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# A Study in the Comparison of Ocular and Extremity Dominance Among a Stuttering and Non-Stuttering School-Age Population

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# A Study in the Comparison of Ocular and Extremity Dominance Among A Stuttering and Non-Stuttering School-age Population

by

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A Thesis in Partial Fulfillment of the Requirements

For the Degree Master of Science

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Each person whose signature appears below certifies that he has read this thesis and that in his opinion it is adequate, in scope and quality, as a thesis for the degree of Master of Science.

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# CHAPTER I

## INTRODUCTION AND REVIEW OF LITERATURE

### 1. Introduction

A number of theories have been advanced which have had implications for the treatment of stuttering. Many of these theories have been the object of study to determine their value.

Delacato (1959, 1963) has proposed consideration of a neuro-psychological approach to the treatment of speech problems, the basic premise of this approach is that man must follow an orderly neurological development; that total or partial underdevelopment of the sensory and motor pathways may result in failure of the individual to perform at his highest potential. Inadequate performance, stated Delacato (1963, p.7), could, among other things, cause the person to exhibit a problem in communication.

To overcome speech problems, Delacato (1963, p.7) felt that the speech defective should be evaluated by determining the weakness of the optimum neurological organization.[1] He states that those levels of development which are incomplete are overcome by sensory stimulation aimed at that level of development. Delacato (1963, p.7) stated that speech is the

1. Patterns of optimum neurological organization were described by Delacato (1963, p.4).

result of complete lateralization, and that if speech problems occur, it would indicate an incompleteness in the nature and the quality of the neurological organization of the person involved.

According to Delacato (1959, p.25), stuttering is the result of too much hemispheric balance. He further stated that children during the fourth to sixth years are in the process of establishing tonal sideness, the dominant hemisphere controls sound skills and the sub-dominant hemisphere controls the tonal activity. Delacato (1963, p.64) felt that stutterers never made this tonal adjustment; therefore, they stutter. They are caught at mid-point of organization, he continued, with both cortical hemispheres in balance and, therefore, in conflict. If we add tonality, continued Delacato (1959, p.25), the hemisphere which controls and which is normally the sub-dominant hemisphere becomes dominant, and the stutter disappears.

It is the purpose of the present study to determine the relationship of eye and extremity dominance and the presence or absence of stuttering. Ten stutterers and ten non-stutterers will be given The Harris Tests of Lateral Dominance, the Leavell Hand-Eye Coordinator Tests, and the Keystone Visual Survey Tests. Results from the statistical analysis will determine the incidence of mixed extremity and ocular dominance among stutterers.

## 2. Definition of Terms

For the purpose of this study, the following definitions are given for the sake of clarity.

1. Stuttering: A disturbance of rhythm and fluency of speech by an intermittent blocking, a convulsive repetition or prolongation of sounds, syllables, words, phrases, or posture of the speech organs.

2. Neurological Organization: The total and uninterrupted ontogenetic neural development, from the spinal cord, vertically upward to the level of cortex, and then the establishment of cortical hemispheric dominance.

3. Lateral Dominance: The consistent choice of one hand, one eye, and one foot on the same side of the body, as in total extremity and ocular dominance. Laterality is an internal awareness of the two sides of the body and their difference.

4. Mixed Dominance: The equal use of both sides in either hand, eye, or foot dominance. Cross dominance is when the dominant eye is on the opposite side of the dominant hand or foot.

5. Dominant Eye: The dominant eye being the consistent choice in monocular-visual situations, and is on the same or opposite side as the preferred hand, and/or foot, and remains stable throughout life. The predominant eye is the eye which controls the binocular-visual situation.

has been referred to as the sighting eye, and can be shifted by changes in vision or controlled by training.

For a vocabulary of terms relating to the eye, see the Appendix.

### 3. Significance of the Study

It has long been recognized (Selzer, 1933; Bryngelson, 1935; Fink, 1938) that the human organism is one-sided. Support for these claims have been provided by Orton (1937), Gesell (1949), Leavell (1954), Walls (1951), and Delacato (1959). These studies support the conclusion that manual dominance and speech function are in some way associated with favor on total right and left dominance. It has been shown (Hildreth, 1950) that failure to establish consistent dominance leads to confusion in acquiring psycho-motor skills, which affects speech. A lack of integration resulting from the absence of visual fusion, stated Selzer (1933), will eventually prove to be the missing link in the problem of cerebral dominance.

Gesell (1949) pointed out that our civilization is becoming increasingly eye minded, and that there was never a time when such relentless demands, imposed and self initiated, were made on the mechanism of seeing. Getman (1962) stated that vision and language are closely related abilities in that they support and extend each other while they save time and energy by replacing action.

The child who demonstrates a lack of eye movement and a lack of speech control, stated Getman (1962, p.27) will probably show many inadequacies in special movement patterns which will play a particular role in the productive action of the total child.

Rodale (1965) reported that disappointment in the results of treating language-impaired children has brought the development of an integrated treatment procedure for speech problems. According to Graw (1962), Delacato hypothesized that this integrated procedure involves the organism functioning physiologically, psychologically, and intellectually. Before complete neurological organization can take place, Graw (1962, p.2) reported that unilateral organization including eyedness, handedness, and footedness are necessary.

## 4. Review of the Literature

### General Review

In discussing the child's need for learning, Kephart (1960) stated:

> For a child whose organism is deficient and show some of the physiological and neurological processes necessary for such learning do not operate normally, it becomes impossible without very special help.

Before any child can be given the amount and kind of help he needs, Kephart (1960, p.16) felt that much must be known about the demands, skills, and abilities of the organism. He further stated that many children are coming

into the schools lacking in basic perceptual-motor skills, and, consequently, are unable to participate and learn from many of the educational activities.

Bryngelson (1935) was of the opinion that any factor which operated against the establishment of one-sided dominance, tends to interfer with normal establishment and development of speaking. Orton (1935), Leavell (1940), Wilson and Leavell (1954), and Subriana (1961) are in general agreement that deficiencies in communication were found to appear significantly more often among persons who had no clear-cut preference regarding laterality.

Cole (1954), in his study of persons having neurological defects of speech, felt that these persons have a common denominator called heredity. In the family of the stutterer, he continued, there are cases of late development of speech, and this inheritance sets the stage for poor language performance. Cole (1954, p.977) concluded by saying that there are those who have inherited a tendency toward a dominant right as well as a dominant left hemisphere.

Regarding ocular dominance, Sutor (1964) reported that years ago it was possible to determine that cross dominance of hand and eye have great prognostic importance for speech difficulties. Delacato (1959, p.59) stated that his investigations have led him to believe that when the controlling eye is on the side opposite that of the handedness, the motor initiation is poor and difficulties in speech, reading,

and writing ensue. He also claimed that similar difficulties do not occur when the controlling eye is on the side of the handedness.

Cerebral Dominance

Travis (1931) has been primarily responsible for the theory of cerebral dominance and handedness in speech disabilities. There was little progress in hemispheric dominance until Orton (1937) attacked the problem with more neurological data. According to Delacato (1963, p.23), Fay gave the field its first real insight into the relationship of the evolution and development of human movement. Eames (1934) was of the opinion that the most common mixed dominant problem occurs when the child is left eyed, but right handed. He continued by saying that the premature group of children with reading difficulties presented more neurological lesions as well as visual problems.

Investigations by Rheingerger, Karlin, and Berman (1943) showed that comparisons of the laterality tendencies and the electroencephalographic pattern of stutterers and non-stutterers disclose an essential similarity between the two groups. In contrast, the laterality studies showed that there were differences enough to suggest that stutterers have somewhat less unilaterality than the non-stutterers.

Karlin and Gurren (1965) noted that a distinctive feature in speech function is the dominance of one cerebral hemisphere dominance over the other. When complete cerebral

hemisphere dominance is lacking, Bryngelson (1934) felt that the stutterer finds it difficult to speak in a normal, smooth-flowing manner.

Karlin and Gurren (1965, p. 96) supported the psychosomatic theory of stuttering with evidence which indicated that biochemical research has not shown significant differences between stutterers and non-stutterers. In a study regarding hand-eye relationship, Leavell (1961) reported that the left-handed and right-eyed subject was found to be more retarded in language arts development. He later reported that since the language function is normally located in the same lobe of the brain that controls the dominant hand; confusion may result when unilaterality is not maintained.

Fiorentino (1965), stated in her study regarding reflex testing methods for evaluating central nervous system development, that primitive reflexes are essential in normal development. Response to these reflexes, she continued, prepares the child for progressive development, such as rolling over, sitting, crawling, standing, and so forth. Furthermore, she felt that in normal development these primitive spinal and brain stem reflexes gradually diminish in order that higher patterns of righting and equilibrium reactions may become manifested. When inhibitory control of higher centers is disrupted or delayed, Fiorentino (1965, p.5) concluded, primitive patterns dominate to the exclusion of higher, integrated sensorimotor activities, and that

certain neurologic dysfunctions are believed to result from specific c.n.s. lesions.

Handedness

Delacato (1963, p.15) reported that Broca and Jackson gave impetus to the tendency to equate handedness with neurological sufficiency through their writings which were the earliest containing physiological data. Handedness became strongly entrenched as the sole criterion of cortical hemispheric dominance, continued Delacato (1963, p. 15), and the beginning of the twentieth century in the United States found one group searching in vain to correlate handedness with a language function.

Handedness and the change of handedness has been considered to have an important relationship to at least some cases of stuttering, according to Delacato (1963, p. 21). He stated, however, that during the period between 1954 and 1958, the trend was away from the correlation of handedness to speech, and that the approach to stuttering tended toward considering the whole person.

Bryngelson (1940, p.151) reported the results of his study of manual dominance in normal speech cases and stutterers. It was shown that fewer speech defectives are right-handed than normal speakers; that more speech defectives are ambidextrous than normal speakers; and that left-handedness and stuttering is found more often in the families of speech defectives than in normal speakers.

On the basis of a survey relating stuttering and handedness, Daniels (1940) concluded that there is no support for a supposed relationship between left-handedness and stuttering. He also reported that the percentage of stutterers among ambidextrous students was not higher than in the population studied. He felt that the changing of handedness in the management of stuttering as well as the techniques employed in the testing for handedness, per se, are of dubious value. Other authorities (Heltman, 1940; Van Dusen, 1939; Williams, 1952), support Daniels (1940) in that handedness and the change of handedness has little effect on speech.

The literature regarding handedness and its relationship to stuttering indicated that there has been little success in the treatment of stuttering using handedness as the sole criterion. Sutor (1964, p.10) felt that the general opinion of professional people who are working with mixed dominance problems is that no attempt should be made to change handedness, but to try to change the controlling eye in the binocular-visual act. It is important to remember, continued Sutor (1964, p.14), that in changing the controlling eye with lenses or visual training, we are establishing neural pathways. We do this, he stated, so that hand and eye coordination and dominance will be consistent. He also reported that several authors have expressed the opinion that mixed dominance is related to speech problems, especially when an attempt is made to change handedness. He also stated

that in trying to changed handedness one author reported he created stuttering and other speech problems.

Investigation of laterality and orientation in relation to learning disabilities have, according to Haring and Ridgway (1967), sometimes rested on controversial theoretical bases (Orton, 1937; Delacato, 1963); but that the relationship can be considered established, even if the exact etiology remains unclear.

Ocular Dominance

Ocular dominance is not new to the literature. Walls (1951) stated that one of the earliest references to ocular dominance was by Giovanni della Porta, in his study, "De refractione" in 1593. Later references cited by Walls (1951, p.389) included the writings of Humphry (1861), Callan (1881), and Rosenback and Wray (1903). Other early 20th century references included Travis (1931), Selzer (1933), Bryngelson (1935), and Fink (1938), as reported by Walls (1951).

In considering vision, Delacato (1963, p.89) stated that we have been erroneous in thinking that acuity is the most significant visual factor. He felt that one reason for this is the fact that we have been structurally oriented, and looked for structural deviations of the eye. He pointed out that the outdated ways of evaluating the eyes for acuity, one at a time, is gone. The child should be able to pass a valid binocular evaluation of visual functions, concluded

Delacato ( 1963, p. 89), given by a visual specialist who is well aware of the developmental aspects of vision.

Groffman (1962) said that it is now felt that the pre-dominant eye is of more significance than the dominant eye. He stated that this pre-dominant eye controls binocular perception, while the other eye plays an assisting rather than equal role. The dominant eye, continued Groffman (1962, p.4) is selected for an essentially monocular act , and is stable from early life. The pre-dominant eye, however, can be shifted, as the binocular pattern is easily influenced by changes in vision, or controlled by training. Delacato (1963, p.90), is in agreement with the importance of the pre-dominant eye in establishing complete neurological organization.

Summary

In reviewing the literature, there is evidence that deficiencies in communication were more frequent among persons who have no clear-cut preferences regarding laterality. Though some authorities on stuttering agree that ocular dominance, with special reference to the controlling eye, plays an important part in determining the development of an adequate language.

The research reviewed suggests that it is extremely difficult to determine whether a visual anomoly, per se, is directly responsible for a cross or mixed dominance syndrome.

The trend favors the pre-dominant eye as a primary factor in determining dominance. It would seem, then, that disturbance in the central nervous system could be generated to cause a slowing of the child's ability to read, write, or speak.

Findings suggest a need for further research dealing with the relationship of eye extremity dominance and the presence or absence of stuttering. It is the writer's opinion that we cannot neglect the subject of dominance in stuttering as controversial as it may be, nor can we afford the luxury of waiting until causes can be unquestionably established by techniques yet to be developed.

## CHAPTER II

## THE PROBLEM

### 1. Statement of the Problem

It is the purpose of this study to determine the relationship of eye, extremity dominance and the presence or absence of stuttering. The present study was designed to investigate the nul-hypothesis that there is no positive correlation between stuttering and the lack of total neurological organization, and that there is no higher incidence of visual problems and mixed or cross dominance in the group of individuals whose speech is characterized as stuttering.

For the purpose of this study, the following questions are posed:

1. Does mixed eye and extremity dominance occur more frequently among subjects of the stuttering population than seen among non-stuttering controls?

2. Is there a pattern of eye and extremity disharmony characteristic of the stutterer?

## CHAPTER III

## PROCEDURE

### 1. General Description of Procedures

In order to investigate the ocular, extremity dominance and patterns characterized as stuttering, two groups of subjects of a school-age population were selected. These groups were given The Harris Tests of Lateral Dominance, the Leavell Hand-Eye Coordinator Tests, and the Keystone Visual Survey Tests.

### 2. Selection of Subjects

The experimental group, composed of ten stutterers, were selected and evaluated by speech clinicians as having the speech disorder referred to as stuttering. These subjects were rated on a five point scale as to their severity of stuttering by the speech clinicians as well as the investigator. The clinicians and the writer agreed as to the degree of severity in all but three subjects. The speech clinicians tended to rate the stutterers higher on the severity scale than did the investigator.

The control group, composed of non-stuttering subjects were selected by school personnel and matched according to chronological age, sex, grade placement, and socio-economic backgrounds.

In selecting subjects for this study, it was felt that careful consideration should be given to the age of thepopulation from which the subjects were drawn. The following review of the literature provides a basis for the considerations made.

Karlin, Karlin, and Gurren (1965) stated that language perception and speech motor centers are located in cortical areas that reach anatomical differentiation later than other motor centers. Cobb and Cole (1939) felt that a delay in myelinization of the nerve tracts at the time when children are taught to talk prevents them from profiting from the instruction and that by the time myelinization is complete the speech patterns are fixed.

Delacato (1959, p.23) said that children tend to remain somewhat ambidextrous until about the age of six and a half, at which time a dominant hand, foot, and eye become established. Allen (1965) stated that the critical period in developing acute vision is between the ages of one and seven.

De Hirsch (1966) was of the opinion that disburbances in spoken language are deviations in perceptuomotor organization, and that severe deficits in oral language are a part of a generalized development dysfunction.

Because complete neurological development appears to be closely related to normal speech development in children, it was felt that the experimental and control groups be selected from a Senior High School population. In this way, the subjects included in this study would have had time to develop

neurologically, taking into account motor, anatomical, and myelinization differentiations.

3. Description of the Groups

The experimental group composed of stuttering subjects, and the control group composed of non-stuttering subjects, were selected from three senior high schools.

The experimental group was selected by speech clinicians assigned to the high schools. The control group was matched by those similar criteria of the experimental group. Parental permission was obtained as well as permission from the revelant high schools included before the subjects could take part in the study. A total of twenty subjects were included in this investigation.

4. Experimental Procedure

Evaluation of Lateral Dominance

It was felt that in order to do an evaluation for lateral dominance, two standardized tests be given, as well as tests for visual abilities. The tests chosen are consistently used in evaluating eye and extremity dominance, and are standardized for rating and scoring. However, the scoring for the Keystone tests were set up by the writer.

The experimental group and the control group were administered the Harris Tests of Lateral Dominance, the Leavell Hand-Eye Coordinator Tests, and the Keystone Visual Survey Tests.

The Harris Tests of Lateral Dominance. Tests of lateral

dominance can be given routinely as a part of the examination procedure in cases of speech defects of neurological difficulties. The lateral dominance tests are brief, interesting, and not fatiguing, and can be used at the beginning, near the middle, or near the end of an examination sequence. For specific directions for administering these tests, see the Appendix of the present study. For additional information, see the Manual of Directions for Administration and Interpretation, Harris Tests of Lateral Dominance.

These lateral dominance tests consist of 11.2 tests, and included tests for knowledge of right and left, hand preferences, simultaneous writing, handwriting, tapping, dealing cards, strength of grip, monocular tests, binocular tests, and foot dominance. If the tests for simultaneous writing, hand preferences, and handwriting all agree in showing the same hand to be dominant, the remaining hand dominance tests can be omitted. Leavell Hand-Eye Coordinator Tests.

These tests function in relation to the general expression of the individual in eye, hand, and foot function as well as in visual imagery, and is a subjective analysis of motor-visual preference. These tests consist of six sections which survey function regarding the evaluation of the eye, hand, and foot function as well as visual imagery.

For specific directions for the administration of these tests, see the Appendix of the present study. For additional

information concerning this test, see the Manual of Instructions for the users of The Revised Leavell Language Developmental Service, Keystone View Company, Meadville, Pennsylvania.

The Keystone Visual Survey Tests. The purpose of these tests is to employ a speedy and practical evaluation of a subject's binocular coordination. The tests were not designed to give diagnostic data, but are used for screening-out purposes only. These tests provide information both at far and near point; give a reliable picture of the subject's visual efficiency, and are administered with the Telebinocular. These tests consisted of twelve procedures which evaluated simultaneous vision, vertical posture and stereopsis at far point, while lateral posture, usable vision were tested at far and near point. The tests for color perception were excluded from the testing since these tests were not applicable in determining visual functioning or acuity.

For specific directions for administering these tests, see the Appendix of the present study. For additional information concerning this test, see the Manual of Instructions for use with The Keystone Visual Survey Service, Keystone View Company, Meadville, Pennsylvania.

5. Procedures for Analysis of Results

The statistical analysis of the data compiled was done by way of the "t" test of significance, as shown in Tables 1 and 3, and the Chi Square Test, as shown in Tables 2, and 4 through 13.

The "t" test included computation of the "t" statistic to test whether scores obtained on selected tests were statistically significant. The Chi Square Test was used to determine the presence or absence of factors indicating a greater or less degree of dominance confusion. The statistical analysis employed included the following:

1. "t" test of significance of the difference of means for the Leavell tests regarding hand-eye coordination from results obtained from stuttering and non-stuttering groups.

2. "t" test of significance of the difference of means for the Keystone tests regarding eye dominance of stutterers and non-stutterers who showed right, left, and mixed eyedness.

3. Chi Square analysis of frequency of stutterers and non-stutterers who showed right, left, and mixed dominance from results obtained from the Harris tests.

4. Chi Square analysis of frequency of stutterers and non-stutterers who showed right, left, and mixed handedness from results obtained from the Leavell tests.

5. Chi Square analysis of frequency of stutterers and non-stutterers who showed right, left, and mixed handedness from results obtained from the Harris tests.

6. Chi Square analysis of frequency of stutterers and non-stutterers who showed right, left, and mixed eyedness regarding scores from the Leavell tests.

7. Chi Square analysis of frequency of stutterers and non-stutterers who showed right, left, and mixed eyedness from results obtained from the Harris tests.

8. Chi Square analysis of frequency of stutterers and non-stutterers who showed right, left, and

mixed foot dominance regarding scores from the Leavell tests.

9. Chi Square analysis of frequency of stutterers and non-stutterers who showed right, left, and mixed footedness from results obtained from the Harris tests.

10. Chi Square analysis of frequency of stutterers and non-stutterers who showed specified visual abilities regarding scores from the Keystone tests.

11. Chi Square analysis of frequency of stutterers and non-stutterers who showed right, left and mixed dominance concerning an overall evaluation of dominance scores obtained from the Harris and Leavell tests.

12. Chi Square analysis of frequency of stutterers and non-stutterers who showed homolateral dominance as compared to mixed dominance from scores obtained from the Leavell and Harris tests.

13. Chi Square analysis of frequency of stutterers and non-stutterers who showed unilateral dominance, mixed dominance, and specified visual abilities from results obtained from the Leavell, Harris, and Keystone tests.

## 6. Ratings Assigned

Harris Tests of Lateral Dominance

Rate a R (strong right) those scores of 100%.

Rate as r (moderate right) those with scores of 75-95%.

Rate as M (mixed) those with scores of 30-70%.

Rate as l (moderate left) those with scores of 5-25%.

Rate as L (strong left) those with scores of 0%.

Within each rating, the cross can be placed in the middle, to the right, or to the left, to indicate the score a little more precisely. The majority of those rated "M" actually showed a slight preference for one side; only scores

of 45, 50, and 55 can really be called ambidextrous on the basis of this test.

Total Hand Dominance Rating

Rate R if all ratings are r or R.

Rate as R if Tests 2 and 3 are both on the R side and note more than two of Tests 4, 5, 6, and 7 are rated as M or L.

Rate as M: (a) if the rating on either Test 2 or 3 favors the otherwise nondominant hand; (b) if the rating on either Test 2 or Test 3 is M, and at least one other test is rated M or in favor of the nondominant hand; or (c) if three or more of Tests 4, 5, 6, and 7 are rated M or in favor of the hand which is not dominant in Test 2 and 3.

Rate as L if Tests 2 and 3 are rated L or 1, and not more than two of Tests 4, 5, 6, and 7 are rated M or R.

Rate as L if all ratings are on the L side.

Total Eye Dominance Rating

Rate as R if Tests 8 and 9 are both rated R.

Rate as r if either Test 8 or 9 is rated R and the other is rated r or M, or if both are rated r.

Rate as M: (a) if both Test 8 and 9 are rated M; (b) if one is rated M and the other is rated r or L; or (c) if one is rated R or r and the other is rated 1 or L.

Rate as L if Tests 8 and 9 are both rated L.

Total Foot Dominance Rating

Rate as R if both ratings are R or r.

Rate as r if one rating is R and the other is M.

Rate as M if one rating is on the right side and the other is on the left, or if one is M and the other is r or L.

Rate as L if one rating is L and the other is M.

Rate as L if both ratings are l or L.

Leavell Hand-Eye Coordinator Tests

Section A - Hand-Foot Preference Tests

Indicate only the total number of "right" choices under this hand-foot preference test. No score for "left" choices.

Section B - Eye-Ear Preference Tests

Indicate only the total score of right-eye and right-ear preferences. No score for "left" choices.

Section C - Hand Dexterity Preference Test

If the larger number of squares was marked with the right hand, indicate with a score of five the right hand as preferred hand function in the X cross-out test. No score for left superiority.

Section D - Visual Imagery, Pointed Objects

First count the number of initial strokes made in a left-to-right direction. Count next the number of objects with the significant or beginning point drawn at the left end of the configuration. Add the number of initial left-to-right strokes to the number of objects with the beginning

point at the left, and place that total on the scoreboard. No score for right-to-left initial strokes.

Section E - Visual Imagery, Incomplete Objects

Note whether the subject has drawn (1) the sail at the right side of the mast; (2) the handle at the right side of the cup, has drawn (3) the limbs of the tree first on the right side of the tree trunk, and (4) has completed the bank, and (5) the ice cream cone by drawing left to right. For each one so drawn, record a score of 1 for "right" on the scoreboard for this test. No score for "left".

Section F - Visual Imagery, Moving Objects

There will be two points scored to each drawing. However, where two wheels are shown, instead of assigning a point for the "significant or beginning points", the wheel to the left is to be the important indication of L -- R significance. This indicates one point in the L -- R score. The other point relates to the initial stroke.

When all scores have been tabulated, add the column of numbers and secure total for right hand-foot or right-eye responses. If the total score of a right-handed person is thirty-two or less, then the subject may be considered to be a confused subject. Likewise, if the total score of a left-handed person is eight or more, then he may be considered to be confused.

Keystone Visual Survey Tests

Test 2 - Vertical Posture (far point)

4 line passing through #3
3 line passing through #2
2 line passing through #1
1 line passing through # 1 and 0
0 line passing through 0

Test 3 - Lateral Posture (far point)

4 disagreement with the key on any line.
3. recognition of arrow only on numbers 15, 14, 13 -- 3, 2, 1
2 arrow points to numbers 12, 13, 14, 15, or 1 thru 6.
1 arrow points to numbers 7 and 11.
0 arrow points to numbers 8, 9, and 10.

Test 4 - Fusion (far point)

4 4 balls widely separated
3 4 balls near each other
2 periodic suppression: 3 balls, 2 balls, 3 balls, etc.
1 4 balls becoming and remaining 3 balls
0 3 balls

Tests 4-1/2, 5 and 6 - Usable Vision (far point, both eyes)

4 49% - 92%
3 96%
2 105%
1 103%
0 98 - 100%

Test 7 - Steropsis (far point)

4 + only
3 0 only
2 numbers 1 thru 8
1 number 9
0 numbers 10, 11, 12

Test 10 - Lateral Posture (near point)

4 arrow points between 9-1/2 - 10-1/2, 1 - 1-1/2
3 arrow points between 8-1/2 - 9-1/2, 1-1/2 - 2-1/2
2 arrow points between 7-1/2 - 8-1/2, 2-1/2 - 3

1 arrow points between 6-1/2 - 7-1/2, 3 - 4
0 arrow points between 4 - 6-1/2

Test 11 - Fusion (near point)

4 4 balls widely separated
3 4 balls near each other
2 periodic suppression: 3 balls - 2 balls - 3 balls, etc.
1 4 balls becoming and remaining 3 balls
0 3 balls

Test 12 - Usable Vision, Both Eyes (near point)

4 10% = 50%
3 60% - 70%
2 80%
1 90%
0 100% +

Test 13 and 14 - Usable Vision, Both Eyes (near point)

4 10% - 50%
3 60% - 70%
2 80%
1 90%
0 100% +

## CHAPTER IV

### The Results

It was the purpose of this investigation to explore the relationship of measures of lateral dominance obtained from stuttering and non-stuttering subjects. Data was obtained from an equal number of stuttering and non-stuttering high school age students. The "t" test of significance and the Chi Square were employed to analyze the data.

### General Description of Results

Results obtained from the Leavell Hand-Eye Coordinator Tests are summarized in Table 1. The mean Leavell scores for the stutterers was 23.1, while for the non-stutterers it was 27.1. The difference between these means was not significant.

Table 1. Summary of scores from the Leavell tests.

| | Stutterers | Control |
|---|---|---|
| N | 10 | 10 |
| Mean of $\bar{X}$ | 23 | 27 |
| | 4.8 | 5.2 |
| t of difference between means | | 1.0 |
| Significance | | $P > .05$ |

A summary of results obtained from The Harris Tests of Lateral Dominance appear in Table 2. In the stuttering group, 3 subjects were found to be right dominant, 7 had mixed dominance, while none of the subjects were left dominant. In the non-stuttering group, 4 subjects were found to be right dominant, 5 had mixed dominance, while 1 was found to be left dominant. The Chi Square for these results was not significant.

Table 2. Summary of Scores From The Harris Tests

| | Right Dominance | Mixed | Left Dominance | N |
|---|---|---|---|---|
| S | 3 | 7 | 0 | 10 |
| N/S | 4 | 5 | 1 | 10 |

$X^2 = 2.039$

$P => .05$

Table 3 summarizes results obtained from the Keystone Visual Survey Tests. The mean Keystone scores for the stutterers was 2.80, while for the non-stutterers it was 2.70. The difference between these means was not significant.

Table 3. Summary of Scores From the Keystone Tests

| | Stutterers | Control |
|---|---|---|
| N | 10 | 10 |
| Mean of $\bar{X}$ | 2.8 | 2.7 |
| | 5.3 | 5.2 |
| t of difference between means | | 2.5 |
| Significance | | P =>.05 |

Evaluation of differences between sub-tests for the two groups was tested by the Chi Square Test. The results obtained from these data are summarized in Tables 4 through 13.

Hand Dominance

Results obtained from the Leavell Hand-Eye Coordinator Tests regarding hand dominance are summarized in Table 4. The stutterers had fewer right handed subjects, an equal number of mixed dominant subjects, and had more left handed subjects than the non-stutterers. The resulting score from these groups was not significant.

Table 4. Summary of Scores From the Leavell Tests Regarding Hand Dominance.

| | Right Dominance | Mixed | Left Dominance | N |
|---|---|---|---|---|
| S | 5 | 1 | 4 | 10 |
| N/S | 7 | 1 | 2 | 10 |

$X^2$ = 1.190

P =>.05

A summary of results obtained from The Harris Tests of Lateral Dominance regarding hand dominance appear in Table 5. The stuttering subjects had a smaller number of right handed dominance, less mixed dominance, but had more left handed dominant subjects than the non-stutterers. The Chi Square for these results was not significant.

Table 5. Summary of Scores From the Harris Tests Regarding Hand Dominance.

| | Right Dominance | Mixed | Left Dominance | N |
|---|---|---|---|---|
| S | 5 | 2 | 3 | 10 |
| N/S | 6 | 3 | 1 | 10 |

$X^2 = 1.713$

$P = > .05$

Eye Dominance

Table 6 summarizes results obtained from the Leavell Hand-Eye Coordinator Tests regarding eye dominance. The stutterers had fewer right eyed subjects, more mixed eyedness, and had an equal number of left-eyed subjects than the non-stutterers. The computed score was not found to be significant.

Table 6. Summary of Scores From the Leavell Tests Regarding Eye Dominance.

| | Right Dominance | Mixed | Left Dominance | N |
|---|---|---|---|---|
| S | 4 | 2 | 4 | 10 |
| N/S | 6 | 0 | 4 | 10 |

$X^2 = 2.471$

$P => .05$

Results obtained from The Harris Tests of Lateral Dominance regarding eye dominance are summarized in Table 7. The stutterers had an equal number of right eyed subjects, had more mixed eyed subjects, and had a smaller number of left eyed subjects than the non-stutterers. The Chi Square score was not significant.

Table 7. Summary of Scores From the Harris Tests Regarding Eye Dominance.

| | Right Dominance | Mixed | Left Dominance | N |
|---|---|---|---|---|
| S | 5 | 2 | 3 | 10 |
| N/S | 5 | 1 | 4 | 10 |

$X^2 = 1.029$

$P => .05$

Foot Dominance

A summary of results obtained from the Leavell Hand-Eye Coordinator Tests regarding foot dominance appear in Table 8.

The stutters had fewer right footed subjects, more mixed footedness, and had more left footed subjects than the non-stutterers. The computed score for these groups was not significant.

Table 8. Summary of Scores From the Leavell Tests Regarding Foot Dominance.

| | Right Dominance | Mixed | Left Dominance | N |
|---|---|---|---|---|
| S | 4 | 4 | 2 | 10 |
| N/S | 6 | 3 | 1 | 10 |

$X^2 = 1.803$

$P => .05$

Table 9 summarizes results obtained from The Harris Tests of Lateral Dominance regarding foot dominance. The stutterers had more right footed subjects, a smaller number of left footed subjects, and an equal number of mixed footedness. The resulting score from these groups was not significant.

Table 9. Summary of Scores From The Harris Tests Regarding Foot Dominance.

| | Right Dominance | Mixed | Left Dominance | N |
|---|---|---|---|---|
| S | 8 | 1 | 1 | 10 |
| N/S | 7 | 1 | 2 | 10 |

$X^2 = .9845$

$P => .05$

## Visual Adequacies

Results obtained from the Keystone Visual Survey Tests regarding visual adequacies are summarized in Table 10. The stutterers had an equal number of subjects having adequate visual abilities, more subjects having adequate acuity, fewer subjects having adequate fusion, a smaller number of subjects having inadequate acuity, an equal number of subjects having inadequate fusion, and more subjects having a severe lack of visual abilities than the non-stutterers. The Chi Square score was not significant.

Table 10. Summary of scores From the Keystone Tests Regarding Visual Adequacies.

0 = Adequate visual abilities
1 = Adequate acuity
2 = Adequate fusion
3 = Inadequate acuity
4 = Inadequate fusion
5 = Lack of visual abilities (Severe)

| | 0 | 1 | 2 | 3 | 4 | 5 | N |
|---|---|---|---|---|---|---|---|
| S | 1 | 2 | 0 | 3 | 3 | 1 | 10 |
| N/S | 1 | 1 | 1 | 4 | 3 | 0 | 10 |

$X^2 = .4760$

$P => .05$

## Overall Dominance

An overall evaluation of dominance was obtained by representing all subjects who showed right dominance for all subtests of the Harris and Leavell tests in a right dominance

category, all subjects showing only left dominance results in a left dominance category, and all other subjects in a mixed dominance category, as shown in Table 11. Among the stutterers, 3 subjects showed right dominance, 5 showed mixed dominance, and 2 showed left dominance. Five of the non-stutterers showed right dominance, 3 showed mixed dominance, and 2 showed left dominance. The computed score for these groups was not significant.

Table 11. Overall Evaluation of Dominance Scores Obtained From The Harris and Leavell Tests.

| | Right Dominance | Mixed | Left Dominance | N |
|---|---|---|---|---|
| S | 3 | 5 | 2 | 10 |
| N/S | 5 | 3 | 2 | 10 |

$X^2 = .8424$

$P => .05$

Further analysis of the possible relationship between stuttering and mixed dominance was obtained by pooling all unilateral dominant subjects into a common group and comparing these with the mixed dominant subjects. This is shown in Table 12. The stutterers had 4 show homolateral extremity dominance, while 6 subjects showed mixed extremity dominance. The non-stutterers had 5 subjects show homolateral extremity dominance, while 5 were found to have mixed extremity dominance. The resulting score from these groups was not significant.

Table 12. Summary of Scores Showing Homolateral Dominance to Those Subjects Having Mixed Dominance.

| | H E D | M E D | N |
|---|---|---|---|
| S | 4 | 6 | 10 |
| N/S | 5 | 5 | 10 |

$X^2 = 1.984$

$P = > .05$

In determining how many subjects in the experimental and control groups had unilateral dominance with adequate visual abilities, unilateral dominance with inadequate visual abilities, mixed dominance with adequate visual abilities, and mixed dominance with inadequate visual abilities, Table 13 was provided to analyze these data. No stutterers showed unilateral dominance with adequate visual abilities, 3 subjects showed unilateral dominance with inadequate visual abilities, 3 subjects had mixed dominance with adequate visual abilities, while 4 subjects had mixed dominance with inadequate visual abilities. Three non-stuttering subjects showed unilateral dominance with adequate visual abilities, 2 subjects showed unilateral dominance with inadequate visual abilities, no subjects showed mixed dominance with adequate visual abilities, while 5 subjects showed mixed dominance with inadequate visual abilities. The Chi Square was found to be significant.

Table 13. Summary of Scores Showing Unilateral Dominance, Mixed Dominance With Visual Abilities.

| | UD AVA | UD IVA | MD AVA | MD IVA | N |
|---|---|---|---|---|---|
| S | 0 | 3 | 3 | 4 | 10 |
| N/S | 3 | 2 | 0 | 5 | 10 |

$x^2 = 7.311$

$P = < .05$

## CHAPTER V

### Discussion of The Results

The results indicate that the laterality measure of the experimental group did not differ significantly from that of the control group. The basic premises, stated as a nul-hypothesis, have been confirmed by the analysis of the study, in that they show no relationship between stuttering and unilateral dominance. In a similar study, Harris (1957) found that mixed dominance was not shown to be significant. The right-hand, left-eyed combination was more frequent in unselected cases, explained Harris (1957), due to the fact that right handedness in general is more frequent in unselected groups. When one compares the percent of the right-handed members of the group who are left-eyed, he continued, the apparent difference disappears. He further stated that the left hand, right eye is equally small in both populations.

It is felt that the results, as they have been presented in the present study, tend to confirm the findings of Harris' (1957) investigation. In the experimental group, 3 subjects had cross dominance, while in the control group, 1 was found to have cross dominance. Mixed dominance, then, would not be considered to be a factor regarding lateral dominance as it relates to stuttering.

Daniels (1940) reported that the percentage of stutterers

among ambidextrous students was not higher than in the population studied. It could be stated, then, that the results of the findings in this investigation concur with the findings reported by Harris (1957) and Daniels (1940) to the effect that the population studied in the present study did not show mixed dominance to occur more frequently in the experimental group than in the control group.

Results obtained from Delacato (1959) and Sutor (1964) in their studies regarding lateral dominance, do not compare favorably with the results reported in this investigation. For instance, Delacato (1959) felt that speech difficulties occur when the child's controlling eye is on the side opposite that of handedness, while Sutor (1964) was of the opinion that cross dominance had great prognostic importance for speech problems. These factors have not proven to be significant in the present study, nor do the results from this investigation support Eames (1934) who felt that the most common mixed dominant problem occurs when the child is left-eyed, but right-handed. It is felt that the discrepancy between the findings in this study, and those of Delacato (1959), Sutor (1964), and Eames (1934), may be due to the small sample used in the present study, the use of tests to measure extremity as well as ocular dominance, and that in using the Chi Square test, the expected N for the various cell was extremely small.

In order to determine whether the subjects included in both groups read with their controlling eye or had alternating vision when reading, a test of visual stress was devised and administered onthe Telebinocular as part of the Keystone Visual Survey Tests. The stuttering group had all of their subjects show alternating vision, while the non-stuttering group had two subjects show alternating vision while reading. Delacato (1959), in a study regarding stutters, found that eleven of his eighteen stutters had alternating vision. This, Delacato (1959) would feel, is simply an evidence of the lack of total neurological organization.

In Table 13, the summary of scores showing unilateral dominance and mixed dominance with the amount of visual abilities present in each group were found to be significant with a probability of less than .05. This evidence points to the possibility that when comparing a stuttering and non-stuttering population regarding extremity and ocular dominance, that this be done in an all inclusive manner. When handedness is compared with handedness, and eyedness with eyedness, the apparent difference disappears. This was pointed out in the study by Harris (1957). However, it is felt that caution must be used in interpreting the results found in Table 13. Most important, however, the results call for more extensive investigation of this factor.

On the bases of records obtained by specialists in orthoptic training, the consensus has developed that stutterers

with acuity or functional visual problems show marked improvement in the lessening of stuttering, as well as other side effects, such as nervousness, etc., when these problems are initiated.

Various optomotrists have stated that vertical and lateral imbalance has been known to negatively affect the central nervous system, thus contributing to a general condition of nervousness in the person having such a condition. In the present study, it was found that in the stuttering group, 2 subjects had vertical imbalance, 2 had lateral imbalance, while 4 subjects had both vertical and lateral imbalance as indicated on the Keystone Visual Survey Tests. In the non-stuttering group, 7 subjects were found to have lateral imbalance problems, 1 had vertical imbalance, while 1 subject was found to have both vertical and lateral imbalance problems.

It has been observed by interested professional workers in the area of stuttering, that a small number of those who stutter wear or have worn lenses. These workers felt that the wearing of lenses by the stutterer might improve any muscle imbalance condition that may exist. In the present investigation, the stuttering group had 5 subjects who wear or had worn lenses, while the non-stuttering group had 2 subjects wearing lenses.

The availability of suitable tests to measure lateral dominance was found to be limited. The three tests included

in the present study were chosen because of their standardization and consistent use in the study of the problem of unilateral dominance. Of the three tests, only the Leavell yielded raw data from which statistical analysis could be directly computed. Harris (1957), in an investigation regarding dominance, asked that a search be made for such tests which will show a decreasing frequency of mixed dominance ratings as children get older. Daniels (1940), in a study on handedness and stuttering, felt that techniques employed in the testing for handedness are of dubious value. It would seem, then, that there are somewhat inadequate testing vehicles suitable to measuring lateral dominance, and that this would call for further investigation to develop more sensitive instruments for the evaluation of the problem of unilateral dominance and its relationship to stuttering.

The small sample used in this study presents several problems from a statistical standpoint. Inasmuch as the results of only one statistical test was significant, it is felt that this does not detract from the contribution of the study. In working with such a small sample, the expected N for the various cells was extremely small. It is felt that, if any effect, the use of a small number would have resulted in indicating a falsely significant difference between the two groups studied. Most important, however, the results call for more extensive investigation of this factor.

Another factor which must be considered in interpreting these results is the probability of having obtained a chance significant result when a large number of similar analyses are performed on data derived from the same subjects. On the basis of chance alone, one of the tests would be significant at the 5% level, even though there were no real true significance in the differences of the groups. At first glance, it would seem that the results obtained for the analysis of overall visual adequacy and extremity dominance could have occurred by chance alone. It is pointed out, however, that this test was distinctly different from all other tests performed; and it is felt that careful consideration should be given to this factor in a total evaluation of the results obtained.

Concerning the selection of subjects for the experimental group, there is the possibility that the visual adequacy and extremity coordination problems would be greater at a younger age level and would have contributed to stuttering, but that are no longer evident in the present samples because these incoordination problems are no longer evident. One can speculate that stuttering became established as a speech pattern at a time when neurological development was incomplete and that it merely persists at the present time or is retained because the inadequacies of development are not gross enough to be evaluated at the age level of the stutterers used in the present investigation.

## Special Supplement
## Discussion of The Results

During the writer's defence of this study, July 25, 1968 at Loma Linda University, La Sierra Campus, it was recommended that additional significant findings brought forth during the defence be included in this paper.

By extensive examination of results obtained from the Keystone Survey Visual Tests, the following findings seem to be indicated.

| Stutterers | Non-Stutterers |
|---|---|
| 1. Half of subjects showed better acuity in one eye at near point and the opposite eye at far point. | 1. None of the subjects showed this phenomnon. |
| 2. On stress card (different reading paragraph in front of each eye) 5 were mixed, showing alternating visual control while reading. Four were one sided. | 2. 2 were mixed. 7 were one sided. |
| 3. Of the total words read on the visual stress card, stutterers showed a score of preferring the left side 8.6 to 7.2 for right. | 3. Normal speakers showed greater right side control: 5.1 left to 7.2 right. Each group contained 2 left handers. |

It is recommended that in future research specific tests be included to compare acuity of the right eye to th at of the left eye at near and far point; to test functional visual control in a visual stress situation; and to determine the effect, if any, that establishing total one sided visual control would have on speech.

## CHAPTER VI

### Summary and Conclusions

It was the purpose of this investigation to explore the relationship of measures of lateral dominance obtained from stuttering and non-stuttering subjects. The present study was designed to investigate the nul-hypothesis which stated that a correlation lacks between the speech disorder known as stuttering and mixed extremity and ocular dominance in a high school population. The data of this investigation indicates that:

1. There is no significant difference in the laterality measure of the experimental group from that of the control group.

2. There is no relationship between stuttering and unilateral dominance.

3. Mixed extremity and ocular dominance does not occur more frequently from subjects of a stuttering population than seen in non-stuttering controls.

4. There is no significant pattern of extremity and ocular disharmony characteristic of the stutterer.

5. A significantly greater proportion of stutterers were shown to have a visual inadequancy in association with extremity incoordination and imbalance.

On the basis of these results, the following conclusions seem warranted.

1. Stuttering subjects do not show a higher incidence of hand dominance confusion than do non-stuttering controls.

2. Stuttering subjects do not show a higher incidence of mixed and ocular dominance or visual inadequacies than do non-stuttering controls.

3. Mixed or cross dominance would not be considered to be a factor regarding lateral dominance as it relates to stuttering.

4. Existing tests are inadequate to differentiate lateral dominance confusions of stuttering subjects if in fact such confusions are significant factors.

5. Further research in the development of instruments to assess lateral dominance is indicated.

6. Further research of the relationship of lateral dominance confusion and stuttering observed by more clinicians is needed.

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# APPENDIX

## VOCABULARY OF TERMS RELATING TO THE EYE

Accommodation - The adjustment of the eye for seeing a different distances.

Ambloyopia - Dimness of vision without any apparent disease of the eye.

Convergence - The process of directing the visual axes of the two eyes to a near point, with the result that the pupils of the two eyes are brought closer together.

Esophoria - A tendency of the eye to turn inward.

Exophoria - A tendency of the eye to turn outward.

Exotropia - Abnormal turning outward from the nose of one or both eyes.

Fusion - The power of coordinating the images received by the two eyes into a single mental image.

Hyperopia - A farsighted condition in which the near vision is more blurred.

Myopia - A nearsighted condition in which the distant vision is more blurred.

Nystagmus - An involuntary, rapid movement of the eyeball which may be lateral, vertical, rotary, or mixed.

Orthoptic Training - A series of scientifically planned exercises for devdoping or restoring the normal coordination of the two eyes.

Phoria - The position of the eyeball in relation to its visual axis. The word "phorias" is used to indicate the various types of muscular imbalance.

Strabismus - Squint; eyes that are not straight - an eye or eyes that deviate in any of the various directions.

Suppression - The conscious or unconscious act of ignoring the vision of an eye, often made by persons who thereby seek to avoid the discomfort of binocular vision.

Telebinocular - An optical instrument so arranged to simulate distance viewing within eight inches. It is used to test and tain.

Vision - The process of getting meaning out of what is seen and is the skill of understanding and integrating what has been seen with the information that is also received through touch, hearing, taste, and smell.

## Administration of Tests

### Harris Tests of Lateral Dominance

Test 1. Knowledge of Right and Left.

Say: SHOW ME YOUR RIGHT HAND. After this is responded to, say: SHOW ME YOUR LEFT EAR. Then: SHOW ME YOUR RIGHT EYE. Stress the underlined words rather strongly and equally. Carefully avoid giving any help by look of approval or disapproval, by glancing at any part of the body indicated or by supplementary directions.

Test 2. Hand Preferences.

Say: SHOW ME HOW YOU THROW A BALL. Record the hand used, R for right hand, L for left hand, and BOTH if subject indicates that he sometimes does it with one hand and sometimes with the other.

Test 3. Simultaneous Writing.

Use page 2 of the Record Blank. Fold back and place the page on the table before the subject with the bottom edge paralled to the edge of the table. Say: I WANT TO SEE HOW WELL YOU CAN WRITE NUMBERS WITH BOTH HANDS TOGETHER AT THE SAME TIME. Put a pencil into each of the subject's hands, place them in the position to write, directly below the L and the R. Say: WHEN I SAY GO, I WANT YOU TO WRITE THE NUMBER ONE WITH BOTH HANDS AT THE SAME TIME: THEN BELOW IT WRITE THE NUMBER TWO WITH BOTH HANDS AT THE SAME TIME: THEN NUMBER THREE, AND SO ON DOWNTO TWELVE. GO AS FAST AS YOU CAN,

AMD REMEMBER THAT YOU MUST WRITE WITH BOTH HANDS AT THE SAME TIME.

Test 4. Handwriting.

On page 3, near the top, ask the subject to write his full name. Record the hand used and the time in seconds. Repeat on the line below with the other hand. Copy the time, in the appropriate spaces on page 1, and record the hand showing better co-ordination in writing.

Test 5. Tapping.

Say: I WANT TO SEE HOW QUICKLY YOU CAN MAKE DOTS WITH A PENCIL, LIKE THIS. Take a pencil and make a row of about ten dots in the top single line of squares, quickly, with one dot in each square. Say: TAKE THE PENCIL AND TRY ONE ROW FOR PRACTICE. Have him practice on the second row of squares. Then say: WHEN I SAY GO, MAKE ONE DOT IN EACH SQUARE AS FAST AS YOU CAN. WHEN YOU GET TO THE END OF THE LINE, GO BACK THE OTHER WAY. Show the subject which set of squares to use, depending on whether he has the pencil in Right or left hand and with your finger show him when to start and how to follow the arrows. Allow 30 seconds, and say: STOP. Then have the subject take the pencil in his other hand, do the third single row of squares for practice, and take a record as before.

Test 6. Dealing Cards.

In advance, divide the deck into two packs of 26 cards

each and place a rubber bank around each pack. Hand one pack to the subject. Say: MAKE BELIEVE THAT THE TWO OF US ARE PLAYING CARDS. DEAL OUT THE CARDS AS FAST AS YOU CAN, FIRST GIVING ME ONE AND THEN GIVING YOURSELF ONE. Explain further if necessary. Before taking a record, allow subject to deal out six cards for practice, and return them to the pack. Then say: READY, GO.

Test 7. Monocular Tests

8.1. Kaleidoscope. -- Pick up the Kaleidoscope. Say: IF YOU TURN IT, LIKE THIS( illustrating), YOU WILL SEE SOME INTERESTING COLOR CHANGES. Hand the Kaleidoscope to subject and record the eye to which he holds it. Allow a short time for him to look into it, and remove out of sight and out of reach.

8.2. Telescope. -= Say: HAVE YOU EVER LOOKED THROUGH A TELESCOPE? Hand the telescope to subject and, if necessary, show him how to get a clear focus by varying the length. Record the eye used.

8.3 Sight Rifle. -- Hand the toy rifle to subject and say: I WANT TO SEE HOW WELL YOU CAN AIM. AIM THE GUN SO AS TO HIT ME RIGHT ON THE TIP OF THE NOSE. Record which eye is in line with the sights, and also the shoulder used.

Test 8. Binocular Tests.

9.1. Cone. Use the three cones and the meaningful pictures of the Miles ABC Vision Tests. Place the three cones

in a pile on the table in front of the subject with the narrow ends toward him and the printed directions side up. Have subject stand. Say: THIS IS AN AIMING TEST, TO SEE HOW FAST YOU CAN AIM. WHEN I SAY GO, PICK UP THIS (pointing to the top cone) IN BOTH HANDS, AND SQUEEZE IT SO AS TO MAKE A ROUND HOLE AT THE END. LIFT IT QUICKLY TO YOUR EYES, LOOK THROUGH IT, AND TELL ME AS QUICKLY AS YOU CAN WHAT THE PICTURE IS THAT I HOLD UP. As he names the picture, note which is the sighting eye. If you are not sure, say: COSE YOUR RIGHT EYE. Then say: WE WILL TRY THIS TWO MORE TIMES. EACH TIME, PICK UP A DIFFERENT CONE FROM THE TABLE AND SEE HOW QUICKLY YOU CAN LOOK THROUGH IT AND TELL ME WHAT THE PICTURE IS.

9.2. Hole in Card. -- Place the cardboard with a hole in its center on the table in front of subject, with the longer dimension paralled to the edge of the table. Say: THIS IS ANOTHER AIMING TEST. WHEN I SAY GO, LIFT UP THE CARD IN BOTH HANDS AND HOLD IT AS FAR IN FRONT OF YOU AS YOU CAN REACH. LOOK THROUGH THE HOLD AND TELL ME AS QUICKLY AS YOU CAN WHAT THE PICTURE IS.

**Test 11. Foot Dominance**

11.1 Kicking. -- Hand the beanbag to subject. Say: MAKE BELIEVE THAT THIS IS A FOOTBALL. SHOW ME HOW YOU CAN KICK IT. Record the foot that touches the beanbag as the dominant foot. Then ask subject to kick it with his other foot.

11.2 Stamping. -- Say: MAKE BELIEVE THERE IS A FIRE, pointing to the floor. SHOW ME HOW YOU WOULD PUT IT OUT WITH YOUR FOOT. Record the foot used for stamping out the fire.

# THE HARRIS TESTS OF LATERAL DOMINANCE

## Record Blank



Name..... Age..... Date..... Examiner.....

**1. Knowledge of Left and Right**
R hand..... L ear..... R eye.....

### HAND DOMINANCE

**2. Hand Preferences** R.....%
.1 Throw a ball .....
.2 Wind a watch .....
.3 Hammer a nail .....
.4 Brush teeth .....
.5 Comb hair .....
.6 Turn door knob .....
.7 Hold eraser .....
.8 Use scissors .....
.9 Cut with knife .....
.10 Write .....

**3. Simultaneous Writing**
No. of Reversals:
R..... L..... .....
Co-ordination better: .....

**4. Handwriting**
Time: R..... L.....
Co-ordination better: .....

**5. Tapping**
Number: R..... L.....
Co-ordination better: .....

**6. Dealing Cards**
Time: R..... L.....
Co-ordination better: .....

**7. Strength of Grip (optional)**
R..... L..... R..... L.....

### EYE DOMINANCE

**8. Monocular Tests**
.1 Kaleidoscope .....
.2 Telescope .....
.3 Sight rifle
Eye .....
Shoulder .....

**9. Binocular Tests**
.1 Cone: ..... ..... .....
.2 Hole: ..... ..... .....

**10. Stereoscopic Tests (optional)**
.1 Teleb: R.....% L.....% Supp?.....

### FOOT DOMINANCE

**11.1 Kick**
Pref..... Other..... Better.....

**11.2 Stamp**
Foot used.....

### RATINGS

Test

**1 KNOWLEDGE OF LEFT AND RIGHT**

Confused : Hesitant : Normal

**HAND DOMINANCE**

| | L | L | M | R | R |
|---|---|---|---|---|---|
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |
| 7 | | | | | |

**EYE DOMINANCE**

| | L | L | M | R | R |
|---|---|---|---|---|---|
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |

**FOOT DOMINANCE**

| | L | L | M | R | R |
|---|---|---|---|---|---|
| 11 | | | | | |
| 11.1 | | | | | |
| 11.2 | | | | | |

**Family Background:**

**Conversion:**

**Qualitative Comments:**

## SIMULTANEOUS WRITING

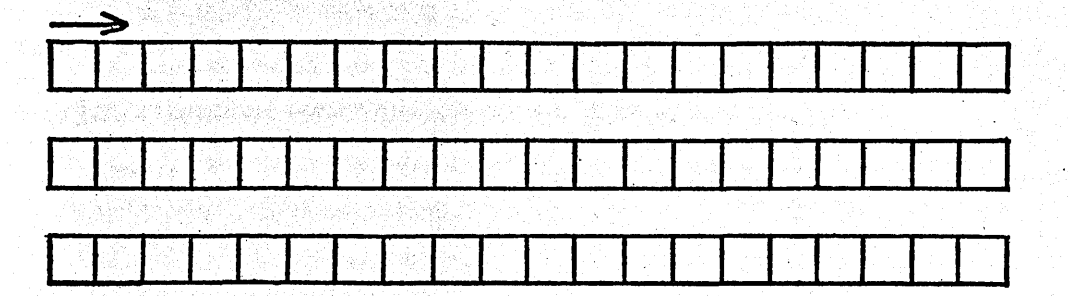
*Left*

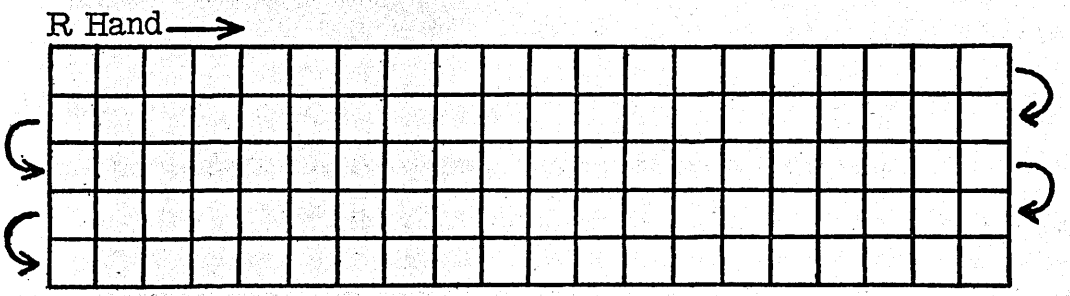
*Right*

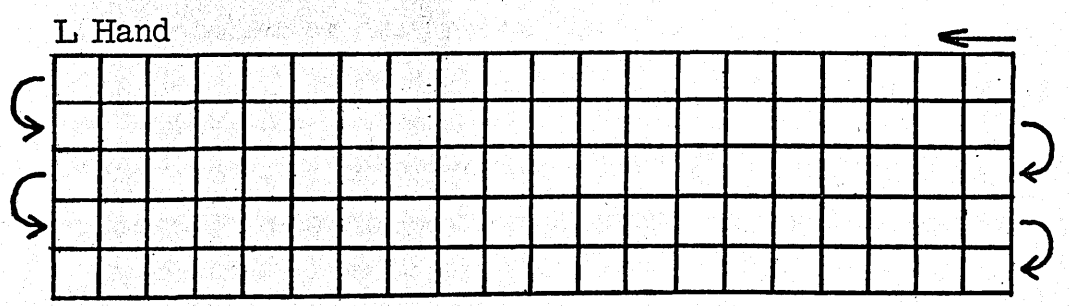
Name..... Hand..... Time..... sec.

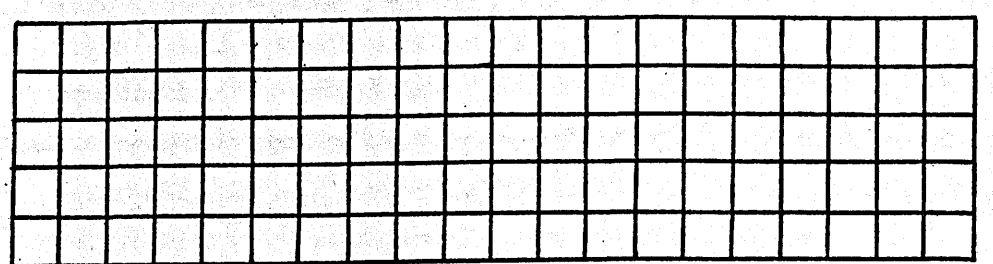
Name..... Hand..... Time..... sec.

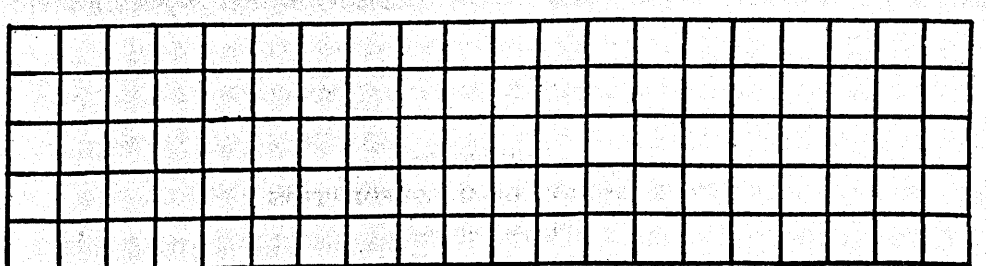
TAPPING







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THE PSYCHOLOGICAL CORPORATION

304 East 45th Street

New York, N. Y. 10017

Leavell Hand-Eye Coordinator Tests

Section A. Hand-Foot Preference Tests

Test 1. -- Ask the subject, WHICH IS YOUR RIGHT HAND? Indicate in the space on that part of the paper whether the subject has given the correct response.

Test 2. -- Ask the subject to pick up a pencil and indicate the hand with which he writes. Record on the test sheet the response by using an R if the right hand was used.

Test 3. -- Ask the subject to indicate with his forefinger and the pencil that he has just used how he would sharpen the pencil, using the forefinger as he would a knife.

Test 4. -- Ask the subject to stand on the floor and hop across the room on one foot. Record the response with an R if he hopped on the right foot.

Test 5. -- Ask the subject to indicate with which foot he would kick a football, by imitating his activity. Note with an R if the response indicated the right foot as preferred.

Section B Eye-Ear Preference Tests

Test 1. -- Use a desk blotter or a manila folder lengthwise to construct a tube from fifteen to twenty inches long and with an aperture one inch in diameter. Ask the subject to hold this tube in both hands and look through the hole with one eye at a pencil held in front of the examiner's face, when twelve or more feet removed from the subject. Record

response with an R in terms of right-eye preference.

Test 2. -- Cut a hole one-half in diameter in the center of a manila folder with a V-shaped cutout at the middle of one side. Have the subject hold this card with both hands at arm's length and, when twelve feet or more away from the examiner, pull the card to the preferred eye in order to look through the hole at a pointed object, such as a pencil, held in front of the examiner. Note whether the right or left eye is used. Record the response with a R if the right eye was used.

Test 3. -- Using a funnel or manoptoscope, have the subject hold the large end of the funnel to his head over both eyes and look through the small end at a pointed object twelve feet away, held in front of the examiner. Note the eye employed in sighting the object and record R if the right eye was used.

Test 4. -- Have the subject make a ring with the forefinger and thumb of each hand, overlapping the two rings. Direct him to pull the rings to the head and with one eye look through the same at a pointed object in front of the examiner while standing twelve feet away. Note and indicate with an R if the preferred eye in this function was the right eye.

Test 5. -- Have the subject pick up a watch or an interval timer and put it to his ear. Note and record with an R if the preferred ear was the right ear.

Section C -- Hand Dexterity Preference Test

With a watch or an interval times with a second hand, note the number of squares that the subject can mark with an X in thirty seconds, using first one hand and then the other. The hand with which the subject makes more X's is considered the preferred, or dominant, hand.

Section D -- Visual Imagery, Pointed Objects

Have the subject draw the five pointed objects indicated under "Objects To Be Drawn". Direct the child to draw the design in a horizontal fashion rather than in a vertical pattern. If necessary this direction should be repeated for any design which the child initiates in a vertical pattern. While the subject designs the first object (a knife), note the direction in which the first dominant strokes are made. When the subject has completed the design, indicate with a pencil the direction in which these initial strokes were made. Follow the same procedure in having the subject draw each of the five symbols.

Section E -- Visual Imagery, Incomplete Objects

Have the subject complete the five symbols on this test sheet. After the subject has drawn the sail on the mast and the handle on the cup, note the side on which the subject first draws the limbs on the tree, the bottom of the piggy bank, and the top of the ice cream cone. Indicate with an arrow in each directional case the side of the configuration from which the first dominant stroke was made.

Section F -- Visual Imagery, Moving Objects

Have the subject draw the five objects designated. As indicated in Section D, when the subject has completed each symbol, indicate with an arrow the direction in which the initial stroke was made.

# PAGE I — LEAVELL HAND-EYE COORDINATOR TESTS

## Subjective Analysis of Motor-Visual Preference

Name _____ Age _____ Date _____

School _____ Grade _____ Examiner _____

A. Hand-Foot Preference Tests

1. Which is your right hand?

   Correct: Yes _____ No _____

2. Hand with which you write _____
3. Hand with which you cut _____
4. Foot on which you hop _____
5. Foot with which you kick a football _____

B. Eye-Ear Preference Tests

1. Telescope _____
2. Hole in card _____
3. Funnel _____
4. Finger ring test _____
5. Watch tick _____

C. Hand Dexterity Test _____

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Right hand 30 sec. | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| Left hand 30 sec. | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Hand Preferred _____

# PAGE II — LEAVELL HAND-EYE COORDINATOR TESTS

## OBJECTS TO BE DRAWN OR COMPLETED ON PAGE III

**Pointed Objects — Page III, Section D—**

Indicate with an arrow the direction of the initial stroke of the pencil in drawing each object.

Draw:
I. Knife
II. Arrow
III. Spoon
IV. Hammer
V. Scissors

**Incomplete — Page III, Section E—**

Indicate with an arrow the direction of the initial stroke of the pencil in drawing each object.

Complete by drawing:
I. Sail on the mast of the boat
II. Cup handle
III. Limbs on *one* side of the tree trunk
IV. Complete the bank
V. Complete the ice-cream cone

**Moving Objects — Page III, Section F—**

Indicate with an arrow the direction of the initial stroke of the pencil in drawing each object.

Draw:
I. Car or truck
II. Wagon with a handle
III. Airplane
IV. Bicycle
V. Scooter

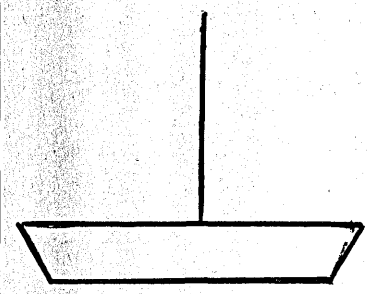
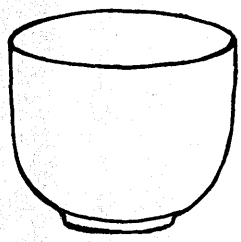
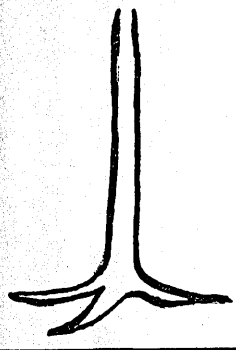
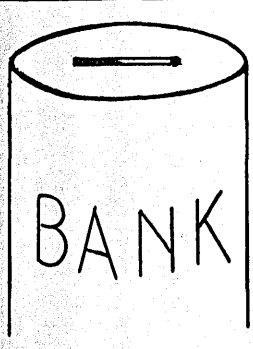
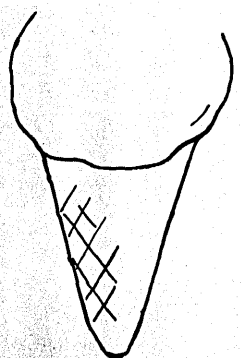
## SCOREBOARD

Score Only the
R's (Right Preferences)
and the L-R's
See Manual Pp. 7-11

| | | |
|---|---|---|
| A. | Hand-Foot Preference (5) | R _____ |
| B. | Eye-Ear Preference (5) | R _____ |
| C. | Hand Dexterity Preference (5) | R _____ |
| D. | Pointed Objects (10) | L-R _____ |
| E. | Incomplete Objects (5) | L-R _____ |
| F. | Moving Objects (10) | L-R _____ |
| | TOTAL | _____ |

## VISUAL-IMAGERY REACTION TEST



| | Section D | Section E | Section F |
|---|---|---|---|
| I. | |  | |
| II. | |  | |
| III. | |  | |
| IV. | |   | |
| V. | |  | |

## Keystone Visual Survey Tests

### The Telebinocular

The telebinocular should be placed on a solid table free from vibration. The subject should be seated in any ordinary chair. The telebinocular should be adjusted vertically, after the subject is seated, until he is in a normal reading position with forearms resting on the table and eyes within the hood of the instrument. Room illumination should be subdued with no direct light on the slides except that emanating from the 10 watt daylight bulb attached to the slide holder.

Subjects should not be allowed to see any of the slides, either in or out of the instrument, except as used during the test. As soon as he has reported on any slide, it should be removed and the next immediately exposed. The subject should not remove his eyes from the instrument until all tests are completed.

Regarding the method of exposing slides, two or three slides should always be in the slide holder, in the order in which they are to be used. As soon as the exposed slide is interpreted, the examiner should lift it out of the slide holder, which exposes the slide behind it. While the subject is interpreting the new slide, another should be placed behind it and so on until the last slide has been used. It is very important that all slides be level in the instrument.

### General Procedures.

NOTE: Use a pencil freely in getting the subject to understand all directions, but not in a way that will change the

findings.

When the cardholder is as far from the student as possible (at the end of the rods), it is at "Far Point". When the cardholder is pushed as close to the student as possible (in close to the instrument), it is at "Near Point."

The cards should be set in the cardholder in proper order; and as each card is removed from the front, it should be placed in the back, thus keeping the cards in proper sequence at all times. The back should be screwed up so that the cards are held up straight but to be not too tight to prevent an easy change from front to back.

| QUESTIONS | INSTRUCTIONS AND INTERPRETATIONS |
|---|---|
| **Test 1 -- Far Point** | Set cardholder at FAR POINT ON SHAFT. |
| "What do you see?" | The answer should be, "A dog and a pig." It is not necessary to ask about the position of the dog. The important thing is that the student see both the dog and pig in all of the cards. |
| **Test 2 - Far Point** | |
| "Does the yellow line pass through the large red ball?" (Pointing.) "Or below it? Or above it? Through what character?" | If the yellow line is seen as apparently passing through any point within the circumference or as touching the ball, the recording is in the EXPECTED column. |
| **Test 3 -- Far Point** | |
| "To what number or between what numbers does the arrow point?" | If the arrow stands definitely at any point, recording should be made accordingly. It is not necessary to wait for stabilization if the arrow fluctuates. However, if the movement continues in one direction |

| | |
|---|---|
| | recording should not be made until the movement in that direction has stopped. Recording should then be made. |
| **Test 4 -- Far Point** | |
| "How many balls do you see?" "What color are they"? | When three balls are seen, or four, becoming three, check in the EXPECTED column. |
| **Test 4-1/2 - Both Eyes - Far Point** | |
| "See the signboards out through a railroad bridge?" "See the black dot in the left-hand white square on this board?" (Point with pencil) "Where is it on the second signboard? "On the right, left, center, top, or bottom?" "On the third, etc.?" | Make a recording check mark only at the number of the last correct response before two successive failures. Responses should be prompt. If the subject hesitates, indicating an effort to guess, the last previous response should be checked as final. |
| **Test 5 -- Right Eye -- Far Point** | |
| "Now let's do the same thing again. No. 1? (And so on in Test 4-1/2). | Follow the procedure for recording as given for Test 4-1/2. |
| **Test 6 -- Left Eye (Same as 5.)** | If the student goes as far as Signboard No. 6, on Test 5, it is feasible to try to start him on Signboard No. 4 in giving Test 6. |
| **Test 7 -- Far Point** | |
| "In this top line (pointing to each figure) what do you see?" "Does one of them seem to float out in the air, closer to you than do the others? Which one? | If the response is negative, call attention to the cross and ask whether it doesn't seem to be closer than the figures on each side of it. When an affirmative reply is obtained, proceed as suggested here. |

"Now which one floats in the second, or next, line down?" "And the next?" Etc."

No recording check is made until the subject can go on farther. Then a check mark is placed at the last correct character called.

Test 10 -- Near Point

Follow the same instructions as given for Test 3.

Test 11 -- Near Point

Follow the same instructions as given for Test 4.

Test 12 -- Both Eyes -- Near Point

"Looking at these balls (pointing to the balls in the center) do you see one with black lines, one with black square dots, and one gray?" Pointing to No. 1 say, "No. 1 is black square dots, No. 2 is black lines, No. 3 is black square dots. Now what do you see in No. 4., etc.?"

When a ball is miscalled and apparently not seen clearly, or when guessing is obvious, check on the record form at the number of the last ball called correctly before two successive failures. In all cases, it is well to allow the student to proceed beyond the point where he misses one ball.

Test 13 -- Right Eye -- Near Point

Use the same procedure as in Test 12.

Test 14 -- Left Eye -- Near Point

Use the same procedure as in Test 12.

# KEYSTONE VISUAL SURVEY TESTS

School Survey Cumulative Record Form No. 5A

For Use with No. 46 Visual Survey Telebinocular

Name_____ Sex_____

Date_____ Teacher_____

Date of Birth_____ C. Age_____ M. Age_____ Grade_____
yr. mo. da. yr. mo. yr. mo.

School_____ City_____

Address_____ Phone_____

Referred by _____

Approved by _____

Principal or_____

**Wearing Glasses: Yes____ No____**

**Snellen Standard (if desired)**

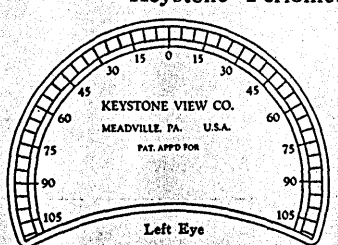
**With Glasses: Right____ Left____**

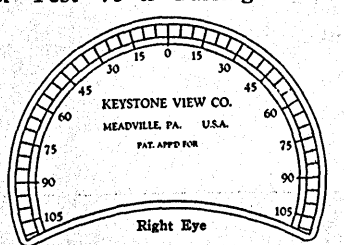
**Without Glasses: Right____ Left____**

| | Left Only | Right Only | UNSATISFACTORY Underconvergence and Low Usable Vision | Hatched Retest Area | EXPECTED Within Heavy Black Lines | Hatched Retest Area | UNSATISFACTORY Overconvergence |
|---|---|---|---|---|---|---|---|
| **Set at Far Point** | | | | | | | |
| Test 1 (DB-10A) Simultaneous Vision (Far Point) | | | | | | | |
| Test 2 (DB-8C) Vertical Posture (Far Point) | only | only | | | | | |
| Test 3 (DB-9) Lateral Posture (Far Point) | only | 15-14-13 · · 3-2-1 Numbers Only | 15 14 13 12 | 11 | 10 9 8 | 7 | 6 5 4 3 2 1 |
| Test 4 (DB-4K) Fusion (Far Point) | only | only | Four, widely separated / Four, near each other | | | | Four, near each other / Four, widely separated |
| Test 4½ (DB-1D) Usable Vision, Both Eyes (Far Point) | | | 1 L 49% · 2 B 70% · 3 T 84% · 4 L 88% · 5 R 92% | 6 T 96% | 7 L 98% · 8 B 100% | 9 B 103% | 10 R 105% |
| Test 5 (DB-3D) Usable Vision, Right Eye (Far Point) | | No Dots Seen Unless Left Eye Is Occluded | 1 T 49% · 2 R 70% · 3 L 84% · 4 T 88% · 5 B 92% | 6 B 96% | 7 L 98% · 8 R 100% | 9 T 103% | 10 R 105% |
| Test 6 (DB-2D) Usable Vision, Left Eye (Far Point) | No Dots Seen Unless Right Eye Is Occluded | | 1 B 49% · 2 L 70% · 3 R 84% · 4 R 88% · 5 T 92% | 6 L 96% | 7 B 98% · 8 L 100% | 9 R 103% | 10 T 105% |
| Test 7 (DB-6D) Stereopsis (Far Point) | + only | only ● | 1 + · 2 ○ · 3 ✳ · 4 ○ · 5 □ · 6 □ · 7 ♡ · 8 + | 9 ✳ | 10 + · 11 ♡ · 12 ○ | | |
| Test 8 (DB-13A) Color Perception (Far Point) | 32 | | 79 | 23 | ALL CORRECT | | |
| Test 9 (DB-14A) Color Perception (Far Point) | 63 | | 92 | 56 | ALL CORRECT | | |
| **Move to Near Point** | | | | | | | |
| Test 10 (DB-9B) Lateral Posture (Near Point) | only | 10-9 · · · · 4-3-2 Numbers Only | 10 9 8 | 7 | 6 5 4 3 | | 2 |
| Test 11 (DB-5K) Fusion (Near Point) | only | only | Four, widely separated / Four, near each other | | | | Four, near each other / Four, widely separated |

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Test 12 (DB-15) Usable Vision, Both Eyes (Near Point) | 1 D 10% | 2 L 20% | 3 D 30% | 4 D 40% | 5 L 50% | 6 D 50% | 7 D 60% | 8 L 60% | 9 D 70% | 10 D 70% | 11 G 80% | 12 L 80% | 13 L 90% | 14 D 90% | 15 L 100% | 16 D 100% | 17 L 102% | 18 D 102% | 19 G 103% | 20 D 103% | 21 D 105% | 22 L 105% |
| Test 13 (DB-16) Usable Vision, Right Eye (Near Point) | 1 D 10% | 2 D 20% | 3 L 30% | 4 D 40% | 5 L 50% | 6 D 50% | 7 D 60% | 8 L 60% | 9 D 70% | 10 L 70% | 11 D 80% | 12 G 80% | 13 L 90% | 14 L 90% | 15 D 100% | 16 D 100% | 17 G 102% | 18 D 102% | 19 L 103% | 20 D 103% | 21 D 105% | 22 L 105% |
| Test 14 (DB-17) Usable Vision, Left Eye (Near Point) | 1 L 10% | 2 D 20% | 3 D 30% | 4 D 40% | 5 L 50% | 6 D 50% | 7 L 60% | 8 D 60% | 9 D 70% | 10 D 70% | 11 L 80% | 12 L 80% | 13 G 90% | 14 D 90% | 15 L 100% | 16 D 100% | 17 L 102% | 18 D 102% | 19 L 103% | 20 G 103% | 21 D 105% | 22 L 105% |

Keystone Periometer Test—75 is Passing.




**Complete directions** for administration of these tests will be found in the manual provided for this purpose.

For **Snellen Equivalents** of Tests 4½, 5, 6, 12, 13, and 14 see the **Manual**, pp. 12 and 14.

Name _____ Sex _____

Date _____ Teacher _____

Date of Birth _____ C. Age _____ M. Age _____ Grade _____

School _____ City _____

Address _____ Phone _____

# STRESS

FIVE GIRLS RIDE FOUR BOYS WALK

LANE ROAD

BUSH. ONE TREE. TWO

WALKED LOOKED

TO AT

TOTAL LEFT EYE _____ TOTAL RIGHT EYE _____

LOMA LINDA UNIVERSITY

Graduate School

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# A Study in the Comparison of Ocular and Extremity Dominance Among A Stuttering and Non-Stuttering High School Population

by

Bruce Frank Brantingham

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An Abstract of a Thesis

in Partial Fulfillment of the Requirements

for the Degree Master of Science

in the Field of Speech Pathology

and Audiology

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ABSTRACT

The nul-hypothesis has been confirmed by the analysis of the study, in that they show no relationship between stuttering and unilateral dominance. The results indicate that the laterality measure of the experimental group did not differ significantly from that of the control group.

Inasmuch as the results of only one statistical test were significant, it is felt that this does not detract from the contribution of the study. It would seem that the results obtained from this comparison, the analysis of overall visual adequacy and extremity dominance, could have occurred by chance alone. It is pointed out, however, that this test was distinctly different from all other tests performed; and it is felt that careful consideration should be given to this factor in a total evaluation of the results obtained.

The statistical analysis of the data compiled were done by way of the "t" test of significance, which included computation of the "t" statistic to test whether scores obtained on selected tests were statistically significant, and the Chi Square Test, which was used to determine the presence or absence of factors indicating a greater or less degree of dominance confusion.

The experimental and control groups were composed of a total of twenty subjects, who were administered The Harris Tests of Lateral Dominance, the Leavell Hand-Eye Coordinator

Tests, and the Keystone Visual Survey Tests for the purpose of exploring the relationship of measures of lateral dominance.

On the basis of the results obtained from this investigation, the following conclusions seem warranted:

1. Stuttering subjects do not show a higher incidence of extremity and ocular dominance confusion than do non-stuttering controls.

2. The lack of unilateral dominance would not be considered a factor regarding lateral dominance as it relates to stuttering.

3. A significantly greater proportion of stutterers were shown to have a visual inadequacy in association with extremity incoordination and imbalance.

4. Further research of the relationship of lateral dominance confusion and stuttering observed by more clinicians is needed.

5. Further research in the development of instruments to assess lateral dominance is indicated.