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AN ATTEMPT TO DETERMINE THE ASSOCIATION, IF ANY, BETWEEN CROSSED DOMINANCE AND ACHIEVEMENT LEVELS IN INSTRUMENTAL MUSIC READING. [Pages 54-56, "Harris Tests of Lateral Dominance" and pages 58-69, "Watkins-Farnum Performance Scales" not microfilmed at request of author. Available for consultation at University of Oklahoma Library].

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The University of Oklahoma, D.Mus.Ed., 1969
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AN ATTEMPT TO DETERMINE THE ASSOCIATION, IF
ANY, BETWEEN CROSSED DOMINANCE AND
ACHIEVEMENT LEVELS IN INSTRUMENTAL
MUSIC READING

A DISSERTATION
SUBMITTED TO THE GRADUATE FACULTY
in partial fulfillment of the requirements for the
degree of
DOCTOR OF MUSIC EDUCATION

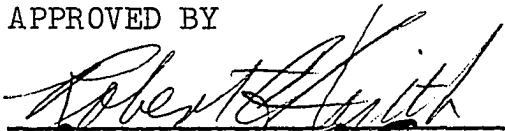
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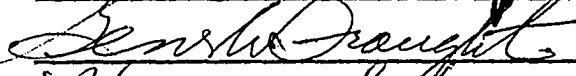
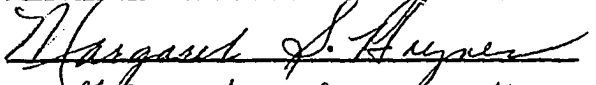
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MUSIC READING

APPROVED BY




DISSERTATION COMMITTEE

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CHAPTER I

PROBLEM

Background

Music educators are continually searching for better means of evaluating and improving instruction in music. Studies and surveys are made in almost all areas of music instruction to identify problems, determine their causes, and try possible solutions. New methods and materials are introduced and the results of their use carefully analyzed to determine any possible degrees of progress that may have been made toward producing more competent and knowledgeable music students.

Performance groups have been developed that have achieved high levels of technical accomplishment; yet, when studies such as those of Giles and Ricci¹ are made, we find

¹Allen Giles and Robert Ricci, "An Experimental Music Curriculum for Gifted High School Students," Music Educators Journal, LIII, No. 3 (November, 1966), 57.

that college freshman music students are generally deficient in music history, music theory, interpretation, and sight-reading.

Of these various areas, the problem of inadequacy in sight-reading is the most distressing to this writer. Students in grade school or high school instrumental performing groups are involved with reading notation during every class period or rehearsal; yet, according to the above-mentioned study, such involvement and training do not seem to develop sight-reading ability. Directors are teaching rhythm patterns, scales, exercises to develop technique, and presenting new music with which to practice sight-reading, and still sight-reading proficiency is much less than desired.

Since the reading of music notation is of such importance to the musician, and the music teacher's efforts to teach sight-reading through music alone seem to be ineffective, more effort must be made to find the possible causes of and solutions for this problem. It is quite possible that the problem is non-musical, and a solution may be found outside the field of music. To this writer, the first and most promising area for investigation is that of verbal reading, because a number of studies have been conducted to determine the causes of reading problems and reading failure in children.

Although many theories have been suggested, as a result of these studies, it is generally agreed that no one

cause can be singled out to explain all cases of reading failure. Schubert has categorized the various causes of reading disabilities as follows: "visual, auditory, and speech defects; physical factors involving poor general health and glandular dysfunction, sex differences, neurological and dominance difficulties; emotional maladjustment, intellectual retardation, educational inadequacies, and poor home environment."² These reading problems exist with no relationship to whether the reader has good or poor vision, or high or low I.Q., although through the fourth grade level there are more boys with reading problems than there are girls.

Studies have indicated that faulty teaching methods, as such, are not the only reasons for reading failure in children. A large percentage of non-readers remain illiterate even though they have been given intensive remedial instruction. Children who can readily comprehend stories being read to them by the teacher cannot themselves read orally words they know, even though these words are of a lower level of reading achievement than is usual for their age level. Many students reverse words, i.e., "was" for "saw" and "no" for "on." It is not uncommon for confusion to exist in reading single letters, e.g., an "m" for an "n"; hence the word "animal" becomes "aminal."

²Delwyn G. Schubert, The Doctor Eyes the Poor Reader (Springfield, Illinois: Charles C. Thomas, 1957), p. 8.

Although some retarded readers do very well in mathematics as to understanding concepts and solving problems, their verbal reading errors carry over into mathematics, and a number "53" is transposed to a "35."

The retarded reader reads at a very slow rate even when reading familiar material. He makes many errors in producing correct sounds from visual symbols. There is usually a blending deficiency of vowel combinations, e.g., "oi" as in oil, "oy" as in boy, and "ow" as in cow. Problems arise in pronouncing a combination of two consonants in which a single sound is heard, e.g., "sh" as in ship, "ch" as in change, and "wh" as in what.

When neurologists first began investigating this type of reading failure, they used the term "congenital word blindness." They were not including all poor readers, illiterates, retarded or reluctant readers, but only members of these groups for whom no other explanation of reading failure could be found except a possible neurological inadequacy or arrested development. The terminology "congenital word blindness" has since been dropped, and the terms "developmental dyslexia" or "specific dyslexia" are now used.

Writers dealing with dyslexia generally use the terms "specific" and "developmental" interchangeably. Critchley, in presenting historical background, includes a

definition by Hermann who gives a detailed description of dyslexia:

. . . a defective capacity for acquiring, at the normal time, a proficiency in reading and writing corresponding to average performance; the deficiency is dependent upon constitutional factors (heredity), is often accompanied by difficulties with other symbols (numbers, musical notation, etc.), it exists in the absence of intellectual defect or of defects of the sense organs which might retard the normal accomplishment of these skills, and in the absence of past or present appreciable inhibitory influences in the internal and external environment.³

Though the area of lateral dominance has been investigated many times, it remains one of the most controversial in the entire field of reading.

"Lateral dominance means the preferred use and better performance of one side of the body as compared to the other side. People tend to be right-handed or left-handed, right-eyed or left-eyed, right-footed or left-footed. While there is a general tendency to be consistently right-dominant or left-dominant, many kinds of dominance patterns are found."⁴

"Dominance is said to be crossed when the dominant hand and dominant eye are of opposite sides. Hand dominance is called mixed or incomplete when the individual does not show a consistent preference for, or superiority of, one

³Macdonald Critchley, Developmental Dyslexia (London: William Hinemann Medical Books Ltd., 1964), p. 11.

⁴Albert J. Harris, Harris Tests of Lateral Dominance (3rd ed.; New York: Psychological Corp., 1958), p. 3.

hand. Eye dominance and foot dominance are similarly called mixed when the preference for one side is not consistent. A person can have mixed hand dominance and still show some preference for one side; similarly with eye and foot. The term mixed dominance, without specific reference to hand or eye or foot, includes both crossed dominance and incomplete dominance."⁵

The absence of a clearly established dominance, according to Orton and other writers who follow him, can be the cause of language difficulties and of dyslexia during development. Dearborn⁶ has long held that there is a strong relationship between laterality (i.e., dominance, lateral or crossed), and reading disability. In his clinical studies he found a greater incidence of left dominance, crossed dominance and lack of dominance among poor readers than among good readers. Dearborn suggests that it is better to be strong dominant to either side with right dominance, both hand and eye, being preferred. Harris⁷ and Gates⁸ both

⁵Albert J. Harris, Harris Tests of Lateral Dominance (3rd ed.; New York: Psychological Corp., 1958), p. 3.

⁶Walter F. Dearborn, "The Nature of Special Abilities and Disabilities," School and Society, XXXI, No. 802 (May, 1930).

⁷Albert J. Harris, How to Increase Reading Ability, A Guide to Individualized and Remedial Methods (New York: Longmann's, Green & Co., 1949).

⁸Arthur I. Gates, The Improvement of Reading, A Program of Diagnostic and Remedial Methods (New York: Macmillan Co., 1927).

suggest that dominance anomalies can be a contributing cause of reading disabilities in certain clinical cases.

Harris also suggests that there may be a slowness in maturation, possibly neurological in nature, in children with severe reading disabilities as evidenced by the late development of a clear dominance pattern. A greater frequency of lateral dominance anomalies was found among poor readers than among unselected cases (Eames).⁹ Witty and Kopel¹⁰ minimize the influence of dominance anomalies, although they do concede that left-eye dominance may induce wrong direction eye movements, i.e., right to left. Monroe¹¹ also had more mixed dominance, right-hand-left-eye and vice versa, among disability cases than with normal readers.

It can be speculated at this point that crossed dominance may have a significant relationship to reading musical notation. The same basic process of reading is followed in both the reading of words (symbols) and the reading of notes (symbols) in that there is common to both a left-right movement of the eyes and a process of perception,

⁹Thomas E. Eames, "The Anatomical Basis of Lateral Dominance Anomalies," American Journal of Orthopsychiatry, IV (1934).

¹⁰Paul Witty and D. Kopel, "Sinistral and Mixed Manual-Ocular Behavior in Reading Disability," Journal of Educational Psychology, XXVII (1936).

¹¹Marion Monroe, Children Who Cannot Read, The Analysis of Reading Disabilities and the Use of Diagnostic Tests in the Instruction of Retarded Readers (Chicago: University of Chicago Press, 1932).

recognition, and interpretation. If, as the above-mentioned writers have suggested, crossed dominance could be a factor in reading disabilities (concerning the reading of words), this writer contends that crossed dominance could also be a factor in the reading of notation by the instrumental musician.

There is one further consideration that must be given to the act of reading music. The reading of words is considered to be a skill facet of language only, while the reading of music notation goes beyond this to include tonal factors, i.e., pitch, timbre, loudness, tonal memory, plus a physical response of either singing or manipulating an instrument. This required physical control and dexterity are also considerations in the study of laterality. It is through a study of lateral dominance that a stronger basis for this study is found. When consideration is given to all aspects of laterality, including cerebral dominance and the functions of the cortical hemispheres, a definite relationship with music (tonality) is readily established.

The brain is divided laterally into a left hemisphere and a right hemisphere, with one hemisphere being dominant and the other being subdominant as to the control of various neurological functions of the body. It is well established that the right cerebral hemisphere controls the movements of the left side of the body and that the left hemisphere controls the right side of the body with the dominant

hemisphere of the brain found to be opposite the side of our sight and hand dominance. "Data indicates that language is controlled at a cortical level in the following ways. The dominant side of the cortex controls the skill facets of language, and the subdominant hemisphere controls the tonal facets of language."¹²

Orton¹³ was one of the first to propose a cerebral dominance theory of laterality in relation to reading disability. From his study of mixed laterality he found a mixed hand-eye dominance in 69 out of a total of 102 cases. Orton claimed that learning to read involves the use of one hemisphere, the dominant. He believed that where a definite dominance has been established a child usually will have no trouble learning to read; however, when there has been no strong left dominance or right dominance established by the time a child is learning to read, difficulties will arise.

Milner,¹⁴ in a study conducted at the Montreal Neurological Institute, investigated asymmetry of function of the left and right temporal lobes of man in auditory tasks. The Seashore Measures of Musical Talents test was

¹²Carl H. Delacato, The Treatment and Prevention of Reading Problems (Springfield, Illinois: Charles G. Thomas, 1959), pp. 15-16.

¹³Samuel Torrey Orton, Reading, Writing and Speech Problems in Children (New York: W. W. Norton & Co., 1937).

¹⁴Brenda Milner, "Laterality Effects in Audition," Interhemispheric Relations and Cerebral Dominance, ed. Vernon B. Montcastle (1965).

administered both before and after temporal lobectomies were performed on a selected group of patients. Pre-operative and post-operative scores and means for time, rhythm, pitch, loudness, timbre and tonal memory were tabulated for both the patients who underwent a left temporal lobectomy and those that underwent a right temporal lobectomy. There were no significant group differences in pre-operative and post-operative test scores in any of the six areas after left temporal lobectomy; but there were significant group differences in all six areas (especially timbre and tonal memory) after right temporal lobectomy. "These clinically rather trivial, though statistically reliable disabilities, seen after right temporal in man, suggest that the right temporal lobe plays a major, the left an ancillary role in non-verbal and auditory functions."¹⁵

It was recognized early in the history of dyslexia that dyslectic children were not all right-handed and that many had not developed a strong left cerebral dominance. Many authors reported a high incidence of left-handedness varying from fifteen to seventy-five per cent of the cases of dyslexia studied. Some writers felt that left-handedness was not so much a factor as left-eyedness, which would possibly affect the normal left-right eye movement. In studies of dyslectic children, the percentage of left-eyed

¹⁵Brenda Milner, "Laterality Effects in Audition," Interhemispheric Relations and Cerebral Dominance, ed. Vernon B. Montcastle (1965), p. 195.

dyslectics was always greater than the percentage of left-eyed subjects in the control groups.

Mixed laterality was then considered as a factor of importance in dyslexia, with writers reporting both affirmative and negative significance. From these developments, considerations have been advanced for "cerebral ambilaterality," "non-maturation," or "imperfect cerebral dominance" to be used as apt and descriptive terminology for dyslectic problems.

Delacato¹⁶ has advanced the theory that a lack of dominance is the major cause of reading problems in children. He contends that laterality has not been fully established in problem cases, and therefore the dominant hemisphere of the brain does not take control of the neurological activities necessary for comprehension of the printed word.

Music teachers have often been surprised when students who usually stutter when speaking do not do so when singing. Delacato feels that stuttering is the result of too much hemispheric balance. "There is no dominance, hence we have a stutter. If we add tonality, the hemisphere which controls tonality and which is normally the sub-dominant hemisphere becomes dominant and the stutter disappears."¹⁷ Other opinions on the causes of stuttering vary greatly.

¹⁶Carl H. Delacato, The Treatment and Prevention of Reading Problems (Springfield, Illinois: Charles G. Thomas, 1959).

¹⁷Ibid., p. 25.

Some writers propose that there is an affective-emotional change resulting from training a child who normally uses his left hand for writing to use his right hand instead. Others claim an undeveloped realization of speech and/or defective organization of the motor system.

When damage to the dominant cortical hemisphere occurs, a condition known as aphasia or the inability to communicate generally develops. The person is unable to read or speak. Tonality is often used as an aide or technique in regaining speech facilities. The person is usually able to sing his name, simple songs, or express his thoughts even though he is unable to speak his name or other words. Delacato explains this as a substitution of function occurring between the two cortical hemispheres. "The only conclusion we can reach is that the tonality carries the skill section, tonality being in the nonaffected area or subdominant hemisphere."¹⁸

These strong associations between tonal factors and dominance factors and the possibility of a significant relationship between crossed dominance and reading disabilities lead directly to the hypothesis of this study.

¹⁸Carl H. Delacato, The Treatment and Prevention of Reading Problems (Springfield, Illinois: Charles G. Thomas, 1959), p. 24.

Hypothesis

Since it is speculated that crossed dominance impairs ability to read music, the hypothesis of this study is that crossed dominance is related to performance on the music sight reading test. Therefore, the group of crossed-dominant subjects will perform differently (lower) than the group of non-crossed-dominant subjects. More specifically, the number of crossed-dominant subjects scoring high will be smaller than the number of non-crossed-dominant subjects scoring high. Also, the number of crossed-dominant subjects scoring low will be higher than the number of non-crossed-dominant subjects scoring low. In other words, crossed dominance and performance of the music reading test are not independent from each other.

CHAPTER II

PROCEDURE

Locale

Approval to conduct this study was obtained from the principal of the high school at Yukon, Oklahoma, the principals of the grade schools, and the director of instrumental music for the Yukon school system. All persons concerned gave full cooperation and assistance in the conducting of the study.

One hundred fifty-three persons were involved in the study, including every instrumental music student in grades five through twelve in the Yukon Public Schools. Since all possible subjects in the school system were tested, no random selection of students was involved.

Yukon, with an approximate population of 8,700, is located sixteen miles west of Oklahoma City. Proximity to this larger city with varied industries gives Yukon a general cross section of population occupation-wise. Business and professional occupations, technical work, manual labor and agriculture are all areas of employment represented.

Method

The structuring of this study was done in such a manner as to eliminate as many variables as possible. All testing was done by this writer to avoid any variances that might have occurred if tests had been administered by different people. The same procedures were followed closely for all subjects throughout the testing period, with care being taken to be as consistent and objective in scoring as possible.

Although the study was somewhat limited by restricting the testing to one school system, several untestable variables were eliminated by the restriction. One teacher instructs all instrumental students in the Yukon schools; therefore, no allowances needed to be made for varying qualities of instruction. If there had been more than one teacher involved in this study, an evaluation of the capabilities and effectiveness, along with a comparison of the teachers' methods and results, would have been necessary.

One method of collecting data, the personal interview, was determined to be the most satisfactory procedure for use in this study, since such interviews provided the opportunity to explain the problem and the nature of the desired data and to arouse the interest of each subject. The interviewer could also insure that the subjects understood the questions and in return that he fully understood the responses given.

In order to test the validity of the hypothesis, it was necessary to test all subjects in two separate areas: (1) the ability to sight read music notation, and the level of proficiency of each subject as compared to their fellow students, and (2) to determine the dominance patterns of each subject and whether or not each subject was crossed-dominant or non-crossed-dominant.

Instruments of Testing

The test chosen for the sight reading portion of this study was the Watkins-Farnum Performance Scale.¹ According to the authors this is the only standardized music reading test presently being published.

The Watkins-Farnum Performance Scale was adapted from the Watkins' Cornet Scale,² an original scale devised and standardized for the cornet. The authors contend that this is an objective measure of musical performance with one of its most noteworthy achievements being the grading of the rhythm patterns which apply not only to the cornet but to the other band instruments as well.

The basic features of the cornet scale were kept, and the following adaptations were made: (1) "The scale was

¹John G. Watkins and Stephen E. Farnum, The Watkins-Farnum Performance Scale: Form A, A Standardized Achievement Test For All Band Instruments (Winona, Minnesota: Hal Leonard Music, Inc., 1954).

²John Goodrich Watkins, Objective Measurement of Instrumental Performance (New York: Columbia University, 1942).

transposed into a key suitable for the instrument being tested"; (2) "The notes of the exercise were kept within the range of the instrument"; (3) "The limitations of each instrument were not exceeded."³

Watkins' correlations on the cornet scale, based on 11 to 30 rankings, ranged from .69 to .90 with the majority being above .80. The correlations in the Watkins-Farnum Performance Scale compare favorably with those of Watkins.

The Watkins-Farnum Performance Scale is published in two forms, Form A and Form B. The reliability coefficient between Form A and Form B is .95. The validity of this scale was found by using rank-order correlations.

Form A was chosen for use in this study.

The subjects were given the same instructions prior to beginning the test, namely: To read each exercise exactly as written, to hold each note its correct value, and to observe all markings and signs. The tempo for each exercise was indicated to each student and was continued for one measure and one beat into the second measure to comply with the instructions given by the authors for administering the test. No further help was given the student during the test except that authorized in the scoring rules. Each subject's performance was checked for eight types of

³John G. Watkins and Stephen E. Farnum, The Watkins-Farnum Performance Scale: Form A, A Standardized Achievement Test For All Band Instruments (Winona, Minnesota: Hal Leonard Music, Inc., 1954), p. 5.

errors: (1) pitch errors, (2) time errors (individual note values), (3) change of time errors (tempo), (4) expression errors, (5) slur errors, (6) rests, (7) holds and pauses, and (8) repeats. Every subject started with exercise number one and continued through the following exercises until he had made a zero score in two consecutive exercises.

Individual score sheets (see Appendix) were used for each subject tested. The music read by the subject was from the test manual and identical in notation to that on the score sheet. Standard size print, however, was used in the manual in order to facilitate ease of reading. The measure was the scoring unit and was counted wrong if any error occurred within it; therefore, only one error was counted in each measure, regardless of the number of errors committed within the measure. Each reading exercise had a "possible score" from which the number of measure errors was subtracted, thus giving the raw score for that exercise. These separate scores were then added for the total raw score. This total score was used for the statistical computations in this study.

One adjustment of the raw scores was necessary. Farnum indicates that based upon data from this test, the instruments should be divided into two groups. The average scores of group I, which includes cornet, soprano clarinet, alto clarinet, bass clarinet, flute, saxophone, and baritone, were consistently ten points higher than the average scores

for group II, which includes trombone, tuba, French horn, oboe, bassoon, and drum. Therefore, in order to "standardize" the raw score of these two groups for this study, ten points were added to the raw scores of all instruments in group II.

Since the suggested ratings (letter grades) given with this test are not based on true normative data but only on testing within one school system, Farnum advises the user of the test to compile medians and scales based on the results obtained in the individual school or system being tested. This suggestion was followed. The only data used in this study were obtained from this testing.

Immediately upon completion of the music reading test, the Harris Tests of Lateral Dominance⁴ were administered to determine whether the subject was crossed-dominant or non-crossed-dominant. Administering this test after the music reading test was in accordance with the directions as to when the test should be given: "The lateral dominance tests are brief, interesting, and not fatiguing, and can therefore be used at the beginning, near the middle, or near the end of an examination sequence."⁵

There were no problems in getting the cooperation of the subjects in taking the lateral dominance tests. The purpose of each of the tests was not explained beforehand,

⁴Albert J. Harris, Harris Tests of Lateral Dominance (3rd ed.; New York: Psychological Corporation, 1958).

⁵Ibid., p. 5.

as Harris suggests that naivete on the part of the subject is conducive to better results. The only explanation offered to the subjects beforehand was that these tests were not those of a passing or failing nature, but they were to do as well as they could on whatever they were asked to do.

For Test 1, Knowledge of Left and Right, the subject was asked for three responses: Show me your right hand, show me your left ear, and show me your right eye. Two reactions were recorded: The correctness of the response, and the presence or absence of error. With both reactions it was also noted whether or not there was hesitation before responding. The subject was rated normal for three errorless responses with no hesitation, hesitant if one or more of the responses was slow, and confused if there were one or more errors. "A rating of 'Confused' obtained by a child of seven or older whose intelligence is normal, should indicate a marked retardation in learning to distinguish right from left. Hesitation is probably not very significant in younger children, but increases in importance with the age of the subject. Confusion was found in 37.6 per cent of seven-year-olds with reading disabilities as compared to 4.9 per cent of unselected seven-year-olds."⁶

All of the actions in Test 2, Hand Dominance, were done in pantomime. The use of pantomime instead of verbal

⁶Albert J. Harris, Harris Tests of Lateral Dominance (3rd ed.; New York: Psychological Corporation, 1958), p. 11.

answers reduces the chance of stereotyped responses and improves validity. The subject was asked to: (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. The hand used in each action was recorded with a response for the right hand scoring a rating of 10 per cent and a response of the left hand scoring 0 per cent. If it were indicated that the subject would use either hand, the rating was 5 per cent. The percentages were added and the following dominance ratings given according to the total percentage: Strong right to those with scores of 100 per cent; moderate right to those with scores of 75-95 per cent; mixed to those with scores of 30-70 per cent; moderate left to those with scores of 5-25 per cent; strong left to those with scores of 0 per cent.

Test 3 required the subject to write Arabic numbers one through twelve in parallel columns, simultaneously with both hands. Page two of the record blank was placed parallel to the edge of the table and both hands placed on it in starting position. An 8 x 11 sheet of light cardboard was then held in front of the subject's eyes in order that he could not see what he wrote. Upon the command "go," the subject would write the numbers as quickly as possible. In order to prevent deliberate reasoning control by the subject and to disclose natural trends in writing, speed was emphasized. "This test is the best in the series for disclosing

directional confusion and mixed or incomplete hand dominance. It is based upon the principle that when both hands attempt to perform the same movement simultaneously, the nondominant hand tends to do it mirror-wise, reversing the left-right directions."⁷ Ratings were assigned according to the number of reversals with either hand and legibility. Hand dominance was again labeled strong right, moderate right, mixed, moderate left, and strong left.

For Test 4, Handwriting, the subject was asked to write his full name. The hand used and the time (in seconds) was recorded. The subject then was asked to write his full name with the other hand, and this hand and the time (in seconds) was noted along with which hand had shown better co-ordination in writing. Hand dominance ratings were assigned according to the difference in time used by the right and left hand. Strong right was for those writing at least twice as fast with the right hand as with the left hand; moderate right for those with at least a 20 per cent margin in speed favoring the right hand; mixed for less than a 25 per cent margin for either hand; moderate left for at least 25 per cent margin favoring the left hand; and strong left for those twice as fast with the left hand.

Test 5, Tapping, is a measure of speed and co-ordination in finger and hand movement, using one hand. The

⁷Albert J. Harris, Harris Tests of Lateral Dominance (3rd ed.; New York: Psychological Corporation, 1958), p. 12.

subject is asked to make a dot in each square and to do so as quickly as possible until he is told to stop. When the first group is finished, the subject is asked to repeat the exercise with the other hand. Thirty seconds were allowed for each hand. The score for each hand was the number of consecutive squares in which one or more dots were placed. The hand showing the better co-ordination was also noted. Hand dominance ratings were assigned as follows: Strong right for those at least twice as fast with the right hand as with the left hand; moderate right for those at least 25 per cent faster with the right hand than with the left hand; mixed for less than 25 per cent preference for either hand; moderate left for those showing at least a 25 per cent greater speed with the left hand over the right hand; and strong left for those that wrote at least twice as fast with the left hand.

Test 6, Dealing Cards, is in contrast to Tests 4 and 5, which involved one-handed actions, in that both the dominant and non-dominant hands are used. The pack of cards is usually held in the non-dominant hand, and the dealing is done by the dominant hand. This test in itself is not a strong indication of hand dominance but may be used as confirming evidence for other suggestions of mixed hand dominance. The subject was given a pack of 26 regulation playing cards and asked to deal them into two stacks as rapidly as possible. The time in seconds was noted as was the hand used

for dealing. The 26 cards were then given back to the subject to be dealt out in the same manner but with the opposite hand. The time and hand were recorded. Hand dominance ratings were assigned as follows: Strong right if it took at least 50 per cent longer to deal with the left hand than the right hand; moderate right if the left hand required at least 4 seconds or 10 per cent more time than the right hand; mixed if neither hand shows a superiority of 4 seconds or 10 per cent; moderate left if the right hand required 4 seconds or 10 per cent more time than the left hand; and strong left if the right hand required at least 50 per cent more time than the left hand.

Test 7, Strength of Grip, was omitted as it is optional. Harris states that it is the poorest of the hand dominance tests and a hand dynamometer was not available to be used.

Test 8, Monocular Tests, required the use of three children's toys: a kaleidoscope, a telescope, and a rifle. The subject was handed the kaleidoscope and asked to look through it to observe the colors. The eye used was recorded. When handed the telescope, the subject was asked to look at the remotest area in the room or out a window to a distant point. The eye used was recorded. The subject was then asked to sight the rifle, aiming at the tester's nose. Both the eye and shoulder used were recorded. "The three parts of this test agree closely with one another, and the rating

based on the three together has very high reliability. The writer has found the three parts to be in complete agreement in 88 per cent of the cases. The kaleidoscope and telescope tests agreed in 98 per cent of the cases."⁸ Eye dominance ratings were then assigned as follows: Strong right if all three responses were right; moderate right if two responses were right; mixed only when the subject tried the tests with both eyes on two or three of the tests; moderate left if two of the responses were left, and strong left if all three responses were left.

Test 9, Binocular Tests, required the use of three paper cones each 7 inches high, and an 8 1/2 inch by 11 inch sheet of light cardboard with a small hole cut directly in its center. The subject was instructed to pick up the cones one at a time, look in the large end directly at the nose of the tester with both eyes open. The sighting eye of the subject was recorded in all three responses. The cardboard sheet was then placed flat on the table directly in front of the subject, and upon the command "go" the subject would pick up the cardboard, hold it at arms' length with both hands, and with both eyes open look directly at the tester's nose. This action was repeated three times with the sighting eye being recorded for each viewing. Eye dominance ratings were assigned as follows: Strong right if all six responses were

⁸Albert J. Harris, Harris Tests of Lateral Dominance (3rd ed.; New York: Psychological Corporation, 1958), p. 16.

the right eye; moderate right if five of the responses were the right eye; mixed if two, three, or four of the responses were right; moderate left if five of the responses were left; and strong left if all six responses were left.

Test 10, Stereoscopic Vision, was an optional test and omitted from this testing. The two preceding tests, 8 and 9, were deemed sufficient to determine eye dominance.

Test 11, Foot Dominance, required the subject to kick a wadded piece of paper. The instructions were to make believe the paper was a ball and to kick it as far as possible. The foot used was recorded as the dominant foot. The subject was then asked to kick with the other foot. If this foot touched the paper, a "yes" was recorded and if it missed, a "no." Dominance ratings were as follows: Right, if the right foot was preferred and performed better than the left; mixed, if the subject performed equally well with either foot; left, if the left foot was preferred and performed better than the right.

The last portion of the test, also foot dominance, was to ask the subject to make believe the wadded paper was on fire and to stamp it out. Dominance ratings were: Right, if the right foot was used; mixed, if both feet were used about equally; and left, if the left foot was used.

The total hand dominance rating was determined on the following basis: Strong right if all ratings were moderate right or strong right; moderate right if Tests 2 and 3 were

both on the right side and not more than two if Tests 4, 5, 6, and 7 were rated as mixed or moderate left; mixed (a) if the rating on either Test 2 or Test 3 favors the otherwise nondominant hand, (b) if the rating on either Test 2 or Test 3 is mixed, and at least one other test is rated mixed or in favor of the nondominant hand, or (c) if three or more of Tests 4, 5, 6, and 7 are rated mixed or in favor of the hand which is not dominant in Test 2 and 3; moderate left if Tests 2 and 3 are rated moderate left or strong left, and not more than two tests of 4, 5, 6, and 7 are rated mixed or moderate right; strong left if all ratings are on the left side.

Whether a subject was classified crossed-dominant or non-crossed-dominant was easily determined by considering the total hand dominance rating and the total eye dominance rating. If both scores were right dominant or if both scores were left dominant, the subject was classified as non-crossed-dominant. If one or both scores indicated mixed dominance, the subject was classified as crossed-dominant.

Test 1 and Test 11 were not used as primary evidence to determine the final dominance rating but only to support the decision made if there was any doubt or vagueness whatsoever in the evidence. If there was evidence of directional confusion, Test 1 was used to support this only and not as a primary determinant. Foot dominance was considered only in accordance with the following statement by Harris: "Foot

dominance is more closely related to hand dominance than to eye dominance. When hand and eye dominance are in agreement, foot dominance agrees in nearly all cases. When there is crossed dominance, foot dominance agrees with hand dominance more than twice as often as with eye dominance. When hand dominance is mixed, foot dominance tends to agree with eye dominance."⁹

This writer hesitated to use Tests 1 and 11 as primary determinants for two reasons: (1) eye and hand dominance are sufficient to determine crossed dominance or non-crossed dominance by themselves; and (2) no reliability data were available for these two tests.

⁹Albert J. Harris, Harris' Tests of Lateral Dominance (3rd ed.; New York: Psychological Corporation, 1958), p. 18.

CHAPTER III

RESULTS

The measure analyzed in the present study was the music performance data (see Appendix) to determine if the frequencies of high scores and low scores on the music reading test were the same for: (1) all crossed-dominant subjects and the total number of non-crossed-dominant subjects, and (2) all crossed-dominant subjects with differing amounts or years of music reading experience.

Farnum,¹ as was indicated in Chapter II, found a ten-point variance between the scores of the two groups of music instruments. Because of this variance, ten points were added to the raw reading scores of all instruments in group II in order to "standardize" the raw scores between both groups of instruments and to facilitate the computation of the median and the high and low reading scores. It was necessary to group grades eleven (6 students) and twelve (4 students) to get a meaningful statistical relationship between the crossed-dominant and non-crossed-dominant subjects.

¹John G. Watkins and Stephen E. Farnum, The Watkins-Farnum Performance Scale: Form A, A Standardized Achievement Test For All Band Instruments (Winona, Minnesota: Hal Leonard Music, Inc., 1954).

All of the subjects were first grouped into a two-by-two-contingency table according to: (1) whether they scored high or low in terms of the median of their own group, and (2) whether they were crossed-dominant or non-crossed-dominant. These groups of frequencies were subjected to a chi square test of independence to determine whether or not crossed dominance was related to test performance.

Crossed-dominant subjects were also grouped into a two-by-three contingency table according to: (1) whether they were high or low in terms of the median of their own age group, and (2) the amount of experience for each subject.

In Table 1, the number of subjects on each age level, the median of the group, the number of crossed-dominant subjects, and the number of non-crossed-dominant subjects are shown.

Table 2 shows the two-by-two contingency table where all subjects who scored above the median of their grade level, and all subjects who scored below the median of their own group were grouped into crossed-dominant or non-crossed-dominant. As shown in Table 4, this data revealed no statistically significant association between the two variables ($\chi^2 = 0.1979$, $df = 1$, $p > .70$).

Table 3 shows the three-by-two contingency table where crossed-dominant subjects were grouped according to: (1) the amount of experience they had, and (2) whether they

TABLE 1

TWO-BY-THREE CONTINGENCY TABLE SHOWING THE NUMBER OF
SUBJECTS AT EACH AGE LEVEL, THE MEDIAN OF THE
GROUP, THE NUMBER OF CROSSED-DOMINANT
SUBJECTS AND THE NUMBER OF NON-
CROSSED-DOMINANT SUBJECTS

Grade	Median	Crossed- Dominant	Non-Crossed- Dominant	Total
5	23.3	16	36	52
6	28.5	12	14	26
7	45.5	5	12	17
8	53.0	4	19	23
9	65.0	12	5	17
10	78.5	4	4	8
11 & 12	69.5	2	8	10
Totals		55	98	153

TABLE 2

TWO-BY-TWO CONTINGENCY TABLE OF ALL SUBJECTS WHO SCORED
ABOVE THE MEDIAN OF THEIR OWN GRADE LEVEL, AND
ALL SUBJECTS WHO SCORED BELOW THE MEDIAN OF
THEIR OWN GRADE LEVEL, GROUPED ACCORDING
TO CROSSED DOMINANCE AND
NON-CROSSED DOMINANCE

	Non-Crossed-Dominant	Crossed-Dominant
High	50	26
Low	48	29

TABLE 3

THREE-BY-TWO CONTINGENCY TABLE OF CROSSED-DOMINANT SUBJECTS
GROUPED ACCORDING TO THE AMOUNT OF EXPERIENCE FOR
EACH SUBJECT AND WHETHER THEY SCORED HIGH OR
LOW ON THE MUSIC READING TEST

Years of Ex.	.5 to 1.5	2.5 to 3.5	4.5 to 6.5
High	12	3	11
Low	21	5	3

scored high or low in terms of the median of their own group. As shown in Table 4, the data revealed a statistically significant association between the amount of experience of the subjects and their performance of the music reading test ($x^2 = 6.79$, $df = 2$, $p < .05$).

TABLE 4

TABLE SHOWING X^2 VALUES, DEGREES OF FREEDOM
AND CORRESPONDING PROBABILITIES FOR
DATA PRESENTED IN TABLES 2 AND 3

Comparison	N	X^2	df	p	
A	153	0.1979	1	$>.70$	NS
B	55	6.7904	2	$<.05$	

Table 4 reveals that there was insufficient evidence of any differences between the frequencies of high and low scores for crossed-dominant subjects and non-crossed-dominant subjects. This finding left unsupported the major hypothesis of this study. It also became evident that

amount of experience is not independent of performance for subjects who are crossed-dominant.

Scoring high or low on the music reading test is not dependent on whether the subjects are crossed-dominant or non-crossed-dominant. In other words, crossed dominance does not correlate with performance on this test. Being crossed-dominant or non-crossed-dominant tells nothing about the tendency to score high or low on the music reading test.

For crossed-dominant subjects, performance tends to correlate with the amount of experience on reading music.

CHAPTER IV

CONCLUSION

Discussion

The present investigation attempted to ascertain whether or not crossed dominance is significantly associated with performance on a music reading test. It was designed to determine if the number of crossed-dominant subjects scoring high on the test was lower than the number of non-crossed-dominant subjects. Yet, the results of this study supported a null hypothesis of no association between crossed dominance and performance on the music reading test.

Since the data did not meet the assumptions of parametric tests, the data obtained from this study were analyzed by use of the chi square (X^2) distribution. It is safer to work with data in the form of frequencies when the assessor lacks high validity. Chi square is capable of testing for significance when the data are in the form of frequencies.

The medians of the raw scores from the music reading test were determined for each grade level. The data were then grouped into frequencies by counting the number of

subjects being high or low, determined by their position of being above or below the median for each grade level. By determining high scores or low scores within each grade level, it then became possible to compare high scores or low scores across age groups. This "standardization" of scores was made possible by creating frequencies for different categories. Chi square is especially designed to handle this kind of data.

The data came from one sample which was categorized into one or more mutually exclusive categories. Chi square is sensitive and appropriate for this manipulation of the data.

Limitations, Interpretation, and Implications for Further Study

There are some limitations to the present study. First, the music reading test used lacked high validity as an instrument and offered no normative data to interpret the results. Also, there is a strong basis for the existence of sampling error. There is no way of knowing whether those subjects who participated in this study are significantly like or different from the general population of music students. Furthermore, each age group was disproportionately represented in the sample, and in some instances the number of subjects in an age group was low enough to suspect that they were not representative of the class to which they belonged. These facts suggest that one of the major

limitations of this study is the lack of power to generalize its findings either to the entire population of students or even to the population of all music students.

Although the results of this study suggest that dominance is not related to the ability to perform on the music reading test, the findings might have been influenced by different sources of sampling error inherent in the data itself. For example, it is possible that the data were biased not only by the fact that there was a small number of crossed-dominant subjects in the whole sample, but also, there was a large difference between the proportion of crossed-dominant and non-crossed-dominant subjects for all groups, and even larger for a few age level groups. In addition, lack of similar amounts of experience within each age group, as well as dissimilar experience for both the crossed-dominant and the non-crossed-dominant group, might have biased the data in an undetermined manner which could have distorted any real influence of crossed dominance on performance.

It is possible that any effect due to non-crossed dominance might have come from the non-random distribution of "years of experience" in the sample. Since this is an important influence in performance (as shown by the results), it could have introduced some systematic error in such a way that any detrimental effect of crossed dominance might have been balanced out by the positive effect of having greater

experience. Future research might hold "years of experience" equal for two groups and then check for the difference in performance between the crossed-dominant and the non-crossed-dominant groups.

Another source of bias might have been introduced by the fact that only .359 per cent of the sample was composed of crossed-dominant subjects. It is possible that this proportion is too small to provide a representative sample of crossed-dominant subjects. Therefore, there are some possibilities that such a sample could have been composed of the best crossed-dominant performers without having included those in the middle and lower range. This observation also leads to the suggestion for a study where the proportion of crossed-dominant and non-crossed-dominant subjects would be almost the same or at least large enough within each age group that a representative sample could be drawn.

The nature of the data and sampling procedures in the present study did not lend themselves to an analysis of the interacting effect of both crossed dominance and "years of experience." It is possible that both variables acting together could produce some effects not apparent if we would look at each possibility separately and independently.

It could be speculated that the effects of "experience" are so strong that whatever detrimental influence crossed dominance might have on performance, it is corrected by training. If this is true, we can only arrive at such a

conclusion after studying the interactional effect of crossed dominance and experience and by comparing its expression in a design containing two major groups, one composed of subjects with a large amount of experience and a second one with little experience. In addition, each of these groups must be sufficiently large to be divided into equally large numbers of crossed-dominant and non-crossed-dominant subjects, and each subject must be randomly and independently selected.

Conclusion

Experience seems to be a more important variable than crossed dominance in influencing performance on the test of reading music. Crossed dominance by itself seems to be unrelated to performance of the test which supposedly measures ability to read music. However, the present study is limited by the specificity or unrepresentativeness of the sample drawn, as well as by the two major deficiencies in the controls. A more conclusive stand could be taken: (1) if two large independent samples of the population of crossed-dominant and non-crossed-dominant subjects were drawn where the amount of experience and the proportion of crossed dominance to non-crossed dominance is held constant within each age group, and (2) if these two variables were studied in interaction.

In conclusion, this research does not support the hypothesis that there is a correlation between crossed

dominance and performance on the music sight reading test. Further, within the limits of this study it can be concluded that the "years of experience" variable seems to be of such importance that, in order to account for whatever relationship might exist between crossed dominance and performance, experience has to be taken into consideration and studied in conjunction with the other variable under study.

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APPENDIX A

RAW DATA USED IN CORRELATIONS

RAW DATA USED IN CORRELATIONS

I ^a	II ^b	III ^c	IV ^d	V ^e	VI ^f	VII ^g	VIII ^h	IX ⁱ	X ^j	XI ^k
1.	M	14	8	3.5	3	5	5	5	0	41
2.	M	15	10	6.5	3	5	5	5	0	56
3.	F	15	10	4.5	3	5	5	5	0	56
4.	F	14	9	5.5	3	4	1	5	+	68
5.	M	16	10	5.5	3	1	3	3	+	64
6.	M	13	8	.5	3	4	1	5	+	67
7.	M	16	10	5.5	3	5	2	5	+	80
8.	M	13	8	2.5	3	4	5	3	0	51
9.	M	13	8	3.5	3	5	5	5	0	67

^aNumber assigned to subject.

^bSex.

^cChronological age.

^dGrade level.

^eYears of experience playing instrument.

^fKnowledge of right and left: 1 = confused, 2 = hesitant, 3 = normal.

^gHand dominance: 1 = strong left, 2 = moderate left, 3 = mixed, 4 = moderate right, 5 = strong right.

^hEye dominance: 1 = strong left, 2 = moderate left, 3 = mixed, 4 = moderate right, 5 = strong right.

ⁱFoot dominance: 1 = strong left, 2 = moderate left, 3 = mixed, 4 = moderate right, 5 = strong right.

^jTotal dominance: + = crossed-dominant, 0 = non-crossed-dominant.

^kRaw score from music reading test.

I	II	III	IV	V	VI	VII	VIII	IX	X	XI
10.	M	14	8	3.5	3	5	5	5	0	50
11.	M	14	8	1.0	2	5	5	5	0	52
12.	F	14	9	4.5	3	5	5	3	0	65
13.	F	14	9	4.5	2	5	2	5	+	66
14.	F	14	9	3.5	3	5	3	5	+	59
15.	F	13	8	3.5	3	5	5	3	0	65
16.	F	15	9	4.5	2	3	5	5	+	91
17.	F	13	8	2.5	3	5	1	5	+	59
18.	M	13	8	3.5	3	4	3	3	+	68
19.	M	17	12	7.0	3	4	5	5	0	87
20.	F	16	11	2.5	3	4	5	5	0	70
21.	F	13	8	3.5	3	4	5	5	0	78
22.	F	14	8	3.5	3	5	5	5	0	112
23.	M	13	8	3.5	3	5	5	5	0	52
24.	M	15	9	2.5	2	5	3	3	+	36
25.	M	13	8	3.5	3	4	4	5	0	67
26.	F	14	9	2.5	1	5	5	5	0	51
27.	F	13	8	1.0	3	5	5	3	0	34
28.	M	13	8	3.5	3	2	1	1	0	58
29.	F	15	9	4.5	3	5	5	5	0	77
30.	F	17	11	6.5	3	5	5	5	0	69
31.	M	17	12	8.5	3	5	5	3	0	96
32.	M	18	12	8.5	2	5	5	5	0	67
33.	M	13	8	2.5	3	4	5	5	0	50

I	II	III	IV	V	VI	VII	VIII	IX	X	XI
34.	M	14	9	4.5	3	4	3	5	+	72
35.	M	13	8	3.5	3	5	5	5	0	71
36.	M	15	10	4.5	2	5	3	5	+	101
37.	M	13	8	3.5	3	1	2	3	0	53
38.	F	15	9	4.5	2	4	1	5	+	93
39.	F	15	9	4.5	3	5	4	5	0	31
40.	M	14	8	1.5	3	5	2	5	+	17
41.	F	15	9	2.5	2	5	3	5	+	33
42.	M	15	10	5.5	3	5	5	5	0	80
43.	F	16	10	4.5	3	5	3	5	+	78
44.	F	14	9	2.5	3	5	1	5	+	60
45.	F	13	8	2.5	2	5	5	5	0	34
46.	F	15	9	4.5	2	4	3	4	+	66
47.	M	13	8	3.5	3	5	5	3	0	50
48.	M	16	10	3.5	3	5	5	5	0	81
49.	M	15	9	4.5	3	4	2	1	+	67
50.	F	16	11	7.5	2	1	1	1	0	48
51.	M	16	11	7.5	2	5	5	5	0	64
52.	M	14	9	4.5	2	4	2	3	+	46
53.	F	16	11	6.5	3	5	3	5	+	79
54.	F	16	11	4.5	3	3	3	5	+	104
55.	F	14	9	3.5	1	5	5	5	0	44
56.	F	13	8	2.5	3	5	5	5	0	71
57.	F	13	8	3.5	3	5	5	5	0	50

I	II	III	IV	V	VI	VII	VIII	IX	X	XI
58.	M	17	12	6.5	3	5	5	5	0	66
59.	F	12	7	1.5	2	5	3	5	+	43
60.	M	13	7	0.5	2	4	5	5	0	00
61.	F	13	7	2.5	3	4	1	3	+	49
62.	F	12	7	2.5	3	5	5	5	0	46
63.	M	12	7	0.5	3	5	5	5	0	9
64.	M	12	7	2.5	2	5	3	5	+	21
65.	M	12	7	2.5	3	5	5	3	0	30
66.	F	12	7	2.5	2	5	5	5	0	57
67.	F	13	7	2.5	2	5	5	5	0	46
68.	M	12	7	2.5	3	4	5	5	0	47
69.	M	12	7	1.5	3	5	3	5	+	43
70.	M	12	7	2.5	3	4	5	5	0	60
71.	F	12	7	1.5	3	5	2	5	+	54
72.	M	13	7	2.5	2	5	5	5	0	77
73.	M	13	7	2.5	3	5	5	5	0	29
74.	M	12	7	2.5	3	5	5	5	0	34
75.	F	13	7	2.5	2	1	1	1	0	61
76.	M	11	6	1.5	3	4	5	5	0	20
77.	M	11	6	1.5	2	5	1	5	+	17
78.	F	11	6	1.0	2	5	5	3	0	28
79.	F	11	6	1.5	3	5	3	3	+	21
80.	M	11	6	1.5	3	3	1	5	+	35
81.	M	12	6	1.5	2	5	1	5	+	28

I	II	III	IV	V	VI	VII	VIII	IX	X	XI
82.	M	12	6	1.5	3	5	2	3	+	33
83.	M	11	6	1.5	1	5	1	5	+	40
84.	F	11	6	1.5	3	4	5	5	0	46
85.	F	11	6	1.5	3	5	2	5	+	47
86.	F	11	6	1.5	3	5	5	5	0	38
87.	M	11	6	1.5	2	3	5	5	+	44
88.	M	12	6	1.5	3	5	2	5	+	17
89.	M	11	6	1.5	2	5	5	5	0	23
90.	F	12	6	1.5	3	5	5	5	0	34
91.	F	11	6	1.5	3	5	1	5	+	47
92.	M	11	6	1.5	2	5	1	5	+	19
93.	F	11	6	1.5	3	5	1	5	+	48
94.	M	11	6	1.5	3	5	5	5	0	29
95.	M	12	6	1.5	3	4	5	5	0	32
96.	F	12	6	1.5	3	5	5	5	0	23
97.	M	11	6	1.5	3	5	5	5	0	25
98.	M	11	6	1.5	3	4	5	5	0	19
99.	M	11	6	1.5	2	4	5	3	0	22
100.	M	12	6	1.5	3	4	5	5	0	39
101.	M	11	6	1.5	3	5	5	5	0	19
102.	M	10	5	.5	3	4	5	5	0	30
103.	F	11	5	.5	3	5	1	5	+	21
104.	F	10	5	.5	2	5	5	5	0	28
105.	M	11	5	.5	3	5	5	5	0	18

I	II	III	IV	V	VI	VII	VIII	IX	X	XI
106.	M	10	5	.5	3	5	5	5	0	25
107.	M	10	5	.5	3	5	5	5	0	25
108.	M	10	5	.5	3	5	1	5	+	39
109.	F	10	5	.5	3	5	5	5	0	16
110.	M	10	5	.5	2	5	1	5	+	16
111.	M	10	5	.5	1	5	5	5	0	23
112.	M	10	5	.5	2	4	5	3	0	22
113.	F	10	5	.5	2	4	5	5	0	25
114.	M	10	5	.5	2	4	5	3	0	16
115.	F	10	5	.5	2	5	5	5	0	29
116.	M	10	5	.5	3	4	1	5	+	11
117.	M	10	5	.5	3	5	5	5	0	26
118.	F	11	5	.5	1	4	5	5	0	14
119.	M	11	5	.5	3	4	5	5	0	22
120.	M	10	5	.5	3	5	5	5	0	22
121.	M	10	5	.5	3	4	3	1	+	42
122.	F	11	5	.5	3	4	5	5	0	28
123.	M	11	5	.5	2	3	5	5	+	8
124.	F	10	5	.5	3	5	5	5	0	27
125.	M	10	5	.5	3	5	5	5	0	8
126.	F	10	5	.5	3	5	5	5	0	25
127.	F	10	5	.5	3	4	5	5	0	38
128.	M	12	5	.5	2	3	5	5	+	3
129.	M	10	5	.5	1	5	3	5	+	5

I	II	III	IV	V	VI	VII	VIII	IX	X	XI
130.	F	9	5	.5	3	5	5	5	0	17
131.	M	10	5	.5	2	5	5	5	0	24
132.	F	11	5	.5	2	4	5	5	0	12
133.	M	11	5	.5	2	5	5	5	0	27
134.	F	10	5	.5	2	5	3	5	+	20
135.	M	10	5	.5	3	5	4	5	0	27
136.	F	10	5	.5	2	5	2	5	+	14
137.	M	10	5	.5	2	5	1	5	+	13
138.	F	10	5	.5	2	5	5	5	0	24
139.	M	11	5	.5	3	5	5	5	0	22
140.	F	10	5	.5	3	5	1	3	+	28
141.	F	11	5	.5	3	5	5	5	0	25
142.	M	10	5	.5	2	5	5	5	0	19
143.	F	10	5	.5	3	5	5	5	0	24
144.	M	10	5	.5	3	5	5	5	0	26
145.	F	10	5	.5	2	4	5	5	0	28
146.	M	11	5	.5	3	4	1	5	+	11
147.	F	10	5	.5	3	3	1	5	+	7
148.	F	10	5	.5	3	5	5	5	0	24
149.	F	10	5	.5	2	5	5	5	0	21
150.	M	10	5	.5	3	5	5	5	0	10
151.	F	11	5	.5	2	4	2	5	+	22
152.	F	10	5	.5	2	5	3	5	+	12
153.	F	11	5	.5	3	5	5	5	0	28

APPENDIX B

SAMPLE RECORD BLANK OF THE HARRIS TESTS
OF LATERAL DOMINANCE

PLEASE NOTE:

Pages 54-56, "Harris Tests of Lateral Dominance" and pages 58-69, "Watkins-Farnum Performance Scales", ©1954 by Hal Leonard Music, Inc. not micro-filmed at request of author. Available for consultation at University of Oklahoma Library.

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APPENDIX C

SAMPLE SCORE SHEETS OF THE WATKINS-FARNUM
PERFORMANCE SCALE