples are small but results strongly suggest the effect of cultural background on rotation, which affects the sampling and the interpretation of the results of this study.

Griffith, R.M. and Vivian H. Taylor, "Incidence of Bender-Gestalt Figure Rotations," Journal of Consulting Psychology, Vol. 24, No. 2, April 1960, p. 133-136.

Provides actuarial data of different clinical groups. The mentally deficient are compared with the other groups.

Halpin, Virginia, "Rotational Errors on Bender-Gestalt," American Journal of Mental Deficiency, Vol. 59, No. 3, January 1955, p. 484-487.

A study on rotational errors in differentiating familial and brain-injured retarded children.

Silverstein, A.B. and P.J. Mohan, "Bender-Gestalt Rotations in the Mentally Retarded," Journal of Consulting Psychology, Vol. 26, No. 4, August 1962, p. 386-388.

The percentage of subjects who made rotation and its relationship to IQ, age, sex and diagnosis are of interest to this study.

Tolor, A. and H.C. Schulberg, An Evaluation of the Bender-Gestalt Test, Springfield, Charles C. Thomas, 1963, p. 3-10, 16-28, 106-137, 173-177.

A critical review of the studies on the Bender Test. The section on mental deficiency and on rotation as a diagnostic sign are of special interest to this study.

APPENDIX 1

ABSTRACT OF

Rotational Tendencies of the High-Grade Mentally
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Bender postulated that the visual-motor gestalt productions of retarded children are generally at a lower level, but she did not clearly specify whether they would be commensurate with, above or below the mental age level when these children are considered as a group. Secondly, she postulated that there is more variation in their productions, even among the high-grade mentally retarded, than in those of the non-retarded children at the same mental age level. This study focused on one aspect of the visual-motor gestalt function, i.e., rotation. Previous studies indicate that many factors could affect rotation. Therefore the amount of rotation made by the normal and retarded children would depend much on how the populations are defined. Studies using retarded subjects from residential institutions suggest that they might make more rotation than normal children of equivalent mental age. The variability in the quantity of rotation among the retarded has not really been studied in comparison to the normal.

¹ Pauline F.T. Tsui, Master's thesis presented to the Faculty of Psychology and Education of the University of Ottawa, Ontario, 1967, ix-53 p.

This study compared the rotational tendencies of the high-grade mentally retarded children with those of average intelligence at the mental age of eight. The retarded children were of WISC IQ between 60 and 79, and the average of WISC IQ between 90 and 109. There were thirty-five in each group, both randomly sampled in the low socio-economic area in the City of Toronto. Only cases diagnosed as brain-damaged were excluded from the average group. The MPD was used as the tool to measure rotation. The two groups were compared on mean MPD rotation, variability within the group, and the number of verticalizations which seemed to suggest lack of awareness of spatial position characteristic of immature perception.

No significant difference was found between the two groups in either the mean MPD rotation or the variabilities in the two groups. Further studies are needed to compare the retarded and average children at other mental age and IQ levels to test Bender's postulations.

The retarded group rotated on average 49.83 degrees, considerably less than Burnett and Fuller's retarded group drawn from a residential institution, and the variability of 21.27 degrees was also less in relation to the mean. The finding makes questionable the normative studies using subjects from residential institutions.

The average group rotated on average 51.17 degrees which was far more than the normal groups in Fuller's studies, probably due to the fact that the children in the former group possessed qualities which affect adversely spatial perception. The mean was so much higher and absolute variability of 22.42 degrees was so great that it makes doubtful whether Fuller's cutting scores for various psychiatric categories could be applied to the population from which the average group was drawn.

The incidents of verticalization were too few in both groups for statistical comparison. Also, these were not the only gross rotations that occurred though by far the most frequent. Occasionally a vertical design would be turned upside-down or into the horizontal position. The fact that only the two retarded children suspected of both brain damage and schizophrenia continued to make gross rotation upon retest suggests that this phenomenon is a malignant sign.