DIFFERENCES IN PERFORMANCE BETWEEN MINIMALLY BRAIN-INJURED AND NORMAL CHILDREN AS MEASURED BY THE "BIRCH-BELMONT AUDITORY-VISUAL INTEGRATION TEST"

THESIS

Presented to the Graduate Council of the North Texas State University in Partial Fulfillment of the Requirements For the Degree of

MASTER OF SCIENCE

By

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The problem with which this study was concerned involved the identification of minimally brain-injured children. The performance on the "Birch-Belmont Auditory-Visual Integration Test" by twenty-five minimally brain-injured students was compared to the performance of twenty-five non-brain-injured children. It was found that when ages and I.Q. scores were not significantly different, and when sexes were approximately proportionate, the M.B.I. children scored significantly lower than did the non-brain-injured children. While it was indicated that the minimally brain-injured children perform less adequately on auditory-visual integration, no comparison of intrasensory and intersensory functioning was made. It was suggested that the test not be employed for sole determination of minimal brain injury, but that it may be used as a screening device quite appropriately.
Development of local normative data was encouraged. It was recommended that specifically designed instruments would be necessary to determine the role of intersensory versus intrasensory functioning in brain-injured children. It was also noted that further studies would be needed to determine if performance on the "Birch-Belmont Auditory-Visual Integration Test" would be significantly affected by cultural differences in child-rearing practices.
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CHAPTER I

INTRODUCTION

Brain damage is a disability that has affected a growing number of children and adults (7). Yarborough (15) has stated that between one-half million and one and one-half million children were hampered by learning disabilities. According to the report only some eighteen percent have been identified and have received special services. Millman (11) has pointed out that many children who have a less than glaring verbal dysfunction have often been classified as having exhibited learning problems due to emotional difficulties. Coleman (5) has cited a failure rate of twenty percent in the average first grade and stated that many of these children were impeded by brain damage which caused visual-perceptual-motor dysfunction.

As brain-injured children have become known in school systems, special classes have been established to meet the unique needs of these exceptional children. The school psychologist or consulting psychologist working with the schools has experienced increasing pressure to identify candidates for the special education classes, but as noted by Coleman (5), it
would be neither feasible nor practical to give extensive psychometric evaluations to high percentages of school populations. While it has been established by Kershman (9) that complete neurological examinations discriminate between the normal and exceptional children at the $P<.05$ level of significance, the dilemma of screening and establishing initial impressions has not been resolved. Even though there have been studies such as those in which Knights and Hinton (10) revealed how brain-injured children perform on standardized tests (such as intelligence, achievement, visual-perceptual functioning and verbal skills), tests specifically designed to detect learning disabilities associated with brain damage are relatively uncommon. Those that do exist suffer from lack of adequate validation. Some of the newer instruments such as the Illinois Test of Psycholinguistics have shown potential for differential diagnosis and remediation planning (13), but unfortunately such tests require a considerable amount of time to administer.

**Purpose and Hypothesis of the Study**

The purpose of this paper was to explore the effectiveness of the "Birch-Belmont Auditory-Visual Integration Test" in discriminating between a group of average or typical classroom students in a given geographic area and a group of minimally
brain-injured students of that same area. The hypothesis tested was that if the minimally brain-injured students do have some impairment in auditory-visual integration, then the minimally brain-injured group should score significantly lower on the instrument when intelligence quotient scores and ages are not significantly different.

Related Literature

Herbert G. Birch and Lillian Belmont (2) reported on their test of auditory-visual integration initially for testing "the explicit hypothesis that impairment in auditory-visual integration would occur more commonly in a group of children with reading retardation than it would in normal age-mate controls" (2, p. 853). In a later publication Birch and Belmont (4) explored the normal and abnormal relations between the two sense systems, audition and vision, and reported in their findings:

Disturbance in integrative organization between the auditory and visual modalities suggest strongly that one way in which to interpret the frequently noted perceptual disorders of brain-injured children is to view them as products of the aberrant development of intersensory liaison (4, p. 55).

The employment of the "Birch-Belmont Auditory-Visual Integration Test" was established on the theory of a dynamic relationship between the sense modalities of audition and vision.
Belmont, Birch, and Karp (1) have stated that evidence that cerebral damage resulted in more disturbance in intersensory rather than intrasensory function has been established. Kershman (9) indicated that both intersensory and intrasensory abilities were more deficient in dyslexic type children. It was found in a brief review of the related literature that not all of the investigators share the same theory of intersensory relationships. Siegenthaler and Goldstein (14) reported findings that were described as consistent with previous work with brain-damaged adults in that there did appear to be a reduction in figure-background perception ability in the auditory-visual areas. They stated, however, that there were some indications that visual and auditory performance might vary independently, and that such a finding might be somewhat contrary to the theory of a dynamic relationship between the central nervous systems. Deutsch and Zawel (6) stated that findings had revealed that brain-injured children function independently on their visual and auditory task performance. It was also suggested that other variables (such as attention as a general factor) may have been involved in this type of study.
The "Birch-Belmont Auditory-Visual Integration Test," which was chosen for this study, does have a theoretical basis, although the theory is not equally accepted by all. Birch and Belmont (4) have stated that "...[brain-damaged] children are not only defective in their auditory-visual integrations but in their intersensory relations as well..." and they conclude that "...the adequacy of such auditory-visual integration should be explored in all children in which neurological damage is suspected..." (4, p.55).

Other studies involving brain-injured children's performance on audio-visual tasks have special significance to the present study. Although no studies were found that would indicate that males would function significantly different than females, Knights and Hinton (10) have reported that brain damage incidence was more common in males than females. It was suggested by Birch and Belmont (4) that the correlations between intelligence and auditory-visual integration tasks were associated but not entirely synonymous. An individual who was better able to integrate auditory-visual tasks was more likely to score higher on an intelligence test. There was no indication however, that performance on the auditory-visual pattern test was a direct function of intelligence.
quotient score differences. Birch and Belmont (3) also stated that the performance on the auditory-visual test was a capacity that was developed gradually by normal children. Their findings have indicated that normal children function little better than chance level when five or six years old, with full competence achieved after the child was eight to nine years old.

Limitations of Study

There were several limitations to the present study. One arose from the problem of accurately identifying the minimally brain-injured children. As noted by Reger (12), the confusion may largely be explained by only recent interest of several different disciplines in the minimally brain-injured child. A second limitation was cited in the research by Kappelman, Kaplan, and Ganter (8). They reported that neurological disorders were often present in children with learning problems. Even though neurological disorders have been found to be more common in disadvantaged children, there has been no indication as to differences between the cultural groups on the "Birch-Belmont Auditory-Visual Integration Test" performance. Although it did not seem particularly to effect the results of the present study, it must be mentioned that the results may or may not generalize readily to other school
situations since a large number of students tested were of the Mexican-American ethnic group.
CHAPTER BIBLIOGRAPHY


CHAPTER II

METHOD

Subjects

As previously mentioned, Reger (6) has indicated considerable confusion in the terminology involved in studying brain-injury cases. Hirschenfang, Silber, and Benton (5) have noted that brain-injury terminology may refer to several subsyndromes and also that behavioral disorders may overlap the brain-injury diagnosis. For the purpose of this paper, minimally brain-injured (M.B.I.) children referred operationally to the student certified by a medical doctor as M.B.I. All identified M.B.I. children in the school system studied were included in the present study. Previous psychological testing had been completed to determine that intellectual functioning was within normal limits. In a review of the files it was found that of the medical reports on the twenty-five children, nineteen had received a neuropsychiatric or neurological examination. The mean age for the group was 117.08 months, with a standard deviation of 11.30 months. The mean I.Q. score was 86.48, with a standard deviation of
8.92. Of the M.B.I. group eighteen were males and seven were females.

The control group consisted of twenty-five fourth grade students who attended a regular classroom and had not been identified as brain injured. All of the regular fourth grade classroom numbers were placed in a box and one was drawn to serve as the control group. The school officials indicated that there was no attempt to stratify or to use special groupings in the classroom placements. The mean age for the control group was 121.20 months, with a standard deviation of 4.62 months. The mean I.Q. score for the group was 85.28, with a standard deviation of 9.55. Of the twenty-five students, sixteen were males and nine were females. The sampling was considered to be typical of fourth grade students in the school system studied.

Instruments Used In This Study

The Goodenough-Harris-Draw-A-Man-Test (3) was used for intelligence quotient score screening. It has been described by Vane and Kessler (7) as a valuable tool for a simple quick estimate of intelligence and as a fairly good predictor of school achievement. Also it has been stated by Hirschenfang, Jaramillo, and Benton (4) that performance type tests may be
more helpful in testing children with neurological disorders than are other types of tests.

The "Birch-Belmont Auditory-Visual Integration Test" designed by Birch and Belmont (2) in 1964, essentially consisted of a visual dot pattern that had a corresponding pattern of rhythmic auditory stimulus. There were three practice exercises followed by ten test patterns as presented in Appendix I. The auditory stimulus consisted of a tap with a half-second pause between short intervals and a one second pause between the long intervals. The task of the subject was to identify a visual dot pattern that corresponded to the patterning of the auditory stimulus.

Procedures

In accordance with the technique of test administration as described by Birch, Belmont, and Karp (1), the auditory stimuli were recorded on a tape recorder to insure uniformity. The interval of one-half second was used for short pauses and one second for long pauses. The sounds were produced by striking a pencil on the side of a wooden desk. The visual stimuli, which consisted of three choices for each item or practice exercise, were placed on a five-by-eight-inch card in order that only one item at a time could be exposed to the
subject. Each child was seen individually by the examiner with the tape recorder to the left of the examiner as he faced the child. The examiner then said, "I am going to play a recording of some tapping patterns, listen." Examples A, B, and C were played. Then the examiner said, "Each pattern you hear is going to be like one of the dot patterns that you see here." He exposed a card on the table directly in front of the child and pointed to the three patterns on it. Then the examiner said, "Let me show you. Listen," and played Example A. He then questioned, "Which one of these did you hear?". Simultaneously, as the child made his choice the examiner said, "It is this one" and pointed to the correct pattern of dots. The examiner then instructed, "Listen again, and then show me which one you heard." Example B was played and then Card B was exposed. If the correct response was given the examiner would say, "That's right," or if an incorrect response was given the examiner would say "No, it is this one" and point to the correct response. Example C followed this same procedure. The examiner then instructed, "Listen carefully and pick out the dots which look like the taps you hear." No further encouragement was given and only the first response given by the subject was accepted. The ten test items were played one at a time preceded
by a comment such as, "Now this one." As each item was played on the tape recording, the card with the three multiple choice items was presented.

After the ten test items were administered the subject was given a standard piece of plain white paper and a pencil. The examiner then instructed, "Now I want you to make a picture of a man; make the very best picture that you can." He then said, "Be sure to make a whole man and put in all of his parts." There was no time limit on this part of the test, and as soon as the child finished he was excused.

Treatment of Data

The correct number of responses was totaled for each subject's performance on the "Birch-Belmont Auditory Visual Integration Test." The mean correct responses and standard deviations were computed for the control and M.B.I. groups. A t-test was then employed to test the null hypothesis that the scores obtained by the two groups were not significantly different.

The Goodenough-Harris-Draw-A-Man Test was scored according to instructions found in the manual (3). The mean I.Q. scores and standard deviations were computed for the control and M.B.I. groups. A t-test was then utilized to test the
null hypothesis that there was no significant difference between the I.Q. scores of the two groups. The mean age and standard deviations were then found for both groups and a t test was run to test the null hypothesis that there was no significant differences between the ages of the two groups. The percentage of male and female composition within each group was then computed to see if the male-female ratio was similar.
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CHAPTER III

RESULTS

As stated in Chapter I, the hypothesis of the study was that if the minimally brain-injured students do have some impairment in auditory-visual integration, then the minimally brain-injured group should score significantly lower on the "Birch-Belmont Auditory-Visual Integration Test" when intelligence quotient scores and ages were not significantly different. Data related to the statistical analysis of the hypothesis is found in Table I.

TABLE I

Means, Standard Deviations, t Values, and Levels of Significance Between the Control and M.B.I. Groups

<table>
<thead>
<tr>
<th></th>
<th>Control Group</th>
<th>M.B.I. Group</th>
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<tr>
<td>Birch-Belmont Auditory-Visual Test</td>
<td>8.20 1.69</td>
<td>5.92 2.78</td>
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<td>Goodenough-Harris I.Q. Scores</td>
<td>85.28 9.55</td>
<td>86.48 8.92</td>
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<tr>
<td>Ages</td>
<td>121.10 4.62</td>
<td>117.08 11.30</td>
<td>1.6421</td>
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N.S.=Non Significant
An examination of the data in Table I revealed no significant difference with respect to I.Q. or age for the two groups. There was slightly more age variability in the M.B.I. group as compared with the control group. The data relative to sex characteristics indicated that about two-thirds of both the control and M.B.I. groups consisted of males, with about one-third of both groups being females.

With respect to the "Birch-Belmont Auditory-Visual Integration Test," even though there was only slightly better than a two point difference between the means of the two groups, a $P$ value of $<.01$ would require a rejection of the null hypothesis. Therefore, it may be concluded that the M.B.I. students scored significantly lower on a test measuring auditory-visual integration than did the control group.

Discussion of Results

The statistical results confirmed that ages and I.Q. scores were not significantly different between the control and M.B.I. groups and that a proportionately equal number of boys and girls were in each group. It was indicated that when these variables were controlled, M.B.I. children score lower on the "Birch-Belmont Auditory-Visual Integration Test" than do non-brain-injured children.
The results support the statements by Birch and Belmont (1) that brain-injured children are defective in their auditory-visual intersensory relations. Other studies, such as Siegenthaler and Goldstein (4) and Deutsch and Zawel (2), which have suggested independent functioning in the two sensory systems, could not be supported or rejected. Similar to the findings of Knights and Hinton (3), this study reveals that the incidence of brain injury was greater in males than in females.

More important, the data offers some support for the "Birch-Belmont Auditory-Visual Integration Test" as a relatively easy method of discriminating between the normal or non-brain-injured students and minimally brain-injured students. While some false negatives and positives were observed, it was indicated that the "Birch-Belmont Auditory-Visual Integration Test" has merit as a screening instrument.

There may be some question as to whether arbitrary assignment to a classroom was synonymous with random assignments. It is contended that the use of the sample was justified, however, in that there was no academic grouping.
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CHAPTER IV

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The performance of twenty-five minimally brain-injured students in a special education class was compared to the performance of twenty-five non-brain-injured children in a regular classroom placement on the "Birch-Belmont Auditory-Visual Integration Test." It was found that when the ages and I.Q. scores were not significantly different and when the sexes were approximately proportionate, the M.B.I. children scored significantly lower than did the normal children.

The position that brain-injured children perform less adequately in auditory-visual integration tasks was supported. The position that intersensory functioning was impaired more than intrasensory functioning could neither be supported nor rejected by results obtained in the present study.

While the instrument was able to discriminate between the two groups of students, this test would probably be more wisely used as one test in a battery of examinations rather than as a single test only.
It may not be advisable to use this instrument for sole determination of minimal brain injury when treatment or management is radical, because children identified as false positives might be severely affected. When treatment or management is not particularly radical (such as when used as a screening device), the instrument might be employed quite appropriately. The close scrutiny and development of local normative data would be recommended for the employment of any such research instrument such as the "Birch-Belmont Auditory-Visual Integration Test."

While a decrement in intersensory function was observed in the present study, further studies with specifically designed instruments would be necessary to determine the theoretical questions as to the role of intersensory versus intrasensory functioning in brain-injured children. Also, it would be necessary to conduct further studies to determine whether the performance on the "Birch-Belmont Auditory-Visual Integration Test" would be significantly affected by the cultural differences in child-rearing practices.
APPENDIX I

AUDITORY-VISUAL TEST PATTERNS

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BIBLIOGRAPHY

Books


Articles


Siegenthaler, Bruce M., and Jerod Goldstein, "Auditory and Visual Figure-Background Perception by Adult Aphasics," *Journal of Communication Disorders*, 1 (1967), 152-158.