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Lateral dominance and its relationship to reading

Margaret Conley

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LATERAL DOMINANCE
AND ITS
RELATIONSHIP TO READING

CARDINAL STRITCH COLLEGE
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Milwaukee, Wisconsin

by
Sister Margaret Conley, O.S.F.

A RESEARCH PAPER
SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF
MASTER OF ARTS IN EDUCATION (READING SPECIALIST)
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Milwaukee, Wisconsin

1972

This research paper has been
approved for the Graduate Committee
of the Cardinal Stritch College by

George J. Crestilli
(Adviser)

Date Feb 29, 1972

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TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	iii
LIST OF TABLES AND GRAPHS	v
CHAPTER	
I. INTRODUCTION	1
Overview of the Problem	
Definition of Terms	
Limitations	
Scope of the Research	
II. REVIEW OF THE RELATED LITERATURE	6
Research Studies	
Literature Other Than Research	
III. PROCEDURE OF RESEARCH STUDY	13
Method Used	
Presentation of Findings	
IV. SOME TECHNIQUES AND INSTRUMENTS FOR IMPROVING THE READING OF CHILDREN WITH CROSSED-DOMINANCE	23
A Good Handwriting Program	
Delacato Program	
Frostig Program	
Self-Concept Development	
V. CONCLUSIONS	32
Summary	
Implications	
Ideas for Further Research	
APPENDIX	37
BIBLIOGRAPHY	43

LIST OF TABLES

Table		Page
1.	Presentation of Findings, No. 1-23.	15
2.	Presentation of Findings, No.24-46.	16
3.	Presentation of Findings, No. 47-69	17
4.	Presentation of Findings, No. 70-92	18
5.	Presentation of Findings, No. 93-111.	19
6.	Frequency Distribution of Single Dominance Children, In Relation to I.Q. Reading Achievement Intervals	20
7.	Dominance-Test Chart on Laterality from 1969 Research Paper Accelerated Group- Gr. 2	38
8.	Dominance-Test Chart on Laterality from 1969 Research Paper Average One - Gr. 2	39
9.	Dominance-Test Chart on Laterality from 1969 Research Paper Average Two Group- Gr. 2	40
10.	Dominance-Test Chart Laterality from 1969 Research Paper Basic Group - Gr. 2.	41

GRAPHS

1.	Graphs Showing % of Children Above, Within, and Below Interval Limits	21
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CHAPTER I

INTRODUCTION

Overview of the Problem

One of today's major social problems in education is the enormous number of children with reading disabilities. The 1971 studies show that 25% of the nation's school population are disabled readers.¹ Because of this, experts have stated that it is essential to develop diagnostic criteria of future failure at early ages in order to direct attention to clearing up causes of the handicap rather than developing remediation programs to change the failure patterns after they have set in.²

Some researchers seem to think that one advance warning signal that a child may have trouble with reading is the lack of a definite hand preference, (Lateral Dominance) early in life. However, the relationship between lateral

¹Helen Huus, "Right to Read, I.R.A. and What You Can Do," The Reading Teacher, Vol. XXV (November, 1971), pp. 112-117.

²Katrina De Hirsch, Jeannette Jefferson Jansky and William S. Langford, Predicting Reading Failure (New York: Harper and Row Publishers, 1966), p. vii (foreward).

dominance and reading ability has been a recurrent controversial issue.¹ Early references to dominance were made as far back as 1937 by Orten and other neurologists in connection with speech disorders.² Dominance theories then gradually became extended to aspects of language development other than speech. Since reading involves the need to perceive the printed symbol in its proper order and direction, it is inevitable that the relationship between laterality and reading development should provoke considerable study.

The study of laterality and its relationship to reading disability has long been of interest to researchers. The notion that crossed-laterality, in which the preferred hand and preferred eye are on opposite sides, and single-laterality, in which the individual shows nearly equal use of both sides, are conditions resulting in reading difficulty of some sort, has been pursued for some time. Some writers have investigated the hypothesis that left-handed children tend to make more reversals in reading than right-handed children. Others have studied eyedness alone, while yet other writers have investigated the problem of the relationship between eyedness and handedness considered together to reversals in reading and

¹Alice Cohen and Gerald G. Glass, "Lateral Dominance and Reading Ability," The Reading Teacher, Vol. XXI (January, 1968), p. 343-348.

²John Money, Reading Disability, Progress and Research Needs in Dyslexia (Baltimore, Md.: The John Hopkins Press, 1962), pp. 103-113.

to reading disability. It has been felt that the child showing crossed laterality or single hand and eye preference may encounter difficulty with eye-hand coordination tasks necessary for reading. Some researchers feel that lack of unilateral eye-hand preference may reflect mild neurological disfunction of some sort, possibly becoming a causal factor in the child's inability to read.¹

With this in mind, then, the present study was undertaken to investigate available evidence which may contribute toward a better understanding of the relationship between differing dominance patterns and reading achievement. This investigation is in regard to the following question: Will fourth grade children who had crossed-dominance in grade two have lower reading scores than those who developed a preferred dominance by grade two?

The purpose of this study is to make a further attempt to investigate possible answers to this inquiry.

Definition of Terms

A listing of terms and their definition may be helpful to the reader of this study.

Crossed-Dominance exists when the dominant hand and dominant eye are on opposite sides of the body.

Lateral Dominance refers to the preference or superiority of one hand and eye in performing motor tasks; for

¹Samuel Weintraub, "Research: Eye-Hand Preference and Reading," The Reading Teacher, Vol. XXI (January, 1968), p. 369.

instance, right lateral dominance would indicate preference for the right hand and eye.

Laterality is another term used interchangeably with Lateral Dominance.

Single Dominance is synonymous with visual motor consistency which occurs when the subject's dominant hand and eye are on the same side of the body.

Original Study refers to Sister Gloria Kellerman's unpublished research paper on "Hair Whorls, Indicators of Hand-Eye Dominance", submitted in partial fulfillment of the requirements for the degree of Master of Education in 1969, at Xavier University in Cincinnati, Ohio. The children in this study were used to make the present study.

Present Study refers to this study which deals with the relationship between lateral dominance and reading ability.

Limitations

Due to the fact that research experts such as Cruickshank,¹ Osgood and Murray,² and Keeney³ disagree on the reliability of testing methods for dominance, one must take this into account when reading this paper.

¹William Cruickshank, The Teacher of Brain Injured Children (New York: Syracuse University Press, 1966).

²Charles Osgood and Miron Murray, Approaches to the Study of Aphasia (Urbana, Ill.: University of Illinois Press, 1963).

³Arthur and Virginia Keeney, Dyslexia: Diagnosis and Treatment of Reading Disorders (St. Louis: C. V. Mosby Co., Publishers, 1968).

One must also consider the unreliability of intelligence tests taken by the children involved in this study. An effort was made to offset this influence by using non-verbal scores so that non-readers would have a better chance of falling into the proper interval. Children who have intelligence quotients below 90 were also dropped, since this would probably imply some built-in reading difficulties. Another influence that must be taken into account is the environmental factors that might be retarding reading potential.

Scope of the Research

The population studied by this researcher consisted of the entire fourth grade class of St. Bartholomew School in Cincinnati, Ohio, during the 1970-71 school year. Although the population in the original study numbered 122, three children have since left the school district. Eight others had non-verbal scores below 90 and were dropped from this study. Therefore, the present population is 111 children.

This research is to be confined to a study of the relationship between lateral dominance and composite reading scores and a possible link connecting the two, in regard to 111 fourth grade students of Saint Bartholomew School in Cincinnati, Ohio, during the 1970-71 school year.

CHAPTER II

REVIEW OF THE LITERATURE

An investigation of the research dealing with laterality shows that extensive work has been done in an effort to determine the relationship of laterality to reading problems. Researchers do not agree that crossed-dominance is or is not a significant factor in reading achievement, but they continue to investigate all the possibilities. They do agree upon the fact that more research is needed in this field.

Research Studies

In Shearer's¹ test of 225 British children, age 7-10 years, for hand preference, he found that among the backward readers, there was no greater proportion of strong left-handedness, but a higher proportion of cross-handedness and weak hand preference and there was more complete confusion in right-left discrimination. Shearer suggests that the relationship between these symptoms and inability to read may be a result rather than a cause; i.e., that consistent

¹E. Shearer, "Physical Skills and Reading Backwardness," Educational Research, Vol. X (June, 1968), pp. 197-206.

training in left-right sequences are important in establishing strong hand preferences and right-left discrimination. He also suggests further study in defining right-left discrimination in backward readers from a developmental view of the emergence of this skill and recommends that handedness patterns should be related to norms of either general child populations or undifferentiated cases of reading retardation.

Hillerich,¹ reporting a study completed in 1962, reviewed the research findings and reported a pattern that suggested that most clinical studies find a high incidence of crossed-dominance among disabled readers. He also states that there is a significant distinction between the dominant eye used in sighting and the controlling eye used in binocular vision; there is also a significant change in the eye-hand dominance pattern of children between second and eighth grades. This latter finding is in opposition to the premise that the dominant hand develops rather early in life and strengthens in preference thereafter, as believed by some.

¹Robert L. Hillerich, "A Study of the Relationship Between Eye-Hand Dominance and the Reading Achievement of Selected Primary Pupils," unpublished doctoral dissertation, Colorado State College, 1962.

Berner¹ and others proposed a different theory. Following the thinking of Fink,² these investigators proposed that the controlling eye in binocular vision--not the dominant eye in sighting--was the significant factor in reading disability. Hence, according to this theory, investigation should determine whether the controlling eye and dominant hand are on the same side. These investigators reported that it was "crossed-control" rather than "crossed-dominance" which was the significant factor in reading disability.

Probably the best study of correlation offered is one done by Carrick and Watson³ of DePauw University. Their conclusion is that there is a significant positive relationship between reading achievement and performance tasks of neurological organization as defined by Delacato. (Reference will be made later in a different chapter, to Delacato's theory.)

¹George Berner, Dorothy Berner, Walter Uhler and Marguerite B. Horn. A Clinical Investigation of Crossed-Control in a Residential Treatment Center, a printed report of the Devereaux Schools, The Devereaux Schools, Deven, Pennsylvania, 1963.

²W. H. Fink, "The Dominant Eye: Its Clinical Significance," A.M.A. Archives of Ophthalmology (April, 1938), pp. 555-582.

³R. Carrick and M. Watson, "Application of the Neurological Organization Theory to Non-pathological Subjects," Neurological Organization and Reading (Springfield, Illinois: Charles C. Thomas, 1966), p.230.

The most complete and detailed report offered in Delacato's latest book is one done by Brian Miracle.¹ This study is recognized by the critics as being one of the best and very well designed. In this study, Miracle comes up with two conclusions: 1) There exists a relationship between the laterality a person possesses and his reading ability, and 2) Neuropsychological training seems to be of far greater value in helping retarded readers than does reading remediation.

Belmont and Birch² show evidence of higher incidence on inconsistent lateral preference in children with reading difficulties. Results of the Mann-Whitney U Test,³ which did a discriminating analysis of the intelligence quotient range, support the positive role played by dominance and directionality factors in reading achievement.

Eames⁴ found lateral dominance anomalies much more frequently among peer readers than among unselected cases,

¹F. Brian Miracle, "The Linguistic Effects of Neuropsychological Technique in Treating a Selected Group of Retarded Readers," in C.H. Delacato (ed.) Neurological Organization and Reading (Springfield, Ill.: Charles C. Thomas, 1966), pp. 156-179.

²L. Belmont and Herbert Birch, "Lateral Dominance, Lateral Awareness and Reading Disability," Child Development, Vol. XXXVI (January, 1965), pp. 57-71.

³Alice Cohen and Gerald G. Glass, "Lateral Dominance and Reading Ability," The Reading Teacher, Vol. XXI (January, 1968), p. 347.

⁴Thomas Eames, "Physical Factors in Reading," The Reading Teacher, Vol. XV (May, 1962), pp. 427-432.

and Crosland's¹ results suggest an association between left-eyedness and reading failure.

More closely related to this study is Cohen's² finding which suggests a positive relationship between certain aspects of directional awareness and reading performance in first grade children.

The research evidence on laterality has neither conclusively supported nor refuted either position. However, it is interesting to note that diagnostic techniques and teaching methods to counteract the offsets that are supposed to accrue from a lack of laterality have already been devised and are presently used by some public and private institutions. Probably the most widely publicized program is that of Delacato. He has set up a program for developing dominance based on appropriate sequence in body positions while sleeping, coordination of the body while crawling or walking, and visual training from the sighting eye. Leavell developed a method for using a stereoscope to train the non-dominant eye to coordinate with the dominant hand. Barger reported a program to train children who make reversal errors

¹H. R. Crosland, "Superior Elementary-School Readers Contrasted with Inferior Readers in Letter-Position, 'Range of Attention' Scores," Journal of Educational Research, Vol. XXXII (1939), pp. 410-427.

²Alice Cohen and Gerald G. Glass, "Lateral Dominance and Reading Ability," The Reading Teacher, Vol. XXI (January, 1968), pp. 343-348.

to read mirror writing and then switch to normal print. All these programs claim to achieve outstanding results.¹

The issue of eye-hand preference and its relationship to reading disability is still confused. Part of this confusion is the result of the instruments used to measure laterality. Different investigators have used different measures. Often times the reliability of these measures is questionable. Equally important, perhaps, is the fact that some of the tests may be measuring a learned preference whereas others may be measures of unlearned preference. Several trends, however, do emerge from the confusion: 1) In both unselected and clinic populations, hand preference becomes better established with age; as the child becomes older, he appears to move toward a preferred hand and away from an inconsistent pattern; 2) To date, evidence collected with unselected populations shows little, if any, relationship between laterality and reading achievement; 3) Neurological implications of laterality patterns are not clear. Certain handedness or eye-hand patterns may be the result of mild neurological impairment. Evidence for or against such a conclusion must await the development of better instruments and of more carefully controlled studies.

¹Karen Tinker, "The Role of Lateral Dominance in Reading," New Directions in Reading (Ralph Staiger and David Sohn, eds.) (New York: Bantam Books, 1967), p. 180.

Literature Other Than Research

Examination of literature, other than research, points out the strong need that exists for uncovering causes of reading disabilities. Walter Straley says: "We need ten million tutors by the end of the 1970's since there are millions of elementary school pupils in urgent need of reading instruction."¹

Psychologists indicate that: "Reading failure frequently results in an impaired self-image and many children become social and emotional casualties as a result of early defeat."² It is true that any child who cannot read is truly disadvantaged in this society. Therefore, it would seem of great importance for the educator to be able to identify at an early age, those children who may be handicapped by directional confusion. It may also be fruitful to develop additional measures of this faculty, dealing with its more subtle manifestations, with the goal of providing special assistance for those children weak in this area.

The present study supports the contention that investigation is warranted concerning the extent of the relationship between laterality factors and reading.

¹Nicholas Paul Criscuolo, "Training Tutors Effectively," The Reading Teacher, Vol. XXV (November, 1971), p. 157.

²Katrina De Hirsch, Jeannette Jefferson Jansky, and William S. Langford, Predicting Reading Failure (New York: Harper and Row, Publishers, 1966), p. 14.

CHAPTER III

PROCEDURE OF RESEARCH STUDY

Method Used

In 1968, on the following dates, September 24 and 25, October 30 and 31 and December 18 and 19, the children of grade two in Saint Bartholomew School were given tests for laterality, using variations of an eye dominance test, formulated by Martin Gardner,¹ and hand dominance test, formulated by Belmont and Birch.² This data was gathered to support the original study undertaken to establish a relationship between hair whorl patterns and laterality.

Since this research is concerned with the relationship between laterality and reading ability, it seemed worthwhile to follow-up this same group of children.

Using the dominance-test results on laterality,³ from the original study, contact was made with the Saint Bartholomew

¹Martin Gardner, The Ambidextrous Universe (New York: Basic Book Publishing Company, 1964), p. 81.

²L. Belmont and Herbert Birch, "Lateral Dominance, Lateral Awareness and Reading Disability," Child Development, Vol. XXXVI (January, 1965), pp. 57-71.

³Dominance-Test Charts on Laterality, Appendix.

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³Dominance-Test Charts on Laterality, Appendix.

School Administrator so that Non-Verbal Scores and reading achievement data could be added to the already-known information.

Non-Verbal Test scores from the S.R.A. test of Educational Ability and Reading Achievement scores from the Stanford Achievement Tests (Form X were procured.) The intelligence tests were administered in December, 1970, and the Reading Achievement Test was administered in May, 1971.

After all data was collected, the children were ranked, highest to lowest, according to Non-Verbal Test scores (Tables 1, 2, 3, 4 and 5). Children with scores below 90 were dropped from this study since this could indicate a built-in reading retardant.

There were now 111 children left from the original study, of these, 84 were single-dominance children and 27 were crossed-dominance.

Finally, arbitrary uniform intervals were set up for the Non-Verbal Test scores and reading achievement. The highest Non-Verbal score interval was paired with the highest reading-score-interval from highest to lowest.

After this, the children were considered in the light of dominance, Non-Verbal measure of Intelligence and reading achievement. A frequency distribution was made for the purpose of comparison. Table 6 shows the frequency distribution. From this table, Graph 1 was derived. At this point, results were examined.

TABLE 1
PRESENTATION OF FINDINGS

<u>Child's Number</u>	<u>Non-Verbal I.Q.</u>	<u>Stanford Reading Ach.</u>	<u>Dominance</u>
1	125	5.6	Single
2	125	5.6	Single
3	124	6.7	Crossed
4	123	9.5 plus	Single
5	122	6.3	Single
6	122	7.7	Single
7	121	5.4	Single
8	120	5.1	Single
9	119	5.0	Single
10	119	8.4	Crossed
11	119	9.3	Single
12	119	7.5	Single
13	119	7.5	Single
14	118	6.7	Single
15	118	5.6	Single
16	117	9.5 plus	Single
17	117	6.9	Single
18	116	4.1	Single
19	116	7.5	Crossed
20	116	8.5	Single
21	115	6.7	Single
22	115	7.7	Single
23	115	4.1	Single

TABLE 2

PRESENTATION OF FINDINGS

<u>Child's Number</u>	<u>Non-Verbal I.Q.</u>	<u>Stanford Reading Ach.</u>	<u>Dominance</u>
24	115	5.1	Crossed
25	115	4.0	Crossed
26	115	7.2	Single
27	114	8.0	Crossed
28	114	6.9	Single
29	114	6.9	Crossed
30	114	7.7	Single
31	113	6.3	Single
32	113	7.7	Single
33	113	8.0	Crossed
34	112	6.9	Single
35	112	3.3	Crossed
36	112	5.2	Single
37	111	6.0	Single
38	111	6.5	Single
39	110	8.0	Single
40	109	4.9	Single
41	109	5.6	Single
42	108	5.1	Single
43	108	6.0	Single
44	108	5.2	Single
45	107	5.9	Crossed
46	107	7.5	Single

TABLE 3

PRESENTATIONS OF FINDINGS

<u>Child's Number</u>	<u>Non-Verbal I.Q.</u>	<u>Stanford Reading Ach.</u>	<u>Dominance</u>
47	106	5.6	Single
48	106	6.9	Single
49	106	5.1	Single
50	105	2.7	Single
51	105	3.9	Single
52	105	5.3	Single
53	105	8.0	Single
54	105	4.7	Crossed
55	105	4.8	Single
56	105	5.9	Single
57	104	5.6	Single
58	104	3.1	Single
59	104	3.9	Crossed
60	104	3.9	Crossed
61	104	5.6	Single
62	104	5.6	Single
63	103	6.5	Single
64	103	5.0	Crossed
65	103	4.2	Crossed
66	102	5.8	Single
67	102	2.8	Crossed
68	102	2.8	Single
69	101	4.6	Crossed

TABLE 4

PRESENTATION OF FINDINGS

<u>Child's Number</u>	<u>Non-Verbal I.Q.</u>	<u>Stanford Reading Ach.</u>	<u>Dominance</u>
70	101	6.9	Single
71	100	2.7	Single
72	100	5.3	Single
73	99	5.3	Single
74	99	2.1	Single
75	99	4.9	Single
76	99	5.2	Single
77	99	4.6	Single
78	98	4.7	Single
79	98	7.2	Single
80	98	4.3	Single
81	98	5.8	Single
82	98	2.5	Crossed
83	97	4.3	Crossed
84	97	4.6	Single
85	97	5.6	Single
86	97	4.6	Single
87	96	8.0	Crossed
88	96	5.2	Crossed
89	95	4.3	Single
90	95	5.9	Single
91	95	4.3	Single
92	95	3.7	Single

TABLE 5
PRESENTATION OF FINDINGS

<u>Child's Number</u>	<u>Non-Verbal I.Q.</u>	<u>Stanford Reading Ach.</u>	<u>Dominance</u>
93	94	4.2	Crossed
94	94	5.7	Single
95	93	4.6	Crossed
96	93	2.9	Crossed
97	93	4.2	Single
98	93	4.6	Single
99	93	3.6	Single
100	92	4.9	Single
101	92	3.8	Crossed
102	92	4.6	Single
103	92	5.2	Single
104	91	3.4	Crossed
105	91	3.8	Single
106	91	3.1	Single
107	90	3.7	Crossed
108	90	2.6	Single
109	90	2.7	Single
110	90	3.4	Single
111	90	3.7	Single

TABLE 6.

FREQUENCY DISTRIBUTION OF SINGLE-DOMINANCE AND CROSSED-DOMINANCE
CHILDREN, IN RELATION TO I.Q. READING ACHIEVEMENT INTERVALS

1.	2.	3.	4.	5.	6.	7.	8.
91 - 95	2.6 - 3.5	12	4	4	2	0	0
96 - 100	3.6 - 4.5	11	2	2	1	2	1
101 - 105	4.6 - 5.5	8	0	2	3	4	4
106 - 110	5.6 - 6.5	3	0	3	1	4	0
111 - 115	6.6 - 7.5	3	2	4	1	5	3
116 - 120	7.6 - 8.5	2	0	1	1	8	1
121 - 125	8.6 - 9.5	0	0	1	0	5	1
Total No. in Each Group		39	8	17	9	28	10
% in Each Group		46.4%	29.6%	20.3%	33.3%	33.3%	37.1%

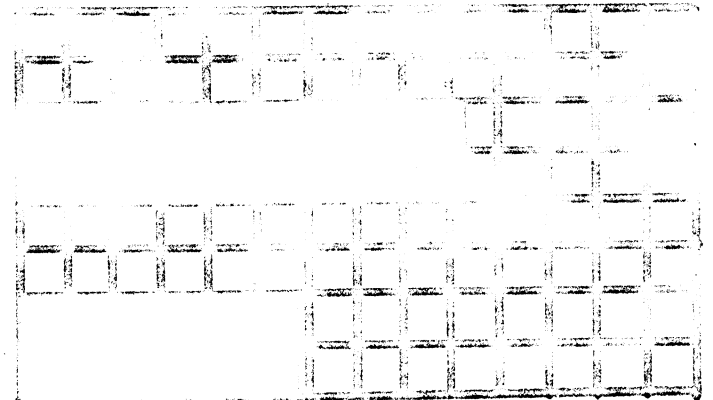
Key:Column 1: Non-Verbal I.Q. Score Intervals.Column 2: Reading Score Intervals.Column 3: No. of Single-Dominants Above Upper Limits of Reading Score Intervals.Column 4: No. of Crossed-Dominants Above Upper Limits of Reading Score Intervals.Column 5: No. of Single-Dominants Within Interval Limits of Reading Score Intervals.Column 6: No. of Crossed-Dominants Within Interval Limits of Reading Score Intervals.Column 7: No. of Single-Dominants Below Lower Limits of Reading Score Intervals.Column 8: No. of Crossed-Dominants Below Lower Limits of Reading Score Intervals.

GRAPH 1.

GRAPHS SHOWING % OF CHILDREN ABOVE, WITHIN, AND BELOW INTERVAL LIMITS

Single
Dominance

Crossed
Dominance

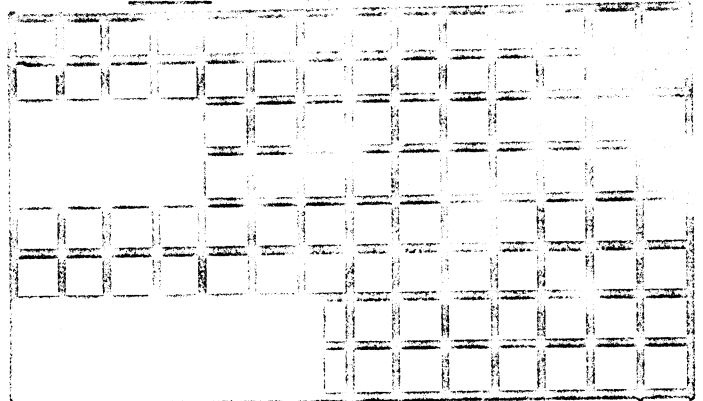


0 5 10 15 20 25 30 35 40 45 50 55 60 65 70

Percent above the upper limits of the intervals

Single
Dominance

Crossed
Dominance

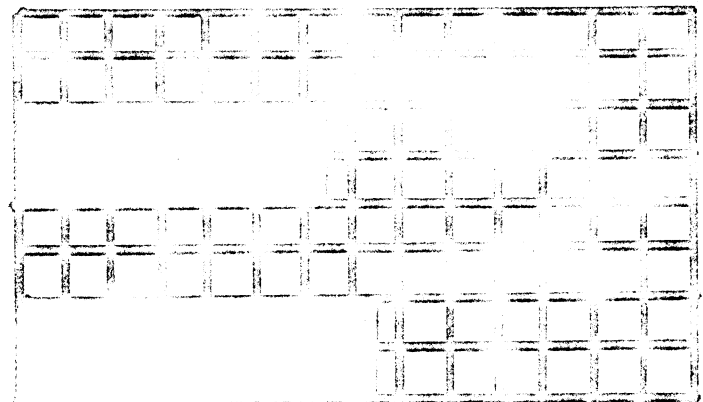


0 5 10 15 20 25 30 35 40 45 50 55 60 65 70

Percent within the interval limits

Single
Dominance

Crossed
Dominance



0 5 10 15 20 25 30 35 40 45 50 55 60 65 70

Percent below the lower limits of the intervals

Presentation of Findings

An examination of Graph 1 discloses that: a) More crossed-dominance children fell below the lower limits of the intervals: 37.1% of the crossed-dominants; 33.3% of the single-dominants. b) The crossed-dominants held their own within the interval limits and as a matter of fact, showed a greater representation here than their single-dominance peers: 33.3%, crossed-dominants; 20.3%, single-dominants. c) The crossed-dominance children failed to rise above the upper limits of the intervals to the degree that the single-dominance children did: 29.6%, crossed-dominants; 46.4%, single-dominants.

Although it is important to note here that the results of this study only indicate concomitancy, point c above, does show that some relationship may exist between the crossed-dominance child and a weaker reading ability even though the relationship is not a causal one.

CHAPTER IV

SOME TECHNIQUES AND INSTRUMENTS FOR IMPROVING THE READING OF CHILDREN WITH CROSSED-DOMINANCE

As you have read in the previous chapters, there is a controversy over the theory of crossed-dominance in relation to reading. Many of the authorities cannot agree to its cause or to its cure, only to the fact that it does exist. The problem has been stated, the literature has been surveyed, and still researchers are faced with the puzzle of what they can do to correct it. We cannot prove this to be the only reason for weak reading and can't get away from multiple causations in reading problems. However, if we could clear up at least one of the multiple causes, we might be able to strengthen the reader in some way. This researcher then, can only offer suggestions as to ways of helping those children who display a lack of eye-hand dominance.

Let's consider developmental approaches rather than remediation programs.

A Good Handwriting Program

Reports show that children with crossed-dominance, in addition to having reading problems, reverse letters, invert

letters, place letters and numerals on the side, mirror their writing, and in general have numerous handwriting problems. From observation over many years in working with all types of disability, such writing is the cause of reading problems. Such errors are not just a tag-along relationship.

While others have eliminated or prevented most problems by having children master a very difficult language situation which involves both handwriting and reading, in many schools of this country the trend has been toward slighting the mastery of a well organized handwriting program and emphasizing reading alone. Perhaps many problems would be solved by greater emphasis on early handwriting instruction, properly programmed. There is a choice--either teach initial handwriting stroke-by-stroke under the exact directions of the teacher--controlled all the way, or continue having reversals, mirroring, and inversions along with the high fifteen percent learning disability problems. It is a choice that instructors must make. Educators are finally awakening to the fact that it is much easier and less wasteful to prevent problems in the first place than it is to "cure" them later. And most of our problems are the "cure-them-later" variety. Early, exacting instruction might have prevented most of them from happening because it is in the early stages of writing that one can more readily detect the reversal problem which indicates that visual motor consistency (single-dominance) is lacking.

Once all letters have been correctly learned with proper placement--there will be time for wide informal use of the correct writing tool. Indeed, after each group of letters has been learned, more and more meaningful words, phrases, and short sentences can be practiced. At the beginning we need to be more concerned with correct, "no-problem" writing than with using a half-learned tool that later causes confusion with all related areas, including spelling and reading.

Two new developments help the teacher in the very important stroke-by-stroke correct learning: a) The Colorgraph presentation of letter shapes. Here adequate attention has been given to direction and sequence. Incidentally, this developmental technique is now available on transparencies for the overhead projector.¹ By flashing these on the chalkboard the instructor can easily individualize the teaching. Simply have pupils trace the steps, erase, then trace again. b) the second new development is the wider use of the overhead projector in teaching handwriting. For initial instruction this device is especially important because on the screen the image is like a moving picture. The child sees an enlarged picture of the teacher's pencil and hand as it touches the correct spot; at the same time the hand and pencil shadow reveals the direction of movement

¹Peterson Handwriting Institute, Projectuals For Print Colorgraph: Projectuals for Cursive Colorgraph (New York: The MacMillan Company, 1971).

as well as the part which follows. This enlarged presentation is superior to a chalkboard presentation. Teachers are urged to make wide use of the tools available for improved instruction, which, without question, reduces the mountain of unnecessary problems.

This method of writing a word and having a child trace it while naming the word was the approach used by the ancient Romans in teaching reading. Grace M. Fernald used the same general device with modifications in successfully teaching reading to children who had been classified as nonreaders.¹

The sooner we abandon the "do-it-in-the-most-comfortable-way" philosophy and emphasize instead, "right-the-first-time," the sooner success will emerge. The more care that is taken with instructing initial correct ways in handwriting, the earlier we shall arrive at an elimination of some of our reading problems.

Kinesthetic-force functions during all writing by hand--either print or cursive style. The more rapidly one writes at any level, the more extensive the employment of kinesthetic-force and the greater the general learning. All reading teachers should be aware of this important force in the mastery of vocabulary on the part of the children. All writing by hand tends to aid retention . . . what we see we tend to remember; what we do we tend to understand, and

¹Grace M. Fernald, Remedial Techniques in Basic School Subjects (New York, N.Y.: McGraw-Hill Book Co., Inc. 1943).

this doing by hand causes the understanding to be retained. Reading and handwriting go together. They support and sustain each other. Reading gives content and writing is the glue that makes things stick. Perhaps this might be one method that might be considered an aid to children with crossed-dominance. Reading teachers that do have a definite stake in handwriting instruction at all levels should be firm supporters of a good strong handwriting program.

Delacato Program

Another strongly recommended approach for developing a single eye-hand dominance is the Delacato program or theory. The theory itself in practice is more of a clinical procedure to be carried on in the home by the parents, but experienced and inventive teachers could devise various methods from those for helping any child in their classroom who has a laterality problem.

Diagnosis and treatment of those who exhibit lack of neurological organization are linked close together by Delacato.¹ Treatment depends on diagnosis and starts at the lowest brain level at which an individual exhibits disorganization.

The diagnostic scale used by Delacato is extensive and starts with an evaluation of cortical laterality.

¹Carl H. Delacato, The Diagnosis and Treatment of Speech and Reading Problems (Springfield, Illinois: Charles C. Thomas, 1965).

Delacato claims that previous measures of laterality were much too simple, and in reality, tested only handedness, whereas the concept should extend to the whole body. Ten tests for right-handed-left-handedness are given, ranging from writing to playing checkers.

Footedness is next observed through five tests, including asking the individual to write with each foot.

Eyedness is evaluated on three criteria, sighting, control, and function. This test uses a number of devices to ascertain complete laterality or its lack. For example, near-point sighting is tested by having the subject sight on a small "x" on a paper, through a narrow three to five inch tube. The child then brings the tube up to his eye, and the eye to which he brings the tube will be his dominant near-point sighting eye.

The second level of brain organization diagnosed is that of bilaterality at the cortex level. Cross patterned walking (simply an exaggerated type of walking quite similar to marching) is the evaluative tool here, and lack of proper rhythm, balance, etc., are indications of improper organization. Binocularity is also evaluated here with a number of devices, one called the Telebinocular.

The third level is that of the mid-brain where creeping is the source of evaluation. Once again, rhythm and body position, as well as body movement, indicate neurological organization.

The final level, that of the pons, is evaluated by posture taken during sleep. This posturalization is, according to Delacato, a continuation of the tonic-neck reflex noticeable in infants when they are lying on their backs. Other postures are accepted as "normal" by Delacato and several simple tests are given to determine if a particular child is posturalizing correctly in sleep.

Treatment then, is started at the lowest level where disorganization is shown. The basic treatment consists of sleep posturizing, cross-patterned creeping, and cross-patterned walking. Treatment also includes eye training at the various levels and the use of occlusion to develop eye laterality. A number of other methods, as well as games, have been suggested by Delacato.

It is important to note that Delacato demands individualized diagnosis and treatment, at least in his latest book.¹ The treatment must be followed until each level of the brain is organized properly.

Although Delacato's comprehensive theory or program has here been stated, this paper has been developed around eye-hand dominance, which is only part of the laterality problem. Therefore, more study in this area needs to be done in order to arrive at more definitive conclusions.

¹Carl H. Delacato, Neurological Organization and Reading (Springfield, Illinois: Charles C. Thomas Publishers, 1966), p. 238.

Frostig Program

Realizing that a child with a laterality problem is a disadvantaged child and also that such a child profits a great deal from auditory and visual perception activities, it would be well to bring in at this time, Marianne Frostig's Developmental Test of Visual Perception.¹ This test, for pre-school and early school age children, was developed out of a need for an instrument which would furnish data for the normal growth of perceptual ability. The results suggest that the period of maximum visual perceptual development usually occurs between three and a half and seven and a half years, with many children experiencing a definite lag in their development, and sometimes even showing a definite laterality problem. This test consists of fifty-four items divided into five sub-tests. 1) Visual motor coordination (with 16 items). Visual-motor coordination is important because well-directed eye-movements are a prerequisite for reading. 2) Constancy of Form (with 18 items). The perception of constancy of shape and size is essential if the pupil is to recognize words when they appear in unfamiliar context, color, size or style of print. 3) Figure ground relationships (with 5 items). The analysis and synthesis of words, phrases, and paragraphs and the ability to locate specific information in a given place on a page require

¹Emerald Dechant, Diagnosis and Remediation of Reading Disability (West Nyack, N. Y. : Parker Publishing Co., 1970), pp. 100-101.

the ability to distinguish figure from ground. 4) Position in space (with 8 items). This requires the pupil to discriminate reversals or rotations in series of schematic figures. 5) Spatial Relationships (with 7 items). This skill measured by this and the previous test is necessary if the pupil is to be able to discriminate between similar letters (b-d) and similar words (saw-was). The effective scoring depends upon the five judges, teachers, or aides, who must be specifically trained in the administration of the test if the results of this test are to be valid and reliable. Development of the skills in which each child was lacking, becomes an individualized program, and is worked upon until the child has mastered that certain skill.

Self-Concept Development

While one is actively concerned with the cognitive functioning of the child, it is important that his affective functioning is also taken into consideration. Therefore, one must be constantly alert to ways in which the child is building a positive self-concept, since what a child thinks of himself will eventually control what he is able to learn.

CHAPTER V

CONCLUSIONS

Summary

While there has been considerable research dealing with reading problems and a possible connection with various physical characteristics, nothing definite has been found in regard to laterality.

This study was simply concerned with investigating some possible connections or links between reading achievement and visual-motor consistency or the lack of it.

In the original study, 122 second graders were tested three times for hand and eye preferences, using variations of Martin Gardner's test for eye-dominance and Belmont and Birch's test for hand-dominance. This testing was done to research a possible connection between laterality and hair whorl patterns. This same group of children was then used for this present study, to see if there is a relationship between laterality and reading.

During October of 1971, information on S.R.A. Non-Verbal measures of intelligence and Stanford Reading Achievement scores were added to the laterality data already gathered on the group of children from the original study.

After all data was compiled, the children were ranked, highest to lowest, according to the Non-Verbal measure of intelligence and children with Non-Verbal scores below 90 were dropped from the present study, since this could indicate a built-in reading retardent.

Then arbitrary uniform intervals were set up for the Non-Verbal scores and the reading achievement, spacing the Non-Verbal scores five points apart and the reading scores one year apart. The highest Non-Verbal score was paired with the highest reading score interval. This paired arrangement was continued for all intervals from highest to lowest.

From this information, a frequency distribution was made using the reading score as a means of distribution. These children with reading scores within the limits of each interval were placed in one column; those with reading scores below the lower limits were placed in another column and those with scores above the upper limits were placed in a third column. This was done for the group who tested as single-dominants and those who tested as crossed-dominants, in grade two.

Finally, percents were calculated for each group and bar graphs were drawn up for the sake of making a comparative study between crossed-dominants and the single-dominants.

Results of the comparative study showed that more crossed-dominance children scored within the interval limits (33.3%) than the single-dominance children (20.3%) and that the difference below the lower limits were not so

great: single-dominants (33.3%) and crossed-dominants (37.1%). However, the crossed-dominance children failed to rise above the upper limits, to the degree that the single-dominants did: single-dominants, (46.4%) and crossed-dominants, (29.6%).

Implications

It would appear from the results of this study that children with crossed-dominance in grade two of the original study, apparently scored lower in reading achievement at grade four, than their single-dominance peers, although the study was somewhat inconclusive.

This conclusion was arrived at because percentage wise, fewer of the crossed-dominance children scored higher than the single-dominance children and a greater number of the crossed-dominance children scored lower than their single-dominance peers, even though the crossed-dominance children did make a fairly good showing within the interval limits. Graph 1 showed that 29.6% of the crossed-dominance children rose above the upper limits of the intervals whereas 46.4% of the single-dominants were so inclined.

Finally, it must be agreed upon that there is no one cure for laterality disfunctions in relation to reading or any other subject or activity, for it is still in need of great research, study and experimentation. Until the time comes when we can actually say just exactly what it is and can find a cure for it, we must be ever on the lookout for

ways to help children with the laterality problem. This research paper has suggested that any one of a number of conditions may or may not be involved as a contributing factor in reading disability. Much of the evidence is equivocal. It becomes obvious that no single factor by itself, if ever, causes reading disability. Therefore, as researchers, educators, and interested people, the problem must be handled piece by piece until it is solved.

Ideas for Further Research

It would be hoped that this study might be the seed from which more far-reaching endeavors might spring.

Possibly it could be extended to a larger population, under more controlled circumstances, to see if the same results would occur.

Also of interest to this researcher was a noticeable pattern that seemed to develop while dominances were being investigated. Some crossed-dominance children use a right-eye-left-hand combination and others use the left-eye with the right hand. It might be of interest to researchers to know if one of these combinations is more problematical than the other.

Newer methods or suggestions could also be investigated in dealing with the training of a child with crossed-dominance.

Since the major tenet of the Doman-Delacato theory is that a child cannot develop the ability to handle language symbols satisfactorily, as required in reading, unless lateral dominance is developed, reading specialists, particularly, dare not neglect this area of research.¹

¹ _____, "The Controversy About Dyslexia," Education Digest (September, 1968), pp. 51-53.

APPENDIX

TABLE 8
AVERAGE ONE - GR. 2

	WHORL			HAND			EYE			PARENTS	
	Clock- Wise	Counter Clock- Wise	Double	9-24-68	10-30-68	12-18-68	9-24-68	10-30-68	12-18-68	Writing Hand	Mother
1 Allen		X		R R R	R R R	R R R	R R R	R R R	R	R	R
2 Mark	X			R R R	R R R	R R R	R R R	R R R	R	R	L
3 Jeff	X			R R R	R R R	R R R	L L L	L L L	R	R	R
4 Tim	X			R R R	R R R	R R R	R R R	R R R	R	R	R
5 Mike	X			R R R	R R R	R R R	R R R	R R R	R	R	R
6 Steve	X			R R R	R R R	R R R	R R R	R R R	R	R	L
7 Roger	X			R R R	R R R	R R R	L L L	L L L	R	R	L
8 Jack	X			R R R	R R R	R R R	R R R	R R R	R	R	R
9 Jeffie		X		R R R	R R R	R R R	R R R	R R R	R	R	R
10 Andy		X		R R R	R R R	R R R	L L L	L L L	R	R	R
11 Jeffrey		X		R R R	R R R	R R R	R R R	R R R	R	R	R
12 Ronnie	X			R R R	R R R	R R R	R R R	R R R	R	R	R
13 Laura	X			R R R	R R R	R R R	R R R	R R R	R	R	R
14 Karen	X			R R R	R R R	R R R	R R R	R R R	R	R	ambid.
15 Mary	X			L L L	L L L	L L L	L L L	L L L	L	R	R
16 Lisa	X			R R R	R R R	R R R	R R R	R R R	R	R	ambid.
17 Beth	X			R R R	R R R	R R R	R R R	R R R	R	R	R
18 Kerry	X			R R R	R R R	R R R	R R R	R R R	R	R	R
19 Nancy	X			R R R	R R R	R R R	R R R	R R R	R	R	R
20 Lori	X			R R R	R R R	R R R	R R R	R R R	R	R	R
21 Shelley	X			R R R	R R R	R R R	R R R	R R R	R	R	R
22 Lisa Ann	X			R R R	R R R	R R R	R R R	R R R	R	R	R
23 Yvonne	X			R R R	R R R	R R R	R R R	R R R	R	R	R
24 Susan		X		L L L	L L L	L L L	R R R	R R R	L	R	R
25 Jenny	X			R R R	R R R	R R R	R R R	R R R	R	R	R
26 Sue Ann	X			R R R	R R R	R R R	R R R	R R R	R	R	R
27 Jane	X			R R R	R R R	R R R	R R R	R R R	R	R	R
28 Connie	X			R R R	R R R	R R R	R R R	R R R	R	R	R
29 Mary Jo	X			R R R	R R R	R R R	R R R	R R R	R	R	R

TABLE 9

AVERAGE TWO GROUP - GR. 2

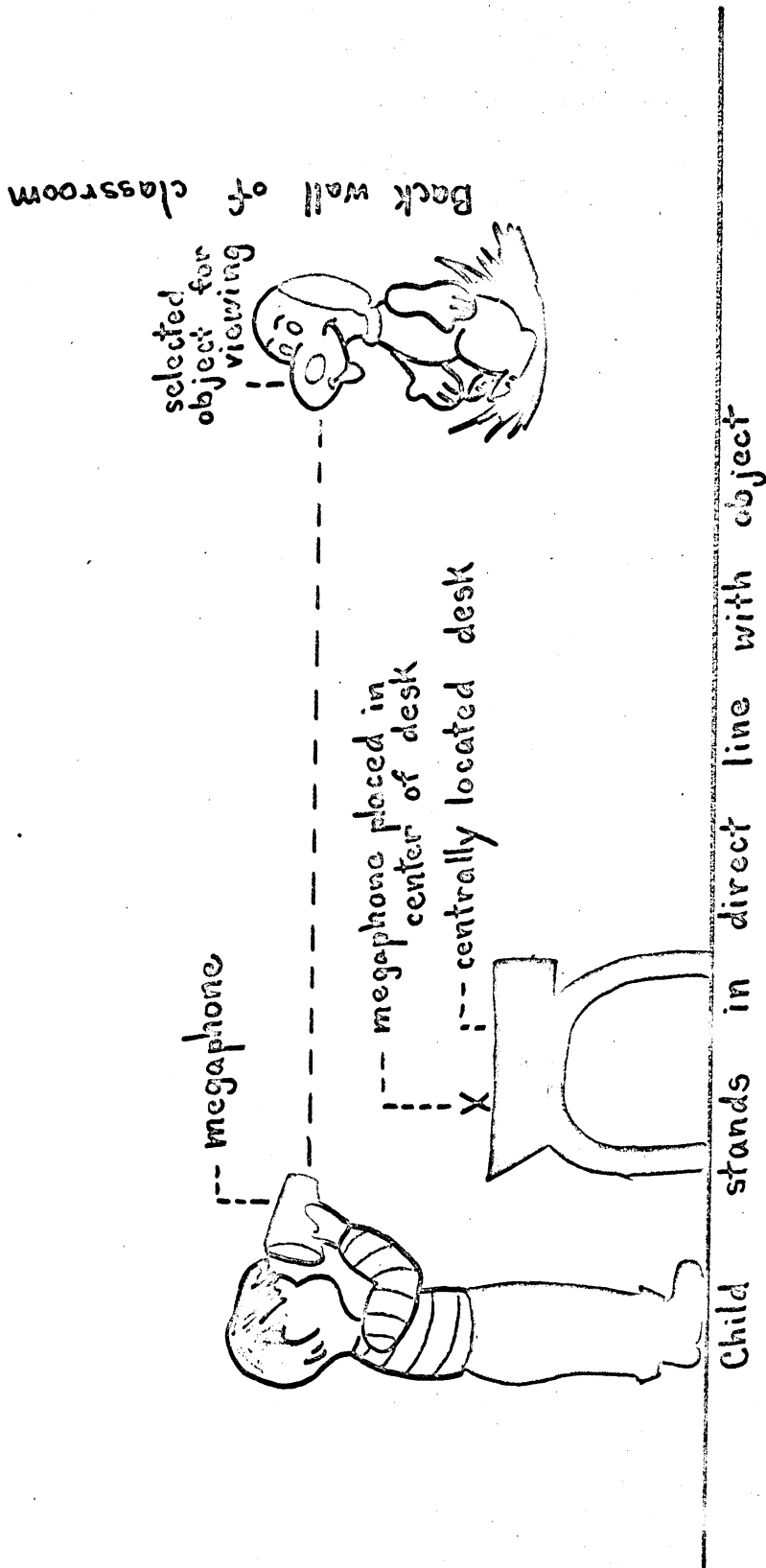
	WHORL			HAND			EYE			PARENTS		
	Clock- Wise	Counter Clock- Wise	Double	9-24-68	10-30-68	12-18-68	9-24-68	10-30-68	12-18-68	Writing Hand	Mother	Father
1 Andy			X	R R R	R R R	R R R	R R R	R R R	R R R	R	R	R
2 Danny			X	R R R	R R R	R R R	R R R	R R R	R R R	R	R	R
3 Doug		X		R R R	R R R	R R R	R R R	R R R	R R R	R	R	R
4 David			X	R R R	R R R	R R R	R R R	R R R	R R R	R	R	R
5 Jim		X		R R R	R R R	R R R	L L L	L L L	R R R	R	R	R
6 Brian		X		R R R	R R R	R R R	R L R	R L R	R R R	R	L	R
7 John	X			R R R	R R R	R R R	R R R	R R R	R R R	R	R	R
8 Robbie	X			L L L	L L L	L L L	R R R	R R R	L L L	L	R	R
9 Joe	X			R R R	R R R	R R R	R R R	R R R	R R R	R	R	L
10 Robert	X			R R R	R R R	R R R	R R R	R R R	R R R	R	R	ambid.
11 Peter	X			R L R	R L R	R L R	R R R	R R R	R R R	R	R	R
12 Gene	X			R R R	R R R	R R R	R R R	R R R	R R R	R	L	R
13 Tom	X			L L L	L L L	L L L	L L L	L L L	L L L	L	R	R
14 Matthew	X			R R R	R R R	R R R	R R R	R R R	R R R	R	R	R
15 Victor	X			R R R	R R R	R R R	R L R	R L R	R R R	R	R	R
16 Jimmy	X			R R R	R R R	R R R	R R R	R R R	R R R	R	R	R
17 Ted	X			R L R	R L R	R L R	R R R	R R R	R R R	R	R	R
18 Dave	X			L L L	L L L	L L L	L L L	L L L	L L L	L	R	L
19 Meg	X			R R R	R R R	R R R	R R R	R R R	R R R	R	R	R
20 Mary	X			R R R	R R R	R R R	R R R	R R R	R R R	R	L	R
21 Glory	X			R R R	R R R	R R R	R R R	R R R	R R R	R	R	R
22 Lisa	X			R R R	R R R	R R R	R R R	R R R	R R R	R	R	R
23 Margie			X	L L L	L L L	L L L	R R R	R R R	L L L	L	para- lized	dead
24 Diane	X			R R R	R R R	R R R	R R R	R R R	R R R	R	R	L
25 JoAnne	X			R R R	R R R	R R R	R R R	R R R	R R R	R	R	R
26 Sue	X			R R R	R R R	R R R	L L L	L L L	R R R	R	R	R
27 Bridgette	X			R R R	R R R	R R R	R R R	R R R	R R R	R	R	R
28 Marcia		X		R R R	R R R	R R R	R R R	R R R	R R R	R	R	R
29 Julie	X			R R R	R R R	R R R	R R R	R R R	R R R	R	R	L
30 Susan	X			R R R	R R R	R R R	R R R	R R R	R R R	R	R	R
31 Marian	X			R R R	R R R	R R R	R R R	R R R	R R R	R	R	R
32 Cathy	X			R R R	R R R	R R R	R R R	R R R	R R R	R	R	R
33 June	X			L L L	L L L	L L L	R R R	R R R	L L L	L	R	R
34 Jeanine	X			R R R	R R R	R R R	R R R	R R R	R R R	R	R	R

DOMINANCE-TEST CHART ON LATERALITY FROM 1969 RESEARCH PAPER

TABLE 10
BASIC GROUP - GR. 2

	WHORL			HAND			EYE			PARENTS		
	Clock- Wise	Counter Clock Wise	Double	9-24-68	10-30-68	12-18-68	9-24-68	10-30-68	12-18-68	Writing Hand	Mother	Father
1 John	X			R R R			L L L			R	R	R
2 Jeff	X			R R R			R R R			R	R	L
3 Steven			X	R R R			R R R			R	R	R
4 Michael		X		R R R			L L L			R	R	R
5 Albert		X		R R R			L L L			R	R	R
6 Kenny		X		R R R			R R R			R	R	R
7 Ralph	X			R R R			R R R			R	R	L
8 Roger	X			R R R			L L L			R	R	R
9 Peter			X	R R R			L L L			R	R	R
10 Kirk	X			L L R			R R R			L	R	R
11 Jimmy	X			R R R			L L L			R	R	R
12 Mark	X			R R R			R R R			R	R	R
13 Jim W.	X			R R R			L L R			R	R	R
14 Paul	X			R R R			R R R			R	R	R
15 David	X			R R L			L L L			R	L	R
16 Tim	X			R L R			L L L			R	R	R
17 Sandy	X			R R R			R R R			R	R	R
18 Diane		X		L L L			R R L			L	R	ambid.
19 Karen	X			R R R			R R R			R	R	R
20 Lisa		X		R R R			R R R			R	R	R
21 Laura		X		L R L			R R R			L	R	R
22 Marilee	X			R R R			R R R			R	R	R
23 Linda	X			R R R			R R R			R	R	R
24 Kim	X			R R R			R R R			R	R	R
25 Maria		X		R R R			L L L			R	R	R
26 Judy	X			R R R			L L L			R	R	R
27 Jennifer	X			R R R			R R R			R	R	R
*28 Theresa		X		L L L			L L L			R	R	R

DIAGRAM FOR TEST PROCEDURE



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