THE DEVELOPMENT OF A PERCEPTUAL-MOTOR SCREENING BATTERY FOR SCHOOL CHILDREN

By

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B.A., Clarke College, 1971

ABSTRACT OF THESIS

Submitted in partial fulfillment
of the requirements for the degree
of Master of Arts in Psychology in
the Graduate School of Morehead
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The purpose of this study was to assemble a learning disabilities battery for use as a perceptual motor screening device for elementary school children. Four tests were selected for use in the battery: The Draw-A-Person Test; the Bender Test; the Visual Organization Test; and the Perceptual Organization Test. Analysis of the battery results can provide information on the level of perceptual motor development and generate information for remedial programs. All tests were individually administered by trained classroom staff. The results of the testing were correlated with reading and mathematics grade equivalents of the Metropolitan Achievement Test which was also administered by the teachers. Statistical analysis through multiple regression correlation coefficients supported the hypothesis that perceptual organization, short-term memory and motoric control are related to academic functioning. A study of the battery subtest components indicated that the Perceptual Organization Test was significantly correlated more frequently and at a higher statistical level with achievement data than the Bender Test and accounted for more of the variance. The visual Organization Test and the Draw-A-Person Test were also significantly correlated more times with grade equivalents than was the Bender Test. These results indicate that the P.O.T. may have greater application for the perceptual-motor development screening with children than does the Bender Test.

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Accepted by the faculty of the School of Education, Morehead State University, in partial fulfillment of the requirements for the Master of Arts Degree.

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CHAPTER I

INTRODUCTION

For the past fifty years, researchers have been studying learning disorders and perceptual dysfunctioning. The learning disabled child, according to Clements (1966):

> . . . is near average or above average general intelligence with learning and/or certain behavioral abnormalities ranging from mild to severe, which are associated with subtle deviant functioning of the central nervous system. These may be characterized by various combinations of deficit in perception, conceptualization, language, memory, and control of attention, impulses or motor function.

Although there are many known and unknown factors involved, a general characteristic of learning disabilities, according to several authors (Bannatyne, 1971: Book, 1974; Cruickshank, 1972; McCarthy & McCarthy, 1969; Bender, 1971) is an underlying perceptual-motor impairment. The perceptual-motor impairment impedes the encoding and/or decoding of relevant environmental stimuli. The child may never learn to read, spell, or do arithmetic well because he does not accurately remember what he has seen, or cannot convey in his motoric output what he has seen and retained. The severity of a perceptual-motor impairment ranges from a mild academic problem to a near complete suppression of academic skills. Most children with learning disabilities develop emotional problems connected with their academic handicap as they proceed through their school careers. These emotional problems further complicate and hinder their academic progress. Bukentica (1971) has

advocated screening devices which would identify the pertinent perceptual and motoric factors early in the child's academic career before an emotional overlay can seriously add to the child's academic distress. Ideally, these instruments would be constructed to select children who are high-risk, to describe the type and degree of dysfunctioning, and to generate information leading to instructional programs aimed at intervention and remediation.

Since the term "learning disability" encompasses a range of dysfunctions (e.g., dyslexia, reading; dyscalcula, mathematics; dysgraphia, writing, etc.), it is doubtful that any one test could detect and isolate a specific disability; for example, the Bender Test requires both perceptual and motor activities simultaneously. The primary dysfunction, therefore cannot be isolated. Bukentica (1971) has suggested assembling a test battery which would consist of a basic test which is sensitive to several major factors and two or three other tests which would selectively screen out contributing factors. The battery results would lead to an analysis of a child's learning strategies and individual strengths and weaknesses. Intervention and remediation techniques would adhere to the needs of the individual rather than to place the child in a descriptive category of below or above average. Such a learning disability battery also must be simple to administer and to score because it would be used as a screening tool by classroom staff with minimal training. To date, there is no known battery that fulfills Bukentica's criteria, although there are several tests which would provide useful information as a member of such a learning disabilities battery.

One of the most widely used and oldest screening test with perceptual-motor components is the Bender Test (Bender, 1938; Koppitz, 1964). The Bender Test was originally devised to detect organic dysfunctioning in adults with cerebral trauma or disease, although Bender later realized that the test could also be used as an estimator of perceptual-motor development in adults and children. Early test administration and analysis were limited by the lack of an objective scoring system. Koppitz (1964) eliminated this deficit by providing scoring criteria for the pencil and paper test of copying the nine gestalt figures. A high test score is related to a low developmental age.

The etiology of the low developmental age may be organic, emotional, or perceptual-motoric. Koppitz developed three scoring systems based upon line quality, rotation and various design deviations to detect the presence and extent of the three major handicaps. The Koppitz Developmental Scoring System (1964) has been used extensively by clinical and school psychologists to estimate developmental age. Standardization and normative data were obtained by administering the test to several hundred elementary school-age children from diverse geographical and economic backgrounds. The test-retest method was used to obtain reliability data.

Koppitz provided construct and criterion-related validity by correlating Bender Test results with achievement test data. The Bender Test scores correlated significantly with the Lee-Clark Reading Readiness Test and the Metropolitan Readiness Test (Koppitz, 1964). The test scores were useful in discriminating the high-achievers from the low-achievers. Later studies by Keogh (1969) and Koppitz (1970)

supported these results. The Koppitz scoring system for the Bender Test has one major limitation: children younger than five years of age find the test designs too complex and children older than nine years of age find the designs too simple to provide adequate performance discriminability (Koppitz, 1970).

Gesell and his associates (Gesell and Amatruda, 1948; Ilg and Ames, 1965) used simple geometric designs in their child development studies. They hypothesized that a child's ability to execute increasingly complex figures (circles, triangles, cubes, etc.) was a function of the child's perceptual-motoric development. Their hypothesis was supported by clinical judgment rather than statistical findings. Louder (1956) attempted to provide an objective scoring system for the Gesell figures. The scoring criteria were not defined with sufficient detail to insure reliable scoring.

A perceptual test with minimal motoric expression that is frequently used by school psychologists is the Frostig Test of Visual Perception (Frostig, 1966). The Frostig Test screens five areas of perceptual development; eye-motor coordination; figure ground discrimination; form constancy; position in space; and spatial relation. The subtests require the child to be able to coordinate eye-hand movements, to distinguish stimuli in contrast and comparison contexts, and to detect and organize disassembled objects. The Frostig Test yields a perceptual quotient that is interpreted much like an intelligence quotient. A chief criticism of the test construction is its poor standardization sample and limited reporting of reliability data. The Frostig Test is administered by a trained examiner or teacher.

Another perceptual test, still being researched, is the Bannatyne Test (1971). This test assesses a child's visuo-spatial memory for designs. The object of this test is for the child to point or verbally indicate the correct matching design from a multiple-choice selection. The instrument is still in the research stage and is not available for general usage.

The Draw-A-Person Test (D.A.P.) (Harris, 1963) combines the coordination of perceptual-motoric output with a culture fair intelligence test. The child is asked to draw a picture of a whole person without any stipulation being made upon size, gender, or detail. The D.A.P. is a popular test instrument with psychometrists and psychologists because it generates information regarding the child's level of perceptual-motor maturity as well as personality data. Since personality factors influence the test performance, the D.A.P. is not used as an exclusive indicator of learning disabilities but it does provide a composite of perceptual-motoric and personality factors.

The Hooper Visual Organization Test (V.O.T.) (Hooper, 1958) is a test of perceptual organization abilities. The test task is the visual arrangement of object parts to make a whole. The V.O.T. has been extensively used to indicate organic dysfunctioning in the perceptual sphere. The rationale for using the V.O.T. as a battery subtest includes the hypothesis that without the ability to visually organize written symbols into word units, reading skills are depressed. Reliability data for adults were provided by the split-halves technique, while validity studies compared the test performance of organically impaired individuals with normal individuals.

Current application of the V.O.T. is hampered by the test stimuli. The V.O.T. includes several pictures which are outmoded (clothing), ambiguous (shoes, key, etc.), or culturally biased (lighthouse). A revision of the test stimuli is warranted.

A test that attempts to screen perceptual-motor development as well as short-term memory and linking perceptual input with motoric output is the Clough Perceptual Organization Test (P.O.T.). Short-term memory functions to retain the perceptual stimuli until it is transferred into the motoric modality. The P.O.T. consists of nine geometric designs and a sample of manuscript and cursive writing (Figure 1). Several of the designs (line, square, circle, triangle, diamond) were taken from the Gesell Copy Forms Test (Gesell & Amatruda, 1948; Ilg & Ames, 1965). The P.O.T. was normed by the author.

The purpose of this study was to assemble a perceptual-motor battery for use as an indicator of the level of perceptual-motor functioning as it relates to academic achievement. The battery should be able to detect perceptual, motor and perceptual-motor functioning levels, provide a description of the child's relative strengths and weaknesses, and yield information about remediation. Four tests were selected for inclusion in the battery-- the P.O.T., V.O.T., D.A.P., and Bender.

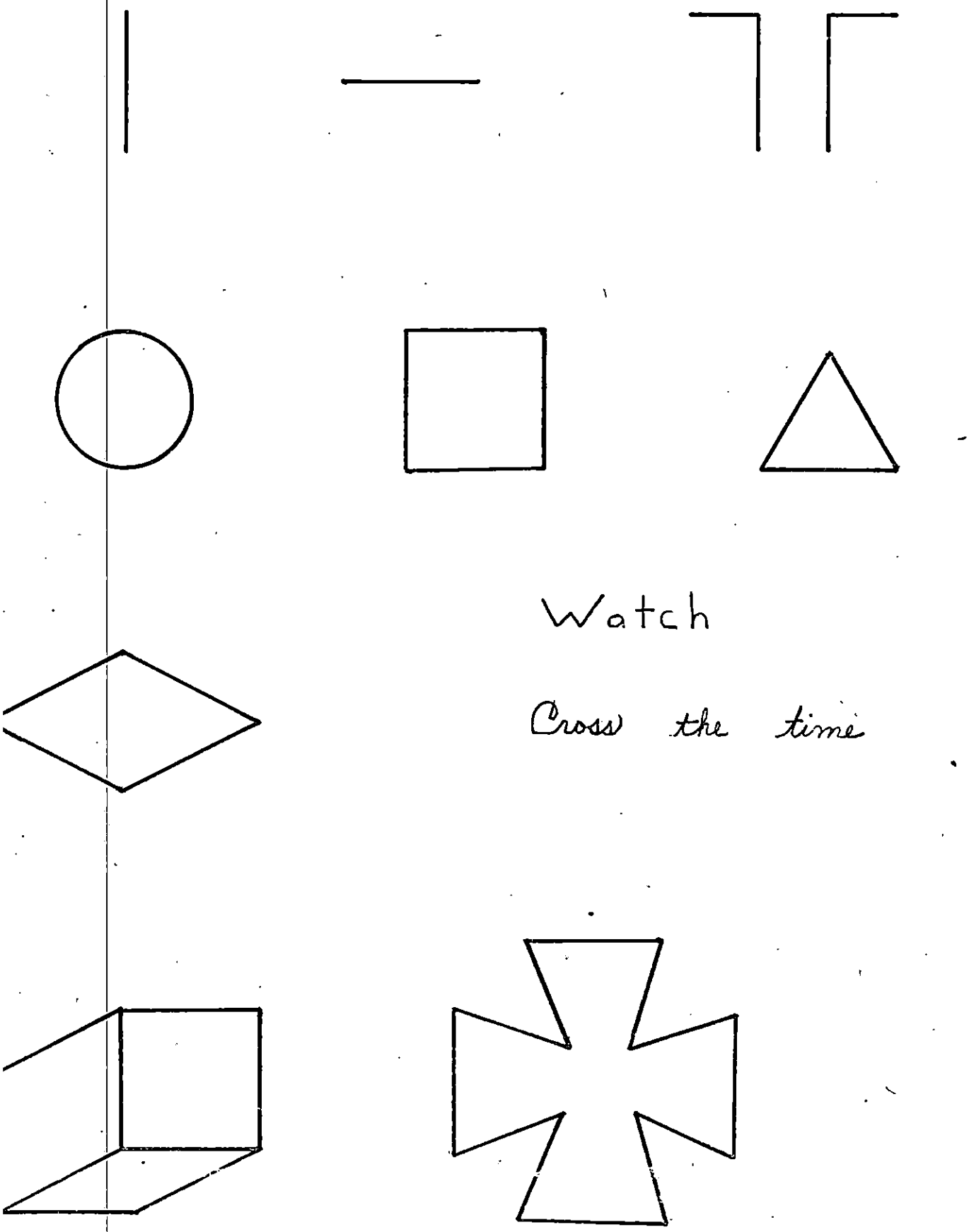

Figure 1. The designs of the Clough Perceptual Organization Test.

The utility of a perceptual-motor screening battery is dependent on its reliability and validity. Criterion-related validity, and more specifically concurrent validity, is applicable to this study. As defined in the A.P.A. standards (APA, 1974), criterion-related is used when an inference is to be made between a test score and the probable result on the criterion variable. The hypothesis of this study is that the scores on perceptual organization, short-term, and motoric control tests are related to the pupils' level of reading and mathematics skills. For this purpose, the perceptual-motor battery was administered to the pupils and the data were correlated with the results of an achievement test. In this instance, statistically significant correlations would indicate a relationship between the present level of perceptual-motor functioning and academic achievement. Although the perceptual-motor scores would not precisely define future performance, an analysis of the individual pupil's battery would generate information concerning possible areas for future improvement and development through remedial education. This study, then, purports to infer concurrent validity because the requirements for a predictive validity study are not met (i.e., there is no training or treatment period.)

CHAPTER II

METHOD

Subjects: The subjects were drawn from thirteen classes for elementary school children (grades 1-3) in the Follow Through Program in Pike County. (This federally funded program is designed to maintain the academic progress these disadvantaged children attained in the Head Start Program.) The number of pupils involved in the study was 259. There were approximately equal groups of first (N=83), second (N-78), and third graders (N-98). The pupils ranged in age from six years to nine years, six months. There were approximately equal numbers of boys and girls. The number used in the normative, reliability, and validity studies was variable because not all test information was available for all students. Fifteen students failed to complete the full test battery due to clerical error or student absence. The achievement data from two classes were unobtainable because the teachers left for summer vacation before the data could be obtained. All data analyses were made on the basis of variable N's for the purpose of utilizing as much data as possible.

Test Selection: The Bender Test was selected as a basic test of perceptual-motor abilities, it does not provide information on the area of dysfunction. A poor test score may result from a perceptual or motoric disability. The V.O.T. was selected to clean out

perceptual dysfunction from the generalized Bender Test. To screen out motoric dysfunctioning from the Bender Test, the D.A.P. was included. The D.A.P. is also invaluable in disclosing attenuating personality factors which might suppress general functioning. Poor D.A.P. and Bender Test scores and an adequate V.O.T. score would point to a motoric dysfunction with a possible additional emotional problem dificit, while average D.A.P. and Bender Test scores and a poor V.O.T. score would lead to the hypothesis of a perceptual dysfunction. A missing part of the learning disability battery, then, is a test which analyzes the short-term memory function which links the perceptual input with the motoric output. The P.O.T. was included to fill this deficit. A poor score and an average Bender, D.A.P. and V.O.T. score would lend itself to a hypothesis of a short-term memory dysfunction.

Administration: The classroom teachers or teacher's aides administered the test battery in a predetermined order (Bender, D.A.P., P.O.T., V.O.T.) on an individual basis. All test administrators received individual instruction in the administration of each of the tests. To insure standardized administration, the teacher read to each pupil a set of instructions prepared by the author (Appendix B).

Scoring: All tests were scored by the author, a graduate student in clinical/school psychology. The method of scoring was supervised by the author's major advisor who taught the scoring procedure and checked approximately twenty test batteries. The Bender Tests were judged according to the Koppitz Developmental Scoring System (1964). The Harris-Goodenough System (Harris, 1963) was used to score the

D.A.P. Tests. The V.O.T. scoring system (Hooper, 1958) was modified after a preliminary survey of test results indicated that several test items were outdated, ambiguous, or culturally biased. For that reason, partial credit was given for predetermined answers not appearing in the manual. A listing of the V.O.T. scoring answers is in Appendix C. All P.O.T.'s were judged according to a system based on the Koppitz system. As with this system, deviations from defined criteria comprised the total score. Each design was judged according to the criteria and the score was subtracted from the total number of deviations possible (Appendix A).

Validity: Concurrent validity was assessed through correlational comparisons with the results of the Metropolitan Achievement Test. The battery subtests were compared individually and as a whole with the mathematics and reading grade equivalents taken from the achievement test data as supplied by the individual classroom teachers.

Data Transposition: To facilitate data interpretation, a transposition was made. Bender Test and P.O.T. scores were subtracted from their respective maximum values, thus eliminating the inverse relationship between these scores and the D.A.P. and P.O.T. scores, and between the correlations of the battery subtests.

CHAPTER III

RESULTS

Scorer Reliability: The test batteries of twenty-five first grade children, scored by the author and independently rescored by a graduate student instructed in the scoring techniques, served as data for the scorer reliability study. An inspection of Table 1 shows that all correlations (Pearson Correlation Coefficients; Guilford, 1956, p. 138) were greater than .95.

Admininstration Reliability: To determine whether there was any difference between teacher and psychometrist administration, a sampling of children (N=14) from four classes from two schools was retested by the author and a graduate assistant one month after the teachers' administration. Because of the samll sample size the data was analyzed using the Spearman Rho technique (Guilford, 1956, p. 286). As may be seen in Table 2, all correlations were significant. The Bender Test retest correlation is lower than the other subtest correlations because of an error in test administration by one teacher.

Normative Data: The normative data by grade level is presented in Table 3. An inspection of this table indicates that scores on tests requiring perceptual-motoric functions increased as a function of increases in chronological age. The D.A.P. scores for all grades are within the average range of intellectual functioning.

TABLE 1

SCORER RELIABILITY DATA FOR TWENTY-FIVE FIRST GRADE TEST BATTERIES

	P.O.T.	D.A.P.	V.O.T.	BENDER
r	.95***	.98***	.99***	.96***
df	23	23	23	23
N	25	25	25	25

***p.> .001

Table 2

TEST-RETEST RELIABILITY CORRELATIONS

	P.O.T.	D.A.P.	V.O.T.	BENDER
p	.91***	.81**	.81**	.66*
N	14	14	10	14

* p.) .01
** p.) .005
*** p.) .001

TABLE 3

TEST MEANS AND STANDARD DEVIATIONS BY GRADE LEVEL FOR THE NORMATIVE POPULATION

		P.O.T.	D.A.P.	V.O.T.	BENDER
First Grade	Mean	37.81	21.34	18.42	20.48
	S.D.	3.50	8.65	4.43	4.98
	N.	81	80	78	80
Second Grade	Mean	39.03	24.58	20.94	21.90
	S.D.	2.80	7.48	4.38	3.51
	N.	78	78	76	78
Third Grade	Mean	41.65	28.83	21.96	24.24
	S.D.	3.04	9.04	4.19	2.82
	N.	96	95	92	96

An inspection of Figure 2 shows the mean subtest data by age level. The test score means show a general increase until the nine year age increment. The irregular variance or drop in the means at this age level occurs because of factors related to the sample. The children in this sample are older than the average age for the third grade placement, which indicates that the children in this sample were probably retained because of illness or failure to succeed.

Correlational Data: The test battery scores were correlated with reading and mathematics grade equivalents derived from the achievement test data. Table 4 shows the intertest correlations for the total sample of elementary school children. Significant correlations were achieved for all but one pairing: (reading grade equivalent with the D.A.P.$_2$ standard scores) however, the correlation between the D.A.P.$_1$ (raw scores) and the reading grade equivalent was significant, indicating a discrepancy between D.A.P. raw and standard scores results. This is probably due to the losses in the value of the raw scores through the normalization process. Females generally do better than do males on the D.A.P. Consequently, females receive a lower standard score than do the males for the same raw scores. Also, the scoring criteria for males and females are different: The Draw-A-Man scale has two more judging criteria than the Draw-A-Woman scale does. Relatively low but significant correlations (e.g. r=.28) were achieved in several pairings.

The intertest correlations by grade level are recorded in Table 5. The Bender Test is significantly correlated fewer times with reading

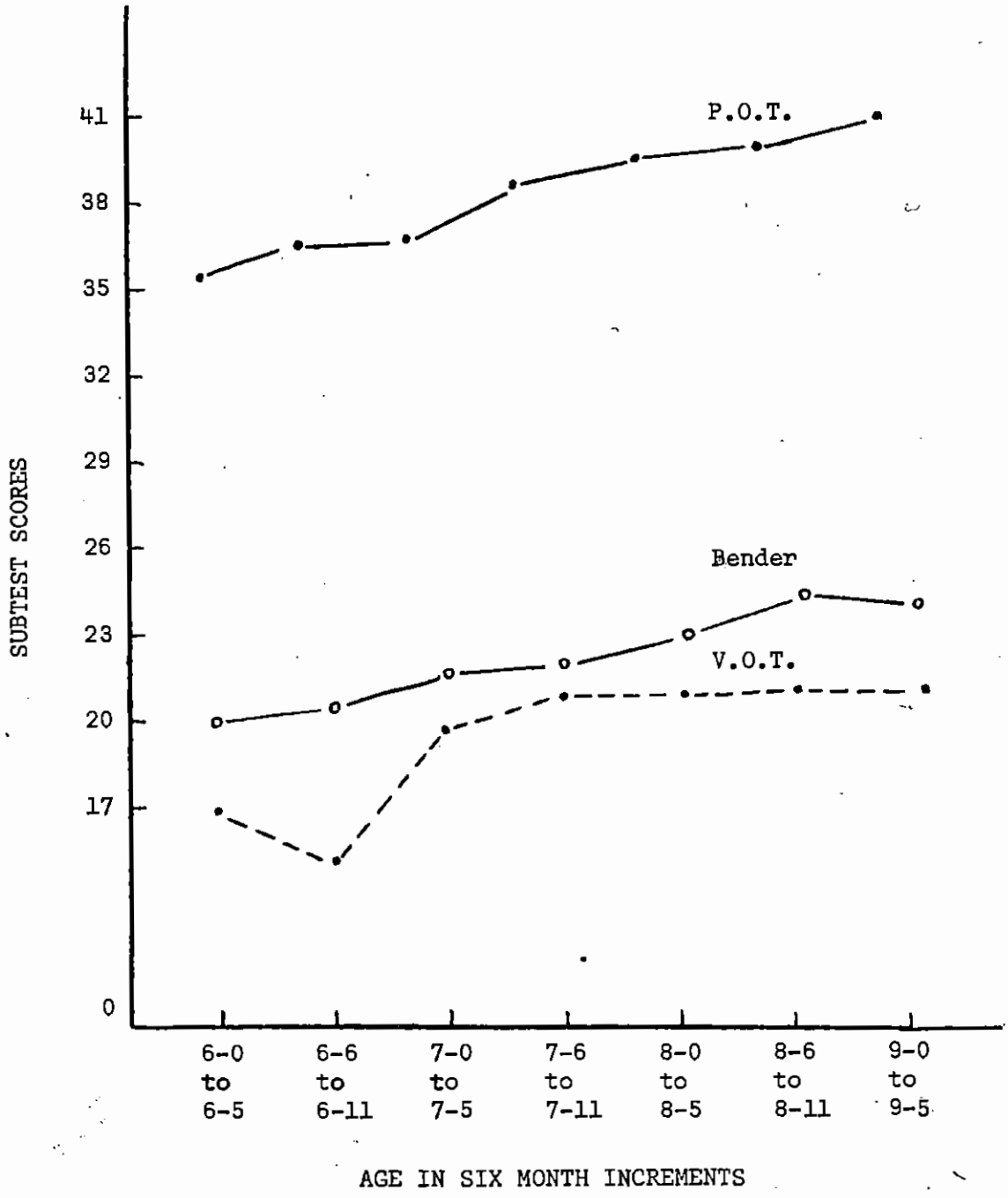

Figure 2. The mean subtest scores as a function of six month increments in age.

TABLE 4

BATTERY SUBTEST CORRELATIONS FOR THE TOTAL SAMPLE

	P.O.T.	D.A.P.$_1$	D.A.P.$_2$	V.O.T.	BENDER
Reading Grade Equivalent	.62** N=148	.36** N-146	.10 N=146	.51** N=143	.42** N=145
Math Grade Equivalent	.62** N=148	.41** N=146	.19* N=146	.49** N=143	.37** N=145
P.O.T.		.53** N=247	.33** N=247	.47** N=237	.47** N=246
D.A.P.$_1$ (Raw Score)			.86** N=250	.38** N=236	.43** N=247
D.A.P.$_2$ (Standard Score)				.28** N=236	.35** N=247
V.O.T.					.34** N=235

* p. > .05
**p. > .01

TABLE 5

BATTERY SUBTEST CORRELATIONS FOR THE TOTAL SAMPLE BY GRADE LEVEL

	Grade	P.O.T.	D.A.P.$_1$	D.A.P.$_2$	V.O.T.	BENDER
Reading Grade	1	.46** N=70	.44** N=68	.47** N=68	.47** N=79	.25* N=68
	2	.40 N=20	.49* N=20	.48* N=20	.01 N=19	.23 N=20
	3	.47** N=58	.05 N=58	.04 N=58	.49* N=54	.17 N=57
Math Grade	1	.48** N=70	.57** N=68	.58** N=68	.44** N=70	.16 N=68
	2	.43 N=20	.48* N=20	.45* N=19	.27 N=19	.39 N=20
	3	.45* N=58	.01 N=58	.07 N=58	.37** N=54	.20 N=57
P.O.T.	1		.51** N=91	.48** N=91	.45** N=88	.36** N=91
	2		.41** N=78	.34** N=78	.31** N=76	.23* N=78
	3		.40** N=78	.37** N=78	.35** N=73	.46** N=77
D.A.P.$_1$ (Raw Score)	1			.93** N=92	.47** N=87	.27** N=90
	2			.95** N=78	.19 N=76	.44** N=78
	3			.95** N=80	.27* N=73	.38** N=79
D.A.P.$_2$ (Standard Score)	1				.52** N=87	.38** N=90
	2				.14 N=76	.41** N=78
	3				.27* N=73	.41** N=79
V.O.T.	1					.36** N=87
	2					.22* N=76
	3					.10 N=72

* p. $>$ .05
** p. $>$ .01

or math grade equivalents than any of the other battery subtests. This may be due to the decreased number in the second grade sample (n=20) and to the inability of the Bender to discriminate above and below average test performance of children in the upper age ranges. The correlations ranged from r=.01 to r=.95.

Table 6 indicates minimal sex differences in test performance. Three non-significant test correlations were recorded: the standard scores from the D.A.P. ($D.A.P._2$) tests were not significantly correlated with reading grade equivalents (females only); since the D.A.P. raw scores ($D.A.P._1$) were significantly correlated, the effect of non-significance can be accounted for by the D.A.P. standardization discrepancy explained previously. All other correlations were significant at the p. = .01 level ($r > 33$).

Intertest correlations by age groupings in six months increments are recorded in Tables 7-10. The paucity of achievement data for some age groupings should be noted when judging the intertest correlations (N varies from 15 to 177). The sample size in the six year to six month grouping is small because the children in this sample are below the average age for children in the last quarter of first grade. The test correlations range from r = .10 (V.O.T, correlated with D.A.P. standard scores for 9.0-9.5 age sample) to r =.96 (D.A.P. raw scores correlated with the D.A.P. standard scores for four age samples). The Bender Test correlates significantly fewer times with the battery subtests than do the other tests. The reasons given for the non-significant correlations are the small N and the aberrant samples of below and above average age children in the 6.0-6.5 and 9.0-9.5 age groupings.

TABLE 6

BATTERY SUBTEST CORRELATIONS BY SEX

	Sex	P.O.T.	D.A.P.$_1$	D.A.P.$_2$	V.O.T.	BENDER
Reading Grade	F	.69** N=71	.33** N=70	.05 N=70	.57** N=68	.49** N=71
	M	.55** N=77	.37** N=76	.21 N=76	.47** N=75	.39** N=74
Math Grade	F	.65** N=71	.44** N=70	.19 N=70	.60** N=68	.45** N=71
	M	.58** N=77	.32** N=76	.26* N=76	.40** N=75	.34** N=74
P.O.T.	F		.52** N=123	.32** N=123	.50** N=118	.45** N=124
	M		.54** N=124	.37** N=124	.44** N=119	.51** N=122
D.A.P.$_1$ (Raw Score)	F			.90** N=123	.42** N=117	.34** N=123
	M			.87** N=127	.35** N=119	.57** N=124
D.A.P.$_2$ (Standard Score)	F				.25** N=117	.21** N=123
	M				.33** N=119	.50** N=124
V.O.T.	F					.31** N=118
	M					.37** N=117

* p.> .05
** p.> .01

TABLE 7

BATTERY SUBTEST CORRELATIONS FOR THE
6-0 TO 6-11 AGE SAMPLE

		P.O.T.	D.A.P.$_1$	D.A.P.$_2$	V.O.T.	BENDER
Reading Grade	Age 6-0/ 6-5	.60 N=8	.74 N=8	.68 N=7	.19 N=7	.41 N=8
	6-6/ 6-11	.37* N=35	.40* N=35	.40* N=34	.40* N=34	.28 N=34
Math Grade	6-0/ 6-5	.54 N=8	.92** N=7	.88** N=7	.15 N=8	.35 N=8
	6-6/ 6-11	.50** N=35	.37* N=34	.44** N=34	.44** N=35	.33* N=34
P.O.T.	6-0/ 6-5		.66* N=10	.58 N=10	.12 N=10	.27 N=11
	6-6/ 6-11		.51** N=48	.48** N=48	.45** N=47	.42** N=48
D.A.P.$_1$ (Raw Score)	6-0/ 6-5			.94** N=11	.42 N=10	.69* N=10
	6-6/ 6-11			.96** N=48	.50** N=46	.46** N=48
D.A.P.$_2$ (Standard Score)	6-0/ 6-5				.40 N=10	.80** N=10
	6-6/ 6-11				.56** N=48	.51** N=48
V.O.T.	6-0/ 6-5					.59 N=10
	6-6/ 6-11					.36* N=46

* p. > .05
** p. > .01

TABLE 8

BATTERY SUBTEST CORRELATIONS FOR THE
7-0 TO 7-11 AGE SAMPLE

	Age	P.O.T.	D.A.P.$_1$	D.A.P.$_2$	V.O.T.	BENDER
Reading Grade	7-0/ 7-5	.53** N=27	.40* N=27	.52** N=27	.56** N=26	.18 N=26
	7-6/ 7-11	.45 N=15	.70** N=15	.70** N=15	.40 N=15	.42 N=15
Math Grade	7-0/ 7-5	.50** N=27	.75** N=27	.75** N=27	.54** N=26	.05 N=26
	7-6/ 7-11	.55* N=15	.54* N=15	.44 N=15	.46 N=15	.37 N=15
P.O.T.	7-0/ 7-5		.53** N=37	.52** N=37	.44* N=33	.10 N=27
	7-6/ 7-11		.43** N=42	.34* N=42	.50** N=42	.44** N=42
D.A.P.$_1$ (Raw Score)	7-0/ 7-5			.97** N=37	.34* N=33	.05 N=36
	7-6/ 7-11			.94** N=42	.30 N=42	.39* N=42
D.A.P.$_2$ (Standard Score)	7-0/ 7-5				.42** N=33	.12 N=36
	7-6/ 7-11				.22 N=42	.42** N=42
V.O.T.	7-0/ 7-5					.23 N=33
	7-6/ 7-11					.36* N=42

* p.) .05
** p.) .01

TABLE 9

BATTERY SUBTEST CORRELATIONS FOR THE
8-0 TO 8-11 AGE SAMPLE

	Age	P.O.T.	D.A.P.$_1$	D.A.P.$_2$	V.O.T.	BENDER
Reading Grade	8-0/ 8-5	.79** N=16	.32 N=15	.36 N=15	.65* N=13	.14 N=15
	8-6/ 8-11	.46* N=27	.07 N=28	.06 N=28	.46* N=25	.15 N=27
Math Grade	8-0/ 8-5	.74** N=16	.18 N=15	.20 N=15	.65* N=13	.19 N=15
	8-6/ 8-11	.43* N=27	.18 N=28	.09 N=28	.34 N=25	.32 N=27
P.O.T.	8-0/ 8-5		.49** N=32	.48** N=32	.55** N=30	.48** N=32
	8-6/ 8-11		.51** N=45	.42** N=45	.08 N=42	.44** N=44
D.A.P.$_1$ (Raw Score)	8-0/ 8-5			.96** N=32	.35* N=29	.31 N=32
	8-6/ 8-11			.96** N=46	.29* N=29	.62** N=62
D.A.P.$_2$ (Standard Score)	8-0/ 8-5				.39* N=29	.33 N=32
	8-6/ 8-11				.31* N=43	.57** N=45
V.O.T.	8-0/ 8-5					.30 N=29
	8-6/ 8-11					.06 N=42

* p.$\rangle$ .05
** p.$\rangle$ .01

TABLE 10

BATTERY SUBTEST CORRELATIONS FOR THE
9-0 TO 9-5 AGE SAMPLE

	Age	P.O.T.	D.A.P.$_1$	D.A.P.$_2$	V.O.T.	Bender
Reading Grade	9-0/ 9-5	.31 N=21	.35 N=21	.55* N=21	.27 N=21	.24 N=20
Math Grade	9-0/ 9-5	.36 N=20	.30 N=20	.55* N=20	.19 N=21	.09 N=20
P.O.T.	9-0/ 9-5		.32 N=33	.26 N=33	.33 N=33	.48** N=33
D.A.P.$_1$ (Raw Score)	9-0/ 9-5			.96** N=34	.11 N=33	.41* N=34
D.A.P.$_2$ (Standard Score)	9-0/ 9-5				.01 N=33	.42** N=34
V.O.T.	9-0/ 9-5					.04 N=33

* p.) .05
**p.) .01

Multiple Regression Analysis: Multiple regression correlation coefficients, using the Doolittle technique (Guilford, 1956, p. 406), are shown in Table 11. The reading and mathematics grade equivalents (dependent variables) were correlated with the battery results (independent variables) including the P.O.T., V.O.T., D.A.P., and the Bender Test, using the total and grade level samples. The degrees of freedom were determined by taking the smallest N in the sample and using the appropriate degrees of freedom computation for that number, thus yielding a conservative level of statistical significance. Inspection of Table 11 shows that eight multiple r's were significant at the .01 level and six at the .05 level. Non-significant partial correlations coefficients occurred at the second grade level due to the sparsity of achievement data which reduced the df to a low number.

An analysis of subtest correlational results indicate the relative superiority of the P.O.T. in comparison to the Bender Test. The P.O.T. is significantly correlated twice as often as the Bender Tests, and these correlations are greater (P.O.T. r's range from .40 to .62; Bender r's range from .16 to .42). Therefore, it would appear that the P.O.T. is a more suitable test than the Bender Test for predicting academic achievement in the elementary grades. The V.O.T. correlations compare favorably in frequency and level of statistical significance with the P.O.T. (r ranges from .37 to .51 excluding the second grade sample) indicating a strong relationship between these two battery subtests. The D.A.P. significant correlations occur in the same frequency and statistical significance levels as do the V.O.T. correlations, but with a lower range (r ranges from .01 to .57) for the total and first grade samples.

TABLE 11

MULTIPLE REGRESSION ANALYSES OF BATTERY AND ACHIEVEMENT TEST CORRELATIONS

Sample	Multiple r		Partial r			
			P.O.T.	D.A.P.	V.O.T.	BENDER
Total df=138	Math .67*	b weight	.62** .56	.42** .07	.49** .29	.37** .07
	Reading .68**	b weight	.62** .32	.36** .10	.51** .20	.42** .25
First Grade df=63	Math .76**	b weight	.48** .30	.57** .10	.44** .23	.16 .26
	Reading .57**	b weight	.46** .21	.44** .06	.47** .12	.25* .13
Second Grade df=14	Math .58	b weight	.43 .25	.48* .06	.27 .18	.39 .14
	Reading .57	b weight	.40 .26	.49* .06	.01 .18	.23 .14
Third Grade df=49	Math .56*	b weight	.45* .44	.01 .10	.37* .26	.20 .42
	Reading .62*	b weight	.47* .44	.04 .30	.49* .23	.17 .37

* p.> .05
** p.> .01

An inspection of the beta weights indicates the prominent role of the P.O.T. in the battery. Without exception, the P.O.T. partial correlations account for more variance than any other subtest regardless of sample. The beta weights for the P.O.T. partial correlations range from .21 to .56 with three beta weights in the .44 to .56 range. The Bender Test generally accounts for the second highest amount of predictive variance with the beta weights ranging from .07 to .42 and only one beta weight in the greater than .40 range. The V.O.T. beta weights are third in amount of variance predicted (range .12 to .29) and the D.A.P. is fourth (range .06 to .30).

CHAPTER IV

DISCUSSION

The results of this study indicate that a battery of perceptual motor tests can be administered as a useful indicator of perceptual-motor functioning. The battery fulfills Bukentica's (1971) criteria of being reliable, easy to administer and score, and being capable of generating useful information for remedial purposes.

Statistical analysis indicated that the major validity hypothesis is supported: adequate levels of perceptual organization, short-term memory, and motoric control are needed for average reading and mathematics achievement. Test correlations were moderately high, indicating a strong relationship between the perceptual-motor tests and test grade equivalents, thereby inferring that a student with average scores on the test battery can be expected to achieve at an average rate in reading and mathematics. The failure of the second grade data to attain statistical significance is due to an insufficient number of achievement data from the second grade sample.

Test re-test reliability correlations were also generally high (range .66 to .91), indicating that the mode of test administration can be duplicated with examiner training. Likewise, the scorer reliability correlations were significant (r .95), indicating that with sufficient training, the scoring results are reasonably similar.

Each subtest contributes an essential element to the understanding of the child's learning strategies. The P.O.T. accentuates the importance of short-term memory linkage in a perceptual motor test; a largely untested concept in already established tests. Without adequate linkage, the learner cannot retain information long enough and accurately enough to transpose the academic stimuli into a meaningful motoric output. In overall importance, the P.O.T. is superior to the long-established Bender Test. The multiple regression analyses indicated that the P.O.T. correlated more frequently and accounted for more of the predictive variance than did the D.A.P., V.O.T., and especially the Bender Test. That this phenomena occurred is probably due to the inherent weaknesses of the Bender Test and the Koppitz Developmental Scoring System. The Bender Test was originally designed to assess organic pathology in adults. As with many tests that have been adapted from the adult to the child level, the Bender Test may have lost some of its descriminative power in the adaptation. The adult scoring systems are far more complex and specialized than those rather gross ones used for screening the perceptual-motor development in children. Because of a scoring system that utilizes only major design distortions and rotations and demands the drawing of relatively complex designs, the Koppitz Developmental Scoring System can provide usable data for children who only fall within a narrow range (five to nine years). The P.O.T. has the advantage of having clearly defined scoring criteria and utilizing familiar geometric designs as test stimuli which results in test performance discrimination over a wider age range.

The significant multiple regression equation analyses between the D.A.P. and the other battery subtests indicate the importance of this test and the relationship of motoric development and intelligence factors to academic achievement. The D.A.P. is an invaluable asset to a screening battery in that it relates motoric competence to intelligence and personality factors.

An analysis of the child's visual organization is necessary to complete the learning profile. The child's success in the accurate perception of relevant incoming stimuli is necessary for achievement. The V.O.T. is a vital component of the test battery because of its skill in selecting out those pupils who can organize their perceptions from those who cannot; a skill which the other subtests fail to bring out. An inspection of the V.O.T. data shows a decrease in discriminability as the children approach nine years of age. This may be due to the fact that nine-year-old children who are in the third grade have been retained for reasons of health or for failure to succeed. The presence of several such children in the third grade sample may have distorted test results. Further research with classes of fourth, fifth, and sixth graders would be necessary to clarify the point.

In summary, the results of this study have supported the major hypothesis. In addition, the efficacy of using the P.O.T. alone as a screening tool has been raised. An analysis of the multiple regression table indicates that there is little gain in multiple r when the V.O.T., D.A.P., and Bender are added to the P.O.T. and are correlated with reading and mathematics. Therefore, the P.O.T. may be used alone as a rough screening device to indicate level of perceptual-motor maturity. The other three tests should not be

discarded as useless since they provide information as to the area and extent of the learning dysfunction. With the P.O.T. data alone, the teacher could assess whether there was a problem. When the data from the other tests are employed, a locus of dysfunction can be established.

The question of maturation of perceptual-motor factors versus intelligence in predicting school achievement is raised. From the multiple regression analyses, it is hypothesized that adequate perceptual-motor development is vital to school achievement. Average or near average intelligence is, of necessity, a strong contributing factor but without average perceptual-motor development, achievement levels are depressed. The administration of perceptual-motor screening batteries to all elementary school pupils is important in predicting academic achievement and in detecting learning problems. The information given by the screening battery may prove to be the discriminatory event in providing a pupil a successful or dismal school experience. More research into the area of perceptual-motor screening batteries will add to the learning efficiency of the pupil.

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APPENDIX A

P.O.T. DEVELOPMENTAL SCORING SYSTEM

Revised P.O.T. Scoring System

Figure 1

1) rotation - 45°
   a) part of figure — score .5
   b) total — score .5

2) distortion
   a) partial (partial linear) — score .5
   b) total (non-linear, scribble) — score .5

Total 2.0

Scoring Examples:

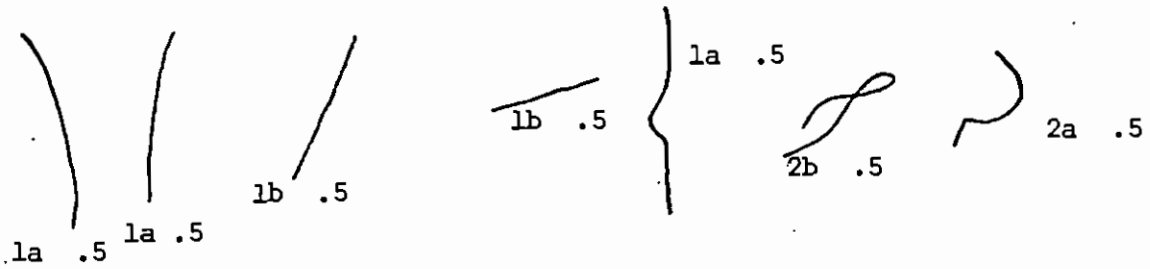


Figure 2

1) rotation - 45°
   a) part of figure — score .5
   b) total — score .5

2) distortion
   a) partial (partial line) — score .5
   b) total (non-linear, scribble) — score .5

Total 2.0

Scoring Examples:

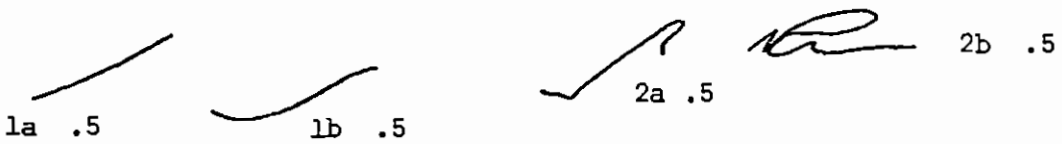
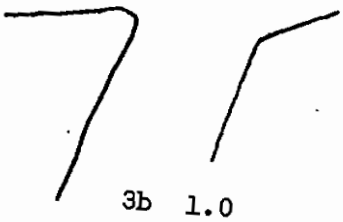


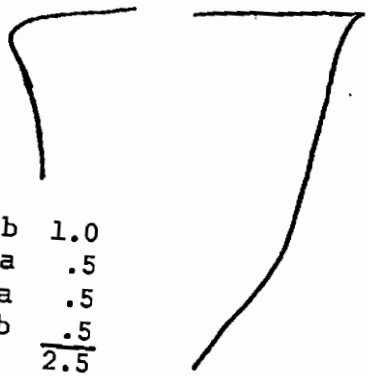
Figure 3

1)	rotation - entire	
	a) partial - one " " flipped	score .5
	b) total - both " " flipped	score 1.0
2)	reversal - "flag" reversed	
	a) partial - one	score .5
	b) total - both	score 1.0
3)	angular distortion	
	a) partial - one " " only drawn correctly	score .5
	b) both	score 1.0
4)	integration	
	a) partial - parts of one not joined within 1/16"	score .5
	b) total - parts of both not joined within 1/16"	score 1.0
5)	distantiation	
	a) not on the same plane	score .5
	b) " "'s less than 3/4" or more than 1 1/2" apart	score .5
6)	proportion	
	a) vertical line more than twice the length of the horizontal	score .5
	b) vertical line less than twice the length of the horizontal	score .5
		Total 8.0

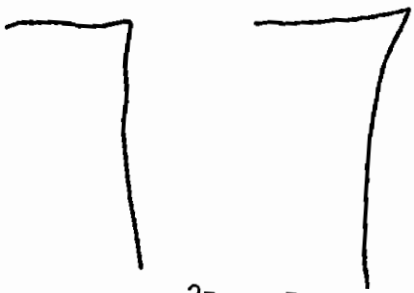


3b	1.0
5a	.5
6b	.5
	2.0

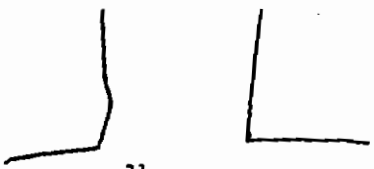
3b	1.0
5a	.5
5b	.5
	2.0



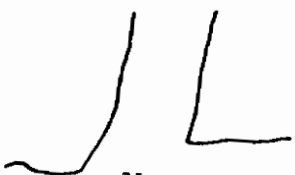
3b	1.0
5a	.5
6a	.5
6b	.5
	2.5



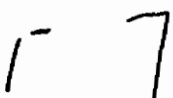
2a	.5
3a	.5
5a	.5
	1.5



1b	1.0
3b	1.0
6b	.5
	2.5

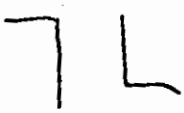


1b	1.0
3a	.5
5a	.5
5b	.5
6a	.5
6b	.5
	3.5



4a	.5
2b	1.0
5a	.5
6a	.5
6b	.5
	3.0

2a	1.0
3b	1.0
5b	.5
	2.5



1a	.5
5a	.5
6b	.5
	1.5

Figure 4

1) distortion
   a) ellipse — score .5
   b) gross malformation — score 1.0

2) integration
   a) circle not closed within 1/16" — score .5
   b) circle not closed within 1/16" and/or line overlap — score .5

Total 2.5

Scoring Examples:

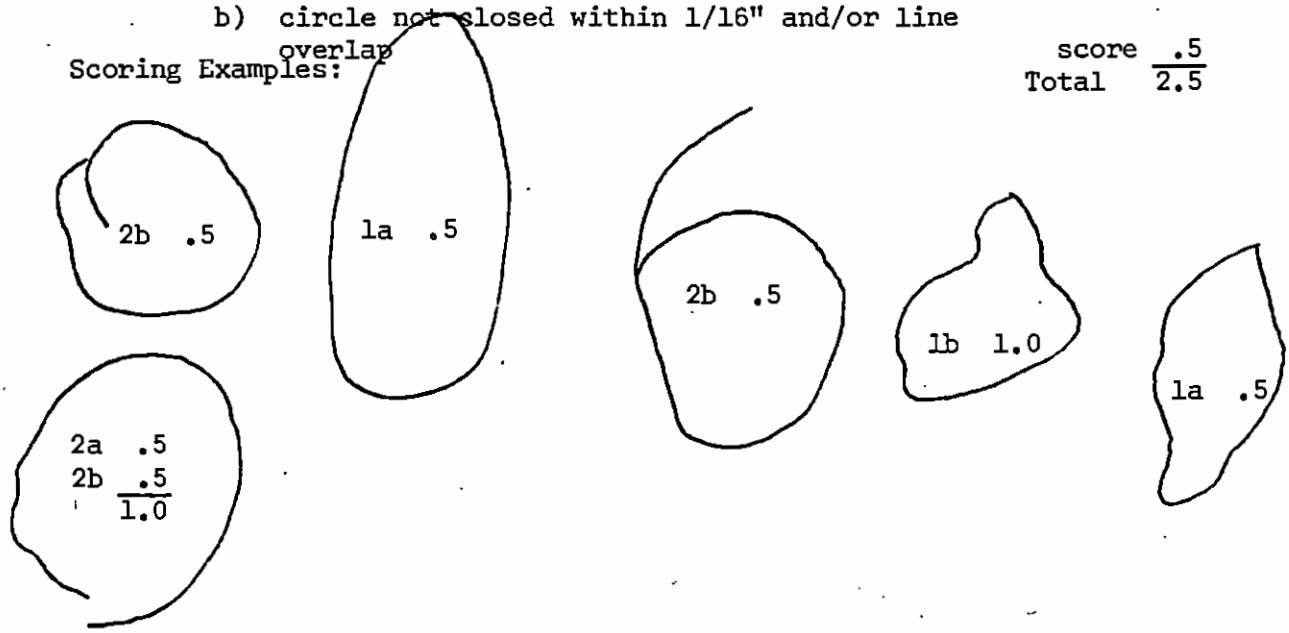


Figure 5

1) rotation
   a) rectangle — score .5
   b) diamond-shaped — score .5

2) distortion
   a) partial (at least one 90° angle) — score .5
   b) total (complete malformation) — score 1.0

3) integration
   a) partial - one line missing or not joined within 1/16" — score .5
   b) total - two or more lines missing or not joined within 1/16" — score 1.0

Total 4.0

Scoring Examples:

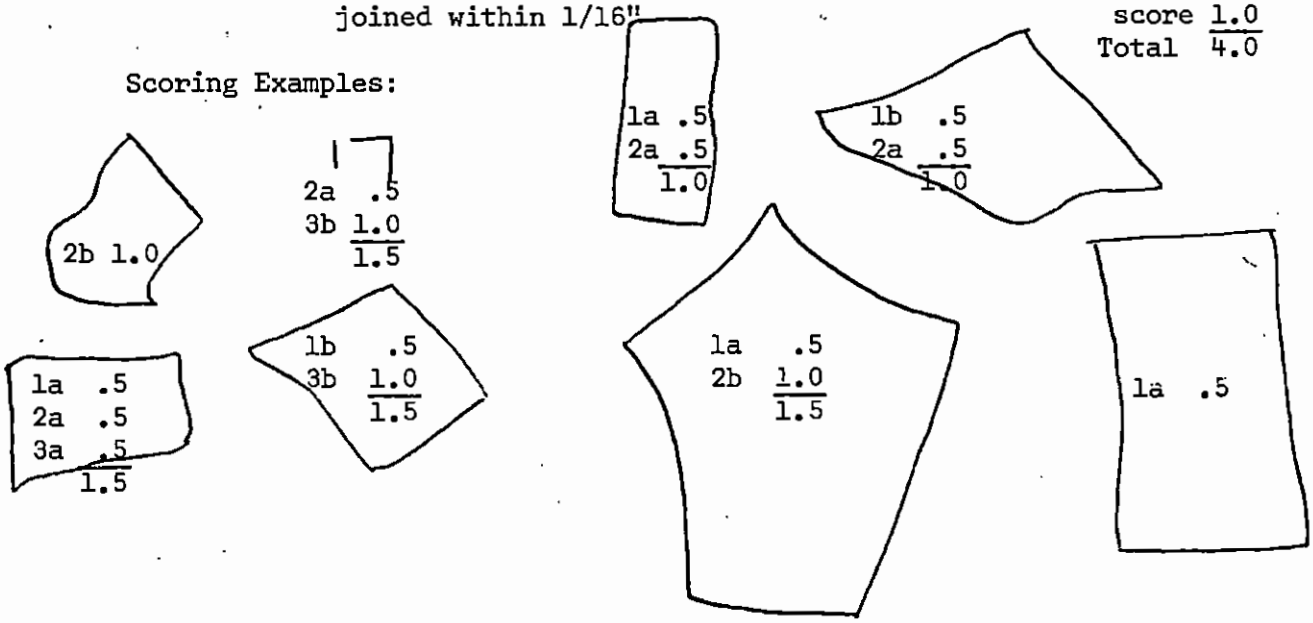


Figure 6

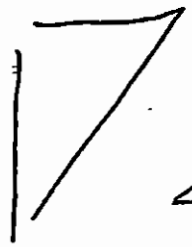
1) rotation - figure rotated — score 1.0

2) distortion
   a) triangle with misdrawn lines or angles — score .5
   b) gross malformation — score .5

3) integration
   a) one line not joined within 1/16" or missing — score .5
   b) two or three lines not joined within 1/16" or missing — score .5

Total 3.0

Scoring Examples:

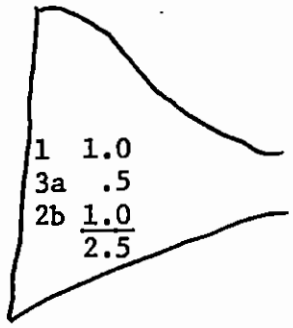


1 1.0
3b .5
1.5

2a .5
2b .5
1.0

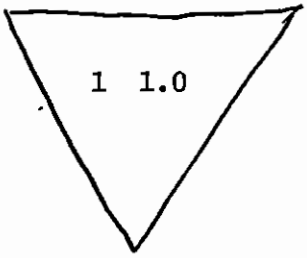
2a .5
2b .5
1.0

2a .5
2b .5
1.0

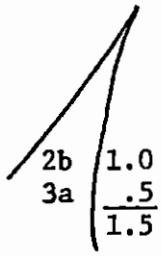


1 1.0
3a .5
2b 1.0
2.5

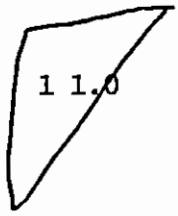
1 1.0



1 1.0



2b 1.0
3a .5
1.5



1 1.0

2b 1.0
3b .5
3a .5
2.0

Figure 7

1) rotation
   a) partial "rotated to acute" angle — score .5
   b) rectangle — score .5

2) distortion
   a) one angle drawn incorrectly — score .5
   b) gross malformation — score 1.0

3) integration
   a) one line missing or not joined within 1/16" — score .5
   b) more than one line missing or not joined — score 1.0

Total 4.0

Scoring Examples:

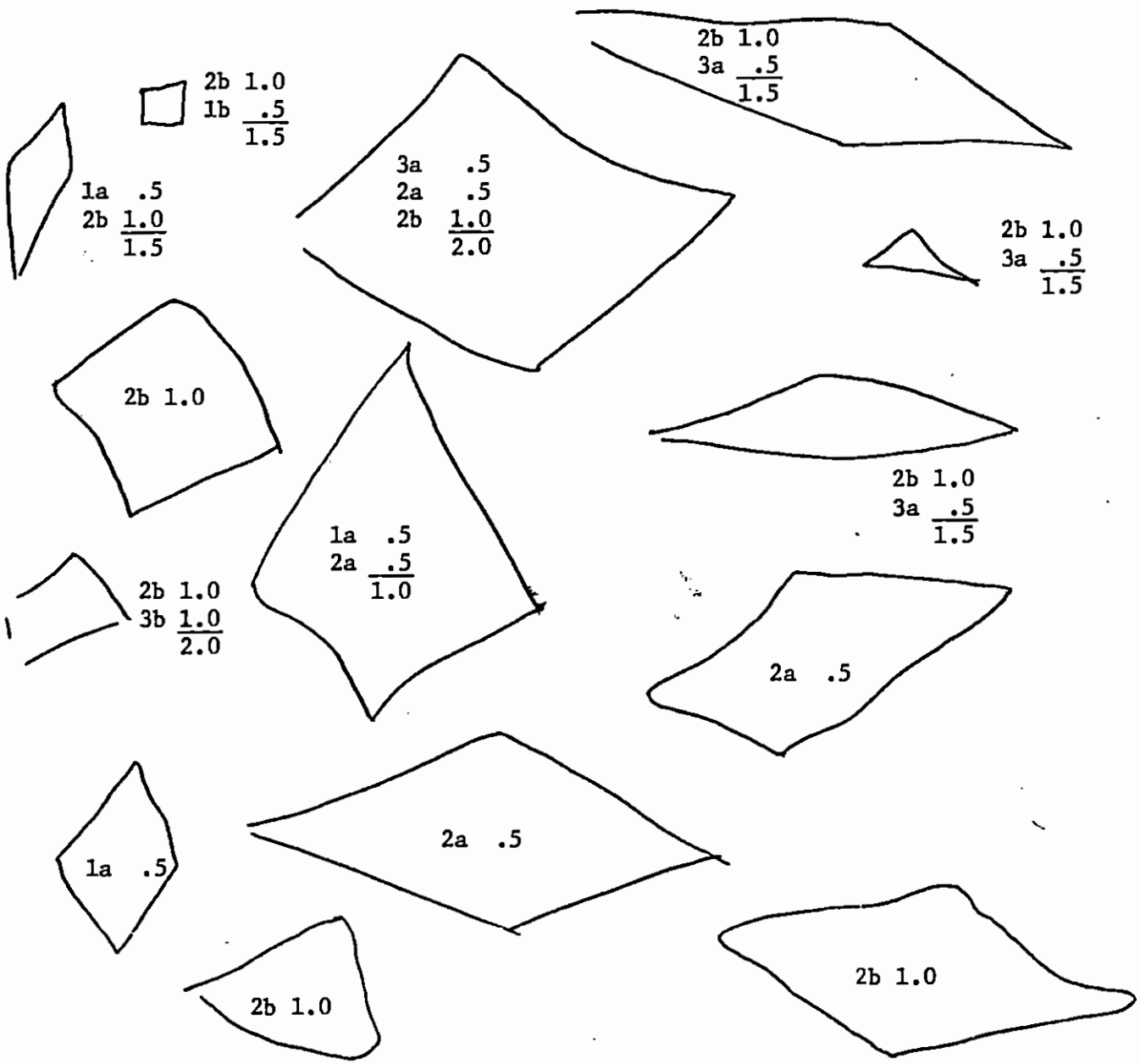


Figure 8a

1) missing letters
   a) only one letter missing — score .5
   b) more than one — score 1.0

2) added letters
   a) one letter added — score .5
   b) more than one letter added — score 1.0

3) distortion of letters
   a) one letter indecipherable — score .5
   b) more than one letter indecipherable — score 1.0

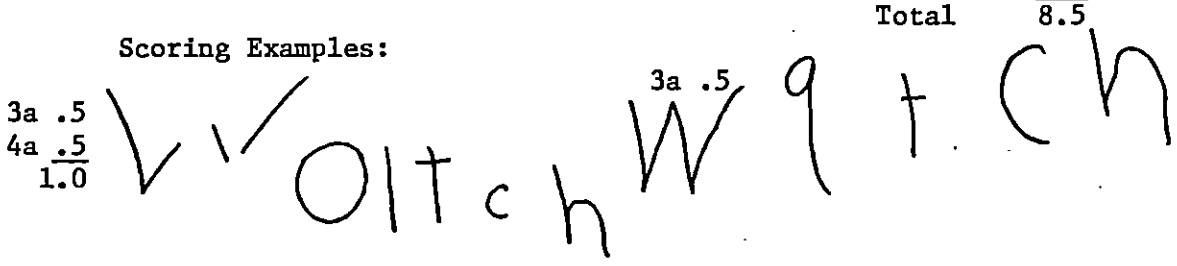
4) integration of letters
   a) one letter widely separated from the rest — score .5
   b) more than one letter widely separated — score 1.0

5) rotation of letters
   a) one letter rotated 45 or more — score .5
   b) more than one letter rotated 45 or more — score 1.0

6) misspelling or all capitals, or cursive writing — score 1.0

Total 8.5

Scoring Examples:



2a .5 waltch

wacth
6 1.0

watch
5b 1.0

watch
5a .5

w at ch
4b 1.0

wath
1a .5

watth
2a .5
1a .5
1.0

wat
1b 1.0

WATCH
6 1.0

watch
3a .5
3b 1.0
1.5

Figure 8

1) missing letters
   a) one missing letter — score .5
   b) more than one missing letter — score 1.0

2) added letters
   a) one letter added — score .5
   b) more than one letter added — score 1.0

3) distortion of letters
   a) one letter indecipherable — score .5
   b) more than one letter indecipherable — score 1.0

4) integration of words
   a) one letter widely separated from the rest — score .5
   b) more than one letter widely separated from the rest — score 1.5

5) rotation of letters
   a) one letter rotated — score .5
   b) more than one letter rotated — score 1.0

6) misspelling - also included printing and capitals
   a) one word misspelled or missing — score .5
   b) two or three words misspelled or missing — score 1.0

Total 9.0

Scoring Examples:

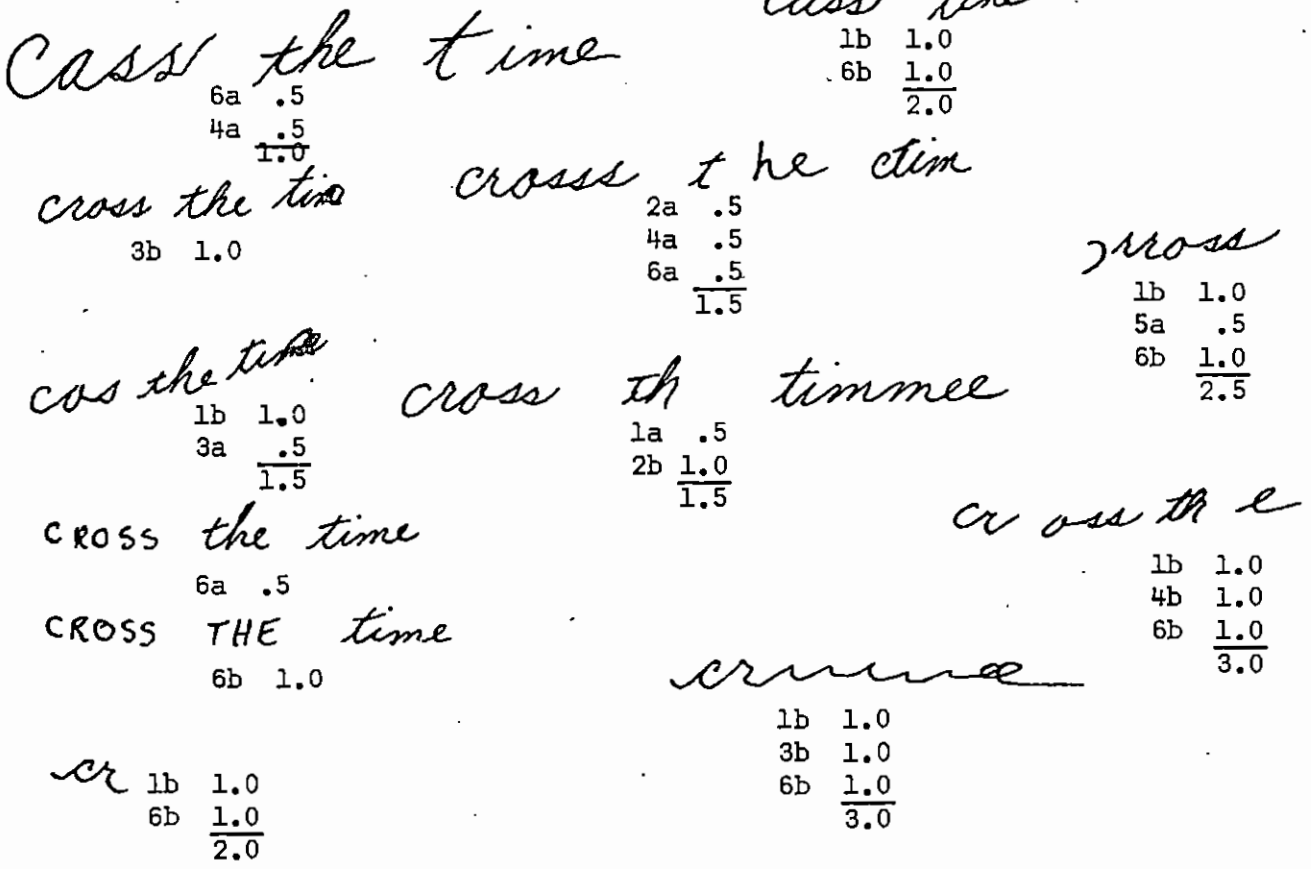


Figure 9

1) perspective error
   a) partial perspective — score .5
   b) figure other than stimulus in perspective — score .5

2) lack of perspective
   a) several rectangles joined in attempt — score .5
   b) unrecognizable figure or single rectangle — score 1.0

3) integration
   a) one line not joined within 1/16" missing or added — score .5
   b) more than one line not joined within 1/16" missing or added — score 1.0

Total 4.0

Scoring Examples:

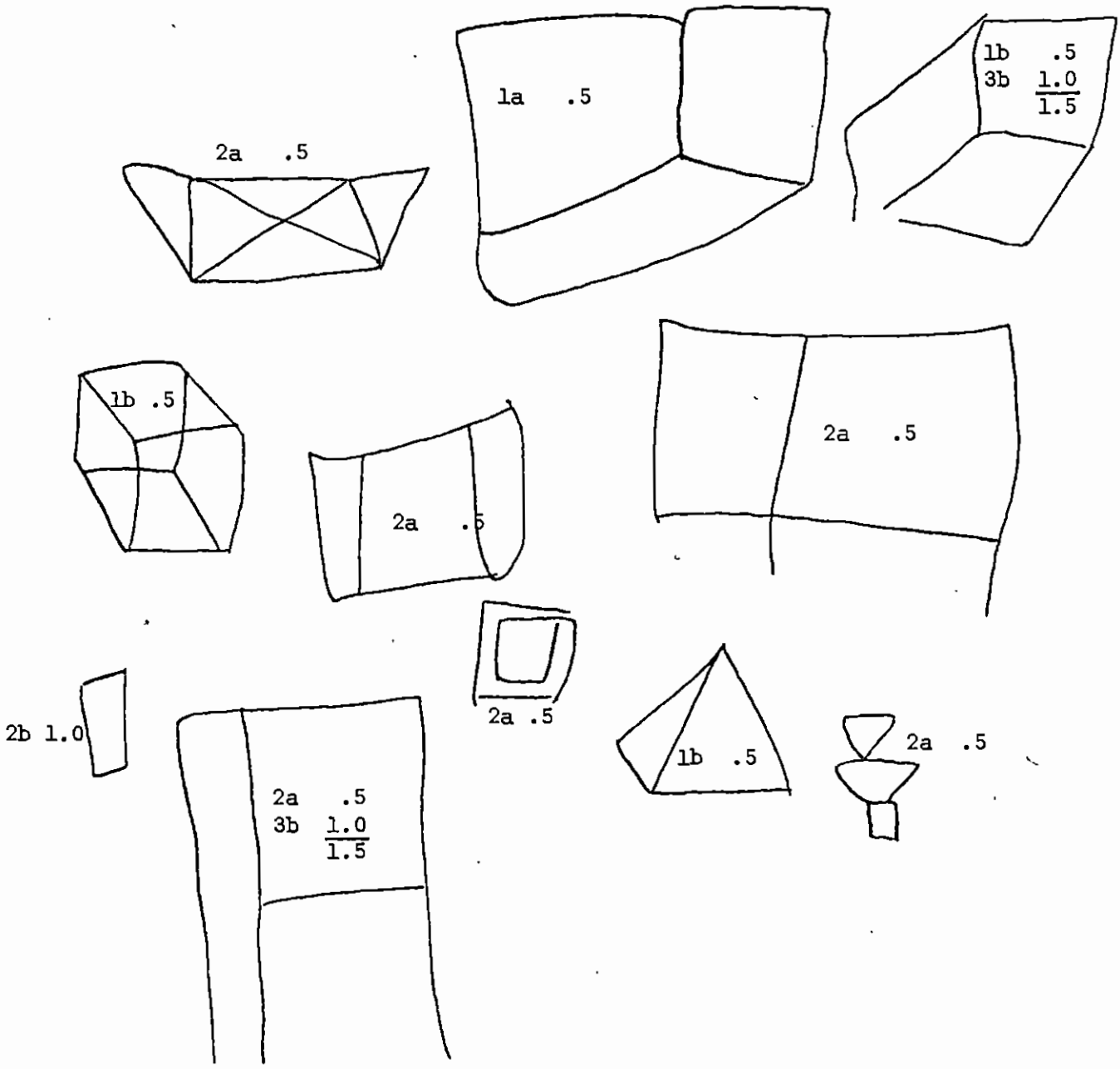


Figure 10

1) rotation — score 1.0

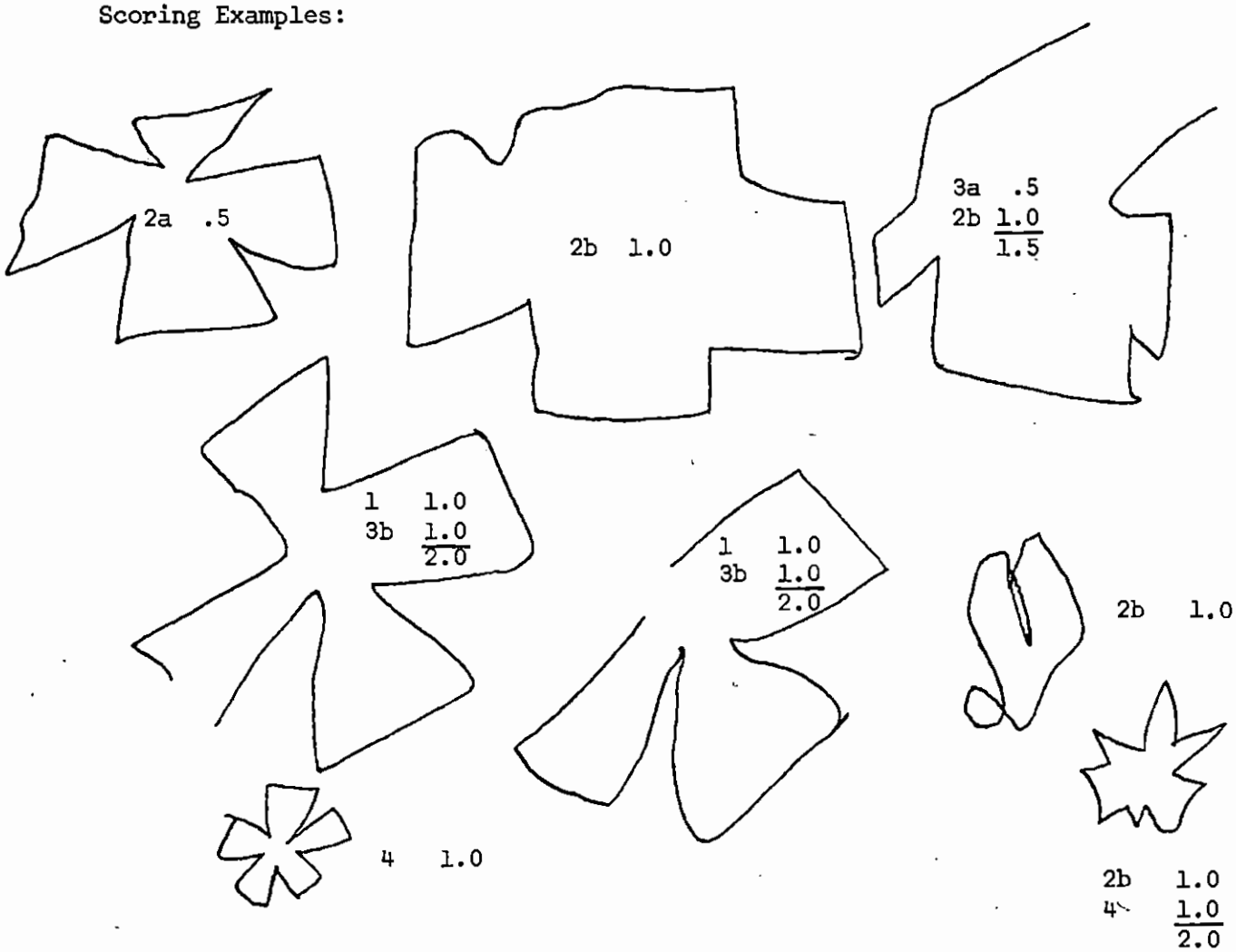
2) distortions
   a) attempt at drawing figure with four arms — score .5
   b) unrecognizable attempt — score 1.0

3) integration
   a) one line missing or not jointed within 1/16" or overlapping — score .5
   b) more than one line missing or not joined within 1/16" — score .5

4) perseveration - figure with five or more arms — score 1.0

Total 4.5

Scoring Examples:



Total Score: 48.5

Figure missing receives minus maximal points for that figure e.g., Fig. 10 = 4.5 points.

APPENDIX B

INSTRUCTIONS FOR TEST ADMINISTRATION

Instructions for Test Administration

For All Tests

Seat the child comfortably at an uncluttered table. Place a #2 lead pencil with eraser before him.

Bender Test

Give the child two sheets of paper, 8 1/2" by 11" (in packet). Show the child the STACK of Bender cards (larger white cards in packet) and say: "I have nine cards here with designs on them for you to copy. Here is the first one. Now go ahead and make one just like it." After the child has adjusted the piece of paper, place the first Bender card, Figure A, at the top of the blank paper in front of the child. No comments need be made. There is no time limit. When the child has finished the first drawing, remove the card, and give him the next one. If the child asks questions concerning the number of dots, answer him by saying ONLY "Make it look as much like the picture as you can." He needn't be encouraged or discouraged to erase or make several attempts. The child may use one or both sheets of paper, do not ask him to use the second sheet. When the child is done make sure his NAME and AGE are on the paper.

Draw-A-Person

Give the child one sheet of paper, 8 1/2" by 11" (in packet). Say to the child, "I want you to draw a picture of the whole person. Do the very best you can." The child may draw a person of either sex. If the child draws only a head, remind him Once to draw a whole person. There is no time limit. Any unusual features drawn by the child, please lable. When the child is done make sure his NAME and AGE are on the paper.

Perceptual Organization Test

Turn the paper with the drawing over and say to the child, "I am going to show you some cards for a little bit and then take them away. I want you to draw what is on the card AFTER I take it away." This is different from the first test. Show the child each card ONCE for FIVE seconds only. If the child asks any questions, say only, "make it look like the card as much as you can." There is no time limit. The NAME and AGE of each child must be on each paper.

Instructions for Test Administration (cont.)

Visual Organization Test

Use the test booklet provided in the packet. Read the instructions on the booklet to the child. If the child asks any questions, tell him to do the best he can and to guess if he is not sure. There is no time limit on this test. Please make sure the NAME and AGE of the child are on the booklet.

NOTE: On the Bender and P.O.T. cards there is a number in the lower left hand corner. The number MUST always be in this corner when the card is presented to the child.

APPENDIX C

MODIFIED V.O.T. SCORING SYSTEM

MODIFIED V.O.T. SCORING SYSTEM

	Full Credit		Half Credit	
	Hooper	Modified System	Hooper	Modified System
1.	fish	fish	----	----
2.	saw	saw	----	----
3.	table, bench	table, bench	----	----
4.	airplane	airplane, jet	----	----
5.	baseball, ball	baseball, ball	football	football
6.	hammer	hammer	----	----
7.	dog, sheep	dog, sheep, lamb	animal	bear, cat, wolf
8.	truck	truck--any kind	auto	auto
9.	cup	cup	vase, jar	vase, jar
10.	hand	hand	glove	glove
11.	apple, peach, etc.	apple, peach orange, pumpkin	fruit	fruit
12.	basket	basket, hamper	----	----
13.	scissors	scissors	----	----
14.	cane, hockey stick	cane, hockey stick, candy cane	----	----
15.	sailboat, boat	sailboat, boat, ship	----	----
16.	teakettle	teakettle or pot, coffee boiler or pot, gas can	----	----
17.	chair	chair	sofa	sofa
18.	candle	candle	----	----
19.	teapot, cream pitcher	teapot, cream pitcher, jug, sugar bowl, coffee pot, cookie jar	----	----

	Full Credit		Half Credit	
	Hooper	Modified System	Hooper	Modified System
20.	cat	cat	animal	pig
21.	flower, pansey, etc.	type of flower, pansey, flower	----	----
22.	mouse, guinea pig	guinea pig mouse, rat	----	----
23.	book	book	----	----
24.	rabbit	rabbit	animal	cat, dog, sheep
25.	block	block	----	box
26.	lighthouse	lighthouse	tower, castle	tower, castle
27.	shoe	shoe	----	----
28.	key	key	----	----
29.	ring	ring	----	----
30.	broom	broom	----	----

APPENDIX D

INDIVIDUAL TEST RESULTS

Pupil Number	A	B	C	D	E	F	G
001	[illegible]	[illegible]	19	86	55	16	15	26
002	4171309	90	30	121	225	10	21	31
003	[illegible]	[illegible]	13	83	145	12	17	23
004	[illegible]	75	32	134	240	5	22	23
005	[illegible]	[illegible]	20	85	220	4	22	24
006	4167519	80	33	125	200	4	29	38
007	[illegible]	[illegible]	29	114	220	9	21	27
008	[illegible]	[illegible]	17	96	225	12	15	19
009	[illegible]	[illegible]	16	91	210	14	22	36
010	[illegible]	95	24	97	135	10	15	15
011	[illegible]	[illegible]	13	56	200	15	20	23
012	4165203	105	14	75	150	15	15	11
013	[illegible]	[illegible]	25	105	235	10	22	15
014	4171324	90	24	103	250	8	23	25
015	[illegible]	[illegible]	15	86	230	13	19	20
016	4171365	140	41	127	210	15	13	38
017	4177507	[illegible]	21	89	120	15	13	11
018	[illegible]	85	21	96	200	11	20	23
019	[illegible]	[illegible]	25	110	185	7	23	25
020	[illegible]	[illegible]	12	73	145	7	21	23
021	[illegible]	75	29	125	250	3	23	45
022	[illegible]	[illegible]	16	99	240	5	21	24
023	[illegible]	[illegible]	17	88	180	12	21	24
024	4125417	[illegible]	34	130	180	11	22	28
025	[illegible]	[illegible]	30	128	220	3	24	25
026	2171302	160	19	89	230	8		
027	[illegible]	[illegible]	17	77	160	12		
028	2104104	120	12	63	175	13		
029	[illegible]	[illegible]	13	53	122	100	6	
030	2170006	115	17	88	135	6		
031	[illegible]	[illegible]	11	82	115	15		
032	[illegible]	140	12	99	80	5		
033	[illegible]	[illegible]	15	91	200	10		
034	2103194	[illegible]	10	78	135	20		
035	[illegible]	[illegible]	19	90	220	9		
036	[illegible]	95	18	99	145	5		
037	[illegible]	[illegible]	17	88	90	12		
038	[illegible]	[illegible]	11	70	140	10		
039	[illegible]	[illegible]	13	82	130	15		
040	[illegible]	140	11	75	190	11		
041	[illegible]	[illegible]	30	124	225	6		
042	[illegible]	[illegible]	16	90	190	12		
043	[illegible]	[illegible]	16	90	145	12		
044	[illegible]	[illegible]	15	83		8		
045	[illegible]	[illegible]	19	98		11		
046	[illegible]	[illegible]	21	105		11		
047	[illegible]	[illegible]	19	92		10		
048	[illegible]	[illegible]	13	79		13		
049	[illegible]	[illegible]	20	87	205	6	15	12
050	[illegible]	[illegible]	23	100	190	7	19	23
051	[illegible]	[illegible]	14	81	115	10	12	13
052	[illegible]	[illegible]	14	81	205	10	16	15
053	[illegible]	[illegible]	18	90	180	6	21	20
054	[illegible]	[illegible]	19	92	60	11	14	10
055	[illegible]	[illegible]	19	92	195	8	20	20
056	[illegible]	[illegible]	20	84	130	10	13	10
057	[illegible]	[illegible]	22	110	210	10	17	19

	Pupil Number	A	B	C	D	E	F	G
058	5165[illegible]4	[illegible]0	27	123	215	5	17	16
059	5165[illegible]5	[illegible]5	23	112	190	4	18	19
060	5165[illegible]3	150	9	75	120	11	12	15
061	5165[illegible]7	90	23	112	225	6	15	15
062	5164112	140	14	89	245	8	18	16
063	5163314	100	11	81	140	10	19	14
064	5172517	95	21	89	115	9	17	16
065	5171312	70	30	106	245	20	25	31
066	5172515	120	15	77	130	13	14	12
067	5172516	115	10	72	180	10	15	15
068	5171320	75	23	101	275	1	25	31
069	5150822	75	23	94	160	6	20	25
070	5170024	90	18	90	165	5	19	17
071	5178326	170	15	84	115	11	14	15
072	5177528	95	17	96	210	5	13	12
073	1168301	150	26	107	180	13	15	24
074	1167503	90	12	77	195	9	17	24
075	1167505	90	41	139	195	11	16	17
076	1166407	75	37	130	240	14	21	33
077	1166409	85	24	103	175	7	18	16
078	1165011	65	25	105	195	10	20	25
079	1164113	95			180	12	13	20
080	1164115	75	38	132	200	7	23	51
081	1170817	110	26	98	175	14	15	21
082	1171319	80	58	155	240	7	23	59
083	1170821	90	22	90	210	11	17	26
084	1168302	85	20	104	165	4	17	45
085	1167504	75			210		19	24
086	1166406	85	37	149	260	4	31	59
087	1165808	90	27	123	245	5	19	21
088	1165010	95	26	120	220	9	20	51
089	1164112		25	117	195			
090	1163314	115	16	94	155	10	15	23
091	1172516	75	35	127	225		31	38
092	1172518	75	25	98	215	8	16	21
093	1171320	150	16	86	190	9	18	27
094	1178322	75	20	94	180	9	16	24
095	1174124				215	5		
096	2278301	105	23	92	165	8	27	33
097	2278305	175	17	100	170	8	19	24
098	2279102	125	28	112	140	7	24	25
099	2285804	[illegible]	42	151	220	3	23	31
100	2276406	50	48	155	220	5	31	34
101	2276405	185	11	70	190	9	19	25
102	2275807	75	24	94	190	9	28	25
103	2277306	95	35	135	200	5	20	23
104	2280810	95	29	103	195	5	21	25
105	2271312	135	15	92	195	12	13	19
106	2272505	70	28	98	180	8	21	24
107	2273311	130	24	94	175	10	21	21
108	2281314	70	32	112	260	5	17	24
109	2273313	95	23	92	175	15	21	24
110	2278315	130	23	101	150	2	27	23
111	2280815	95	20	81	210	7	20	23
112	2275815	170	17	83	185	12	25	29
113	2276420	85	24	103	155	9	16	15
114	2276322	125	25	105	195	9	21	26
115	2272524	90	21	97		8		

	Pupil Number	A	B	C	D	E	F	G
116	2272526	105	32	121		3	25	24
117	1277502	120	9	70	115	14		
118	1279101	40	34	113	220	7		
119	1275804	100	18	90	245	6		
120	1280006	120	18	85	170	13		
121	1275003	75	25	96	260	14		
122	1274105	65	22	90	285	13		
123	1280807	65	32	108	225	4		
124	1285006	95	13	75	195	13		
125	1278310	115	15	84	190	13		
126	1278312	140	20	94	170	14		
127	1275809	130	15	77	285	11		
128	1280011	125	29	103	150	12		
129	1272514	60	20	94	245	13		
130	1280816	120	18	95	180	9		
131	1285016	100	18	85	240	12		
132	1284120	90	24	96	275	8		
133	1280822	70	20	89	280	10		
134	1278313	70	33	111	270	8		
135	1278324	100	23	101	225	11		
136	1279126	95	31	119	240	7		
137	1275815	55	33	103	220	10		
138	3275002	85	17	86	205	4		
139	3278304	100	16	85	255	6		
140	3277506	60	11	75	245	8		
141	3275008	105	21	97	260	5		
142	3275001	95	29	104	235	8		
143	3276405	65	34	105	235	6		
144	3275805	70	22	90	245	11		
145	3275807	80	37	119	235	6		
146	3273309	55	52	148	225	8		
147	3285010	75	29	106	215	10		
148	3280812	85	21	90	210	11		
149	3276414	90	23	101	235	7		
150	3276411	100	16	79	190	12		
151	3275813	55	22	90	235	6		
152	3285015	95	10	63	225	12		
153	3280817	35	25	89	210	7		
154	3283319	155	21	82	215	7		
155	3284121	80	13	68	220	9		
156	3283323	80	10	74	215	12		
157	3285025	90	22	84	180	8		
158	3294127	35	10	71	245	4		
159	5278301	70	29	104	225	5		
160	5277503	45	35	115	225	4		
161	5277505	130	40	125	265	4		
162	5275807	75	20	98	250	4		
163	5275809	85	20	87	235	2		
164	5287511	105	21	82	195	5		
165	5286413	140	21	82	240	10		
166	5285015	115	22	84	230	10		
167	5280002	85	22	92	175	7		
168	5280804	50	36	119	270	2		
169	5287506	175	14	77	215	5		
170	5287508	65	27	102	250	7		
171	5285010	140	27	102	240	7		
172	5292512	55	26	92	225	6		
173	5299114	115	27	94	215	4		

	Pupil Number	A	B	C	D	E	F	G
174	5293316	95	25	90	230	9		
175	2385801	50	27	93	190	7		
176	2385803	85	13	66	215	3	32	38
177	2385002	75	26	95		4	32	36
178	2390804	115	39	114	190	6	21	21
179	2387506	90	20	89	205	0	29	40
180	2385005	75	25	81	200	12	38	37
181	2382508	55	39	114		6	32	33
182	2382507	90	22	84	190	4	25	33
183	2382509	50	40	123	260	5	56	57
184	2386410				210			
185	2385811	60	34	105	135	4	36	34
186	2386413	75	37	110	210	3	33	41
187	2385815	75	25	89	115	5	23	35
188	2383317				155			
189	2382512	100	23	87	155	4	18	27
190	2391319	70	26	88	190	5	35	40
191	2386414	50	29	106	135	7	26	32
192	2390021	95	28	88	230	6	26	32
193	2388316	115	31	110	210	8	18	19
194	2384123	60	23	86	155	3	24	30
195	2385118	85	27	94		5	27	33
196	2387520	75	15	79	160	5	21	33
197	2380025	60	40	115		14	31	31
198	2385027	75	23	86		9	23	32
199	2380029	95	17	75		9	18	30
200	2390031	75	32	94		4	27	25
201	1392502	55	37	110	135	3		
202	1384104	55	45	137	290	3		
203	1390801	100	14	64	175	8		
204	1390803	110	32	100	210	8		
205	1390005	95	20	74	205	11		
206	1395806	95	17	77	155	9		
207	1385006	75	20	89	205	8		
208	1392507	60	19	72	270	8		
209	1385809	85	29	96	200	6		
210	1388810	60	57	150	260	3		
211	1391811	55	43	113	265	9		
212	1389112	45	33	104	230	5		
213	1390813	90	30	91	205	10		
214	1387514	95	34	116	255	5		
215	1301316	105	21	79	215	4		
216	1390015	65	23	79	255	11		
217	1382517	90	27	93	180	8		
218	1382518	70	17	60	240	6		
219	1385819	105	14	70	195	12		
220	1384120	60	26	100	270	3		
221	1397522	90	21	80	200	4		
222	1390024	70	21	84	225	7		
223	1303326	90	19	76	120	10		
224	1395821	95	17	69	195	17		
225	4386301	40	41	117	225	4	25	33
226	4381303	20	42	118	255	4	44	44
227	4387505	45	24	87	180	5	25	29
228	4387507	50	32	101	215	4	35	33
229	4386409	35	37	110	255	2	39	54
230	4385011	45	49	130	260	4	29	34
231	4392513	65	28	88	240	3	37	44

Pupil Number		A	B	C	D	E	F	G
232	4392515				110		23	30
233	4391317	45	45	117	260	3	26	29
234	4399119	40	55	134	250	3	31	31
235	4308321	45	56	126	255	3	27	35
236	4388302	65	36	119	270	6	35	39
237	4385004	60	28	95	215	3	30	33
238	4383306	50			240		39	52
239	4391305	65	16	75	235	7	20	26
240	4390810	40			280		35	41
241	4399112	35	32	102	225	3	30	59
242	4399114	70	24	89	215	8	25	30
243	4394116	70	24	89	170	5	21	35
244	4393318	40	34	105	230	2	25	37
245	4393320	35	23	87	230	3	30	36
246	4393322	30	39	114	245	4	24	31
247	4392524	80	31	100	220	12	19	22
248	4392526		30	99	180	4	21	28
249	5388301	60	24	87	215	7	44	42
250	5388303	55	32	101	245	4	42	75
251	5387505	95	23	86	250	7	30	30
252	5387507	65	36	106	255	4	45	42
253	5386409	30	32	101	285	4	49	59
254	5384111	25	27	93	260	3	57	52
255	5384113	60	31	99	260	7	45	45
256	5300815	80	31	80	240	4	26	28
257	5390817	45	23	73	200	4	46	60
258	5390819	50	31	86	265	6	44	62
259	5395121	30	35	100	240	2	44	33
260	5395823	75	20	74	240	10	39	42
261	5388302	55	22	92	245	5	35	36
262	5384104	40	33	114	220	4	53	51
263	5383306	60	16	81	270	5	56	57
264	5390808	50	43	121	200	3	27	26
265	5397510	170	32	102	220	3	22	25
266	5397512	65	19	80	255	6	26	33
267	5384414		12	73	245	12	33	33
268	5395816	155	24	89	225	8	25	25
269	5394118	85	27	94	230	5	36	23
270	5394120	65	38	112	180	7	25	21

LEGEND

A	P.O.T. Score
B	D.A.P.$_1$ Score
C	D.A.P.$_2$ Score
D	V.O.T. Score
E	Bender Score
F	Reading Grade
G	Math Grade