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A STUDY OF THE BENDER VISUAL-MOTOR GESTALT TEST IN RELATION TO READING DIFFICULTIES

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ABSTRACT

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PROBLEM

The purpose of this study was to examine the relationship between visual-perceptual development, as measured by the Bender Visual-Motor Gestalt Test, and reading ability of primary school children. The problem was to assess the findings from the Bender-Gestalt Test in relation to reading achievement, and to evaluate the effectiveness of the test in detecting and predicting reading difficulties.

METHOD

Four null hypotheses were set up as follows:

1. There is no significant difference between scores on the Bender Visual-Motor Gestalt Test for Grade One children of normal intelligence with reading difficulties and scores of a group comparable in age and intelligence who are successful in reading.

2. (a) There is no significant correlation between scores on the Bender Visual-Motor Gestalt Test and reading scores for good readers.

(b) There is no significant correlation between scores on the Bender Visual-Motor Gestalt Test and reading scores for poor readers.

3. (a) There is no significant difference in the numbers of boys and of girls found in the group of successful readers.

(b) There is no significant difference in the numbers of boys and of girls found in the group of unsuccessful readers.

4. (a) There is no significant difference between Bender Visual-Motor Gestalt scores for boys and for girls in the group of successful readers.

(b) There is no significant difference between Bender Visual-Motor Gestalt scores for boys and for girls in the group of unsuccessful readers.

POPULATION AND SAMPLE

The study was based on the Bender-Gestalt records of fifty Grade One children drawn from the total Grade One population (178 children) of three schools in adjacent areas, similar in socio-economic development, in the School Division of Winnipeg. The age range 6-7 to 7-6, and I.Q. range 101 to

115 were established in order to control variation.

The total group (178) was given the Gates Primary Reading Test of Word Recognition, and from the results a median score was obtained. Within the age and I.Q. range established, the top twenty-five readers who were at least five points above the median, and the bottom twenty-five who were at least five points below the median, were selected.

In order to ensure that the groups were similar in age and intelligence, and different in reading ability, the differences between each category were tested statistically. There were no differences for age and intelligence, but differences significant at the .01 level were obtained for reading.

The Bender-Gestalt records of the selected groups were quantified according to the Pascal and Suttell method,[1] and these scores were tabulated.

RESULTS

Hypothesis 1.--This was rejected at the .01 level, since significant differences occurred between the Bender-Gestalt records of good and of poor readers.

Hypothesis 2.--(a) The null hypothesis was accepted,

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[1] G. R. Pascal and B. Suttell, The Bender-Gestalt Test, Quantification and Validity for Adults. New York: Grune and Stratton, 1951.

as the correlation between Bender-Gestalt and reading scores for good readers could have arisen from chance.

(b) The null hypothesis was rejected at the .01 level, as a significant correlation between Bender-Gestalt and Reading Scores was obtained for poor readers.

Hypothesis 3.--(a) Since significantly more girls than boys were found in the group of successful readers, the null hypothesis was rejected at the .01 level.

(b) Since significantly more boys than girls were found in the group of unsuccessful readers, the null hypothesis was rejected at the .01 level.

Hypothesis 4.--Both parts of the null hypothesis were accepted since the differences in Bender-Gestalt performance for boys and for girls within the groups were not significant.

Analysis of reactions to individual designs in the Bender-Gestalt test.--In addition to testing the hypothesis, the Bender-Gestalt records were tested for single design differences. Differences significant at the .01 level occurred in Designs 2, 3, 4, 6, 7 and 8 between good and poor readers.

Within the designs, each scorable deviation was measured in terms of its discriminating power for good and poor readers. Significant at the .01 level were: asymmetry in Design 3, tremor in Design 4, workover in Design 5, curve

extra in Design 6, double line and distortion in Design 7, and angles missing in Design 8.

Critical Score.--By inspection, a critical score of 75 was obtained from the Bender-Gestalt raw scores. This was the score above which most of the good readers rose and below which most of the poor readers fell. For this sample, the score misclassified three good readers or 12% of the group, and five of the poor readers or 20%. That is, eight children in the sample of fifty were misplaced when the critical score was used.

Statistical Analysis.--The techniques used in this study included: The Mann-Whitney U test, the Spearman rank correlation coefficient, tests to determine the significance of differences between two uncorrelated percentages, and tests to determine the significance of the differences between means in two small independent samples.

CONCLUSIONS

The findings indicated that the Bender Visual-Motor Gestalt Test was effective in differentiating between good and poor readers for the sample selected. The total Bender-Gestalt scores showed significant differences between the groups, as did single designs, and specific types of deviations. However, it was noted that some good readers could give inadequate Bender-Gestalt responses, and poor

readers could give satisfactory responses. The conclusions were that the Bender Visual-Motor Gestalt Test would be most effective in a battery of diagnostic tests, although considerable weight could be given to the findings, especially in the age range 6-7 to 7-6.

Further testing with different ranges of age and intelligence would be desirable for a more complete evaluation of the test.

The implications for education are concerned with the need for early identification of children with learning problems, and adequate program planning.

ACKNOWLEDGEMENTS

The writer wishes to acknowledge the help and constant support of Dr. Wm. Lucow in his capacity as adviser for this thesis; the assistance given by Mr. T. Haxby of the Metropolitan Planning Commission in defining specific areas for population selection; the willing co-operation of the administrators and teachers in the School Division of Winnipeg in providing opportunities to conduct the study; and the assistance and interest volunteered by others not directly associated with the study.

September, 1961 Marjorie J. McLean

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CHAPTER I

INTRODUCTION

Purpose of the Study

The purpose of this study is to examine the relationship between visual-perceptual development, as measured by the Bender Visual-Motor Gestalt Test, and reading ability of primary school children.

Experimental studies have shown that success in beginning reading experiences is related primarily to intellectual maturity, but maturation of the finer processes of auditory and visual perception, and small muscle control, are of significance, too. The child with normal hearing who experiences difficulty in detecting sound differences within words or between words, the child whose perception of detail and form is inadequate for word discrimination, or the one whose skill in printing and writing is slow to develop, is often found in the group of children with reading difficulties even though the measured intellectual ability is normal.

This study deals with the area of visual-perceptual development and its relationship to skill in word-recognition at the primary school level.

Problem and Hypotheses

The problem.--Since the Bender Visual-Motor Gestalt Test is used as a measure of visual-perceptual development, the problem is to assess the findings from this test in relation to reading achievement, and to evaluate the effectiveness of the test in detecting and predicting reading difficulties in primary school children.

The writer observed that certain children who were underfunctioning academically, frequently experienced difficulty in tests of visual-motor control. Deviations which occurred between the test design and test response varied in both number and kind. The possibility of a relationship between reading and visual-perceptual development in young children became so apparent that experimental investigation was warranted.

The widely-known Bender Visual-Motor Gestalt Test, sensitive to basic difficulties in perception and to maturational aspects of visual-motor development, was selected as the criterion measure of perceptual growth.

The hypotheses were based on scores obtained from the quantification of the Bender Visual-Motor Gestalt responses, where high scores represented gross deviations from the test design, and from scores obtained on a test of word-recognition.

The problem for this thesis centers about the relationship of this criterion measure to reading difficulties of primary school children.

The hypotheses.--Stated informally, the hypotheses are as follows:

1. Scores on the Bender Visual-Motor Gestalt Test will be significantly higher for Grade One children of normal intelligence with reading difficulties than for those of a comparable group who are successful in reading.

2. Correlation between Bender Visual-Motor Gestalt responses and reading scores will be negative.

3. More boys than girls will be found in the group of unsuccessful readers, and more girls than boys in the group of successful readers, in keeping with the findings

(presented in this thesis) that girls score better than boys on the Bender Visual-Motor Gestalt Test.

4. Within each group, boys will tend to have poorer Bender Visual-Motor Gestalt records than girls.

Background of the Problem

The introduction to formal learning is a crucial period in the life of a beginner. At this stage he may encounter failure that is so significant that further learning growth will be impeded. As an aid to teacher judgment, tests of intelligence and tests of general readiness are utilized frequently. The problem to consider is whether or not these estimates evaluate fully the basic processes involved in learning to read. These would include the finer processes of audition and visual perception. If the Grade One child meets with failure which is due, in part, to developmental

factors, then it becomes even more essential to refine the instruments of assessment to the extent that the margin of error in judgment will be reduced. Only then will planned preventive academic programming be possible.

Many tests have been devised to give over-all estimates of readiness, but the literature reveals the need for extension and refinement of these measures. Two factors arise that complicate measurement and its interpretation. The results obtained may indicate a maturational lag which can be overcome in time, or they may be indicative of a basic difficulty that has the same origin as the reading difficulty. The latter would include cases of gross or minimal brain damage. The second factor concerns the prediction of learning rate.

Theory and research in this area do not reveal clearly whether reading progress will be comparable to that of a normal reader, eventually, or whether a slower learning rate in the language area can be anticipated.

This study does not seek to answer all of these questions, but it sets out to examine more fully one aspect of reading readiness which is concerned with visual perception. The complexities of measurement and of interpretation have been indicated. Extensive research has been done to clarify and understand how the individual perceives, but the literature reveals that the implications for education are still being considered experimentally.

Foremost among the writers who have made significant

contributions in this area are psychologists, neurologists, psychiatrists, and educational authorities. M. D. Vernon (English psychologist), A. J. Harris, H. Robinson, and G. Fernald (American educational authorities), and many others have approached the problem physiologically, psychologically, and educationally. A. A. Strauss, L. E. Lehtinen, and N. C. Kephart have deepened our insight into perceptual deviations experienced by brain-injured children through their work with special classes and individually-adapted educational programs. L. Bender reviews the maturational process in visual-perceptual development in terms of normalcy. This serves as a point of departure in assessing varying degrees of maturation, and deviations from the expected level of performance. Many other writers have contributed to a greater understanding of the whole process of visual perception in relation to the reading act. Their findings are discussed in detail in Chapters II and III.

The Local Problem

In the Winnipeg Metropolitan area which includes suburban and city schools, varying approaches have been used to assess readiness for learning. Where kindergartens are a part of the school system, as in the Winnipeg School Division,

the teacher prepares an evaluation sheet on each child. These may or may not include tests of readiness and intelligence, but are weighted heavily with teacher judgment. In many Grade One classes, mastery tests are used after skills have been presented in order to assess readiness for the next level of instruction. Where formal tests are not in use, teachers evaluate readiness in terms of their knowledge of the development required to move ahead in the reading program. Many teachers are highly proficient in making such judgments, but the accuracy of the evaluations could probably be increased through the use of reliable diagnostic instruments in doubtful cases, at least.

At the end of the Grade One term, the teacher implements the promotion policy of her particular school division. The Grade One child with reading difficulties in Winnipeg may repeat his year, or may be placed in a continuing program with loosely defined grade levels, which in many cases will lead to four years in the primary section. Others may fail the child or decide to give a social promotion if conditions warrant this. Flexibility in programming, especially in Winnipeg, is usually adopted if needed, but this is not true of all areas nor of all schools.

In some situations, the child with reading difficulties is expected to fit into the graded program. This is usually

done by repeating grades at crucial stages, such as first, third, or sixth. In these situations, attempts to adjust the program may or may not be made. If no adjustment is made within this framework, the procedure tends to interfere to some extent with the learning rate of the child, as it does not allow for graduated academic growth. Part of the problem, however, is related to early and accurate identification of the reading difficulty.

Definition of Terms

In this study, visual-perceptual development refers to the developmental or maturational aspects of the way in which objects or symbols are seen and apprehended. This is dealt with more fully in Chapter II. Developmental or maturational aspects relate to the total growth process which is different for each individual. A maturational lag indicates that one or more areas have not kept pace with general physical development, but are developing at a different rate.

The reference to intellectual maturity is in terms of sufficient intellectual development to cope with the reading task. Reading ability, in this study, refers to the degree of skill attained in word-recognition by Grade One pupils.

The terms, successful and unsuccessful readers, or

good and poor readers, are used to designate the two groups of children in this study. A good reader in this sample is defined as a child who scores at least five points above the reading median for the total Grade One population, and a poor reader is one who scores at least five points below the reading median.

Flexibility in programming refers to adapting the academic materials to the needs and level of development of the learner. Graduated academic growth denotes step-by-step learning along a developmental scale, where each new phase of the learning task bears a relationship to the previous level, but shows a gradual increase in complexity.

In this study, frequent reference is made to the Bender Visual-Motor Gestalt Test. The literature indicates that this test is also known as the Bender-Gestalt Test, the B-G, or the Bender. The shortened forms, the Bender-Gestalt Test, or Bender, occur in this thesis.

Sample and Population

A sample of fifty cases was taken from the total Grade One population (178 children) in three schools in the Winnipeg School Division. These children were between the ages of 6-7 and 7-6, and were within the I.Q. range of 101 to 115. They represented the top 25 readers and the bottom 25 readers

within the selected age and I.Q. range. The groups were treated statistically in terms of chronological age and intelligence in order to ensure that the two groups were drawn from the same population. The Mann-Whitney U Test, a non-parametric measure, was used to test for differences.

Method of Investigation

The Bender Visual-Motor Gestalt Test was administered to the selected population of Grade One children as a measure of visual-perceptual development. The test consists of nine designs or patterns on separate cards which were copied by the subjects. (The designs are shown in Figure 1, page 38). The responses were scored in terms of the scorable deviations outlined on the score sheet in Appendix H. For each type of deviation from the original design, the subject was given a point-score, obtained through reference to the scoring manual and to the qualitative descriptions and samples given.

A total raw score was calculated for each design, and for the test performance as a whole. In testing for group differences, the analysis was based on the total raw score obtained for all the designs. To test for differences within the Bender-Gestalt Test, single design scores and item-deviations were analyzed.

Differences in Bender-Gestalt performance between good

and poor readers for total design scores and subtest scores were tested by the Mann-Whitney U Test.

Spearman rank correlations were obtained between reading and Bender-Gestalt scores for both groups of readers.

Differences between numbers of boys and girls in good and poor groups were tested by the t-test for percentage differences.

The significance of the differences between single-item deviations on Bender-Gestalt records of good and poor readers was obtained by establishing mean differences, and testing in terms of another t-test.

Original aspect of this study.--The hypotheses for this study suggest that significant differences exist between the Bender Visual-Motor Gestalt Test responses of normal Grade One children who are successful in word recognition and the responses of normal Grade One children who are not successful. A number of studies have been conducted with children in a relatively wide age range, but this study seeks to narrow the age range and the range of intelligence to reduce the influence of developmental factors due to age and I.Q. differences. In this way, the value of a measure of perceptual growth as reflected in a test of visual-motor control may be assessed more precisely in relation to reading difficulties in young children. The six to seven year age level was chosen because

it is the crucial stage for beginning reading experiences when it is assumed that sufficient maturation for formal learning has been attained.

Outline of the Study

Chapter I introduces the problem for the thesis, which is concerned with the relationship between skill in word-recognition at the Grade One level and visual-perceptual development, as measured by the Bender Visual-Motor Gestalt Test. Chapters II and III present a review of the literature based on both the role of visual perception in reading, and the evolution of the Bender-Gestalt Test.

In Chapter IV, the experimental procedures are outlined. This chapter includes data to show that the samples are drawn from the same population, and are comparable in chronological age and intelligence, but different in reading ability.

Chapter V presents the statistical findings for the study stated in terms of the hypotheses. In addition, a detailed analysis of the Bender-Gestalt Subtests and single-item-deviations is given.

Chapter VI summarizes the study and considers the educational implications.

CHAPTER II

THE ROLE OF VISUAL PERCEPTION IN READING

The hypotheses for this study suggest a relationship between mature visual perceptual functions as measured by the Bender Visual-Motor Gestalt Test and success in word recognition at early learning levels. The visual-motor task has been described by Rapaport as involving "essential motor activity guided by visual organization."[1] He comments that:

> The 'space' of visual organization and the 'space' of motor actions are not two psychologically independent spaces...The interaction is one of the most finely tuned functions.[2]

In order to consider these two inter-related facets of development more fully, it is necessary to explore the nature of visual perception and its role in the reading act.

Visual Perception

In a recent report, Vernon[3] traces the development of

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[1] D. Rapaport, M. Gill, and R. Schafer, Diagnostic Psychological Testing. Vol. I. Chicago: The Year Book Publishers, Inc., 1947, 1948, 1949, p. 249.

[2] Ibid., p. 250.

[3] M. D. Vernon, A Further Study of Visual Perception. Cambridge: University Press, 1952.

the theories of perception from those of the original Gestalt school to the broader and more comprehensive modern theories which are based on the principles of gestalten or wholeness, but which embrace the total reaction of the entire personality. According to Bender, the gestalt function may be defined as "that function of the integrated organism whereby it responds to a given constellation of stimuli as a whole, the response itself being a constellation, or pattern, or gestalt."[4] She adds that gestalt psychology has "failed to account for drives and tendencies of human conducts, growths, and regressions."[5]

In describing the nature of perception Vernon states that:

> Every act of perception consists of extremely exact registration in the receptor areas of the cortex, of even the minutest qualities and variations in the sensory patterns conveyed to them; followed by a combination integration of certain of these qualities resulting in a new construction - a percept which is not isolated, but exists as a part of a systematic categorization of experience in concepts and schemata.[6]

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[4] L. Bender, "A Visual Motor Gestalt Test and its Clinical Use, "Research Monograph No. 3. New York: American Orthopsychiatric Association, 1938, p. 3.

[5] Ibid.

[6] Vernon, op. cit., p. 14.

Vernon points out that "the last essential stage of the perceptual process then is that of identification and understanding of meaning."[7] She continues:

> The nature of the percept is not in any sense completely determined by the physical qualities of the stimulus, but is largely a function of constructive tendencies in the individual, some innate and some acquired through experience.[8]

According to Penfield and Roberts:

> Each time a thing is seen or heard or experienced, the individual has a perception of it. A part of that perception comes from his own concomitant interpretation. Each successive perception forms and probably alters the permanent concept.[9]

Strauss and Lehtinen state that:

> Perception involves primarily those elements which are in existence now and their organization into a meaningful whole...Our perceptions are used to build our concepts and these in turn serve to increase and elaborate our perceptions.[10]

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7 Vernon, op. cit., p. 22.

8 Vernon, op. cit., p. 47.

9 W. Penfield and L. Roberts, Speech and Brain Mechanisms. Princeton, New Jersey: Princeton University Press, 1959, p. 228.

10 A. A. Strauss and L. E. Lehtinen, Psychopathology and Education of the Brain-Injured Child. Vol. I. New York: Grune and Stratton, 1947, p. 115.

Cronbach suggests that "perception is directed both by standing attitudes and momentary ones."[11] He comments further that "some parts of the situation are noticed, but other parts remain in the background and may never influence our response."[12]

Cronbach's reference to the "figure-ground phenomena" is contained in the principles or laws of perceiving as determined by the gestalt psychologists and outlined by Vernon. She includes the following which are significant for our purposes:

> 1. The differentiation and organization of the field will take place in accordance with what has been called the Law of Pragnanz. The structures or configurations which are differentiated from the surrounding 'ground' will tend to be as "good" as possible,...as clear, impressive, and stable as possible.
>
> 2. Law of closure - Experiments demonstrate tendency towards continuity and completion. Continuous closed figures show more stability and persistence than do discontinuous ones.[13]

Vernon points out that the gestalt principles are "no more than tendencies, which are fluctuating rather than persistent."[14] However, they do provide a significant frame

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[11] L. J. Cronbach, Educational Psychology. New York, Chicago: Harcourt, Brace and Co., 1954, p. 283.

[12] Ibid., p. 278.

[13] Vernon, op. cit., p. 57 ff.

[14] Vernon, op. cit., p. 79.

of reference for studies of perception since the phenomena of perception frequently relate back to these established principles.

Perceptual Growth

Perception has been defined as a function of the perceiver primarily in terms of a total response. This means that perception is not static but involves complete interaction with interpretation. For further understanding of the perceptive processes and their meaning, it is necessary to consider maturational factors and the extent to which they influence perception. From the point of view of physical development as it is related to the perceiving instrument, Gesell states that there are three basic functional fields:

> 1. the skeletal component of the visual system which seeks and holds the image;
>
> 2. the visceral component which discriminates and defines the image;
>
> 3. the cortical component which unifies and interprets the image.[15]

Gesell continues:

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[15] A. Gesell, "Vision and Reading from the Standpoint of Child Development," Clinical Studies in Reading II. No. 77 (January, 1953), p. 130.

> The three functional fields develop conjointly but by no means uniformly. The ratio between skeletal, visceral, and cortical manifestations varies with advancing stages of maturity. In the course of individual development gradients of performance are built up concurrently but unevenly in the three basic functional fields. ...All of these variables and gradients are subject to the organizing processes of growth. Accordingly, each age of infancy and childhood affords a distinctive constellation of visual behavior patterns.[16]

Further aspects of perceptual growth were noted by Lowenfeld in creative activities. He observed the child's increasing awareness and use of kinesthetic experiences, and noted a growing response to visual stimuli "from a mere conceptual response as seen in early child art to the most intricate analysis of visual observation."[17]

The analysis of visual observation is frequently accompanied by a motor activity such as drawing, or writing, or creative art, and as Lowenfeld has suggested, it is often through this visual-motor response that the assessment of the perceptive process is effected. Bender[18] made very careful assessments of visual-motor activities of children from preschool to adult levels. She found that the first drawings

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16 Ibid.

17 V. Lowenfeld, Creative and Mental Growth. (Revised edition. New York: The Macmillan Co., 1952. 1953, p. 37.

18 Bender, op. cit., p. 6 ff.

of children are scribblings representative of motor play. These may have significance after production. Bender noted also a tendency to perseverate any one learned pattern which may be given in response to any figure that is offered. Series and masses are more readily grasped by children than absolute number or size.

According to Bender there is rapid differentiation of form between the ages of four and seven years. She suggests that "the visual motor patterns arise from motor behavior that is modified by the characteristics of the visual field."[19] Bender states that:

> There is constant interplay or integration between the motor and sensory features which can never be separated, though one or the other may advance more rapidly than the other in the maturation process and appear for a time to dominate any given stage in the evolution of the gestalt.[20]

Bender has found that retardation in maturation seems to simplify the pattern reaction.

The literature reveals that maturational factors influence perception and perceptual responses. Since reading is initially a visual act, and is usually introduced during the

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[19] Bender, op. cit., p. 13.

[20] Bender, op. cit., p. 13.

period of rapid differentiation of form, it is of interest to consider how it is affected by the developmental aspects of perceptual growth. As stated previously, the structural growth rate is different for different individuals, and it has been shown that the understanding of form varies at different maturational levels. In addition, experiments show that mild or severe brain-injury may complicate the perceptual process.

Reading and Visual Perception

According to Harris:

> The place of perception in the reading process becomes clear if we consider the sequence of events that make up the act of reading. This sequence involves motor adjustments, sensory excitation, perception, grasp of meaning, reaction, and readjustment; the cycle is repeated over and over as one reads.[21]

Educators have been very much aware of the role of perception in reading, but have been unable to formulate comprehensive instructional approaches because the nature of perception is still being revealed. Theories have been advanced

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[21] A. J. Harris, "Perceptual Difficulties in Reading Disability." Paper presented to the Pre-Conference Institute of the International Reading Association, May 4, 1961, p. 1. (This paper is to be published in the Conference Proceedings for 1961.)

in support of the hypothesis that some individuals are part-perceivers and some, whole perceivers. Theoretically, this aspect of perception should influence the teaching method used, but since the identification of varying types of perceivers has not been established definitely, instructional procedures would be experimental in nature.

Studies show that differences in perception of form exist to the extent that one child may experience a meaningless, fluctuating figure-ground percept where another may experience a clearly defined construct. These variations of perception have been carefully outlined by Strauss and Lehtinen, and Strauss and Kephart[22] in their studies of brain-injured children. They have devised learning and teaching methodology for extreme deviates, and have found positive response from their students. However, their methods and theories of learning have been questioned, and are still in the stage of analysis and experimentation.

The acceptance of the theory of deviation in perception due to brain-injury has been widespread, but the identification of young children with this difficulty has presented a severe

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22 Strauss, op. cit., and A. A. Strauss and N. C. Kephart, Psychopathology and Education of the Brain-Injured Child. Vol. II. New York, London: Grune and Stratton, 1955.

problem since the symptomology of the disturbed child, the brain-injured, and the emotionally immature may show overlapping features. Study of the deviate in perception is coming more sharply into focus, and it appears that considerable emphasis is being given to what is labelled as a "developmental lag" in perceptual development. The difficulty arises when the etiology of the "lag" is considered.

Harris[23] suggests that if the perceptual difficulty is a problem of maturation, then learning may proceed eventually at a normal rate. However, if it is complicated by subtle injury to the brain, continued interference in learning may occur. He emphasizes the fact that it is a difficult task to differentiate between these two aspects of perception, and points out that it cannot be done with complete confidence by an able staff of neurologists, psychiatrists, and clinical psychologists. Harris places emphasis on the fact that the diagnosis cannot be achieved with complete confidence. He does not underestimate the great strides that have been taken in this field, but implies the need for continued experimentation in this area.

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[23] Harris, op. cit.

To date, the literature suggests that agreement as to the significance of perceptual difficulties in learning to read has not been reached by educators. Bond and Tinker[24] point out that the occurrence of brain injury is very rare, and that a careful, systematized instructional approach usually will overcome the learning difficulties. Fernald indicates that interference in normal perception, retention, and memory is basic to lack of success in reading, but she quotes Gates who states that the difficulty might have been overcome if "the right guidance had been given at the right time."[25] Vernon comments that "in general the child is unlikely to be greatly handicapped in learning by any deficiency in the visual perception of word shapes."[26]

Possibly the discussion by Harris gives a more comprehensive picture of the role of visual perception in reading.

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24 G. L. Bond, and M. A. Tinker, Reading Difficulties-Their Diagnosis and Correction. New York: Appleton-Century-Crofts, Inc., 1957, p. 98 ff.

25 G. M. Fernald, Remedial Techniques in Basic School Subjects. New York, London: McGraw-Hill Co., Inc., 1943, p. 166 ff.

26 M. D. Vernon, Backwardness in Reading. A Study of its Nature and Origin. Cambridge: University Press, 1957, p. 30.

Harris states that:

> In reading disability cases that involve neurological defects or delayed maturation there is difficulty with the Gestalt aspects of visual and auditory perception. The whole-part relationship is inadequate. Wholes tend to be perceived in a vague and global, undifferentiated way. Parts tend to be perceived as separate unrelated units rather than in the whole-part relationship, so that visual closure and auditory blending are deficient. There is likely to be some figure-background difficulty. Laterality and directional orientation tend to be delayed in development and there is likely to be difficulty with the left to right sequence and with diagnols. The child's body image as projected in his drawings of the human figure is likely to be immature, undifferentiated and somewhat distorted.[27]

Although as Vernon indicates the role of visual perception in learning to read may be of less importance than certain other aspects such as auditory perception, sensitivity to sequence of sounds, and sound-blending, it appears that the child with perceptual immaturity or deficiency will encounter difficulties and confusion unless he is identified. The confusion cannot be eliminated, but it can be controlled and reduced.

Since identification of children with such difficulties is a major problem, considerable work has been done to refine diagnostic techniques in this area. Only as diagnostic procedures can be improved will understanding be increased.

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[27] Harris, op. cit., p. 13.

Experimentation has evolved as an attempt to gain further insight into the role of perception in learning, and to devise methods and measures of evaluating perceptive processes. This approach should clarify and guide learning and teaching procedures for classroom and clinic. Studies suggest that much insight has been gained, but the evidence is not conclusive.

Experimental Studies on Visual Perception and Learning

Hildreth (1934) conducted a study to assess the nature of reversal tendencies in reading and writing in children. She was interested in the developmental aspects of these tasks and considered the tendency towards reversals to be primarily a function of maturation. Her findings were as follows:

1. None of the children examined showed a high degree of consistency in the tendency to make reversals.

2. Some word and symbol elements were more subject to reversals than others.

3. Some indication of positive correlation was evident between mental ability and reversal tendency.

4. Left-handed children tended to make on the average more reversals, although this was not significant statistically.

5. A tendency existed for the poorest readers to make more reversals than good readers, just as the poorest readers made more kinds of all other types of errors than good readers.

6. The inconsistency of the reversal tendency prevented a conclusion that reversal tendency is a cause of poor reading.[28]

Hildreth noted the tendency towards deviant perception in reading, but could not conclude whether this was a cause or effect of poor reading. She stated that many studies pointed to "the frequency of the tendency in normal young children and the decline of the tendency with gain in mental maturity and experience."[29]

Vernon noted from an unpublished study by E. Newson (1957) that "five-year-old children may be unable to see the difference between a shape and its mirror image even when it is pointed out. This indicates a real inability to attach any importance to orientation."[30] Another perceptual variation is shown where Vernon quotes Piaget and Inhelder (1948) on their studies with young children:

> The work...seemed to show that in the early stages children depend for their realization of order upon moving in such a way as to copy directly a perceived sequence. Thus they can reproduce the order of beads on a string only by taking up one bead after another

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[28] G. Hildreth, "Reversals in Reading and Writing," Journal of Educational Psychology. Vol. 25, No. 1 (January, 1934), pp. 1-20.

[29] Ibid., p. 2.

[30] Vernon, op. cit., p. 17.

> and placing it exactly in the same position relative to the preceding one as it has in the original. They cannot until they have reached a certain age perceive visually the complete sequence of beads on the string as a whole with related parts.[31]

In 1939 Petty[32] undertook an experimental study of certain factors influencing reading readiness. She tested a large group of Grade One children who were spending their first year in school. Her aim was to study five factors that appeared to be related to readiness for learning. These factors were: intelligence, ability as revealed through an analytical study of children's drawings, ability to deal with symbols in reading, susceptibility to illusions, and eidetic ability.

With this very narrow age range, Petty found that there was no correlation between reading achievement and chronological age. Mental age was described as a potent factor in the determination of readiness. A positive relationship existed between drawings and reading age. In fact, Petty indicated that types of perceivers might well be identified by observing drawing performances and assessing drawings, and suggested

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31 Vernon, op. cit., p. 19.

32 M. C. Petty, "An Experimental Study of Certain Factors Influencing Reading Readiness." Journal of Educational Psychology. Vol. 30 (1939), pp. 215-229.

that instructional methodology could be geared to the needs of these analytic and synthetic performers.

In testing her hypotheses, Petty found that ability to deal with symbols seemed necessary to succeed in reading. She found that it was impossible to draw any conclusions regarding the relationship between reading achievement and illusions. The factor of eidetic ability revealed a positive relationship, but it was felt that the extent of the importance of this factor was questionable. Her final conclusion was that none of the correlations were high enough to be accurate in every case of individual prediction.

This study points up again the difficulty in isolating and measuring readiness factors for learning. However, such studies provide background for further experimentation in the analysis of learning processes.

Kendall[33], in 1948, attempted to determine whether difficulty in learning to read was associated with unfavourable scores in a test of visual-motor memory, or with a tendency to reverse the designs. His conclusions were that for the sampling population of children aged six to sixteen years

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33 B. S. Kendall, "A Note on the Relation of Retardation in Reading to Performance on a Memory-For-Designs Test," Journal of Educational Psychology. Vol. 25 (1948), pp. 370-373.

there was no significant relationship between retardation in reading and difficulty in visual-motor integration, whether it took the form of inability to remember the drawings or of a tendency to make errors of poor orientation.

The findings suggest that the wide age range may have obliterated factors operating for the younger age group and not for the older. Follow-up studies examined certain aspects of visual-motor integration more fully.

A study undertaken by Sister Mary James Harrington and D. Durrell[34], reported in 1955, investigated mental maturity versus perception abilities in primary reading. The findings based on a second grade population showed that ability to use phonics correlated highly with achievement, auditory and visual discrimination of word elements ranked high, and mental age (as measured by the Otis-Quick-Scoring Test) had little influence.

When the age-range is narrowed and gross differences in mental ability are eliminated, the studies suggest that factors of development other than intelligence are important for success in early learning experiences. The evidence shows

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[34] Sister M. J. Harrington and D. D. Durrell, "Mental Maturity versus Perception Abilities in Primary Reading," Journal of Educational Psychology. Vol. 46 (1955), pp. 375-380.

that the perceptual factors are involved more significantly at the primary levels, and that confusions occurring in these stages may figure largely in later patterns of reading difficulty, although the initial immaturity or deficiency has been overcome. Hence the urgency for precise diagnosis at the crucial stages of learning.

K. de Hirsch[35] published a study based on tests designed to discover potential reading difficulties at the six-year-old level. As director of the pediatric language disorder clinic in the Vanderbilt Clinic, New York City, she noted that a large number of intelligent children were referred for somatic or behavioral complaints. Upon investigation it was learned that the disturbances did not develop until the children had been exposed to the experience of continued failure at school. K. de Hirsch set out to find which children at the end of the kindergarten year would be liable to experience difficulties in Grade One. She indicated that her procedures had not been evaluated statistically but were still in the experimental stages.

A number of de Hirsch's tests appear to be more applicable to clinic than classroom, although it would be possible for

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35 K. de Hirsch, "Tests Designed to Discover Potential Reading Difficulties at the Six Year Old Level." American Journal of Orthopsychiatry. Vol. 27, No. 3 (1957), pp. 556-576.

certain of the diagnostic procedures to be used by the teacher. The areas tested by de Hirsch are outlined in some detail to show the scope of her multi-sensory approach in diagnosis, and to give insight into the reasons for selecting particular instruments for measurement.

The following were included:

1. Measures of Intelligence - The Wechsler Intelligence Scale for Children was considered to be the most satisfactory measure.

2. Reading Readiness Tests - de Hirsch stated a preference for the Metropolitan Readiness Test, but indicated that none of the Readiness Tests seemed to cover all the facets of behavior which were significant for success in learning.

3. Motor Tasks - These involved the larger muscles. de Hirsch pointed out that "movement like perception requires patterning. A certain level of motor skills is not only essential for learning to write and print, but it is also indicative of the child's overall maturity."[36]

4. Visual-Motor Tasks - For these de Hirsch used the Bender Visual-Motor Gestalt Test as she believed it to be one of the most important in the battery. She noted that

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[36] Ibid., p. 567.

perceiving and reproducing configurations are functions required in the reading process.

5. Figure-Drawings - The Draw-a-Person Test was used as an indicator of a child's body image, and was considered to be closely related to spatial concepts.

6. Laterality Tests - de Hirsch suggested that failure to establish superiority of left and right might indicate physiological immaturity which would tend to show up in reading.

7. Discrimination Tests - These were used to discriminate between identical shapes when they were presented in correct and reversal form.

8. Language Tests - These tests were related to rhythm, imitative ability, or auditory memory.

9. Tests for Figure-Ground Relationships - According to de Hirsch this factor was related to perceptual organization.

10. Non-Verbal Tests for Abstract Behavior - de Hirsch gave the children block designs to copy, and watched whether they were able to analyze wholes into parts and synthesize parts into wholes. She also observed their ability to sort objects into categories.

11. Verbal Tests - These tests were designed to assess understanding of directions, comprehension of language,

and concepts in language.

The use of this battery of tests suggests that readiness for learning cannot be measured by one approach alone. Since attempts are made to isolate certain factors, it seems essential to assess the relative merits of the various measuring instruments separately in order to arrive at conclusions regarding their effectiveness in a battery designed to evaluate potential reading ability.

De Hirsch states that:

> Without a measure of maturation...perceptual, motor, conceptual, and behavioral...the child will be unable to cope with his (reading) task. The youngster whose neurophysiological organization still is primitive, the one whose language equipment is inferior, is the one who will run into trouble in the first and second grade.[37]

According to de Hirsch, children between five and a half and six and a half years usually make dramatic strides in over-all maturation. Her research with six year old children, although not presented statistically, underlines the importance of looking closely at this age level. She comments that "a child of more than six years whose perceptual, motor, visuomotor, and conceptual performance is still relatively primitive, the child who has trouble with

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[37] Ibid., P. 567.

structuralization of behavior patterns is liable to run into difficulties when exposed to reading."[38] She notes, further, that "there is found a fairly steady, though small number of children whose deviant responses show difficulties at various levels of integration, but who do not show the usual positive signs in the classical neurological examination."[39] Her impressions are that "many of these relatively subtle signs go undiscovered until the time when these children are confronted with a task which is as complex as is the mastering of oral and printed symbols."[40]

Another contribution to research in visual perception was made in a study by J. T. Goins in 1958.[41] The purpose of her study was to ascertain the level of competence in visual-perception of first grade children, and the correlation of their perceptual abilities with their achievement in reading. The second part of her study was to determine the effect that training in recognition of visual forms would

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38 Ibid., p. 574.

39 Ibid.

40 Ibid.

41 J. T. Goins, "Visual Perceptual Abilities and Early Reading Progress," Supplementary Educational Monographs. No. 87 (February, 1958), p. iii-108.

have on progress in learning to read.

Her findings were as follows:

> 1. Scores on pattern copying, on reversals, and on the combined perceptual score correlated most highly with reading achievement. The frequency distributions obtained on each of the visual perception tests showed a wide range of individual performance.
>
> 2. Two factors of visual perception were revealed by the analysis, one relating to the speed of perception and the second to the ability to keep in mind a figure against distraction (strength of closure). This second factor had a substantial common variance with reading skill, although these perception tests were unlike the act of reading.
>
> 3. That distinct types of perceivers may exist was evidenced by the tendency toward a bimodal distribution on the tests, Picture Squares and Reversals.
>
> 4. Skill in perception through tachistoscopic visual form training was achieved to any measurable extent only by the initially superior readers in the group.
>
> 5. No positive effect was produced by the tachistoscope training on the reading skill of the group as a whole.[42]

The correlations found in this study reconfirm the significance of visual perception in the learning-to-read stage. Goins suggests that:

> The results as a whole indicate the fruitfulness of the search for interrelationships among aspects of visual perceptual abilities and show that there is some relation between them and the reading process.

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[42] Ibid., pp. 98-101.

> The evidence points to the need for a broader concept than has formerly prevailed concerning the assessment of visual abilities of beginning readers."[43]

From the study by Goins it is apparent that pattern copying has the highest single correlation with reading. The patterns used by Goins were selected from the original battery of Thurstone's tests of visual perception.

The Bender Test and Reading Potential

Throughout the literature there appears to be a constant search for refined and valid measures of visual perception which have some bearing on predicting success in reading. As de Hirsch suggests, a broad approach is necessary for full assessment of reading potential, but it is evident that certain of her testing instruments were given more weight than others. Her impressions were that the Bender Visual-Motor Gestalt Test which is essentially a pattern-copying test was one of the most important tests in the battery.

Within recent years increased emphasis has been given to the Bender Visual-Motor Gestalt Test as a measure of readiness for learning. The test appears to be a simple yet sensitive instrument that reflects aspects of both maturation

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[43] Ibid., p. 101.

and emotional disturbance. In view of the trends in previous studies, this instrument, probably more than any other presently known, seems to be of significance in assessing learning problems relating to perceptual difficulties. Although studies of learning and its relation to perceptual growth in young children as measured by the Bender Visual-Motor Gestalt Test are few in number, it appears that experimentation with this instrument is increasing. A discussion of the test itself is of sufficient importance to warrant a separate chapter.

CHAPTER III

THE BENDER VISUAL-MOTOR GESTALT TEST

The Test and its Uses

Lauretta Bender was influenced by Wertheimer of the gestalt school of psychology in her selection of configurations for her test. Bender felt that this school's greatest contribution was in the field of perceptual psychology, although their interpretation tended to minimize the emotional aspects of perceiving. Bender pointed out that "gestalt psychology claims that organized units or structuralized configurations are the primary forms of biological reactions at least at the psychological level of animal behavior, and that in the sensory field these organized units or gestalten correspond to the configurations of the stimulating world."[1]

According to the literature, a response to visual stimuli, developed in terms of basic gestalt principles, reveals not only the nature of the perceptual processes of the perceiver, but suggests the ways in which the individual organizes and deals with his environment.

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[1] L. Bender, "A Visual Motor Gestalt Test and its Clinical Use," Research Monograph No. 3. New York: American Orthopsychiatric Association, 1938, p. 5.

Bender believed that:

> There is a tendency not only to perceive gestalten but to complete gestalten and to reorganize them in accordance with principles biologically determined by the sensory-motor pattern of action. This pattern of action may be expected to vary in different maturation or growth levels and in pathological states organically or functionally determined.[2]

The configurations selected by Bender were submitted to children, adults, mental defectives, and mentally sick patients. After extensive experimentation, Bender was able to formulate the sequence of development from the point of view of maturation, and was able to derive considerable meaning from deviant designs by adults. Figure I shows the configurations selected by Bender. Her description of each figure is as follows:

> Figure A - chosen as an introductory figure because it soon became evident that it was readily experienced as closed figures on a background.
>
> Figure I - should be so perceived that the dots appear as a series of pairs...an example of a gestalt formed on the principle of proximity of parts.
>
> Figure II - perceived usually as a series of short slanting lines consisting of three units so arranged that the lines slant from left above to right below... determined on the principle of proximity of parts.

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[2] Ibid.

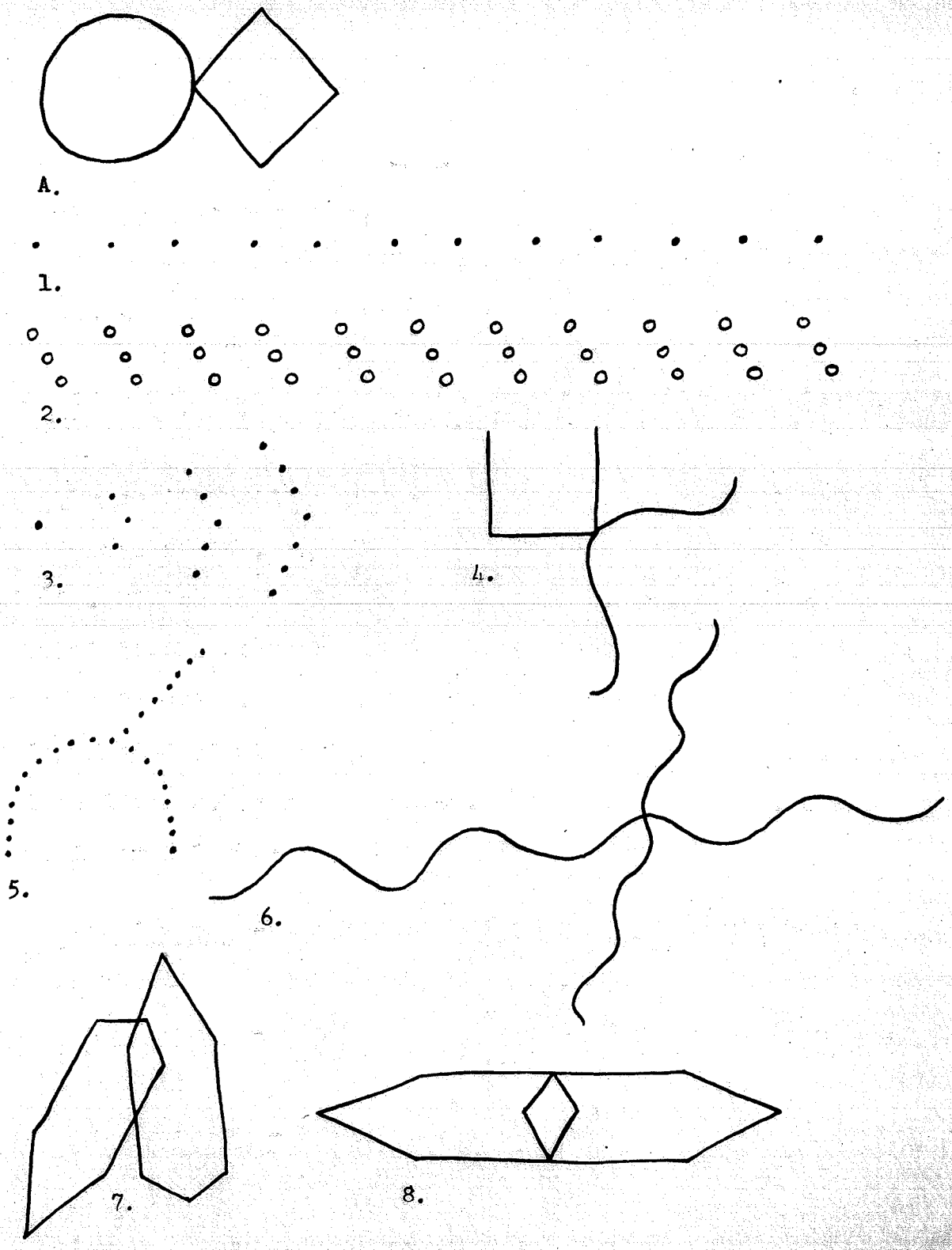

Fig. 1. Test figures adapted from Wertheimer.

Figure III - formed by dots arranged...in relation to the mid-line like the two sides of a diamond, converging toward the first single dot.

Figure IV - is ordinarily perceived as two units determined by the principle of continuity of geometrical or internal organization, the open square with the bell-shaped form at the lower right hand corner.

Figure V - was seen as an incomplete circle with an upright slanting stroke made in dotted lines. (This was considered to be similar in principle to Figure A).

Figure VI - was seen as two sinusoidal lines with different wave lengths, crossing each other at a slant.

Figures VII and VIII - consisted of two configurations made up of the same units, but rarely perceived as such.[3]

For many years the Bender Visual-Motor Gestalt Test was considered to be of significance in the battery of tests used by clinical psychologists. Its interpretation was qualitative rather than quantitative, and success in utilizing this instrument varied with the background and insight of the psychologist.

In 1938 Bender published the monograph describing the test and outlining its clinical use. Later she was asked to prepare a manual of instructions to accompany the test, and this was published in 1946. She described the test as a

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[3] Ibid., p. 19.

"non-social, neutral, apparently innocuous test in a battery of personality tests."[4] Bender indicated that the test had been used as a "maturational test in visual-motor gestalt function of children, to explore retardation, regression, loss of function and organic brain defects in both adults and children, and to explore personality deviations especially where there are regressive phenomena."[5] The manual gives a summary of expected responses for the various developmental levels of children. It was suggested that these could be used for evaluating maturational norms and levels of retardation and regression.

Eventually, interpretative guides for clinical psychologists were published by various workers in the field. An attempt was made to outline the significance of the deviations in terms of personality assessment. In 1949 Max Hutt submitted a tentative guide on the administration and interpretation of the Bender Test.[6] Two comprehensive reports were

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4 L. Bender, Instructions for the Use of Visual-Motor Gestalt Test. New York: The American Orthopsychiatric Association, 1946, p. 1.

5 Ibid.

6 M. L. Hutt, "A Tentative Guide for the Administration and Interpretation of the Bender-Gestalt Test." U. S. Army Adjutant General's School, 1945 (Restricted).

given in texts of Projective Psychology in 1950 by A. Woltmann[7] and in 1951 by F. Halpern.[8]

In 1953, A. Benton, in the Fourth Mental Measurements Year Book, commented:

> It belongs to a class of test procedures that of visuomotor and visual memory tests, which have been demonstrated to possess distinctive clinical merits, particularly in the evaluation of cerebral injury and disease. Where disturbances in visuomotor behavior and visual perception exist, performance on the test should be able to reflect these disabilities. That it possesses any power to identify psychogenic disturbances, as in the psychoneuroses, remains to be demonstrated.[9]

In the same year H. White reviewed the test and stated that "the Bender-Gestalt is becoming a frequently used test, but only recently has some of the needed basic experimental data been appearing."[10]

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7 A. Woltmann, "The Bender Visual-Motor Gestalt Test" in Projective Psychology. Edited by L. Abt and L. Bellak. New York: Alfred A. Knopf, 1950, pp. 322-355.

8 F. Halpern, "The Bender Visual-Motor Gestalt Test" in An Introduction to Projective Techniques. Edited by G. Anderson and H. Anderson. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1951, pp. 324-340.

9 A. L. Benton, In the Fourth Mental Measurements Year Book. Edited by O. K. Buros. New Jersey: The Gryphon Press, Highland Park, 1953, p. 288.

10 H. H. White, In the Fourth Mental Measurements Year Book. Edited by O. K. Buros. New Jersey: The Gryphon Press, Highland Park, 1953, p. 289.

White adds that:

> One group of workers is concerned with the problem of maturation. There is general agreement that the significant maturation occurs within the age range of four to eleven years, with fairly stable patterns. There is some relation to reading factors, but this is limited by intelligence and emotion.[11]

The comment on intelligence and emotion as limiting factors in the relationship between reading and Bender-Gestalt performance is based upon literature which implies that reading readiness and visual-perceptual development may be manifestations of a larger developmental process. The literature suggests that emotional factors may affect Bender-Gestalt performance and not reading achievement, but such an inference has little bearing on this study since reference is to children in the early adolescent stage, at which level the Bender is known to be more sensitive to emotional disturbance that it is at learlier levels.

White[12] concludes that the Bender Visual-Motor Gestalt Test has merit, but further experimental work is essential He notes that the test is of value in measuring certain aspects of maturation, and also, the presence of organic brain involvment. His impression is that frequently it is useful in

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[11] Ibid.

[12] Ibid.

recognizing the schizophrenic but it is somewhat less useful with the neurotic. He suggests that it is limited by age and possibly low intelligence, and indicates that cultural influences have not been explored.

For many psychologists the lack of a quantitative scoring system constituted a weakness in the test. They felt that quantitative measures would increase the accuracy of the qualitative interpretation. With this in mind, scoring systems were devised and published in 1948 and 1951. The experimenters set out to evaluate quantitatively the amount of distortion in the figure reproductions.

Quantification of the Bender Visual-Motor Gestalt Test

One of the earliest attempts to quantify the Bender-Gestalt Test was presented by F. Billingslea in 1948.[13] The purpose of his study was three-fold and was outlined as follows:

> 1. to develop an objective scoring method for the Bender-Gestalt Test;
>
> 2. to objectify by means of operational definitions the perceptually meaningful factors of the test;
>
> 3. to give some measure of the test's reliability and validity.[14]

Billingslea set out to devise a complex scoring sheet with sixty-three indices to denote units of deviation from the given design. He noted that the problem was to decide what conditions should be accepted as indicative of a destroyed gestalt. He found that his index of scores proved to be statistically reliable, but concluded that the system of scoring should be simplified.

In 1951, a scoring manual was published by Pascal and

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[13] F. Y. Billingslea, "The Bender-Gestalt: An Objective Scoring Method and Validating Data," Journal of Clinical Psychology. Vol. 4, No. 1 (January, 1948), pp. 1-9.

[14] Ibid., p. 2.

Suttell. They observed that the Bender Visual Motor Gestalt Test had been used extensively, but the number of attempts at quantification were meager. In their opinion the lack of a feasible method of scoring the Bender designs served as a deterrent to the accumulation of experimental data about the test. They indicated that this was the primary reason for undertaking the research.

Pascal and Suttell[15] set up a score sheet of weighted deviations and a manual of procedure with illustrations to illuminate scoring methods. With their scoring system the greater the deviation from the stimulus the higher was the score on the Bender Test. Each design, except design A, was inspected for scorable deviations. Scores were accumulated by designs, plus the scores which had to do with the test as a whole, called "Configuration Scores", and a final raw score was obtained. They computed norms for adults based on a Z-Score, but children's norms were not presented.

Pascal and Suttell did not ignore the Bender records of young children, however, but asserted that the age of six years served as a base-line for their work. They believed that form at that age showed considerable relationship to

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15 G. R. Pascal and B. Suttell, The Bender-Gestalt Test, Quantification and Validity for Adults. New York: Grune and Stratton, 1951, p. 5 ff.

the stimulus, yet revealed dramatically, maturational factors. Regressions in older age groups could be assessed more rapidly in terms of degrees of primitivization. Studies with groups of children were conducted, but only raw scores were used to determine the extent of the destruction of the gestalt.

Pascal and Suttell presented their findings for various age groups in a manual, and described in detail the kinds of reproductions they expected from children at different stages of development. They stated that "the incidence of deviations common to six and seven-year-olds, and not common to ages of nine or above, is indicative of at least failure in normal maturation."[16]

In the study with forty-six normal children ages 6-3 to 9-3, Pascal and Suttell noted a fairly regular decrease in scores on all designs with increasing age, except for design three. Their study with disturbed and normal children revealed significant differences in design reproductions. They suggested that "in addition to measuring maturation, the method of scoring the Bender records is measuring in children something similar to that which it measures for adults."[17]

Pascal and Suttell pointed out that their scoring

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16 Ibid., p. 55.

17 Ibid., p. 42.

method was not entirely objective, but they had found it to be reliable in re-test situations if the scorer adhered closely to the manual, and began by scoring the practice forms included with the instructions. This procedure brought the scorer's interpretation into line with that of the writers.

In 1952 Addington[18] set out to investigate the reliability and validity of the Pascal and Suttell scoring method. He concluded that the differences between clinical and non-clinical groups were statistically significant, indicating that the scoring method was valid in the sense that it distinguished between the groups. He supported Pascal and Suttell in cautioning that the scoring system be used only for screening and in conjunction with other tests.

In reviewing the Pascal and Suttell scoring method in 1953, Cronbach commented that "the authors' ideas advance the usefulness of the Bender-Gestalt appreciably."[19] The review notes that the method is exhaustively illustrated with scorable deviations. The authors are commended for

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18 M. C. Addington, "A Note on the Pascal and Suttell Scoring System of the B-G Test," Journal of Clinical Psychology. Vol. 8 (1952), pp. 312-313.

19 L. J. Cronbach, In the Fourth Mental Measurements Year Book. Edited by O. K. Buros. New Jersey: The Gryphon Press, Highland Park, 1953, p. 290.

emphasizing the inherent limitations of the procedure, and for presenting their method in such a factual manner. The reviewer states that "it lends an objective element to a test that has always been surrounded by subjectivity."[20]

Experiments with the Bender-Gestalt Test continued, but little use was made of the scoring methods until recently. Studies indicate that a modification of the Pascal-Suttell method has been devised, but this is still in the experimental stages.

Research studies with the Bender-Gestalt Test and learning difficulties in young children appear to be gaining momentum. The value of the developmental aspects of the test in relation to learning tended to be minimized partly because of the clinical nature of the instrument. However, widespread interest in the use of the test as a measure of maturity of visual perception is developing as more significance is attached to the role of visual perception in learning.

Experimental Studies

An experiment carried out by Fabian in 1945 involved the study of vertical rotation in visual motor performance

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20 Ibid.

and its relationship to reading difficulties. Fabian noted that:

> Children learning to use written language symbols frequently reverse those that have similar configurations. As they advance in the reading program, reversal errors in reading and transcription are usually corrected, but in a small percentage of children this confusion of symbols remains.[21]

Fabian[22] studied 586 school children from kindergarten to Grade Three to determine the incidence of vertical rotation and its relationship to age and past experience. Vertical rotation occurs when a design is rotated from a horizontal to a vertical position. Fabian used the Bender-Gestalt Test and set out to classify the rotational tendencies in the different age levels. He found that the rotation of gestalt forms was a very common feature in the pre-school and beginning school children. He noted that over 50% of these pupils rotated the horizontal figures and about 80% of the rotations were from the horizontal to the vertical. It was apparent that as the child progressed in the school program, the rotational tendency became less pronounced, so that from the ages of 6-6 to 7-6 there were about 20% with vertical rotations, and from 7-6 to 9-0, only about 7% rotated the figures.

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

[22] Ibid., pp. 129-154.

When the figures were presented in the rotated form, reporductions tended to be more accurate, but other distortions occurred. Fabian comments that "the absence of rotation when the stimuli are vertically oriented reinforces the impression that horizontal configurations are more likely to initiate figure-ground changes in young children."[23]

Fabian found that in the middle of Grade One about 50% of the pupils made symbol reversals with only a slight discrepancy between the sexes. At the end of Grade One, about 50% of the boys and 36% of the girls were making reversals. By the age of eight years, the reversals were less common in both sexes, although they occurred almost twice as often in boys.

Fabian believed that the results were in agreement with other reports on the universal tendency of young children to reverse symbols in the primary grades. The exaggeration of this tendency in boys was in harmony with the fact that reading retardation was found more frequently among them.

According to Fabian the tendency towards verticalization which was demonstrated by the Bender-Gestalt Test "is a developmental phenomenon which is gradually corrected as

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[23] Ibid., p. 33.

the child matures but does not disappear until he is seven or eight years of age. Physiological, psychophysical, and psychological forces contribute to this tendency."[24]

Fabian relates this verticalization tendency to symbol and word reversals and sees it as an expression of the same type of development. She suggests that "although verticalization is a developmental phenomenon its persistence may be indicative of either mental deficiency or organic brain disease where it is a regressive feature."[25]

In 1950, Harriman and Harriman[26] attempted to assess the Bender-Gestalt Test as a measure of school readiness. They experimented with a group of nursery school pre-readers and a group of second grade children who were able to read. Their hypothesis was that the Bender-Gestalt reproductions of readers would resemble more closely the responses of adults than would those of pre-readers. They found that there were significant differences in at least four major determinants when five and seven-year-old normal children were

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[24] Ibid., p. 151.

[25] Ibid., p. 152.

[26] M. Harriman and P. L. Harriman, "The Bender Visual-Motor Gestalt Test as a Measure of School Readiness," Journal of Clinical Psychology. Vol. 6, No. 2 (1950), pp. 175-177.

compared. They felt that the maturational factor was clearly demonstrated and that it was justifiable to say that the Bender-Gestalt Test could be employed as a measure of a pupil's readiness for learning.

Baldwin[27] (1950) examined the Harriman study and concluded that some weight might have been attached to their results if an actual attempt to teach the younger group had been unsuccessful. She felt that the study demonstrated the effects of the general developmental process, but her over-all impressions were that a crucial study must involve a comparison of Bender-Gestalt reproductions of readers and non-readers of similar age and school experience.

A study of copying ability in children was outlined by Townsend[28] in 1951. A battery of tests was used and among these was the Bender-Gestalt Test. Townsend proposed to assess the inter-relations of certain measures of form perception, motor abilities, and copying, and the relation of each of these to chronological and mental age for groups

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27 M. V. Baldwin, "A Note Regarding the Suggested Use of the Bender-Gestalt Test as a Measure of School Readiness," Journal of Clinical Psychology. Vol. 6, No. 2 (1950), pp. 412-415.

28 E. A. Townsend, "A Study of Copying Ability in Children," Genetic Psychology Monographs. Vol. 43 (1951), pp. 1-49.

of children in the first three grades of elementary school. The criteria for scoring were based on features of preciseness.

Townsend noted the following:

> 1. The correlation of copying with form perception was significantly higher than the correlation of copying with motor ability. (The conclusions were that form perception may be considered as more influential in copying than motor abilities).
>
> 2. Copying correlates significantly more highly with mental age than with chronological age.
>
> 3. With chronological age there is rapid improvement in copying to about year seven and thereafter the development continues irregularly and at a slower rate.
>
> 4. With mental age development is rapid to about year eight and thereafter continues irregularly and at a slower rate.
>
> 5. The mental age group 4.6 to 6.5 was noted to do very poorly on all drawings judged not only by components but also by form.
>
> 6. Some rotation errors occurred in copying in the first grade in some children but tended to disappear by the third grade.
>
> 7. In form perception, reversals and size errors were made more frequently than expected.[29]

According to Townsend a variability in performance from drawing to drawing and person to person might exist so that "copying in and of itself is an unpredictable variable

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[29] Ibid., p. 48.

in the subject, and in the type of copy to be made."[30]

Townsend's findings give weight to the need for a broad approach to the problem of readiness. The study demonstrates the maturational aspects of development in young children, and underlines the hypothesis that pattern copying is related closely to perception of form.

In a continued exploration of this hypothesis, Elizabeth Koppitz[31] undertook a series of studies beginning in 1958. From her work, considerable insight has been gained in the use of the Bender-Gestalt Test as a predictor of readiness for learning. For purposes of analysis, Koppitz devised her own scoring method based on the Pascal-Suttell system.

Twenty categories were selected from the original scoring method, and from these Koppitz found that seven categories differentiated significantly in studies of learning disturbances. Later, four categories were employed. The categories used for scoring purposes were distortion of shape, rotation, substitution of circles for dots, perseveration, failure to integrate parts into wholes, more than three angles

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[30] Ibid., p. 48.

[31] E. M. Koppitz, "The Bender-Gestalt Test and Learning Disturbances in Young Children," Journal of Clinical Psychology. Vol. 14, No. 3 (July, 1958), pp. 292-295.

in a curve, and extra or missing angles in the hexagon.

Koppitz showed that children from grades one to four who had significant deviations in the Bender-Gestalt Test as measured by her own scoring procedures experienced limited success in school achievement. She reported that for the first two grades both visual motor perception and I.Q. are related significantly to school achievement and may even overlap. She concluded that the Bender-Gestalt Test differentiated well between the above average and below average students in the first four grades of school.

Again in 1958, Koppitz[32] reported her findings on a study of the relationship between the Bender-Gestalt Test and the Wechsler Intelligence Scale for Children. She selected ninety children from grades one to four. The Benders were scored according to the system developed and validated by Koppitz.

The findings showed a highly significant relationship between the full scale I. Q. and Bender-Gestalt reproductions for all children. However the break-down revealed that for grades three and four there was a significant increase. She

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32 E. M. Koppitz, "Relationships between the Bender-Gestalt Test and the Wechsler Intelligence for Children," Journal of Clinical Psychology. Vol. 14, No. 4 (October, 1958), pp. 413-416.

suggested that the Bender was related more closely to maturation of visual perception at the six and seven year level than to intelligence.

With the verbal I.Q., Koppitz noted that the relationship was significant for the whole group. The tests of verbal reasoning-information, comprehension, and similarities showed no significant relationship to the Bender. A strong trend was noted for grades One and Two in arithmetic, and a significant relationship occurred in grades Three and Four.

The relationship with the performance I.Q. was consistently significant at all levels for all grades separately or combined. The analysis of the separate subtests for grades one and two revealed a significant relationship between the Bender-Gestalt Test and picture arrangement, picture completion, and object assembly. Picture arrangement and object assembly, especially the latter, were considered to be highly significant for these grades.

On the basis of this study Koppitz concluded that the performance I.Q. and the Bender-Gestalt Test were significant indicators of learning problems in children in grades One and Two. She suggested that the findings pointed to the possibility that learning problems in the first two grades may be associated with slow development and immaturity in visual motor perception. There was reason to believe that the Bender

might be a good predictor of learning problems in the first two years of school.

Koppitz suggested that:

> By the third grade most children have matured sufficiently in visual motor perception, so that this area no longer presents the major problem in most cases. The relationship between the Bender and the learning problem shows a trend in the positive direction, but is no longer significant. At this level the WISC full scale I.Q., the verbal I.Q., and the performance I.Q. all show highly significant relationships to learning problems.[33]

In 1959, Koppitz, Sullivan, et al.[34] published a study on the prediction of first grade school achievement with the Bender-Gestalt Test and human figure drawings. They selected six classrooms of grade one children with a mean age of six years and three months.

They found that the Bender-Gestalt Test and the drawings predicted achievement quite well. They noted that both tests had the power to predict, but the predictive power was greater when the tests were used together. A relatively low but significant correlation occurred between the Bender and

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[33] Ibid., p. 415.

[34] E. M. Koppitz, J. Jullivan, et al., "Prediction of First Grade School Achievement with the Bender-Gestalt Test and Human Figure Drawings," Journal of Clinical Psychology. Vol. 15 (1959), pp. 164-168.

the drawings, and it was believed that the assumption was confirmed that the two tests measured primarily different factors but were supplementary to each other. In this group, no significant relationship was found between age and Bender reproductions.

Further studies with figure drawings and Bender designs were published by Koppitz in 1960.[35] The findings suggested that the Bender-Gestalt Test is primarily an indicator of a young child's maturity in visual perception and visual-motor coordination and is only slightly influenced by emotional factors. The human figure drawings revealed significant differences when scored as emotional indicators.

Another study of the Bender-Gestalt Test on young children was undertaken by Koppitz in 1960.[36] The sampling population consisted of 1055 school children in forty-four classes in eleven schools, rural, small-town, and urban. The age range was from five years to ten years five months. The Bender-Gestalt was scored in four categories - distortion

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35 E. M. Koppitz, "Teacher's Attitude and Children's Performance on the Bender-Gestalt Test and Human Figure Drawings," Journal of Clinical Psychology. Vol. 16, No. 2 (April, 1960), p. 204.

36 E. M. Koppitz, "The Bender Gestalt Test for Children: A Normative Study," Journal of Clinical Psychology. Vol. 16, No. 4 (October, 1960), pp. 432 ff.

of shape, rotation, integration, and perseveration.

The results were as follows:

1. Girls seem to mature a little earlier than boys do in visual motor function, yet none of the differences were statistically significant at any of the age levels tested.

2. Mean Bender-Gestalt scores decrease as the subjects get older, i.e. the performance improves with age.

3. There is a marked change in the scores between the ages of five and seven years, and then it becomes more gradual. It seems to level off at age nine when sufficient maturity in visual motor perception has been acquired.

4. Up to the age of eight years the Bender-Gestalt Test discriminates both those with outstanding visual motor perception and those with immature visual motor function.

5. After levelling off the Bender-Gestalt test can no longer be used to screen out exceptionally capable children. However, it clearly differentiates those whose visual motor perception is below what would be normally expected on each of the age levels investigated.

6. No statistically significant differences were found between the mean Bender scores or mean time scores for boys and girls.[37]

Koppitz noted that time seems to be of importance only if a child is very slow or very fast. Her impressions were that the slow-working child was likely to have difficulty in school since he was unable to complete his work on time,

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[37] Ibid., pp. 432 ff.

and the fast working child usually showed lack of concentration and effort to carry through the details required by the task. She suggested that a very short time was associated with poor test performance and with poor school achievement.

Aileen Clawson[38] (1959) examined the Bender-Gestalt Test as an index of emotional disturbance in young children. She concluded that meaningful diagnostic signs were present in the children's Bender records.

F. Lachmann[39] (1960) investigated the relationship between perceptual-motor development and reading disability in children ages 8-0 to 11-11. He set up two age levels (8-0 to 9-11, and 10-0 to 11-11) and three groups of children, those retarded in reading, those emotionally disturbed but normal readers, and those who were classed as normal children. He attempted to show that certain aspects of the Bender-Gestalt Test would differentiate among the three diagnostic groups and between the two age levels.

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38 A. Clawson, "The Bender-Gestalt Test as an Index of Emotional Disturbance in Children," Journal of Projective Techniques. Vol. 23, No. 2 (June, 1959), pp. 198-206.

39 F. M. Lachmann, "Perceptual-Motor Development in Children Retarded in Reading Ability," Journal of Consulting Psychology. Vol. 24, No. 5 (1960), pp. 427 ff.

The Bender Deviations under study were:

1. Difficulty in constructing angles
2. Rotation of figures
3. Primitivization of figures
4. Inability to maintain slant

The results showed that distortions were found more frequently in records of children with a reading disability than with normal performers. With children retarded in reading and emotionally disturbed children, the difference was just below a significant level. Lachmann concluded that the hypothesis received some support from his findings but it could not explain fully the presence of reading disorders. He drew no etiological implications from his study.

Throughout these studies the findings suggest that visual-motor perception is measured more readily in young children if some type of pattern copying test is used. From studies such as the Koppitz series the importance of the Bender-Gestalt Test as a sensitive measure of visual-motor development is underlined. The studies show that particular features of the Bender Test tend to reflect the readiness of children for certain learning acts, especially those relating to reading tasks. With young children the findings suggest that the Bender is less sensitive to factors of emotional disturbance and is more aligned to factors of development.

Scoring procedures for the Bender have been devised, although the published methods tend to be cumbersome. Refinement of the scoring procedures has been recommended, and several attempts have been made in this area.

Much experimental work with the Bender-Gestalt Test is required to establish it as definite measure of learning readiness. Its original purpose for personality assessment in a battery of clinical tests has not been minimized, but a wider use appears to be evolving. The role of the test in educational psychology seems to be increasing in importance.

Investigators have demonstrated that in a wide age-range the Bender Test shows a relationship to both mental age and chronological age, and in a narrow age-range, mental age remains as an influencing factor. With a normal group of successful learners the sensitivity of the Bender to learning tasks seems to decrease.

Few studies have been recorded on sex differences in the Bender-Gestalt performance of young children. In the study by Fabian, it was noted that boys made more symbol reversals than the girls at the end of Grade One. Reversals were less common in both sexes by the age of eight years, but they occurred almost twice as often in boys. Fabian indicated that these findings were in harmony with the fact that reading retardation was found more frequently among boys. Fabian did not report on sex differences in Bender-Gestalt performance,

but indicated that design rotations in young children were an expression of the same kind of developmental process.

Baldwin pointed out the need for studies involving the comparison of good and poor readers of similar age and school experience. Earlier, Hildreth had noted the tendency for poor readers to make more reversals than good readers.

From this it could be concluded that an effective study of the Bender would be one in which a narrow age range and narrow range of mental ability had been established. If this were carried out with very young children, the role of development as measured by the Bender-Gestalt Test in relation to learning tasks would be more clearly delineated. In addition, it would be possible to obtain some assessment of sex differences for good and for poor readers, and for Bender-Gestalt performance.

The present study was undertaken to examine more closely the effectiveness of the Bender-Gestalt Test as a measure of learning readiness. In order to test the relationship between perceptual development and reading achievement in young children and reduce the influence of intellectual development, chronological age and mental age factors were controlled.

For this study the original Pascal and Suttell scoring method of the Bender-Gestalt Test was selected because its

reliability and validity had been relatively well established, although the subjective features and the complexity of scoring had been recognized.

A study of perceptual development in young children in relation to school achievement has significance for educators, although the literature implies that conclusions must be only tentative because of the many unknown factors in the nature of perception. Whether or not the Bender-Gestalt Test is an actual measure of visual perceptual development in children could very well be argued. Studies do suggest that the factors measured by this test show a relationship in young children to the factors involved in beginning reading tasks. Investigators indicate that these factors appear to be of a visual-perceptual nature.

With these facts in mind, this study presents the hypothesis that within a narrow age range and narrow range of mental ability in Grade One children, the Bender-Gestalt Test will show a greater number of distortions for children with reading difficulties than for those of a comparable group of successful readers.

CHAPTER IV

EXPERIMENTAL PROCEDURE

The Hypotheses

The null hypotheses guiding this study were as follows:

1. There is no significant difference between scores on the Bender Visual-Motor Gestalt Test for Grade One children of normal intelligence with reading difficulties and scores of a group comparable in age and intelligence who are successful in reading.

2. (a) There is no significant correlation between scores on the Bender Visual-Motor Gestalt Test and reading scores for good readers.

(b) There is no significant correlation between scores on the Bender Visual-Motor Gestalt Test and reading scores for poor readers.

3. (a) There is no significant difference in the numbers of boys and of girls found in the group of successful readers.

(b) There is no significant difference in the numbers of boys and of girls found in the group of unsuccessful readers.

4. (a) There is no significant difference between Bender Visual-Motor Gestalt scores for boys and for girls in the group of successful readers.

(b) There is no significant difference between Bender Visual-Motor Gestalt scores for boys and for girls in the group of unsuccessful readers.

Testing Instruments

The tests used in this study were:

1. The Bender Visual-Motor Gestalt Test, as a measure of visual-motor development

2. The Gates Primary Reading Test, Type 1, Word Recognition for Grade One and Grade Two (first half), as a measure of proficiency in word recognition

3. Intelligence test scores were taken from school records where available, and were supplemented with additional tests if needed. The instrument used was the California Test of Mental Maturity, Primary Short Form, 1950.

Selection of Cases

The area for population selection was chosen through conference with a member of the Metropolitan Planning

Commission and Welfare Council of Greater Winnipeg.[1] With reference to maps of the Metropolitan area detailing the socio-economic levels of various groups and with information obtained from the report of the Commission,[2] it was determined that a sample could be obtained from three schools in the School Division of Winnipeg, in a section of the city known as "an area in transition."[3] In this district, similarities were noted in housing, national background, income level, and community services. The three schools selected were John M. King, Wellington, and Montcalm. School boundaries were delineated by the Winnipeg School Board Office.

For the sampling population, eight classes of Grade One children consisting of 178 pupils were chosen from these three schools. Ninety-five children were from John M. King School, fifty-seven from Wellington, and twenty-six from Montcalm. From the total group, children in the first year in Grade One, ages 6-7 to 7-6 within the I.Q. range 101 to 115, were selected. Children with severe language and emotional problems, and known defects of vision and hearing

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1 Interview with T. Haxby, Metropolitan Planning Commission and Welfare Council of Greater Winnipeg, June, 1960.

2 Proceedings of "Areas in Transition Committee of the Welfare Council of Greater Winnipeg," 1959, a mimeographed report issued by the Welfare Council of Greater Winnipeg.

3 Ibid., p. 1.

were eliminated from this group.

Fifty subjects were chosen from the sample in the selected age and I.Q. range. These included the top twenty-five readers who scored at least five points above the total group reading median, and the bottom twenty-five who scored at least five points below the total group median. These groups were designated as successful and unsuccessful readers.

In order to demonstrate that the groups were drawn from the same population, and were comparable in chronological age and intelligence, and yet different in reading ability, the Mann-Whitney U Test for two-sample studies was applied.[4] A two-tailed test was used for age and I.Q. as direction was not indicated.

Direction, in this sense, refers to a prediction as to whether or not one group median is significantly higher or lower than the other. Since no prediction was made regarding chronological age and I.Q., direction was not indicated. A one-tailed test was used in measuring differences in reading, as a prediction was made regarding these scores, and steps were taken to ensure that differences would exist.

Table 1 shows the range of scores and medians for each category, and Table 2 shows the significance of the difference between the groups of successful and unsuccessful readers. Basic data for Tables 1 and 2 are presented in

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[4] S. Siegel, Nonparametric Statistics for the Behavioral Sciences. New York, Toronto, London: McGraw-Hill Book Co., Inc., 1956, pp. 120-126.

TABLE 1

RANGE OF SCORES AND MEDIANS FOR CHRONOLOGICAL AGE, I.Q., AND READING SCORES

Groups	N	C.A.	Mdn.	I.Q.	Mdn.	Rdg.	Mdn.
Unsuccessful Readers	25	6-7 to 7-6	7-0	101 to 115	107	3 to 20	16
Successful Readers	25	6-7 to 7-5	7-1	103 to 114	109	30 to 47	35

TABLE 2

DIFFERENCES BETWEEN THE GROUPS FOR CHRONOLOGICAL AGE, I.Q., AND READING SCORES

	Successful R_1	Unsuccessful R_2	U	p
C.A.	687.5	587.5	262.5[a]	.33
I.Q.	719	556	231[a]	.11
Rdg.	950	325	0	.00003**

** Significant at the .01 level.

[a] Corrected for ties.

Tables 10 to 22 in the Appendix (B and C).

The values of U indicated that the only significant difference occurred between reading scores for good and poor groups. Differences in age and I.Q. scores were not significant and were considered to be due to chance. Therefore, on the basis of these findings, two groups of children were found representative of the same population, similar in chronological age and intelligence, but very different in skill in word recognition.

Method of Investigation

After satisfying the criteria for sample selection as outlined in the previous section, the children in these two groups were given the Bender-Visual-Motor Gestalt Test. The Bender records of the selected sample were quantified, scored, and tabulated according to the Pascal-Suttell scoring manual.[5] (For score sheet, see Appendix H.) It should be noted that this scoring proceeded only after scoring a number of sample records provided in the manual to bring the examiner's appraisals into line with those of the authors of the manual.

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[5] G. R. Pascal and B. Suttell, The Bender-Gestalt Test, Quantification and Validity for Adults. New York: Grune and Stratton, 1951.

When the scoring was completed, the following procedures were used to test the hypotheses:

1. In order to ascertain the significance of the differences between the Bender-Gestalt records of successful and unsuccessful readers, the Mann-Whitney U Test was applied. A one-tailed test was used to test the hypothesis since the direction of the test was in favor of the good readers. The probability of .01 or less was accepted as significant.

2. In order to test for correlation between reading and Bender-Gestalt scores the Spearman rank correlation technique was used.

3. The differences between the numbers of boys and girls in the group of successful readers, and between the numbers of boys and girls in the group of unsuccessful readers were tested by the formula,[6]

$$t = \frac{P_1 - P_2}{\sqrt{PQ\left(\frac{1}{N_1} + \frac{1}{N_2}\right)}} \quad \text{with } (N_1 + N_2 - 2) \text{ d/f}$$

P_1 = % of boys in sub-group
P_2 = % of girls in group
P = the pooled percentage of boys in the total group given by:

$$P = \frac{N_1P_1 + N_2P_2}{N_1 + N_2}$$

$$Q = (100 - P)$$

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[6] H. E. Garrett, Statistics in Psychology and Education. New York, London, Toronto: Longmans, Green & Co., 1953, Fourth Edition, pp. 236-237.

4. In order to test for differences in performance on the Bender-Gestalt Test between boys and girls, the Mann-whitney U Test was used and direction was predicted. The hypothesis was accepted at the .01 level of significance.

In addition to testing the hypotheses, further analysis of the Bender-Gestalt records was necessary to assess the significance of the various subtests and items within the subtests in terms of successful and unsuccessful readers. The following procedures were used:

1. To determine the differences between the single subtest scores, the Mann-Whitney U Test was selected as the most powerful measure of differences for these scores. The .01 level of significance for one-tailed tests was used to test the hypothesis.

2. To measure the differences between each scorable item for each subtest, means were established and the differences between the means were tested.[7]

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[7] Ibid., p. 224.

$$t = \frac{M_1 - M_2}{\sqrt{\frac{\Sigma(X_1 - M_1)^2 - \Sigma(X_2 - M_2)^2}{(N_1 - 1) + (N_2 - 1)} \left(\frac{N_1 + N_2}{N_1 N_2}\right)}}$$

with $(N_1 + N_2 - 2)$ d/f

3. A critical score on the Bender-Gestalt Test was obtained by inspecting the raw scores (Table 18 in Appendix C), and identifying the score above and below which the group could be divided into good and poor readers.

Summary

This chapter outlines the experimental procedures for the study. The four hypotheses dealing with differences in Bender-Gestalt performance of good and of poor readers, and with sex differences in reading and in Bender-Gestalt performance, were presented. The testing instruments used were the Bender Visual-Motor Gestalt Test, the Gates Primary Reading Test of Word Recognition, and the California Test of Mental Maturity, Primary Short Form.

In the sample selection, it was established that the two groups were drawn from the same population, and were comparable in chronological age and intelligence, but different in skill in word recognition.

The Mann-Whitney U Test was used to test for differences between the groups of successful and unsuccessful readers in intelligence, chronological age, and reading. The chapter

indicated that this test would be used to measure differences in Bender-Gestalt performance. Other statistical measures to be employed included a "t" test to determine differences in percentages of boys and girls within and across the groups, and a "t" test to determine mean differences in the Bender-Gestalt item-analysis. The Spearman rank correlation coefficient was to be used to assess the relationship between reading and Bender-Gestalt Scores.

The following chapter presents the data and the results of the statistical analysis.

CHAPTER V

PRESENTATION OF THE DATA

Testing the Hypotheses

The first null hypothesis suggested that scores on the Bender Visual-Motor Gestalt Test would not be significantly higher for the selected group of unsuccessful readers than for the successful readers. A high score on the Bender-Gestalt Test was considered to be less desirable than a low score. Table 3 presents the findings in terms of Bender-Gestalt raw scores for each group. Additional basic data are found in Table 23 of Appendix D.

According to Table 3, a significant difference was obtained between the Bender-Gestalt Test scores for good and poor readers in favor of the good group. The findings show that more scorable deviations occurred in the Bender-Gestalt responses of poor readers than in the responses of good readers. Therefore, the first null hypothesis was rejected at the .01 level.

The second hypothesis stated that scores on the Bender-Gestalt Test and reading would not yield a correlation significantly different from zero. Table 4 shows the significance of the obtained correlations for each of the

TABLE 3

DIFFERENCES BETWEEN BENDER-GESTALT SCORES FOR EACH GROUP

	Successful (N-25)	Unsuccessful (N-25)		
	R_1	R_2	U	p
B-G Scores	425.5	849.5	100.5	.00003**
Median	59	90		
Range	25 to 155	45 to 157		

** Significant at the .01 level.

TABLE 4

SPEARMAN RANK CORRELATIONS FOR BENDER-GESTALT AND READING FOR EACH GROUP

	N	d^2	r_s	p
Successful	25	1861.5	.28[a]	.05
Unsuccessful	25	1234.25	.52[a]	.005**

** Significant at the .01 level.

[a] Corrected for ties.

reading groups. The basic data are given in Tables 35 and 36 in Appendix E.

The findings in Table 4 indicated a significant correlation between reading and Bender-Gestalt scores for the group of poor readers. That is, a significant correlation occurred between a high score on the Bender-Gestalt Test and a low score in reading. However, the correlation for good readers was not significant at the .01 level, which indicated a correlation that could readily arise from chance.

To test the third null hypothesis, that there is no difference between the numbers of girls and boys found in the groups of successful and unsuccessful readers, percentage differences were determined. Table 5 shows the percentage differences between boys and girls within each group, and Table 6 shows the percentage differences between boys in each group, and between girls in each group. Data for these two tables were taken from Tables 37 to 40 in Appendix F.

Tables 5 and 6 show that percentage differences between boys and girls within each group, between boys in good and poor groups, and between girls in the groups of successful and unsuccessful readers were all significant at the .01 level. On the basis of these findings, the null hypothesis was rejected.

TABLE 5

PERCENTAGE DIFFERENCES BETWEEN BOYS AND GIRLS WITHIN EACH GROUP

	Boys (N=22)		Girls (N=28)			
Groups	N_b	$\%_b$	N_g	$\%_g$	D%	t
Successful	5	22.7	20	71.4	14.14	3.45**
Unsuccessful	17	77.3	8	28.6	14.14	3.45**

** Significant at the .01 level

TABLE 6

PERCENTAGE DIFFERENCES BETWEEN BOYS IN EACH GROUP AND GIRLS IN EACH GROUP

	Group I (N=25)		Group II (N=25)			
	N	% Successful	N	% Unsuccessful	D%	t
Boys	5	20%	17	68%	14.04	3.42**
Girls	20	80%	8	32%	14.04	3.42**

** Significant at the .01 level.

The fourth null hypothesis indicated that within each group there would be no difference in Bender-Gestalt performance for boys and girls. The results are shown in Table 7. These findings were obtained from the basic data in Tables 24 and 25 of the Appendix D.

Since the differences between the Bender-Gestalt performance of boys and girls within each group were not significant at the .01 level, the fourth hypothesis was accepted.

To summarize:

1. The null hypothesis of no significant difference between scores on the Bender Visual-Motor Gestalt Test for Grade One children of normal intelligence with reading difficulties from scores of a group comparable in age and intelligence who are successful in reading was rejected at the .01 level.

2. (a) The hypothesis that there is no significant correlation between scores on the Bender Visual-Motor Gestalt Test and reading scores for good readers was accepted, as the obtained correlation could have occurred from chance.

(b) The hypothesis that there is no significant correlation between scores on the Bender Visual-Motor Gestalt Test and reading scores for poor readers was rejected, as the correlation was significant at the .01 level.

TABLE 7

DIFFERENCES BETWEEN BENDER-GESTALT SCORES OF BOYS AND GIRLS WITHIN EACH GROUP

	Boys (N=5)	Girls (N=20)	U
Successful	$R_1 = 79.5$	$R_2 = 245.5$	35.5[a]
	Girls (N=8)	Boys (N=17)	
Unsuccessful	$R_1 = 103.5$	$R_2 = 221.5$	67.5[b]

[a] Significant at the .01 level with U = 16.

[b] Significant at the .01 level with U = 28.

3. (a) The null hypothesis of no significant difference in the numbers of boys and girls found in the group of successful readers was rejected at the .01 level.

(b) The hypothesis that there is no significant difference in the numbers of boys and girls found in the group of unsuccessful readers was rejected at the .01 level.

4. (a) The hypothesis that there is no significant difference between Bender Visual-Motor Gestalt scores for boys and girls in the group of successful readers was supported by the findings, and therefore, accepted.

(b) The hypothesis that there is no significant difference between Bender Visual-Motor Gestalt scores for boys and girls in the group of unsuccessful readers was accepted.

Bender-Gestalt Subtest Findings

Each subtest of the Bender-Gestalt Test was treated statistically with the Mann-Whitney U test in order to determine the significance of differences for single designs within the test in differentiating between good and poor readers. The basic data are in Tables 26 to 34 in Appendix D, and the summary of the findings is shown in Table 8.

For this study, Designs 2, 3, 4, 6, 7, and 8 differentiated significantly at the .01 level. This would suggest

TABLE 8

DIFFERENCES BETWEEN THE BENDER-GESTALT SUBTEST SCORES FOR SUCCESSFUL AND UNSUCCESSFUL READERS

	Successful (N=25)	Unsuccessful (N=25)		
Designs	R_1	R_2	U	p
1	551	724	226	.0465
2	479	796	154	.0011**
3	494	781	169	.0027**
4	493	782	168	.0025**
5	607.5	667.5	282.5	.4761
6	432	843	107	.00005**
7	482.5	781.5	157.5	.001 **
8	486.5	765.5	161.5	.0018**
Config.	525.5	729.5	200.5	.0146

** Significant at the .01 level.

that most of the subtests in the Bender-Gestalt Test have the potential for discriminatory power in assessing learning difficulties.

Bender-Gestalt Subtest Items

In order to assess more fully the nature of the discriminating features of each design, the specific scorable deviations were examined item by item for each Bender-Gestalt record. Since scores could not be ranked, mean differences were obtained for each item, and the significance of these was tested. Table 9 shows the results taken from the basic data in Tables 41 to 49 in Appendix G.

Scorable items at both the .01 level and .05 level were presented to facilitate appraisal of the significant kinds of deviations that differentiated between the groups. The results show that at the .01 level there are seven significant types of deviations which occur in Designs 3, 4, 5, 6, 7, and 8. At the .05 level, twelve additional deviations were found relative to all designs, except design 5.

TABLE 9

DIFFERENCES FOR DISCRIMINATING SUBTEST DEVIATIONS IN THE BENDER-GESTALT TEST

Design	Deviation	t[a]
1	Wavy line	2.37
2	Shape of circle	2.18
3	Asymmetry	3.53**
	No. of dots	2.37
4	Tremor	3.20**
	Curls	2.05
	Second attempt	2.50
5	Workover	3.82**
6	Curve extra	3.66**
	Asymmetry	2.15
	Angles	2.40
	Distortion	2.66
7	Double line	3.00**
	Distortion	2.90**
	Angles missing	2.15
8	Angles missing	4.00**
	Double line	2.10
Config.	Overlap	2.48

** Significant at the .01 level.

[a] t = 2.68 at the .01 level and 2.01 at .05.

Critical Score

Inspection of the total scores on individual Bender Visual-Motor Gestalt records (Table 18, Appendix C) reveals that if a critical score of 75 is selected, 88% of the successful readers are found below this score, and 80% of the unsuccessful readers are found above it. That is, eight children (three good readers and five poor readers) would be misplaced in this sample if such a critical score were used. Further sampling would be necessary to assess the significance of this score, but experimentally, it would be of value.

Discussion

The Bender-Gestalt Test and Reading.--The test findings show that for the selected sample of two groups of Grade One children drawn from the same population and comparable in intelligence, and chronological age, and school experience, a highly significant difference occurred between the groups in response to tests of word recognition and visual-motor control. The difference in reading was anticipated, since the groups were divided on the basis of high and low reading scores, but the difference in performance on the Bender-Gestalt could be only hypothesized. This hypothesis was

verified at the .01 level when tested with the Mann-Whitney U Test.

Correlations.--To assess the relationship of pattern copying to success in reading, the correlations between Bender-Gestalt scores and reading scores were tested for significance. The correlation of .52 for poor readers and Bender-Gestalt scores was shown to be significant at the .01 level. The correlation between high reading scores and low Bender-Gestalt scores was considered not to be significant for this sample. This would suggest that varying degrees of inadequacy on the Bender-Gestalt Test have greater significance for reading failure than correspondingly greater degrees of adequacy have for graduated success. The implication is that once a certain level of maturity is reached in perception of form, degrees of refinement tend to be of less importance in relation to reading activities.

Critical score.--When the Bender-Gestalt raw scores were tabulated for each group, a raw score range of 25 to 155 was established for good readers, and 45 to 157 for unsuccessful readers as shown in Table 3. This would indicate that it is entirely possible for a particular child without reading difficulties to perform inadequately on the Bender Visual-Motor Gestalt Test. Inspection

of the distribution of scores, however, reveals that poor readers usually obtain high scores and good readers, low scores.

By selecting a Bender-Gestalt score, designated as a critical score, it was noted that most of the good readers fell below this score, and most of the unsuccessful readers were above it. The score of 75, selected for this sample, would misclassify three of the good readers and five of the poor readers. Such a score could be of value in the diagnosis of reading difficulties, but would need to be verified as a true critical score by testing a full range of readers at varying age levels.

The range of Bender-Gestalt scores for both groups and the location of a critical score indicate that a child without reading difficulties may give an unsatisfactory response to the Bender Visual-Motor Gestalt Test. This raises doubt regarding the effectiveness of the instrument in detecting reading weakness. The over-all findings suggest that considerable weight could be given to the instrument, but not as a single measure of learning problems. Its place in a battery of tests would be of prime importance, but too much emphasis on this test, alone, could distort the assessment of the learning difficulty.

Bender-Gestalt subtests.--To gain further insight into the discriminating features of the Bender-Gestalt Test, each subtest was examined in relation to reading efficiency. Table 8 shows that significant differences occurred for Designs 2, 3, 4, 6, 7, and 8. These findings would suggest that the test as a whole is a rather powerful predictor of word-reading difficulties at the Grade One level, if used in conjunction with other measures of achievement and ability.

Knowing that particular designs differentiate more significantly than others adds to the diagnostic effectiveness of the Bender-Gestalt Test. However, within each design, the results show that certain kinds of deviations are more likely to occur for children with limited reading success than for good readers. These were presented in detail in Table 9. The significance of these deviations for other developmental levels would need to be tested before assuming that they could aid in differentiating between good and poor readers. However, these findings serve as a significant frame of reference for further testing.

Implications were drawn from single design study by Koppitz[1] in her work with young children. She noted that

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[1] E. M. Koppitz, "The Bender-Gestalt Test and Learning Disturbances in Young Children," Journal of Clinical Psychology. Vol. 14, No. 3 (July, 1958), pp. 292-295.

perseveration in Designs 1, 2, and 6; distortions in A, 3, 5, and 7; substitutions of dashes or circles for dots on 1, 3, 5; and failure to integrate parts on A, 4, 7, had a relationship to difficulties in integration of parts and wholes, and inability to control visual-motor activity. This, she felt, could indicate immaturity in young children, and retardation or possible brain damage in older children.

Sex differences.--In considering sex differences, possibly some of the most interesting findings of this study are shown in Tables 5 and 6. When the percentages of boys and girls were determined, it was shown that most of the boys were within the group of unsuccessful readers, and the greater number of girls in the group of successful readers. It should be noted, however, that when the boys were in the group of good readers, and the girls in the group of poor readers, the Bender-Gestalt Test failed to differentiate between boy and girl performances. Whether or not, different factors were operating to influence reading scores for boys as compared to girls, could not be determined through this study. Of importance were the significant findings between achievement of boys and girls, and between Bender-Gestalt performance of boys and girls.

The literature indicates that differences are to be

expected because of differences in rate of physical development. However, this has serious implications for educators. At the end of the school year it becomes apparent that a number of school children, primarily boys, will either have to repeat or go into a continuing program which in all probability will mean a lost year at some point, according to chronological age and grade placement. This fact has deeper implications when one examines statistical reports from various child service centres. The number of boys referred for learning problems far exceeds the number of girls. The question can be raised - Are these the same children who were unable to maintain the classroom pace for learning at beginning reading stages? If developmental factors relating to the finer processes of perception, audition, and motor responses are involved, are these children being forced into failure situations through no fault of their own? What steps can be taken towards prevention of chronic reading difficulties?

Conclusions.--The findings from this study suggest that a group of children of average mental ability is unable to keep pace with their peers, partly because of differences in visual-perceptual development as reflected through the Bender Visual-Motor Gestalt Test. Correlations for this group show significant relationships between reading and perceptual

development. The need for further study is apparent, but there are indications from the literature and from this analysis that the Bender Visual-Motor Gestalt Test as one of a battery of test would be a reliable and valid instrument in assessing learning difficulties at the primary level.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Summary of the Study

The purpose of the study.--The purpose of this study was to examine the relationship between visual-perceptual development, as measured by the Bender Visual-Motor Gestalt Test, and reading ability of primary school children. The problem was to assess the findings from the Bender-Gestalt Test in relation to reading achievement, and to evaluate the effectiveness of the test in detecting and predicting reading difficulties in primary school children.

The hypotheses.--Four null hypotheses were set up to study the Bender Visual-Motor Gestalt Test in relation to reading difficulties. They were as follows:

1. There is no significant difference between scores on the Bender Visual-Motor Gestalt Test for Grade One children of normal intelligence with reading difficulties from scores of a group comparable in age and intelligence who are successful in reading.

2. (a) There is no significant correlation between scores on the Bender Visual-Motor Gestalt Test and reading scores for good readers.

(b) There is no significant correlation between scores on the Bender Visual-Motor Gestalt Test and reading scores for poor readers.

3. (a) There is no significant difference in the numbers of boys and girls found in the group of successful readers.

(b) There is no significant difference in the numbers of boys and girls found in the group of unsuccessful readers.

4. (a) There is no significant difference between Bender Visual-Motor Gestalt scores for boys and girls in the group of successful readers.

(b) There is no significant difference between Bender Visual-Motor Gestalt scores for boys and girls in the group of unsuccessful readers.

A review of the literature.--A review of the literature included studies and reports pertaining to visual perceptual development, and its role in reading growth, along with a review of the Bender Visual-Motor Gestalt Test in terms of its evolution, its effectiveness as a predictor of learning problems, and systems of quantification.

The study was undertaken to ascertain the significance of factors other than intelligence in successful beginning reading experiences. Studies indicated that perception of

form correlated more closely with pattern-copying than did motor tasks with pattern-copying. Consequently, the pattern-copying tasks involved in the Bender Visual-Motor Gestalt Test were selected to show the maturational aspects of visual perception in relation to reading achievement.

The sampling population.--In selecting a sampling population, Grade One was chosen as this was considered to be a level that would reflect a variety of maturational factors. To control the influence of wide differences in development due to age or intelligence, a narrow age range and narrow range of intelligence were established.

The total Grade One population (178 children) from three schools in adjacent areas which were described as similar in terms of socio-economic development was chosen for study. The Gates word-reading test was administered to this total group and a reading median of 25 was established. Through conference with teachers, and reference to medical cards, children with known gross language, hearing, vision, and emotional problems were eliminated. Group tests of intelligence were administered where necessary, and on the basis of these tests, the very bright and very dull were excluded from the study.

Selection of cases.--In order to establish two groups of readers, an arbitrary division was made five points above and five points below the total group reading median. Within the I.Q. range of 101 to 115, the bottom twenty-five children with scores of 20 or less were selected, and the top twenty-five with scores of 30 or more. These two groups were designated as successful and unsuccessful readers.

To determine whether or not the sample was obtained from the same population, non-parametric statistics were applied. No significant differences occurred between the groups in age and I.Q. scores, but wide differences were obtained in reading scores. Therefore, the groups selected varied widely in word-reading skill, but were comparable in intelligence and chronological age.

Summary of the findings.--The Bender Visual-Motor Gestalt Test was administered to each of the children in the selected groups of good and poor readers. The responses were then tabulated and quantified according to the Pascal-Suttell method. Significant differences occurred between the test responses of the two groups. The correlation between Bender-Gestalt scores and poor reading scores was significant at the .01 level. Six of the eight Bender-Gestalt designs (2, 3, 4, 6, 7, and 8) showed significant differences when

tested. Within the designs, specific types of deviations appeared to be more discriminating in identifying good and poor readers than others. Significant at the .01 level of confidence were: asymmetry in Design 3, tremor in Design 4, workover in Design 5, curve extra in Design 6, double line and distortions in Design 7, and angles missing in Design 8.

The predictive value of deviations on single designs was questioned, as research, to date, tends to be rather limited. However, the value of the complete test in a diagnostic battery was considered to be significant. The use of a critical score (75 for this study) was suggested as a further measure of analysis of learning difficulties.

Although there was a fairly even selection of boys and girls in the total selected sample (44% boys, 56% girls), a higher percentage of boys was found in the group of unsuccessful readers, and more girls were found in the group of successful readers. Within the groups of good and poor readers, there were no significant differences in Bender-Gestalt performance.

Conclusions

Null Hypothesis 1.--There is no significant difference between scores on the Bender Visual-Motor Gestalt Test for Grade One children of normal intelligence with reading difficulties from scores of a group comparable in age and intelligence who are successful in reading was rejected at the .01 level of significance.

Null Hypothesis 2.--(a) There is no significant correlation between scores on the Bender Visual-Motor Gestalt Test and reading scores for good readers was accepted.

(b) There is no significant correlation between scores on the Bender Visual-Motor Gestalt Test and reading scores for poor readers was rejected at the .01 level.

Null Hypothesis 3.--(a) There is no significant difference in the numbers of boys and girls found in the group of successful readers was rejected at the .01 level.

(b) There is no significant difference in the numbers of boys and girls found in the group of unsuccessful readers was rejected at the .01 level.

Null Hypothesis 4.--(a) There is no significant difference between Bender Visual-Motor Gestalt scores for boys and girls in the successful group of readers was accepted.

(b) There is no significant difference between Bender Visual-Motor Gestalt scores for boys and girls in the unsuccessful group of readers was accepted.

The study suggests that the Bender-Gestalt Test is effective in assessing learning difficulties especially at beginning reading levels, but its use as a single measure of readiness would probably be doubtful. The fact that children who are able to read may produce distorted designs, although the majority do not, indicates that the Bender Visual-Motor Gestalt Test should be used only in conjunction with other measures of learning difficulties. From the results obtained, the conclusion could be reached that the maturational aspects of visual perception as revealed through the Bender Visual-Motor Gestalt Test, are significant in relation to the reading act at beginning stages.

Implications for Education

Of particular interest in this study was the occurrence of more boys than girls in the group of unsuccessful readers. Test findings indicated that this was the group experiencing the greatest difficulty in form perception. If this points to a maturational lag in visual perception, and possibly in other areas, what are the implications for educators?

Would it be possible to identify these children through a series of tests and observations, and evolve a program of an ungraded nature designed to meet their particular needs on a group basis? Could this program be operated without grade levels until such time as the teacher felt that a particular child had reached a level of maturity in performance in line with his peer group or close to it? To what extent could auxiliary personnel such as Speech and Hearing therapists, psychologists, reading supervisors, and reading clinicians, contribute to such a program? Would this be the kind of group that would benefit from a rather rigid, definite, multi-sensory approach in reading instruction to establish habits of perceiving printed matter accurately through eye and hand reinforcement? Does this group made up predominantly of boys, require different types of basic materials to catch and sustain interest?

There are no clear-cut answers to these questions, since guidance and experimentation in this area are limited. The questions are raised to point the way to methods and procedures that could be implemented on an experimental basis. The purpose for this experimentation would be to provide graduated learning experiences for a group of children with special problems in order to minimize learning disabilities. The emphasis would be on prevention

of learning problems through careful programming and pacing of instruction. This procedure would tend to reduce the number of children, identified as potential reading problems, who are brought to the point of failure before corrective measures are taken.

The Bender Visual-Motor Gestalt Test was shown to be of value in the assessment of learning problems at beginning stages. The findings suggest that this test or similar types of pattern-copying tests could probably be given increased emphasis in an assessment battery, but would have less weight if used as single measures of development. The wider implications for this study have meaning for the educator in terms of devising methods and procedures for instruction in order to prevent learning disabilities before corrective measures are required.

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APPENDIX A

STATISTICAL TECHNIQUES

Formula Used for Testing Differences Between Selected Groups

Mann-Whitney U Test:[1]

$$U = n_1 n_2 + \frac{n_1(n_1 + 1)}{2} - R_1 \qquad (6.7a)$$

$$U = n_1 n_2 - U' \quad \text{(Smaller value is U)} \qquad (6.6)$$

Correction for Ties:[2]

$$\Sigma T = \frac{t^3 - t}{12}$$

Significance of U:[3]

$$z = \frac{U - \frac{n_1 n_2}{2}}{\sqrt{\frac{(n_1)(n_2)\ (n_1 + n_2 + 1)}{12}}} \qquad (6.8)$$

$$z = \frac{U - \frac{n_1 n_2}{2}}{\sqrt{\left(\frac{n_1 n_2}{N(N - 1)}\right)\left(\frac{N^3 - N}{12} - \Sigma T\right)}} \qquad (6.9)$$

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[1] S. Siegel, Nonparametric Statistics for the Behavioral Sciences. New York, Toronto, London: McGraw-Hill Book Co., Inc., 1956, pp. 116-126.

[2] Ibid., p. 125

[3] Ibid., p. 123, 125

Formula Used for Determining Correlation Coefficients:[4]

$$r_s = \frac{\Sigma x^2 + \Sigma y^2 - \Sigma d^2}{2\sqrt{\Sigma x^2 \Sigma y^2}} \qquad (9.4)$$

Correction for tied scores:[5]

$$\Sigma T_x = \frac{t^3 - t}{12}$$

$$\Sigma T_y = \frac{t^3 - t}{12}$$

$$\Sigma x^2 = \frac{N^3 - N}{12} - \Sigma T_x$$

$$\Sigma y^2 = \frac{N^3 - N}{12} - \Sigma T_y$$

Significance of r_s:[6]

$$t = r_s\sqrt{\frac{N - 2}{1 - r_s^2}} \qquad (9.8)$$

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[4] Ibid., p. 210.

[5] Ibid., p. 209.

[6] Ibid., p. 212.

Formula Used For Determining Percentage Differences:[7]

$$t = \frac{P_1 - P_2}{\sqrt{PQ\left[\frac{1}{N_1} + \frac{1}{N_2}\right]}} \quad \text{with } (N_1 + N_2 - 2) \text{ d/f}$$

P_1 = % of boys in sub-group.

P_2 = % of girls in group.

P = the pooled percentage of boys in the total group given by:

$$P = \frac{N_1P_1 + N_2P_2}{N_1 + N_2}$$

$Q = (100 - P)$

$t = 2.68$ at the .01 level of significance.

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[7] H. E. Garrett, Statistics in Psychology and Education. New York, London, Toronto: Longmans, Green & Co., 1953, Fourth Edition, pp. 236-237.

Formula Used For Testing Differences Between Subtest-Deviations In The Bender Visual-Motor Gestalt Test:

Differences Between Means In Small Independent Samples:[8]

$$t = \frac{M_1 - M_2}{SE_D}$$

$$d/f = N_1 + N_2 - 2$$

$$SE_D = \sqrt{\frac{\Sigma(X_1 - M_1)^2 + \Sigma(X_2 - M_2)^2}{(N_1 - 1) + (N_2 - 1)} \left(\frac{N_1 + N_2}{N_1 N_2}\right)}$$

For this sample:

d/f = 48

t = 2.68 at the .01 level of significance.
= 2.01 at the .05 level of significance.

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8 Garrett, op. cit., p. 224.

APPENDIX B

SUMMARIES OF SCORES FOR INDIVIDUAL PUPILS

TABLE 10

SUMMARY OF SCORES OBTAINED BY EACH INDIVIDUAL IN GROUP ABOVE READING MEDIAN (SUCCESSFUL READERS)

Pupil (N=25)	C.A.	I.Q.	Rdg.	B-G
A	7-5	111	32	116
B	7-2	110	31	55
C	7-0	108	33	70
D	6-11	109	35	155
E	7-5	104	43	54
F	6-9	110	31	64
G	7-4	105	34	48
H	7-3	111	44	105
I	7-5	108	37	66
J	6-7	104	43	71
K	7-4	107	33	59
L	7-4	107	47	57
M	7-1	109	34	66
N	7-4	105	31	60
O	6-8	110	31	59
P	7-1	103	36	46
Q	6-11	112	37	52
R	6-11	113	30	74
S	6-8	111	33	39
T	7-5	110	45	25
U	6-10	112	35	45
V	7-1	110	34	64
W	6-8	109	38	28
X	7-2	114	38	46
Y	6-8	108	36	52

TABLE 11

SUMMARY OF SCORES OBTAINED BY EACH INDIVIDUAL IN GROUP BELOW READING MEDIAN (UNSUCCESSFUL READERS)

Pupil (N=25)	C.A.	I.Q.	Rdg.	B-G
A	6-8	104	10	121
B	7-0	101	9	118
C	6-10	113	15	90
D	7-0	107	19	89
E	7-1	106	19	105
F	7-3	107	20	47
G	7-3	107	16	76
H	6-9	101	3	112
I	6-9	115	16	99
J	7-2	101	13	86
K	7-1	107	18	45
L	6-8	107	16	80
M	6-8	111	18	85
N	6-11	105	4	142
O	7-6	108	16	74
P	7-0	109	17	116
Q	7-2	115	20	60
R	7-4	101	18	136
S	7-0	111	13	86
T	6-7	102	15	121
U	6-11	112	15	109
V	7-0	110	15	110
W	6-11	105	9	157
X	7-2	103	19	84
Y	7-0	110	8	72

TABLE 12

SUMMARY OF RAW SCORES OBTAINED BY GROUP ABOVE READING MEDIAN FOR EACH DESIGN IN THE BENDER-GESTALT TEST

	I	II	III	IV	V	VI	VII	VIII	Config.	Total
	3	2	0	4	3	2	4	7	0	25
	0	0	3	8	3	2	4	4	4	28
	0	5	2	7	4	9	7	5	0	39
	4	0	5	7	8	11	4	4	2	45
	0	0	3	15	5	4	12	4	3	46
	2	7	6	11	4	5	7	4	0	46
	4	8	2	4	0	4	19	7	0	48
	3	2	5	11	9	6	4	8	4	52
	2	2	2	7	7	15	12	5	0	52
	2	4	7	7	9	6	10	3	6	54
	3	2	16	7	8	6	7	4	2	55
	2	7	7	4	4	4	15	4	10	57
	4	10	4	10	3	14	7	5	2	59
	5	10	6	6	5	5	11	11	0	59
	5	7	8	4	6	9	5	10	6	60
	0	4	3	7	18	9	16	5	2	64
	5	5	5	7	3	7	19	9	4	64
	8	2	11	8	13	5	7	12	0	66
	5	2	16	7	8	7	3	16	2	66
	5	5	8	18	8	11	14	1	0	70
	5	2	5	3	10	11	20	11	4	71
	0	10	11	18	3	6	16	4	6	74
	21	11	8	14	5	17	12	15	2	105
	5	7	7	11	13	13	28	24	8	116
	9	40	24	7	7	9	31	18	10	115
Mdn	4	5	6	7	6	7	11	5	2	59

TABLE 13

SUMMARY OF RAW SCORES OBTAINED BY GROUP BELOW READING MEDIAN FOR EACH DESIGN IN THE BENDER-GESTALT TEST

	I	II	III	IV	V	VI	VII	VIII	Config.	Total
	2	2	8	1	5	11	4	8	4	45
	3	5	8	7	7	4	4	7	2	47
	3	5	8	8	8	9	8	11	0	60
	5	8	8	10	4	17	8	4	8	72
	4	10	10	14	2	15	5	8	6	74
	0	2	16	11	5	13	12	16	1	76
	5	10	6	8	9	9	15	8	10	80
	2	19	8	7	5	11	12	9	11	84
	5	18	4	18	8	6	18	8	0	85
	12	5	10	11	10	10	12	8	8	86
	7	12	8	8	3	22	19	5	2	86
	3	10	16	7	7	10	24	8	4	89
	5	2	8	15	5	11	25	10	9	90
	4	12	5	14	8	19	26	9	2	99
	4	10	8	18	7	6	27	17	8	105
	2	14	10	7	5	18	27	16	10	109
	4	21	8	18	9	17	20	5	8	110
	7	14	10	15	7	17	17	21	4	112
	7	7	10	19	7	25	23	14	4	116
	5	8	16	11	7	27	19	21	4	118
	10	9	13	18	7	19	20	21	4	121
	12	18	3	8	7	17	34	19	3	121
	18	5	7	19	9	27	31	16	4	136
	4	26	16	8	5	33	29	15	6	142
	7	8	17	22	13	29	33	28	0	157
Mdn	5	10	8	11	7	17	19	10	4	90

APPENDIX C

FREQUENCY DISTRIBUTION OF SCORES

TABLE 14

DISTRIBUTION OF READING SCORES FOR THE TOTAL GRADE ONE GROUP

Reading Scores *	f
45 - 49	5
40 - 44	13
35 - 39	20
30 - 34	26
25 - 29	30
20 - 24	29
15 - 19	29
10 - 14	14
5 - 9	10
0 - 4	2
N =	178
Mdn. =	25

*Gates Primary Reading Test - Type 1 - Word Recognition.

TABLE 15

DISTRIBUTION OF AGE SCORES
FOR SELECTED GROUPS

C.A.	f (Combined Group)	f (Above Rdg. Median)	f (Below Rdg. Median)
7-6	1	0	1
7-5	4	4	0
7-4	5	4	1
7-3	3	1	2
7-2	5	2	3
7-1	5	3	2
7-0	7	1	6
6-11	6	3	3
6-10	2	1	1
6-9	3	1	2
6-8	7	4	3
6-7	2	1	1
N	50	25	25
Mdn.	7-0	7-1	7-0

TABLE 16

DISTRIBUTION OF I.Q. SCORES
FOR SELECTED GROUPS

I.Q.	f (Combined Group)	f (Above Rdg. Median)	f (Below Rdg. Median)
115	2	0	2
114	1	1	0
113	2	1	1
112	3	2	1
111	5	3	2
110	7	5	2
109	4	3	1
108	4	3	1
107	7	2	5
106	1	0	1
105	4	2	2
104	3	2	1
103	2	1	1
102	1	0	1
101	4	0	4
N	50	25	25
Mdn.	108	109	107

TABLE 17

DISTRIBUTION OF READING SCORES
FOR SELECTED GROUPS

Reading (Raw Score)	f (Combined Group)	f (Above Rdg. Median)	f (Below Rdg. Median)
45 - 49	2	2	0
40 - 44	3	3	0
35 - 39	8	8	0
30 - 34	12	12	0
25 - 29	0	0	0
20 - 24	2	0	2
15 - 19	15	0	15
10 - 14	3	0	3
5 - 9	3	0	3
0 - 4	2	0	2
N	50	25	25
Mdn.	25	35	16

TABLE 18

DISTRIBUTION OF BENDER-GESTALT SCORES FOR SELECTED GROUPS

B - G (Raw Scores)	f (Combined Group)	f (Above Rdg. Median)	f (Below Rdg. Median)
150 - 159	2	1	1
140 - 149	1	0	1
130 - 139	1	0	1
120 - 129	2	0	2
110 - 119	4	1	3
100 - 109	4	1	3
90 - 99	2	0	2
80 - 89	6	0	6
70 - 79	6	3	3
60 - 69	6	5	1
50 - 59	7	7	0
40 - 49	6	4	2
30 - 39	1	1	0
20 - 29	2	2	0
N	50	25	25
Mdn.	73	59	90

TABLE 19

DISTRIBUTION OF BOYS AND GIRLS IN GROUPS ABOVE (+) AND BELOW (-) READING MEDIAN

Total number of girls	28
Total number of boys	22
No. of girls in + group	20
No. of boys in + group	5
No. of girls in - group	8
No. of boys in - group	17

APPENDIX D

APPLICATION OF THE MANN-WHITNEY U TEST

TABLE 20

FINDINGS FROM APPLICATION OF
MANN-WHITNEY U TEST TO I.Q. DIFFERENCES

Group I (n_1) (Above Rdg. Mdn.)		Group II (n_2) (Below Rdg. Mdn.)	
I.Q.	Rank (R_1)	I.Q.	Rank (R_2)
103	6.5	101	2.5
104	9	101	2.5
104	9	101	2.5
105	12.5	101	2.5
105	12.5	102	5
107	19	103	6.5
107	19	104	9
108	24.5	105	12.5
108	24.5	105	12.5
108	24.5	106	15
109	28.5	107	19
109	28.5	107	19
109	28.5	107	19
110	34	107	19
110	34	107	19
110	34	108	24.5
110	34	109	28.5
110	34	110	34
111	40	110	34
111	40	111	40
111	40	111	40
112	44	112	44
112	44	113	46.5
113	46.5	115	49.5
114	48	115	49.5
$n_1=25$	$R_1=719.0$	$n_2=25$	$R_2=556.0$

Table 20 - Continued

Correction for tied scores:

Score	Ties	Score	Ties
101	4	110	7
103	2	111	5
105	4	112	3
107	7	113	2
108	4	115	2
109	4		

$$\Sigma T = \frac{t^3 - t}{12}$$

$$= \underline{\underline{91.5}}$$

Computation for value of U:

$$U = n_1 n_2 + \frac{n_1(n_1 + 1)}{2} - R_1 \qquad (6.7a)$$

$$= 625 + \frac{25\ (26)}{2} - 719$$

$$= \underline{\underline{231}}$$

$$U = n_1 n_2 - U' \qquad (6.6)$$

$$U' = \underline{\underline{394}}$$

Significance of U:

$$z = \frac{U - \frac{n_1 n_2}{2}}{\sqrt{\left(\frac{n_1 n_2}{N(N-1)}\right)\left(\frac{N^3 - N}{12} - \Sigma T\right)}} \qquad (6.9)$$

$$= \frac{231 - 312.5}{\sqrt{\left(\frac{625}{50\ (49)}\right)\left(\frac{50^3 - 50}{12} - 91.5\right)}}$$

Table 20 - Continued

$$z = -\frac{81.5}{51.8}$$

$$= \underline{-1.6}$$

$\therefore p = .0548 \times 2 = .11$ for a two-tailed test.[a]

---

[a] Ibid., p. 247, (Table A).

TABLE 21

FINDINGS FROM APPLICATION OF
MANN-WHITNEY U TEST TO
DIFFERENCES IN CHRONOLOGICAL AGE

Group I (n_1) (Above Rdg. Mdn.)		Group II (n_2) (Below Rdg. Mdn.)	
C.A.	Rank (R_1)	C.A.	Rank (R_2)
6 - 7	1.5	6 - 7	1.5
6 - 8	6	6 - 8	6
6 - 8	6	6 - 8	6
6 - 8	6	6 - 8	6
6 - 8	6	6 - 9	11
6 - 9	11	6 - 9	11
6 - 10	13.5	6 - 10	13.5
6 - 11	17.5	6 - 11	17.5
6 - 11	17.5	6 - 11	17.5
6 - 11	17.5	6 - 11	17.5
7 - 0	24	7 - 0	24
7 - 1	30	7 - 0	24
7 - 1	30	7 - 0	24
7 - 1	30	7 - 0	24
7 - 2	35	7 - 0	24
7 - 2	35	7 - 0	24
7 - 3	39	7 - 1	30
7 - 4	43	7 - 1	30
7 - 4	43	7 - 2	35
7 - 4	43	7 - 2	35
7 - 4	43	7 - 2	35
7 - 5	47.5	7 - 3	39
7 - 5	47.5	7 - 3	39
7 - 5	47.5	7 - 4	43
7 - 5	47.5	7 - 6	50
n_1= 25	R_1= 687.5	n_2= 25	R_2= 587.5

Table 21 - Continued

Correction for tied scores:

Score	Ties	Score	Ties
6 - 7	2	7 - 0	7
6 - 8	7	7 - 1	5
6 - 9	3	7 - 2	5
6 - 10	2	7 - 3	3
6 - 11	6	7 - 4	5
6 - 11	6	7 - 5	4

$$\Sigma T = \underline{\underline{113.5}}$$

Computation for value of U:

$$U = n_1 n_2 + \frac{n_1(n_1 + 1)}{2} - R_1 \qquad (6.7a)$$

$$= 950 - 687.5$$

$$U = n_1 n_2 - U' \qquad (6.6)$$

$$U' = \underline{\underline{362.5}}$$

Significance of U:

$$z = \frac{U - \frac{n_1 n_2}{2}}{\sqrt{\left(\frac{n_1 n_2}{N(N-1)}\right)\left(\frac{N^3 - N}{12} - \Sigma T\right)}} \qquad (6.9)$$

$$z = \frac{262.5 - 312.5}{\sqrt{\left(\frac{625}{50(49)}\right)\left(\frac{50^3 - 50}{12} - 113.5\right)}}$$

$$= -\frac{50}{51.7}$$

$$= \underline{\underline{-.97}}$$

$\therefore p = .1660 \times 2 = \underline{\underline{.3320}}$ for a two-tailed test.[a]

---

[a] Ibid., p. 247, (Table A).

TABLE 22

FINDINGS FROM APPLICATION OF MANN-WHITNEY U TEST TO DIFFERENCES IN READING SCORES

Group I (n_1) (Above Rdg. Mdn.)		Group II (n_2) (Below Rdg. Mdn.)	
Rdg.	Rank (R_1)	Rdg.	Rank (R_2)
30	26	3	1
31	28.5	4	2
31	28.5	8	3
31	28.5	9	4.5
31	28.5	9	4.5
32	31	10	6
32	31	13	7.5
33	33	13	7.5
33	33	15	10.5
33	33	15	10.5
34	36	15	10.5
34	36	15	10.5
34	36	16	14.5
35	38.5	16	14.5
35	38.5	16	14.5
36	40.5	16	14.5
36	40.5	17	17
37	42.5	18	19
37	42.5	18	19
38	44.5	18	19
38	44.5	19	22
43	46.5	19	22
43	46.5	19	22
44	48	20	24.5
45	49	20	24.5
47	50		
n_1= 25	R_1= 950.0	n_2= 25	R_2= 325.0

Table 22 - Continued

Computation for value of U:

$$U = n_1 n_2 + \frac{n_1(n_1 + 1)}{2} - R_1 \qquad (6.7a)$$

$$= 950 - 950$$

$$= 0$$

$$U = n_1 n_2 - U'$$

$$0 = 625 - U' \qquad (6.6)$$

$$U' = \underline{625}$$

Significance of U:

$$z = \frac{U - \frac{n_1 n_2}{2}}{\sqrt{\left(\frac{n_1 n_2}{N(N-1)}\right)\left(\frac{N^3 - N}{12} - T\right)}} \qquad (6.9)$$

$$= \frac{0 - 312.5}{\sqrt{2656.25}}$$

$$= -\frac{312.5}{51.5}$$

$$= \underline{-6.1}$$

$\therefore p < .00003$ for a one-tailed test**

---

[a] Ibid., p. 247, (Table A).

** Significant at the .01 level.

TABLE 23

FINDINGS FROM APPLICATION OF MANN-WHITNEY U TEST TO DIFFERENCES IN BENDER-GESTALT SCORES

Group I (n_1) (Above Rdg. Mdn.)		Group II (n_2) (Below Rdg. Mdn.)	
B-G	Rank (R_1)	B-G	Rank (R_2)
25	1	45	4.5
28	2	47	8
39	3	60	17.5
45	4.5	72	25
46	6.5	74	26.5
46	6.5	76	28
48	9	80	29
52	10.5	84	30
52	10.5	85	31
54	12	86	32.5
55	13	86	32.5
57	14	89	34
59	15.5	90	35
59	15.5	99	36
60	17.5	105	37.5
64	19.5	109	39
64	19.5	110	40
66	21.5	112	41
66	21.5	116	42.5
70	23	118	44
71	24	121	45.5
74	26.5	121	45.5
105	37.5	136	47
116	42.5	142	48
155	49	157	50
n_1= 25	R_1= 425.5	n_2= 25	R_2= 849.5

Table 23 - Continued

Computation for value of U:

$$U = n_1 n_2 + \frac{n_1(n_1 + 1)}{2} - R_1 \qquad (6.7a)$$

$$= 950 - 425.5$$

$$= \underline{\underline{524.5}}$$

$$U = n_1 n_2 - U'$$

$$524.5 = 625 - U'$$

$$U' = 100.5$$

Values for U and U′ reversed[a]

$$\therefore U = \underline{\underline{100.5}}$$

Significance of U:

$$z = \frac{U - \frac{n_1 n_2}{2}}{\sqrt{\frac{(n_1 n_2)\ (n_1 + n_2 + 1)}{12}}} \qquad (6.8)$$

$$= \frac{100.5 - 312.5}{\sqrt{\frac{(25)(25)\ (25 + 25 + 1)}{12}}}$$

$$= \frac{-212}{51.5}$$

$$= \underline{\underline{-4.1}}$$

$\therefore p \leq .00003^{**}$ for a one-tailed test.[b]

---

[a] Ibid., p. 120.

[b] Ibid., p. 247, (Table A).

** Significant at the .01 level.

TABLE 24

FINDINGS FROM APPLICATION OF MANN-WHITNEY U TEST TO DIFFERENCES IN BENDER-GESTALT SCORES OF BOYS AND GIRLS IN POOR GROUP

Girls (n_1)		Boys (n_2)	
B-G	Rank (R_1)	B-G	Rank (R_2)
76	6	45	1
80	7	47	2
84	8	60	3
89	12	72	4
90	13	74	5
109	16	85	9
118	20	86	10.5
121	21.5	86	10.5
		99	14
		105	15
		110	17
		112	18
		116	19
		121	21.5
		136	23
		142	24
		157	25
$n_1=8$	$R_1=103.5$	$n_2=17$	$R_2=221.5$

$U = 136 + 36 - 103.5$

$= \underline{68.5}$

$U' = \underline{67.5}$

$\therefore U = \underline{67.5}$ (smaller value is U)

Critical value of $U \propto .01$ is 28 for a one-tailed test.[a]

[a] Siegel - op. cit., p. 275, (Table K).

TABLE 25

FINDINGS FROM APPLICATION OF MANN-WHITNEY U TEST TO DIFFERENCES IN BENDER-GESTALT SCORES OF BOYS AND GIRLS IN GOOD GROUP

Boys (n_1)		Girls (n_2)	
B-G	Rank (R_1)	B-G	Rank (R_2)
52	8.5	25	1
57	12	28	2
60	15	39	3
71	21	45	4
105	23	46	5.5
		46	5.5
		48	7
		52	8.5
		54	10
		55	11
		59	13.5
		59	13.5
		64	16.5
		64	16.5
		66	18.5
		66	18.5
		70	20
		74	22
		116	24
		155	25
$n_1=5$	$R_1=79.5$	$n_2=20$	$R_2=245.5$

$U = 100 + 15 - 79.5$

$= \underline{\underline{35.5}}$

$U' = \underline{64.5}$

$\therefore U = \underline{\underline{35.5}}$ (smaller value is U)

Critical value of $U_{\alpha} .01$ for a one-tailed test.[a]

[a] Ibid., p. 275, (Table K).

TABLE 26

FINDINGS FROM APPLICATION OF MANN-WHITNEY U TEST TO DIFFERENCES IN DESIGN I OF THE BENDER-GESTALT TEST

Group I (n_1) (Above Rdg. Mdn.)		Group II (n_2) (Below Rdg. Mdn.)	
B-G	Rank (R_1)	B-G	Rank (R_2)
0	3.5	0	3.5
0	3.5	2	10
0	3.5	2	10
0	3.5	2	10
0	3.5	3	16.5
2	10	3	16.5
2	10	3	16.5
2	10	4	23.5
2	10	4	23.5
3	16.5	4	23.5
3	16.5	4	23.5
3	16.5	4	23.5
4	23.5	5	33.5
4	23.5	5	33.5
4	23.5	5	33.5
5	33.5	5	33.5
5	33.5	5	33.5
5	33.5	7	41.5
5	33.5	7	41.5
5	33.5	7	41.5
5	33.5	7	41.5
5	33.5	10	46
8	44	12	47.5
9	45	12	47.5
21	50	18	49
$n_1=25$	$R_1=551$	$n_2=25$	$R_2=724$

Table 26 - Continued

Correction for tied scores:

Score	Ties	Score	Ties
0	6	4	8
2	7	5	12
3	6	7	4

$$\Sigma T = 253.5$$

Computation for value of U:

$$U = 625 + \frac{25(26)}{2} - 551$$

$$= 399$$

$$U' = 226$$

$\therefore$ U = 226 (Smaller value is U)

Significance of U:

$$z = \frac{226 - 312.5}{\sqrt{\frac{625}{50\ (49)}\ \frac{50 - 50}{12} - 253.5}}$$

$$= -\frac{86.5}{51.4}$$

$$= -1.68$$

$\therefore$ p = .0465 for a one-tailed test.[a]

---

[a] Ibid., p. 247, (Table A).

TABLE 27

FINDINGS FROM APPLICATION OF MANN-WHITNEY U TEST TO DIFFERENCES IN DESIGN II OF THE BENDER-GESTALT TEST

Group I (n_1) (Above Rdg. Mdn.)		Group II (n_2) (Below Rdg. Mdn.)	
B-G	Rank (R_1)	B-G	Rank (R_2)
0	2	2	8.5
0	2	2	8.5
0	2	2	8.5
2	8.5	5	19
2	8.5	5	19
2	8.5	5	19
2	8.5	5	19
2	8.5	7	25
2	8.5	8	29.5
2	8.5	8	29.5
4	14.5	8	29.5
4	14.5	9	32
5	19	10	36
5	19	10	36
5	19	10	36
7	25	10	36
7	25	12	41.5
7	25	12	41.5
7	25	14	43.5
8	29.5	14	43.5
10	36	18	45.5
10	36	18	45.5
10	36	19	47
11	40	21	48
40	50	26	49
$n_1=25$	$R_1=479$	$n_2=25$	$R_2=796$

Table 27 - Continued

Correction for tied scores:

Score	Ties	Score	Ties
0	3	8	4
2	10	10	7
4	2	12	2
5	7	14	2
7	5	18	2

$$\Sigma T = 157.5$$

Computation for value of U:

$$U = 625 + \frac{25(26)}{2} - 479$$

$$= 471$$

$$U' = 154$$

$$\therefore U = 154 \text{ (Smaller value is U)}$$

Significance of U:

$$z = \frac{154 - 312.5}{\sqrt{(.26)(10412.5 - 157.5)}}$$

$$= -3.06$$

$p = .001^{**}$ for a one-tailed test.[a]

---

[a] Ibid., p. 247, (Table A).

** Significant at the .01 level.

TABLE 28

FINDINGS FROM APPLICATION OF MANN-WHITNEY U TEST TO DIFFERENCES IN DESIGN III OF THE BENDER-GESTALT TEST

Group I (n_1) (Above Rdg. Mdn.)		Group II (n_2) (Below Rdg. Mdn.)	
B-G	Rank (R_1)	B-G	Rank (R_2)
0	1	3	6.5
2	3	4	9.5
2	3	5	13
2	3	6	17
3	6.5	7	20.5
3	6.5	8	28.5
3	6.5	8	28.5
4	9.5	8	28.5
5	13	8	28.5
5	13	8	28.5
5	13	8	28.5
5	13	8	28.5
6	17	8	28.5
6	17	8	28.5
7	20.5	10	37
7	20.5	10	37
7	20.5	10	37
8	28.5	10	37
8	28.5	10	37
8	28.5	13	42
11	40.5	16	45.5
11	40.5	16	45.5
16	45.5	16	45.5
16	45.5	16	45.5
24	50	17	49
$n_1=25$	$R_1=494$	$n_2=25$	$R_2=781$

Table 28 - Continued

Correction for tied scores:

Score	Ties	Score	Ties
2	3	7	4
3	4	8	12
4	2	10	5
5	5	11	2
6	3	16	6

$$\Sigma T = 195.5$$

Computation for value of U:

$$U = 625 + 325 - 494$$

$$= 456$$

$$U' = 169$$

$$\therefore U = 169 \text{ (smaller value is U)}$$

Significance of U:

$$z = \frac{169 - 312.5}{\sqrt{(.26)(10412.5 - 195.5)}}$$

$$= -2.78$$

$$\therefore p = .0027^{**} \text{ for a one-tailed test.}^{a}$$

---

[a] Ibid., p. 247., (Table A).

** Significant at the .01 level.

TABLE 29

FINDINGS FROM APPLICATION OF MANN-WHITNEY U TEST TO DIFFERENCES IN DESIGN IV OF THE BENDER-GESTALT TEST

Group I (n_1) (Above Rdg. Mdn.)		Group II (n_2) (Below Rdg. Mdn.)	
B-G	Rank (R_1)	B-G	Rank (R_2)
3	2	1	1
4	4.5	7	14
4	4.5	7	14
4	4.5	7	14
4	4.5	7	14
6	7	8	24
7	14	8	24
7	14	8	24
7	14	8	24
7	14	8	24
7	14	10	28.5
7	14	11	32.5
7	14	11	32.5
7	14	11	32.5
7	14	14	37
8	24	14	37
8	24	15	40
10	28.5	15	40
11	32.5	18	44.5
11	32.5	18	44.5
11	32.5	18	44.5
14	37	18	44.5
15	40	19	48.5
18	44.5	19	48.5
18	44.5	22	50
n_1=25	R_1=493	n_2=25	R_2=782

Table 29-- Continued

Correction for tied scores:

Score	Ties	Score	Ties
4	4	14	3
7	13	15	3
8	7	18	6
10	2	19	2
11	6		

$$\Sigma T = 255$$

Computation for value of U:

$$U = 625 + 325 - 493$$

$$= 457$$

$$U' = 168$$

$$\therefore U = 168 \text{ (smaller value is U)}$$

Significance of U:

$$z = \frac{168 - 312.5}{\sqrt{(.26)(10412.5 - 255)}}$$

$$= -2.81$$

$$\therefore p = .0025^{**} \text{ for a one-tailed test.}^{a}$$

---

[a] Ibid., p. 247, (Table A).

** Significant at the .01 level.

TABLE 30

FINDINGS FROM APPLICATION OF MANN-WHITNEY U TEST TO DIFFERENCES IN DESIGN V OF THE BENDER-GESTALT TEST

Group I (n_1) (Above Rdg. Mdn.)		Group II (n_2) (Below Rdg. Mdn.)	
B-G	Rank (R_1)	B-G	Rank (R_2)
0	1	2	2
3	5.5	3	5.5
3	5.5	4	10.5
3	5.5	5	17
3	5.5	5	17
3	5.5	5	17
4	10.5	5	17
4	10.5	5	17
4	10.5	5	17
5	17	7	27.5
5	17	7	27.5
5	17	7	27.5
6	22	7	27.5
7	27.5	7	27.5
7	27.5	7	27.5
8	36	7	27.5
8	36	7	27.5
8	36	8	36
8	36	8	36
9	42	8	36
9	42	9	42
10	45.5	9	42
13	48	9	42
13	48	10	45.5
18	50	13	48
$n_1=25$	$R_1=607.5$	$n_2=25$	$R_2=667.5$

Table 30 - Continued

Correction for tied scores:

Score	Ties	Score	Ties
3	6	8	7
4	4	9	5
5	9	10	2
7	10	13	3

$$\Sigma T = 205.5$$

Computation for value of U:

$$U = 625 + 325 - 607.5$$

$$= 342.5$$

$$U' = 282.5$$

$$\therefore U = 282.5 \text{ (smaller value is U)}$$

Significance of U:

$$z = \frac{282.5 - 312.5}{\sqrt{(.26)(10412.5 - 205.5)}}$$

$$= -.06$$

$$\therefore p = .4761 \text{ for a one-tailed test.}^{a}$$

---

[a] Ibid., p. 247, (Table A).

TABLE 31

FINDINGS FROM APPLICATION OF MANN-WHITNEY U TEST TO DIFFERENCES IN DESIGN VI OF THE BENDER-GESTALT TEST

Group I (n_1) (Above Rdg. Mdn.)		Group II (n_2) (Below Rdg. Mdn.)	
B-G	Rank (R_1)	B-G	Rank (R_2)
2	1.5	4	4.5
2	1.5	6	12.5
4	4.5	6	12.5
4	4.5	9	20.5
4	4.5	9	20.5
5	8	10	24.5
5	8	10	24.5
5	8	11	28.5
6	12.5	11	28.5
6	12.5	11	28.5
6	12.5	13	32.5
6	12.5	15	35.5
7	16.5	17	39
7	16.5	17	39
9	20.5	17	39
9	20.5	17	39
9	20.5	18	42
9	20.5	19	43.5
11	28.5	19	43.5
11	28.5	22	45
11	28.5	25	46
13	32.5	27	47.5
14	34	27	47.5
15	35.5	29	49
17	39	33	50
$n_1=25$	$R_1=432$	$n_2=25$	$R_2=843$

Table 31 - Continued

Correction for tied scores:

Score	Ties	Score	Ties
2	2	10	2
4	4	11	6
5	3	13	2
6	6	15	2
7	2	17	5
9	6	19	2

$$\leq T = \underline{\underline{73}}$$

Computation for value of U:

$$U = 625 + 325 - 432$$

$$= \underline{518}$$

$$U' = \underline{107}$$

$\therefore$ U = $\underline{\underline{107}}$ (smaller value is U)

Significance of U:

$$z = \frac{107 - 312.5}{\sqrt{(.26)(10412.5 - 73)}}$$

$$= \underline{\underline{-3.96}}$$

$\therefore$ p = $\underline{\underline{<.00005}}^{**}$ for a one-tailed test.[a]

---

[a] Ibid., p. 247, (Table A).

** Significant at the .01 level.

TABLE 32

FINDINGS FROM APPLICATION OF MANN-WHITNEY U TEST TO DIFFERENCES IN DESIGN VII OF THE BENDER-GESTALT TEST

Group I (n_1) (Above Rdg. Mdn.)		Group II (n_2) (Below Rdg. Mdn.)	
B-G	Rank (R_1)	B-G	Rank (R_2)
3	1	4	3.5
4	3.5	4	3.5
4	3.5	6	9
4	3.5	8	15.5
4	3.5	8	15.5
5	8	12	21.5
7	11	12	21.5
7	11	12	21.5
7	11	15	26.5
7	11	17	30
7	11	18	31
10	17	19	33.5
11	18	19	33.5
12	21.5	20	37
12	21.5	20	37
12	21.5	23	39
14	25	24	40
15	26.5	25	41
16	28.5	26	42
16	28.5	27	43.5
19	33.5	27	43.5
19	33.5	29	46
20	37	31	47.5
28	45	33	49
31	47.5	34	50
$n_1=25$	$R_1=482.5$	$n_2=25$	$R_2=781.5$

Table 32 - Continued

Correction for tied scores:

Score	Ties	Score	Ties
4	6	16	2
7	5	19	4
8	2	20	3
12	6	27	2
15	2	31	2

$$\leq T = 54.5$$

Computation for value of U:

$$U = 625 + 325 - 482.5$$

$$= 467.5$$

$$U' = 157.5$$

$$\therefore U = 157.5 \text{ (smaller value is U)}$$

Significance of U:

$$z = \frac{157.5 - 312.5}{\sqrt{(.26)(10412.5 - 54.5)}}$$

$$= -2.9$$

$$\therefore p = .001^{**} \text{ for a one-tailed test.}^{a}$$

---

[a] Ibid., p. 247, (Table A).

** Significant at the .01 level.

TABLE 33

FINDINGS FROM APPLICATION OF MANN-WHITNEY U TEST TO DIFFERENCES IN DESIGN VIII OF THE BENDER-GESTAIT TEST

Group I (n_1) (Above Rdg. Mdn.)		Group II (n_2) (Below Rdg. Mdn.)	
B-G	Rank (R_1)	B-G	Rank (R_2)
1	1	5	13
3	2	5	13
4	6	5	13
4	6	7	18
4	6	8	23
4	6	8	23
4	6	8	23
4	6	8	23
4	6	8	23
5	13	8	23
5	13	9	28
5	13	9	28
5	13	10	30.5
7	18	11	33
7	18	14	36
8	23	15	37.5
9	28	16	40.5
10	30.5	16	40.5
11	33	16	40.5
11	33	17	43
12	35	19	45
15	37.5	21	47
16	40.5	21	47
18	44	21	47
24	49	28	50
n_1=25	R_1=486.5	n_2=25	R_2=765.5

Table 33 - Continued

Correction for tied scores:

Score	Ties	Score	Ties
4	7	10	2
5	7	11	3
7	3	15	2
8	7	16	4
9	3	21	3

$$\Sigma T = 98$$

Computation for value of U:

$$U = 625 + 325 - 486.5$$

$$= 463.5$$

$$U' = 161.5$$

$$\therefore U = 161.5 \text{ (smaller value is U)}$$

Significance of U:

$$z = \frac{161.5 - 312.5}{\sqrt{(.26)(10412.5 - 98)}}$$

$$= -2.92$$

$$\therefore p = .0018^{**} \text{ for a one-tailed test.}^{a}$$

---

[a] Ibid., p. 247, (Table A).

** Significant at the .01 level.

TABLE 34

FINDINGS FROM APPLICATION OF MANN-WHITNEY U TEST TO DIFFERENCES IN CONFIGURATION IN THE BENDER-GESTALT TEST

Group I (n_1) (Above Rdg. Mdn.)		Group II (n_2) (Below Rdg. Mdn.)	
B-G	Rank (R_1)	B-G	Rank (R_2)
0	5	0	5
0	5	0	5
0	5	0	5
0	5	1	12
0	5	2	17
0	5	2	17
0	5	2	17
0	5	3	22.5
2	17	4	28
2	17	4	28
2	17	4	28
2	17	4	28
2	17	4	28
2	17	4	28
3	22.5	4	28
4	28	6	37
4	28	6	37
4	28	8	42
4	28	8	42
6	37	8	42
6	37	8	42
6	37	9	45
8	42	10	48
10	48	10	48
10	48	11	50
$n_1=25$	$R_1=525.5$	$n_2=25$	$R_2=729.5$

Table 34 - Continued

Correction for tied scores:

Score	Ties	Score	Ties
0	11	6	5
2	9	8	5
3	2	10	4
4	11		

$$\Sigma T = 305.5$$

Computation for value of U:

$$U = 625 + 325 - 525.5$$

$$= 424.5$$

$$U' = 200.5$$

$$\therefore U = 200.5 \text{ (smaller value is U)}$$

Significance of U:

$$z = \frac{200.5 - 312.5}{\sqrt{(.26)(10412.5 - 305.5)}}$$

$$= -2.18$$

$\therefore$ p = .0146 for a one-tailed test.[a]

---

[a] Ibid., p. 247, (Table A).

APPENDIX E

CORRELATIONS

TABLE 35

SPEARMAN RANK CORRELATIONS BETWEEN BENDER-GESTALT AND READING SCORES FOR GROUP BELOW READING MEDIAN

X (B-G Rank)	Y (Rdg. Rank)	d_i	d_i^2
21.5	20	1.5	2.25
20	21.5	-1.5	2.25
13	15.5	-2.5	6.25
12	4	8	64
15	4	11	121
2	1.5	.5	.25
6	11.5	-5.5	30.25
18	25	-7	49
14	11.5	2.5	6.25
10.5	18.5	-8	64
1	7	-6	36
7	11.5	-4.5	20.25
9	7	2	4
24	24	0	0
5	11.5	-6.5	42.25
19	9	10	100
3	1.5	1.5	2.25
23	7	16	256
10.5	18.5	-8.5	72.25
21.5	15.5	6	36
16	15.5	.5	.25
17	15.5	1.5	2.25
25	21.5	3.5	12.25
8	4	4	16
4	23	-17	289
N = 25	N = 25		Σd^2 1234.25

Table 35 - Continued

Correction for ties:

$\Sigma t_x = \underline{1}$ (Table 16) $\qquad \Sigma t_y = \underline{15.5}$ (Table 17)

$\Sigma x^2 = \underline{1299} \qquad \Sigma y^2 = \underline{1284.5}$

$$r_s = \frac{x^2 + y^2 - d^2}{2\sqrt{\Sigma x^2 \Sigma y^2}} \qquad (9.4)$$

$$= \frac{1299 + 1284.5 - 1234.25}{2\sqrt{(1299)(1284.5)}}$$

$$= \frac{1349.25}{2583.4}$$

$$= \underline{.52}$$

Significance:

$$t = r_s\sqrt{\frac{N - 2}{1 - r_s^2}}$$

$$= .52\sqrt{\frac{23}{1 - .2704}}$$

$$t = .52\ (5.6)$$

$$= \underline{2.912}$$

$\therefore p > .0005 < .005^{**}$ for a one-tailed test with df = 23[a]

---

[a] Ibid., p. 248, (Table B).

** Significant at the .01 level.

TABLE 36

SPEARMAN RANK CORRELATIONS BETWEEN BENDER-GESTALT AND READING SCORES FOR GROUP ABOVE READING MEDIAN

X (Rdg. Rank)	Y (B-G Rank)	d_i	d_i^2
20	24	-4	16
22.5	11	11.5	132.25
18	20	-2	4
12.5	25	-12.5	156.25
4.5	10	-5.5	30.25
22.5	16.5	6	36
15	7	8	64
3	23	-20	400
8.5	18.5	-10	100
4.5	21	-16.5	272.25
18	13.5	4.5	20.25
1	12	-11	121
15	18.5	-3.5	12.25
22.5	15	7.5	56.25
22.5	13.5	9	81
10.5	5.5	5	25
8.5	8.5	0	0
25	22	3	9
18	3	15	225
2	1	1	1
12.5	4	8.5	72.25
15	16.5	-1.5	2.25
6.5	2	4.5	20.25
6.5	5.5	1	1
10.5	8.5	2	4
N = 25	N = 25	$\leq d^2$ = 1861.50	

Table 36 - Continued

Correction for ties:

Σt_x = 11.5 (Table 20) $\quad\quad$ Σt_y = 2.5 (Table 19)

Σx^2 = 1288.5 $\quad\quad$ Σy^2 = 1297.5

$$r_s = \frac{\Sigma x^2 + \Sigma y^2 - \Sigma d^2}{2\sqrt{\Sigma x^2 \, \Sigma y^2}}$$

$$= \frac{1288.5 + 1297.5 - 1861.5}{2\sqrt{(1288.5)\ (1297.5)}}$$

$$= \frac{724.5}{2584.4}$$

$$= .28$$

Significance of r_s:

$$t = r_s\sqrt{\frac{N - 2}{1 - r_s^2}}$$

$$= .28\sqrt{\frac{23}{1 - .0784}}$$

$$= .28\ (4.9)$$

$$= 1.372$$

$\therefore$ $p < .10 > .05$ for a one-tailed test with df = 23[a]

---

[a] Ibid., p. 248, (Table B).

APPENDIX F

TESTS OF SIGNIFICANCE BETWEEN PERCENTAGES

TABLE 37

PERCENTAGES OF BOYS AND GIRLS WITHIN EACH GROUP[a]

		Boys	Girls
Total Group	N	22	28
	%	44%	56%
Successful Readers	N	5	20
	%	22.7%	71.4%
Unsuccessful Readers	N	17	8
	%	77.3%	28.6%

[a] Based on N = 22 (B) N = 28 (G)

TABLE 38

DIFFERENCES BETWEEN PERCENTAGES OF BOYS AND GIRLS WITHIN EACH GROUP

Successful Readers:

$$P = \frac{22\ (22.7) + 28\ (71.4)}{50}$$

$$= 49.97$$

$$\sigma_{D\%} = \sqrt{50\ (50)\left[\frac{1}{22} + \frac{1}{28}\right]}$$

$$= 14.14$$

$$t = \frac{48.7}{14.1}$$

$$t^a = 3.45^{**}$$

Unsuccessful Readers:

$$P = \frac{22\ (\ 77.3) + 28\ (28.6)}{50}$$

$$= 50.03$$

$$\sigma_{D\%} = \sqrt{50\ (50)\left[\frac{1}{22} + \frac{1}{28}\right]}$$

$$= 14.14$$

$$t = \frac{48.7}{14.1}$$

$$t^a = 3.45^{**}$$

[a] Ibid., p. 427, (Table D).

** Significant at the .01 level.

TABLE 39

PERCENTAGE DISTRIBUTION ACCORDING TO GROUPS*

		Boys	Girls
Total Group	N	22	28
	%	44%	56%
Successful Readers	N	5	20
	%	20%	80%
Unsuccessful Readers	N	17	8
	%	68%	32%

*Based on N = 25 for each group.

TABLE 40

DIFFERENCES BETWEEN PERCENTAGES OF BOYS IN GOOD AND POOR GROUPS AND GIRLS IN GOOD AND POOR GROUPS

Boys:

$$P = \frac{25\ (68) + 25\ (20)}{50}$$

$$= \underline{\underline{44\%}}$$

$$\sigma_{D\%} = \sqrt{44\ (56)\ \frac{1}{25} + \frac{1}{25}}$$

$$= \underline{\underline{14.04}}$$

$$t = \frac{48}{14.04}$$

$$t^a = \underline{\underline{3.42}}^{**}$$

Girls:

$t^a = \underline{\underline{3.42}}^{**}$ (Differences = differences for boys.)

[a] Ibid., p. 427, (Table D).

**Significant at .01 level.

APPENDIX G

TESTS OF SIGNIFICANCE BETWEEN SCORES OF GOOD AND POOR READERS ON SINGLE DESIGNS IN THE BENDER-GESTALT TEST

TABLE 41

DIFFERENCES BETWEEN SCORES OF GOOD AND POOR READERS ON DESIGN 1 OF THE BENDER-GESTALT TEST

Design 1	n_1(+)	Score	n_2(-)	Score	M_1	M_2	t
1. Wavy line	9	18	17	34	.72	1.36	2.37*
2. Dot, dash, circle	12	36	12	36	1.44	1.44	0
3. Dashes	1	2	0	0	.08	0	1
4. Circles	1	8	3	24	.32	.96	1.05
5. Number of dots	2	20	3	14	.80	.56	.38
6. Double row	0	0	1	8	0	.32	.31
7. Workover	9	18	12	24	.72	.96	.29
8. Second attempt	0	0	0	0	0	0	0
9. Rotation	0	0	0	0	0	0	0
10. Design missing	0	0	0	0	0	0	0

(+) Good Readers

(-) Poor Readers

TABLE 42

DIFFERENCES BETWEEN SCORES OF GOOD AND POOR READERS ON DESIGN 2 OF THE BENDER-GESTALT TEST

Design 2	n_1(+)	Score	n_2(-)	Score	M_1	M_2	t
1. Wavy line	19	38	21	42	1.52	1.68	.97
2. Dash or dots	7	21	13	39	.84	1.60	1.95
3. Shape of circle	0	0	4	12	0	.48	2.18*
4. Circle miss.,ext.	3	9	8	24	.36	.96	1.76
5. Circles touching	2	10	5	25	.40	1.00	1.25
6. Dev. slant	6	18	8	24	.72	.96	.63
7. No. columns	5	42	3	8	1.68	.64	1.49
8. Fig. on two lines	0	0	7	56	0	2.24	.31
9. Guide lines	0	0	0	0	0	0	0
10. Workover	9	16	11	22	.64	.88	.28
11. Second attempt	0	0	0	0	0	0	0
12. Rotation	0	0	1	8	0	.32	.31
13. Design missing	0	0	0	0	0	0	0

** Significant at .01 level.

* Significant at .05 level.

TABLE 43

DIFFERENCES BETWEEN SCORES OF GOOD AND POOR READERS ON DESIGN 3 OF THE BENDER-GESTALT TEST

Design 3	n_1(+)	Score	n_2)-)	Score	M_1	M_2	t
1. Asymmetry	13	39	23	69	1.56	2.76	3.53**
2. Dot, dash, circle	15	45	20	60	1.80	2.40	1.67
3. Dashes	0	0	2	4	0	.16	1.45
4. Circles	1	8	0	0	.32	0	.31
5. No. dots	8	16	16	32	.64	1.28	2.37*
6. Extra row	1	8	0	0	.32	0	.31
7. Blunting	2	16	3	24	.64	.96	.19
8. Distortion	1	8	0	0	.32	0	.31
9. Guide lines	0	0	0	0	0	0	0
10. Workover	13	26	14	28	1.04	1.15	.39
11. Sec. attempt	0	0	0	0	0	0	0
12. Rotation	1	8	2	16	.32	.64	.59
13. Des. miss.	0	0	1	8	0	.32	.31

**Significant at .01 level.
*Significant at .05 level.

TABLE 44

DIFFERENCES BETWEEN SCORES OF GOOD AND POOR READERS ON DESIGN 4 OF THE BENDER-GESTALT TEST

Design 4	n_1(+)	Score	n_2(-)	Score	M_1	M_2	t
1. Asym. curve	18	54	17	51	2.16	2.04	.31
2. Brk. curve	0	0	0	0	0	0	0
3. Crv. not cent.	12	12	13	13	.48	.52	.08
4. Curls	1	4	6	24	.16	.96	2.05*
5. Not joined	0	0	2	16	0	.64	1.42
6. Crv. rotated	18	54	17	51	2.16	2.04	.31
7. Touch-up	0	0	0	0	0	0	0
8. Tremor	14	56	21	84	2.24	3.36	3.20**
9. Distortion	0	0	0	0	0	0	0
10. Guide lines	0	0	0	0	0	0	0
11. Sec. attempt	0	0	5	15	0	.60	2.50*
12. Rotation	4	32	6	48	1.28	1.92	.73
13. Des. miss.	0	0	0	0	0	0	0

**Significant at .01 level.
*Significant at .05 level.

TABLE 45

DIFFERENCES BETWEEN SCORES OF GOOD AND POOR READERS ON DESIGN 5 OF THE BENDER-GESTALT TEST

Design 5	n_1(+)	Score	n_2(-)	Score	M_1	M_2	t
1. Asymmetry	4	12	3	9	.48	.36	.40
2. Dot, dash, circle	19	57	17	51	2.28	2.04	.63
3. Dashes	0	0	2	4	0	.16	1.45
4. Circles	1	8	1	8	0	.32	.32
5. Ext. join. dts.	16	32	17	34	1.28	1.36	.09
6. Ext. rotations	5	15	3	9	.60	.36	.77
7. No. dots	4	8	5	10	.32	.40	.36
8. Distortion	3	24	2	16	.96	.64	.42
9. Guide lines	0	0	0	0	0	0	0
10. Workover	2	4	13	26	.16	1.04	3.82**
11. Sec. attempt	1	3	1	3	.12	.12	0
12. Rotation	0	0	0	0	0	0	0
13. Des. Miss.	0	0	0	0	0	0	0

**Significant at .01 level.

TABLE 46

DIFFERENCES BETWEEN SCORES OF GOOD AND POOR READERS ON DESIGN 6 OF THE BENDER-GESTALT TEST

Design 6	n_1(+)	Score	n_2(-)	Score	M_1	M_2	t
1. Asymmetry	13	39	20	60	1.56	2.40	2.15*
2. Angles	18	34	23	46	1.36	1.84	2.40*
3. Pt. crossing	9	18	9	20	.72	.80	.07
4. Crv. extra	1	8	11	88	.32	3.52	3.66**
5. Dbl. line	5	6	5	8	.24	.32	.47
6. Touch-up	1	8	2	24	.32	.96	1.10
7. Tremor	17	68	21	84	2.72	3.36	1.33
8. Distortion	1	8	8	64	.32	2.56	2.66*
9. Guide lines	0	0	0	0	0	0	0
10. Workover	0	0	1	2	0	.08	1.00
11. Sec. attempt	2	6	2	8	.24	.32	.27
12. Rotation	0	0	0	0	0	0	0
13. Des. miss.	0	0	0	0	0	0	0

**Significant at .01 level.

*Significant at .05 level.

TABLE 47

DIFFERENCES BETWEEN SCORES OF GOOD AND POOR READERS ON DESIGN 7 OF THE BENDER-GESTALT TEST

Design 7	n_1(+)	Score	n_2(-)	Score	M_1	M_2	t
1. Ends not join.	0	0	0	0	0	0	0
2. Angles ext.	5	15	3	9	.60	.36	.77
3. Angles miss.	7	21	14	42	.84	1.68	2.15*
4. Ext. scatter	7	21	9	27	.84	1.08	.62
5. Dbl. line	9	15	17	30	.60	1.20	3.00**
6. Tremor	20	80	22	88	3.20	3.52	.75
7. Distortion	12	120	19	224	4.80	8.96	2.90**
8. Guide lines	0	0	0	0	0	0	0
9. Sec. attempt	2	6	4	12	.24	.48	.85
10. Rotation	2	16	5	40	.64	1.60	1.23
11. Des. miss.	0	0	0	0	0	0	0

**Significant at .01 level.
*Significant at .05 level.

TABLE 48

DIFFERENCES BETWEEN SCORES OF GOOD AND POOR READERS ON DESIGN 8 OF THE BENDER-GESTALT TEST

Design 8	n_1(+)	Score	n_2(-)	Score	M_1	M_2	t
1. Ends not join.	0	0	0	0	0	0	0
2. Angles ext.	7	21	3	9	.84	.36	1.41
3. Angles miss.	4	12	16	48	.48	1.92	4.00**
4. Ext. scatter	3	9	8	24	.36	.96	1.76
5. Dbl. line	9	13	17	23	.52	.92	2.10*
6. Tremor	20	80	22	88	3.20	3.52	.75
7. Distortion	7	48	11	96	1.92	3.84	1.81
8. Guide lines	0	0	0	0	0	0	0
9. Workover	0	0	1	1	0	.04	1.00
10. Sec. attempt	2	9	2	6	.36	.24	.41
11. Rotation	0	0	0	0	0	0	0
12. Des. miss.	0	0	2	16	0	.64	1.42

**Significant at .01 level.
*Significant at .05 level.

TABLE 49

DIFFERENCES BETWEEN SCORES OF GOOD AND POOR READERS ON CONFIGURATION OF THE BENDER-GESTALT TEST

Configuration	n_1(+)	Score	n_2(-)	Score	M_1	M_2	t
1. Place. Des. A	6	12	5	10	.48	.40	.33
2. Overlap	11	36	15	72	1.44	2.88	2.48*
3. Compression	1	3	3	9	.12	.36	1.04
4. Lines drawn	0	0	0	0	0	0	0
5. Order	13	26	12	24	1.04	.96	.28
6. No order	0	0	1	8	0	.32	.31
7. Relative size	0	0	0	0	0	0	0

* Significant at .05 level.

APPENDIX H

BENDER-GESTALT SCORE SHEET

BENDER-GESTALT SCORE SHEET[1]

Design 1
1. Wavy line(2)_____
2. Dot,dash,cir.(3)_____
3. Dashes (2)_____
4. Circles(8)_____
5. No. dots(2 ea.)_____
6. Dbl. row(8)_____
7. Workover(2)_____
8. Sec.attem.(3 ea.)_____
9. Rotation (8)_____
10. Des. miss (8)_____

Design Total_____

Design 2
1. Wavy line(2)_____
2. Dash or dots(3)_____
3. Shape cir.(3)_____
4. Cir.miss.,ext.(3)_____
5. Cir.touch.(5)_____
6. Dev.slant(3)_____
7. No. col.(2 ea.)_____
8. Fig.on 2 lines(8)_____
9. Guide lines(2)_____
10. Workover(2)_____
11. Sec.attem.(3ea.)_____
12. Rotation(8)_____
13. Des.miss.(8)_____

Design Total_____

Design 3
1. Asymmetry (3)_____
2. Dot,dash,cir.(3)_____
3. Dashes(2)_____
4. Circles(8)_____
5. No.dots(2)_____
6. Extra row(8)_____
7. Blunting(8)_____
8. Distortion(8)_____
9. Guide lines(2)_____
10. Workover (2)_____
11. Sec.attem.(3ea.)_____
12. Rotation(8)_____
13. Des.miss.(8)_____

Design Total_____

Design 4
1. Asym.crv.(3)_____
2. Break crv.(4)_____
3. Crv.not center(1)_____
4. Curls (4)_____
5. Not joined(8)_____
6. Crv.rotat.(3)_____
7. Touch-up(8)_____
8. Tremor(4)_____
9. Distortion(8)_____
10. Guide lines(2)_____
11. Sec.attem.(3ea.)_____
12. Rotation(8)_____
13. Des.miss.(8)_____

Design Total_____

Design 5
1. Asymmetry(3)_____
2. Dot,dash,cir.(3)_____
3. Dashes (2)_____
4. Circles(8)_____
5. Ext.join.dots(2)_____
6. Ext.rotation(3)_____
7. No.dots(2)_____
8. Distortion(8)_____
9. Guide lines(2)_____
10. Workover(2)_____
11. Sec.attem.(3ea.)_____
12. Rotation(8)_____
13. Des.miss.(8)_____

Design Total_____

Design 6
1. Asymmetry(3)_____
2. Angles(2)_____
3. Pt.cross.(2ea.)_____
4. Crv.extra(8)_____
5. Dbl.line(1 ea.)_____
6. Touch-up(8)_____
7. Tremor(4)_____
8. Distortion(8)_____
9. Guide lines(2)_____
10. Workover(2)_____
11. Sec.attem.(3ea.)_____
12. Rotation(8)_____
13. Des.miss.(8)_____

Design Total_____

Design 7
1. Ends no. join(8)_____
2. Angles ext.(3)_____
3. Angles miss.(3)_____
4. Ext.scat.(3)_____
5. Dbl.line(1 ea.)_____
6. Tremor (4)_____
7. Distortion(8ea.)_____
8. Guide lines(2)_____
9. Sec.attem.(3ea.)_____
10. Rotation(8)_____
11. Des.miss.(8)_____

Design Total_____

Design 8
1. Ends no.join(8)_____
2. Angles ext.(3)_____
3. Angles miss.(3)_____
4. Ext.scat.(3)_____
5. Dbl.line(1 ea.)_____
6. Tremor (4)_____
7. Distortion (8ea.)_____
8. Guide lines(2)_____
9. Workover(2)_____
10. Sec.attem.(3ea.)_____
11. Rotation(8)_____
12. Des.miss.(8)_____

Design Total_____

Config. Design
1. Place.Des.A(2)_____
2. Overlap(2ea.)_____
3. Compression(3)_____
4. Lines drawn(8)_____
5. Order (2)_____
6. No order (8)_____
7. Rel.size(8)_____

Total_____

Design Totals

1._____ 5._____
2._____ 6._____
3._____ 7._____
4._____ 8._____
Config._____

Total raw score_____

[1] G.R. Pascal and B. Suttell, The Bender-Gestalt Test, Quantification and Validity for Adults. New York: Grune and Stratton, 1951, p. 209.