PREDICTABILITY OF THE ILLINOIS TEST OF PSYCHOLINGUISTIC ABILITIES ON VISUAL-MOTOR TASKS

APPROVED:

Willard Stang
Major Professor

Dee W. Casey
Minor Professor

Legend W. Holland
Director of the Department of Speech and Drama

Robert B. Toulouze
Dean of the Graduate School
Predictability of the Illinois Test of Psycholinguistic Abilities on Visual-Motor Tasks

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By

Nancy Jane Earls Taylor, B. S.
Denton, Texas
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CHAPTER I
INTRODUCTION AND REVIEW OF THE LITERATURE

Language has often been described in terms of its receptive and expressive aspects. Mykelbust (15) and McCarthy (14) use the term "receptive language" to describe the ability to comprehend and attach meaning to linguistic symbols expressed by others. "Expressive language" involves the expression to others of ideas, emotions, or desires through the use of linguistic symbols.

The development of language follows a sequential pattern which has been determined phylogenetically, ontogenetically, neurologically and psychologically (15, p. 2). Ferrier (9) states that the child's language develops in the following general manner: "... he learns to listen to the language and understand it before he learns to express ideas through spoken language; he expresses ideas in spoken language before he learns the written language of his culture." Although children may acquire language skills at different ages, they all seem to follow the same general pattern described by Ferrier.

Several models of the linguistic process have been constructed. These conceptual models allow a better understanding of visual-motor tasks as they relate to the concept
of language development. Osgood (17, p. 96) postulates that any model that proposes to incorporate language behavior must take into consideration the symbolic processes, perceptual integration, and the motor skill integration which are particularly important in language behavior. Osgood describes his model of language as having three processes and three levels of organization between the stimulus and the response. The first process is called decoding, which encompasses the total process whereby physical energies in the environment are interpreted by an organism. The second process is called encoding, during which the intentional selection of meaningful units, their grammatical integration and expression by the motor pathways is achieved. The third process, the associative process, establishes the link between sensory and motor integrations as wholes. The three levels of organization apply to all three processes. Three levels of organization described by Osgood are as follows: projection, integration, and representation. The projection level of organization relates both the receptor and the muscle events to the brain by the neural mechanisms. It involves the reflexes. The integration level of organization organizes and sequences both the incoming and outgoing neural events. The integrational level of organization has two divisions. The integrations are evocative in nature when the central pattern is sufficiently strong to complete itself once it is initiated. An example of this is the formation of all skill components
such as the grasping, pointing, flexing movements of the fingers; the reaching, leaning, turning movements of object orientation; the syllables of spoken language. The integration form under conditions of either lower frequency or lesser temporal contiguity may be merely predictive in nature in that the occurrences of some of the central correlates of a pattern merely serve to "tune up" the others with which they have been associated. An example of this is demonstrated when one sees a falling object, one becomes set for the noise of its striking, even though the noise level of the environment is above that of the noise produced by the falling object (17, p. 99). The representation or cognitive level of organization involves the termination of the decoding operations and the initiation of the encoding operations.

Wepman, Jones, Bock and Pelt (24) have postulated a model which has some similarities to Osgood's model. The model of Wepman et al. has three levels of function: conceptual, perceptual, and reflexive. Wepman, et al. regarded the oversimplified division of sensory input leading directly to motor output as failing to express the essential integrative process of language formulation. They state that

... in its place the present concept shows a triad of events in which modality-bound input leads to integration and symbol formulation which in turn leads to modality-bound motor output ...
the agnosias and apraxias are transmissive disorders, nonsymbolic in nature, bound by the pathways of reception and expression.

The model stresses a modality-bound separation of transmission at every level for both input and output, the important role of recall in all phases of perceptual and conceptual language, as well as the role of both internal and external feedback. Like the Osgood model, it distinguishes a meaning or symbolic level from a level of more automatic sequencing of language materials, and these in turn from sensory and motor input and output. It also implies a separation of decoding from encoding processes. It includes integration at all levels, as well as imitation, and includes the function of memory. One way in which their model is distinguished from Osgood's is that it is not assumed to be completely general in its application, but limited to aphasia.

McCarthy and Kirk (13) developed a clinical model similar to Osgood's model. They expanded Osgood's model to encompass four channels of communication, two levels of organization and three psycholinguistic processes. The model developed by McCarthy and Kirk has considerable commonality with the Osgood model, except for the integrative level. Osgood's evocative process does not allow for memory component, whereas the model developed by McCarthy and Kirk does. In this respect, the automatic-sequential level resembles the concepts in the Wepman et al. model.
A model presented by Fairbanks (18, p. 103) has similar channels of communication and psycholinguistic processes to those of Osgood and McCarthy and Kirk. The encoding and decoding channels of communication are employed in Fairbanks' model while the auditory and vocal psycholinguistic processes are used. The message begins at the brain of the first speaker and is produced by the speech mechanisms of the first speaker then is received in the ear of the second speaker. The second speaker's message follows the same pattern as did the first speaker's message, and is received by the ear of the first speaker and is interpreted by the brain of the first speaker. Fairbanks' model separates three modes of feedback which are the proprioceptive, the tactual, and the auditory. These feedbacks are utilized by the comparator, which serves the function of comparing output with input in order to derive an error signal. When an error in the output is made, it is noted by the comparator and is corrected by the mixer.

The models of the linguistic process which have been discussed employ sensory modalities for the decoding, encoding and feedback processes. One of the sensory processes used is vision. Brisbane (4, p. 86) states that vision is the least developed sense at birth; however, within a week the child becomes increasingly aware of his surroundings. The eyes begin to work together. Wunderlich (25) states that the child settles on the eye position which serves him best in his particular environment after experimenting with a
variety of eye postures and sets for several months after birth.

The development of cortical control over eye-limb coordination proceeds in a cephalocaudal pattern, that is from head to tail (26). The efficiency of eye-arm coordination and eye-hand coordination reverses with the development of the infant. Eye-palm coordination preceded eye-finger coordination. Eye-finger flexion coordination precedes eye-finger tension coordination.

Wunderlich (25) states that motor differentiation begins from a gross uncoordinated movement and terminates in a fine isolated, well-coordinated motor response. The development occurs from proximal to distal points. An infant between sixteen and twenty weeks old illustrates the proximal phase of arm development by his thrusting his arm awkwardly toward his target. The arms seem to move predominantly from the shoulder and both arms move together rather than moving independently.

Vernon (21) notes that by the age of three or four, most children can correctly name familiar objects when they are depicted in simple drawings. However, they often do not grasp what the people are doing in a picture of scenes and human activities. Children of two can discriminate between simple shapes, such as a square, a circle, and a triangle, as reported by Vernon (21), but they cannot reproduce or
correctly copy these forms until they are about four or five years old.

The eyes and hands are the most important tools for learning (10, p. 23). The eye registers impressions which are sent to the brain; the impulses to act on these impressions are sent to the muscles of the hands. At about the age of six months, the eyes and hands gradually begin to come into coordination.

There seem to be some basic sensory-motor skills which are closely related to early verbal learning. Staat (20, p. 424) states that "grasping a pencil or crayon properly and making marks in various directions involves sensory-motor skills that are basic to the ease with which the child will learn to write." Accurate visual-motor coordination enables the child to learn to read, write, spell, and undertake any other work involving the accurate recognition and reproduction of visual symbols.

Statement of the Problem

The purpose of this study was to determine whether or not individual scores derived by the Illinois Test of Psycholinguistic Abilities can be used as predictors of performance on visual motor tasks of the Wechsler Intelligence Scale for Children and the Frostig Developmental Test of Visual Perception for a child who has learning problems. These three well-known tests, the Illinois Test of Psycholinguistic Abilities, the Wechsler Intelligence Scale for
Children and the Frostig Developmental Test of Visual Perception, are commonly used to assess problems of individuals with learning problems. Each test had its peculiar purpose: the Illinois Test of Psycholinguistic Abilities is most frequently used to assess various levels of language function and is commonly administered in speech clinics as a means of evaluating the general level of language achievement of young children. The Frostig Developmental Test of Visual Perception is a test of reading skill commonly used to evaluate various language skills which are appropriate to the reading process. The Wechsler Intelligence Scale for Children is a tool used by psychologists to assess intelligence as it has been defined by the test designers. Whatever it does measure, it is, at least, highly related with success in school (23).

Each of these three widely used tests contains at least one subtest which has been included to evaluate the subject's visual motor skills. Each test is organized to provide developmental level of information related to chronological age.

The appraisal of children with learning disabilities frequently involves the administration of all three of these tests, a process requiring more than three hours. Casual inspection of the three tests indicates that such multiple testing may be a duplication of effort. Since the Illinois Test of Psycholinguistic Abilities is a routinely used tool
of speech clinicians, it would be helpful if a generalization could be made about the possible relation between the visual motor subtest scores of the Illinois Test of Psycholinguistic Abilities and the similar visual motor subtest scores of the Wechsler Intelligence Scale for Children and the Frostig Developmental Test of Visual Perception. If a high correlation exists between the similar subtest items on the other two tests, and if such a relationship exists between the subtest scores and the subject's overall scores, these subtests may provide a very useful predictor of what individual subjects can be expected to achieve with any of the three tools.

Review of the Literature

There have been no publications of research conducted which compare the performance on visual motor tasks, as measured by the Illinois Test of Psycholinguistic Abilities, the Frostig Developmental Test of Visual Perception and the Wechsler Intelligence Scale for Children. One explanation for the lack of such published research may be due to the fact that the Frostig Developmental Test of Visual Perception and the Illinois Test of Psycholinguistic Abilities are relatively recently published tests. The Frostig Developmental Test of Visual Perception was published in 1963; the Illinois Test of Psycholinguistic Abilities was published in 1961.
Interest in multiple-disciplinary approaches to learning difficulties is also a rather recent innovation. Numerous studies have been conducted using one of the three tests in question in a special relationship. Bilovshy and Share (2) investigated the performance of twenty-four noninstitutionalized children with Down's Syndrome on the *Illinois Test of Psycholinguistic Abilities*. They reported that these children were most deficient in their ability to deal with nonmeaningful symbols and the retention of these symbols either on the short term or long term basis was minimal. Bilovshy and Share (2) reported that the children did relatively well on the representational level when compared to their performances on the automatic-sequential level. Their performances on the auditory modality were deficient; however, whenever the mode of reception was visual, or whenever the mode of expression was motor, the children performed well above their language norms.

Kass (12) examined some psychologic correlations of reading disability with the *Illinois Test of Psycholinguistic Abilities*, a visual automatic test, a maze test, a memory for designs test, and perceptual speed test. These tests were given to twenty-one elementary school children from the school of Decatur, Illinois. The ages of the children ranged from seven years no months to nine years eleven months; the children were in the second, third and fourth grades. The results indicated that the children were deficient on the
following tests: sound blending, maze, memory for design and perceptual speed and the visual automatic subtest of the Illinois Test of Psycholinguistic Abilities. The children seemed to have problems at the integrational level of the psycholinguistic functioning. Kass concluded that the Illinois Test of Psycholinguistic Abilities, as a diagnostic instrument, seemed to be valuable in some respects and not in others. The auditory-vocal association, auditory-vocal sequencing and the visual-motor sequencing subtests of the Illinois Test of Psycholinguistic Abilities seemed to be best in denoting those children who had not learned to read after at least one year in school, although they had normal intelligence.

The Illinois Test of Psycholinguistic Abilities was administered by Dickson (8) to ten children with functional articulation defects judged to be language delayed and ten children with articulation defects judged not to be language delayed. The language-delayed group obtained significantly lower scores on the total test and on eight out of the nine subtests than the nonlanguage-delayed group. The raw scores of the language-delayed group were lower than the reported language age norms for the total test and the nine subtests, while the raw scores of the nonlanguage-delayed group were equal to or less than the reported norms for the total test and eight out of the nine subtests.
Butt (5) investigated the relationship between speech, language and reading abilities of fifty-nine third-grade children with normal intelligence. The children were divided into three groups according to their articulation ability. They were given the Peabody Picture Vocabulary Test, Illinois Test of Psycholinguistic Abilities, and the Gates-MacGintie Reading Test. Although the group with normal articulation did score higher on the Gates-MacGintie Reading Test and on the Illinois Test of Psycholinguistic Abilities than did the deviant articulation groups, Butt found no significant differences among the three groups.

Ferrier (9) also conducted a study designed to evaluate the psycholinguistic abilities of children who were considered to have functional articulation defects. He used forty elementary school children who were between the ages of six years seven months and eight years seven months. The referring speech therapist judged these children to have moderately severe articulation problems. The Templin-Darley 176 Item Test of Articulation and the Illinois Test of Psycholinguistic Abilities were administered. On the Illinois Test of Psycholinguistic Abilities, Ferrier found that the children performed inadequately on the automatic sequential and the representational levels of psycholinguistic ability. Vocal encoding was the weakest subtest in the representational level. There was a tendency toward the reduction of verbalization by the children who had severe articulation problems;
this may have been a factor which explained the lowered test scores on this subtest beyond what might have been earned by an equally able but more vocal group of children. Defective articulation seemed to the researcher to affect vocal encoding performance by reducing the total amount of verbalization.

Studies have been conducted which reported the performance of culturally deprived children on the Illinois Test of Psycholinguistic Abilities. Weaver and Weaver (22) postulated that the culturally deprived children would make significantly lower scores on the subtests involving the auditory and vocal channels; they believed that the culturally deprived children would earn significantly lower language age scores than their mental ages. The sixty-one children were selected from members of a project for Early Training for Culturally Deprived Children. The authors did not state any further explanation of the project for Early Training for Culturally Deprived Children. They reported a generally decreasing trend of scores in the following order: association, sequencing, decoding, encoding, and automatic. The children's representational level exceeded their automatic-sequential level of organization. The following modalities, as used on the Illinois Test of Psycholinguistic Abilities, are in decreasing order of utilization by the culturally deprived children: visual, motor, vocal, and auditory. Weaver and Weaver noted that the culturally deprived children seemed to exhibit a patterning of their scores which was similar to the
pattern exhibited by the educable and trainable mentally retarded children. Weaver and Weaver discussed studies conducted by Donovan, Gens, Hudson, Schlanger, Schlanger and Gottsleben and Sirkin and Lyons, who all generally concluded that there was a general increase in language disturbance as the intelligence quotient decreased. Weaver and Weaver also discussed research reported by Smith, who stated that his study showed a gain in language abilities for educable mentally retarded children who had been exposed to an experimental language development program. Weaver and Weaver's conclusions were made on the basis of the previous studies they discussed.

Johnson (11) compared the scores earned by a group of residential school deaf children and the standardization sample of the Illinois Test of Psycholinguistic Abilities on four selected subtests. The twenty-eight children from six to nine years of age had IQ's ranging from 80 to 120, as measured by the Columbia Mental Maturity Scale, and all had a hearing loss of 60 db in the better ear and were diagnosed as being deaf prior to one year of age. The visual decoding, motor decoding, visual-motor sequencing, and the visual-motor association subtests were given. Johnson found no significant differences between the Illinois Test of Psycholinguistic Abilities' sample group and the six year olds on any of the four subtests. There was significant difference between the deaf and the Illinois Test of Psycholinguistic Abilities'
sample group above the six-year level on the visual-motor sequencing subtest. Significant differences were also found between the two groups on all of the subtests at the 8-6 and the 9-0 chronological age level. Johnson concluded that the linguistic deficit in the deaf increases with age compared to the normal. Johnson also concluded that "the deaf appear to solve their verbal problems in a different manner than hearing children do."

The Frostig Developmental Test of Visual Perception has been compared with other well-known tests. Olson (16) compared the Frostig Developmental Test of Visual Perception with the California Achievement Test, 1963 Revision of the California Short-Form Test of Mental Maturity, the Gates Advanced Primary Reading Test, Hearing Sounds in Words Test, and Visual Memory of Words Test from the Durrell Analysis of Reading Difficulty Test. The purpose of this study was to determine the predictive value of the Frostig Developmental Test of Visual Perception for general achievement in the second grade and the relationship between the Frostig test and the specific reading abilities. Seventy-one second-grade children with normal intelligence were given the battery of tests. Olson concluded from the results that the Frostig Developmental Test of Visual Perception had some value as a predictor of general achievement in the second grade but does not predict as well as the Hearing Sounds in Words, Visual Memory for Words, reversible words in context, and synthesizing
words in context or the Gates Paragraph Reading and Word Recognition Tests. However, all four subtests of the Frostig Developmental Test of Visual Perception, except from constancy, showed significant relationships with specific reading abilities.

Culbertson and Gunn (7) compared the Bender Gestalt Test and the Frostig Developmental Test of Visual Perception with emotionally disturbed, schizophrenic, retarded and organic brain-damaged children, in hopes of finding the relationship between the Frostig Developmental Test of Visual Perception and the Bender Gestalt in predicting visual-motor skills of abnormal clinical groups of children. Of the sixty-five children tested, sixteen were emotionally disturbed, sixteen were schizophrenic, eighteen were mentally retarded and fifteen had organic brain syndrome. The children were selected from the Mendota State Hospital and the Madison Public School System of Wisconsin. The children's ages ranged from seven years five months to twelve years five months. The tests were individually administered to the children. Culbertson and Gunn reported a significant correlation between the two tests and the child's intelligence. The correlation between the Frostig Developmental Test of Visual Perception and the Bender Gestalt Test of .52 was found in the schizophrenic and emotionally disturbed group of children, which suggests that both tests are closely related and probably tap many of the same visual-perceptual variables.
Culbertson and Gunn noted that there was a consistency of performance on both tests with the groups whose prominent difficulty is emotional disturbance, while variable performance on those visual-motor tasks was found in children whose intelligence or neurological system was impaired. Correlations relating the total Bender Gestalt scores with each of the five subtests scores of the Frostig Developmental Test of Visual Perception with all of the children suggests that subtest IV and V of the Frostig are significantly related to the Bender Gestalt scores in this population, while none of the other three subtests were significantly related. Culbertson and Gunn concluded that the Frostig Developmental Test of Visual Perception was a useful instrument in diagnostic testing when used as a check or compliment to the Bender Gestalt Test.

Allen, Haupt, and Jones (1) investigated the contributions of perceptual skills to intellectual functioning in a retarded population by comparing the scores of the Frostig Developmental Test of Visual Perception and the Wechsler Intelligence Scale for Children. Sixty-five educable retarded children attending public schools were given the tests. Twenty of the children who obtained high perceptual quotient scores comprised the high-perceiver group, since they showed no marked impairment of perceptual skill, and twenty children who did not obtain high perceptual quotient scores comprised the low-perceiver group, for they showed
significant impairment of perceptual skill. The high-perceiver group performed with significantly greater proficiency on the Wechsler Intelligence Scale for Children than did the low-perceiver group, and the high-perceiver group were consistently superior to the low-perceiving group in the verbal skills. Allen, Haupt, and Jones concluded that the retarded children with apparently intact perceptual abilities are generally more efficient than the retarded children with impaired perceptual development, as measured by the Wechsler Intelligence Scale for Children performance subtests. Those children with apparently intact perceptual abilities seem to receive more meaningful organization of the environment and have better discrimination of the important items from the irrelevant facets of the perceptual world than those children whose perceptual development seems to be impaired.

Black and Davis (3) investigated the relationship between intelligence and sensorimotor proficiency in 245 mentally retarded children. The Wechsler Intelligence Scale for Children, Finger Localization Test, and Fingertip-Symbol Recognition Test were given to the children. Black and Davis found no significant relationship between the intelligence and the fingertip-symbol recognition tasks.

Chang and Chang (6) investigated the relationship of visual-motor skills and reading achievement in second and third grade students of superior ability. The children were
from the University Elementary School at the University of Hawaii. The children were given the Bender Gestalt Test and the Wechsler Intelligence Scale for Children. Chang and Chang found that the scores from these tests were significantly related to the second grade reading level but not to the third grade reading level. It was concluded that maturation of visual-motor skills of superior students is accelerated and the chronology of the relationship between visual-motor development and reading skill is advanced.

Robeck (19) studied the subtest patterning on the Wechsler Intelligence Scale for Children of thirty-six children who were from six years eleven months to thirteen years nine months old and who had reading problems. The full-scale intelligence quotients ranged from 85 to 136. Robeck found, in contrast with the standardization population, that the children scored significantly higher on the subtests of comprehension, block design, comparison, picture completion, vocabulary, and object assembly; however, on the picture arrangement, digit span, arithmetic, information and coding, the children scored below the group used in the test's standardization.

As noted from the models of the language process, there seem to be some basic sensory-motor skills which are closely related to the acquisition of language. These three tests were designed to measure some of those basic sensory-motor skills. This study was designed to investigate whether or
not selected items from the **Illinois Test of Psycholinguistic Abilities** could be used to predict the performance on similar test items from the **Wechsler Intelligence Scale for Children** or the **Frostig Developmental Test of Visual Perception** for children who have learning problems. Although no research has been published which compares the performance on visual-motor tasks as measured by the **Illinois Test of Psycholinguistic Abilities**, **Wechsler Intelligence Scale for Children** and the **Frostig Developmental Test of Visual Perception**, numerous studies have been conducted using one of the three tests with other tests. In general, the literature reviewed reveals that the three tests seem to be of some value in evaluating, and predicting learning ability, and correlating with other tests used in a given study of a selected population.


CHAPTER II

STATEMENT OF THE PROBLEM

The purpose of this study is to determine whether or not scores derived from the Illinois Test of Psycholinguistic Abilities can be used reliably as predictors of performance on visual motor tasks of the Frostig Developmental Test of Visual Perception and the Wechsler Intelligence Scale for Children for a child who has learning problems. The purpose of this study is to ascertain whether similar visual motor processes are being measured by the visual motor tasks of the three tests. If the tests do measure the same process, then the time involved in diagnostic testing of children who have learning problems can be reduced by eliminating those sections of the tests which are redundant, without sacrificing any information which would be obtained from using all of the tests. Also, if a high correlation exists between the similar subtest items on the other two tests and if such a relationship exists between the subtest scores and the subject's overall scores, these subtests may provide a very useful predictor of what individual subjects can be expected to achieve with any of the three tools.
Procedure

From the Pupil Appraisal Center of North Texas files the test scores of children referred for general learning disabilities were obtained. The Wechsler Intelligence Scale for Children was administered by a staff psychologist or a doctoral student in counselling of North Texas State University. The Frostig Developmental Test of Visual Perception was administered by a Pupil Appraisal Center staff reading specialist or a North Texas State University doctoral student. The Illinois Test of Psycholinguistic Abilities was administered by a supervised graduate assistant in the area of speech and hearing therapy. All of the tests were given individually and were part of the initial evaluation of the child.

Subjects

The thirty children used in this study were selected from the students referred to the Pupil Appraisal Center of North Texas for evaluation of their learning disabilities. Those children selected met two criteria: they were within an age range of three to nine years and they had the three tests administered to them during their initial diagnostic evaluation. The ages of the children ranged from six years nine months to nine years three months, with a mean of eight years three months and a standard deviation of two years six months. The children's intelligence quotients were within the normal range, as measured by the Wechsler Intelligence Scale.
Scale for Children; they had normal hearing acuity and no physical handicaps which would impair their ability to learn in a regular public school classroom. The children were enrolled in the public schools of Denton County, Texas, and they were referred from regular classrooms.

The Pupil Appraisal Center provides diagnostic and therapeutic services for children who manifest reading difficulties, personal adjustment problems or speech and hearing problems. The Pupil Appraisal Center serves those children living and attending a school in Denton County, Texas.

The Illinois Test of Psycholinguistic Abilities, the Wechsler Intelligence Scale for Children and the Frostig Developmental Test of Visual Perception are three well-known tests which are commonly used to assess the abilities of children with learning problems. Each test has its particular stated purpose and design.

Frostig Developmental Test of Visual Perception

The Frostig Developmental Test of Visual Perception (3), developed by Marianne Frostig, was published in 1964. The Frostig Developmental Test of Visual Perception attempts to measure five operationally defined perceptual skills. Frostig (4, p. 464) notes that Thurston, Wedell, and Cruickshank have stated that eye-hand coordination, figure-ground perception, form constancy, spatial relationships, and position in space appear to develop relatively independently of each other. Frostig included these five visual perceptual skills
because these five skills seemed to be the most important of all possible ones for school performance.

The Frostig Developmental Test of Visual Perception has five subtests: eye-hand coordination, figure-ground, constancy of shape, position in space, and spatial relationships. For this study Test I and Test V were used. Test I is an eye-hand coordination test. The term eye-hand coordination, as used by Frostig, means "the ability to coordinate vision with movements of the body or with movements of a part or parts of the body" (1, p. 16). This test entails eye-hand coordination involved in the drawing of a continuous straight, curved, or angled line between boundaries of various widths, or from one point to another point without guide lines. Test V is concerned with spatial relationships. Frostig indicates that the ability of an observer to perceive the position of two or more objects in relation to himself and in relation to each other is involved in spatial relationships (1, p. 74). Test V requires the child to copy a design, using dots as guidelines. This subtest measures the child's ability to analyze simple forms and patterns.

Frostig suggests that the Developmental Test of Visual Perception can be used as a screening device for nursery school, kindergartens, and first grade children, or as a clinical evaluation instrument for older children who have learning difficulties. The test can be administered to a group or to an individual by a person who has had proper
training in its use. As a group test, it requires less than an hour to give; as an individual test, it takes from thirty to forty-five minutes to give.

The 1961 standardization of the Frostig Developmental Test of Visual Perception is based on the responses of 2116 children whose ages ranged from three to nine years. The children were divided by ages into groups of one-half year; there were at least 107 children in each one-half-year group. Although the researchers tried to obtain a stratified socio-economic sample, the sample of Southern California children tended to be in the middle class.

The perceptual age level for each subtest was defined in terms of performance of the average child in the corresponding age group. The perceptual age divided by the chronological ages times ten and adjusted to the nearest whole number yields the scale score. The perceptual quotient is obtained from the sum of the subtest scores after correction for age variation has been made.

For a reliability study, Frostig administered the test individually to fifty children with learning difficulties. The Pearson product-moment coefficient or the retest reliability was .98. In another reliability study, Frostig recorded the test-retest reliability estimate to be .80 on a group of thirty-five first graders and thirty-seven second graders.
The Illinois Test of Psycholinguistic Abilities was published in 1961 by McCarthy and Kirk (6). The test was designed to evaluate specific aspects of language as they relate to the developmental progress of children between the ages of two and one-half and nine years of age. The test is based on a modified form of a theoretical model which was formulated by Osgood (12) and described in Chapter I.

The Illinois Test of Psycholinguistic Abilities has nine subtests. There are two subtests for the three processes on the representational level and three subtests on the automatic-sequential level. The subtests are as follows: auditory decoding, visual decoding, auditory-vocal association, visual-motor association, vocal encoding, motor encoding, auditory-vocal automatic, auditory-vocal sequencing, and visual-motor sequencing. For this study only the scores from the total test performance, the visual-motor association subtest and the visual-motor sequencing subtest were used. In the visual-motor association subtest the child is presented with a single stimulus picture and a set of four pictures. The child is to select the one picture from the set of four which most meaningfully is related to the stimulus picture. The subtest assesses the ability to relate meaningful visual symbols. The visual-motor sequencing is similar to the auditory-vocal sequential except the child is required to reproduce a sequential picture set or a geometrical design which was
previously presented. The purpose of this test is to assess the child's ability to reproduce a sequence of visual stimuli from memory.

The test was individually administered to each child. The examiner's manual contains tables which supply language-age norms and standard scores for the raw scores obtained.

The Illinois Test of Psycholinguistic Abilities was standardized on 1100 children who were randomly selected from the school list from Decatur, Illinois. Several criteria for selection were established: the test population represented three occupational groups as classified by the 1950 United States census; intelligence scores ranged between 80 and 120 on the Stanford Binet; no Negroes were included, nor were children who had sensory defects or any physical handicaps; the preschool children had not attended nursery school. Seven hundred children met the criteria. These children were between the ages of two years and nine years of age. The children were divided into fourteen groups by ages, placing them in groups of one-half year intervals. The same number of boys and girls were in the total group.

Reliability tests were conducted. The test-retest reliability was measured with a group of six and six-and-one-half-year-old children. The correlation for the total score was .70, while the correlation for the nine subtests ranged from .37 to .79. The visual-motor sequencing subtest had a correlation of .18, while the correlation of the visual-
motor association subtest was .34. These were minimal estimates, according to the authors, and they noted that the stability was this good or better. The full-range stability coefficient estimates were statistically derived; the range of these estimates was from .73 to .96 for the nine subtests, with a .86 for the visual-motor sequencing subtest and a .74 for the visual-motor association subtest, while the estimate for the total test was .97 (7, p. 33). Because of its recency and uniqueness, a limited amount of validity data is available on the Illinois Test of Psycholinguistic Abilities; however, McCarthy and Kirk's investigation of the contents of the test showed that the Illinois Test of Psycholinguistic Abilities did seem to indicate that the test does measure the child's language ability (7, p. 42). A range of .82 to .95, indicating the intercorrelations of each subtest with the total score, seems to indicate that the relationship of each subtest to the total ability being measured. The Illinois Test of Psycholinguistic Abilities total test score was found to correlate with the mental age at .95 and with chronological age at .94 (7, p. 42).

Wechsler Intelligence Scale for Children

The Wechsler Intelligence Scale for Children (13), developed by Wechsler, was published in 1949. The test is generally used by psychologists to measure the intelligence of children.
The test has two parts, verbal tests and performance tests. The general practice is to give five verbal and five performance tests, although six verbal and six performance tests are provided. These extra two tests are given for various statistical, clinical and administrative reasons, as described in Chapter I of the examiner's manual (14, p. 19).

By comparing each child's test score with the scores earned by individuals of the same age, intelligence quotients are derived. Raw scores and scale scores can be obtained on this test. The verbal score is secured by adding the five scaled scores of the five verbal tests which have been administered; likewise, the performance score is computed by adding the five performance scaled scores which have been given. The full-scaled score is the sum of the verbal score and the performance score; these three scaled scores can be converted into intelligence quotients by the use of the tables provided in the manual.

The subtests on the verbal section are as follows: information, comprehension, arithmetic, similarities and vocabulary; the performance subtests are as follows: picture completion, picture arrangement, block design, object assembly and coding. For this study, only the last three performance subtests were used. The block design subtest requires the analysis and reproduction of abstract designs; it involves visual-motor perception and coordination. The object assembly subtest requires the seeing of relationships
of parts to the whole in a familiar configuration along with a critical appraisal of small details. Visual perception and visual-motor integration are involved in the execution of this subtest. The coding subtest assesses the ability to learn an unfamiliar task, and it requires speed of visual-motor reaction and the association of symbols.

The Wechsler Intelligence Scale for Children was standardized on 2200 children. There were 100 boys and 100 girls at each age from five through fifteen years. The children were selected on the basis of their being able to meet certain requirements based on the United States Census Bureau data for 1940. The states were divided into four geographical areas, which were represented on a percentage basis. The urban and rural areas were proportionately represented in the sample. The children's fathers were distributed according to their occupational classification similarly to all employed white males.

The interrelationships among the twelve tests of the Wechsler Intelligence Scale for Children were computed. Each subtest was significantly correlated with the verbal score, the performance score and the full-scale score.

The scores from the subtests related to visual-motor tasks from each of the three tests were recorded. These scores were computed to determine the relationship among the visual-motor subtests scores of the Illinois Test of Psycho-linguistic Abilities and the similar visual-motor subtests
scores of the Wechsler Intelligence Scale for Children and the Frostig Developmental Test of Visual Perception. A further computation was made to verify the presence of a significant correlation among the correlation coefficients.
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CHAPTER III

RESULTS

The results of selected subtests related to visual-motor tasks from the Illinois Test of Psycholinguistic Abilities were compared with the results of selected visual-motor subtests from the Wechsler Intelligence Scale for Children and the Frostig Developmental Test of Visual Perception. The visual-motor association and the visual-motor sequencing subtests and the total test score from the Illinois Test of Psycholinguistic Abilities were used, while the eye-hand coordination, the spatial relationships subtests and the total test score of the Frostig Developmental Test of Visual Perception were used. The block design, object assembly, and coding subtests and the performance scaled score were used from the Wechsler Intelligence Scale for Children.

The scaled scores for the Wechsler Intelligence Scale for Children subtests and the Illinois Test of Psycholinguistic Abilities subtests were obtained from their test manuals. Since many of these scaled scores were negative fractional numbers, these scores were coded by adding three to remove the negative sign and multiplying by 100 to remove the decimal point. This provided greater ease in computation.
The scaled scores of the Frostig Developmental Test of Visual Perception were used on the two subtests, Test I and Test V. The perceptual quotient score was used for the total test score item. Frostig (1, p. 30) defines the perceptual quotient as

... a deviation score obtained from the sum of the subtest scale scores after correction for age variation. Unlike the scale scores, however, it is not a ratio; it has been defined in terms of constant percentiles for each age group, with a median of 100, upper and lower quartiles or 110 and 90, respectively, and other percentile ranks consistent with I.Q. values of the Wechsler Intelligence Scale for Children.

The scaled scores and the perceptual quotient were used for they eliminated the age factor in the comparison.

The scores were programmed for simple correlation, program S006 as described by McCallon (3). Using the S006 method of computing the scores, the score of each child for each item was compared individually with his other nine test scores. Such a comparison should reveal the relationship between the subtest items and the total test score and the relationship between each of these subtest items.

Pearson Product Moment Coefficients of Correlation were obtained. The correlation measured the extent to which the subtests were linearly related, and it is symbolized by \( r \). The value that \( r \) may assume varies between +1.0 to -1.0. A correlation of +1.0 is a perfect positive correlation (4, p. 142). The mean and standard deviation for each test item were also obtained.
Fisher's $z$ function was calculated. Fisher's $z$ function is "a mathematically defensible method of testing the significance of an $r$, especially when the coefficient is very high or very low" (2, p. 199). The following formula was used for the computing: \[ z = \frac{1}{\sqrt{N-3}} \] (2, p. 199). From a table containing the conversion of a Pearson $r$ into a corresponding Fisher's $z$ coefficient, the $z$ coefficients were obtained. The .95 confidence interval for the true $z$ was computed by $z \pm 1.96 \times \left( \frac{1}{\sqrt{N-3}} \right)$ (2, p. 199). These $z$'s were converted back into $r$'s by use of the provided table in order to obtain the .95 confidence interval for the true $r$. "The fiducial probability is .95 that this interval contains the true $r$," states Garrett (2, p. 199).

Table I shows the correlation coefficients of the Wechsler Intelligence Scale for Children subtests with the other subtests. There were no significant correlations between the Wechsler Intelligence Scale for Children subtests and the subtests of the Illinois Test of Psycholinguistic Abilities and the Frostig Developmental Test of Visual Perception. A negative correlation was found between the Wechsler Intelligence Scale for Children block design and the Frostig Developmental Test of Visual Perception total score, between the Wechsler Intelligence Scale for Children object assembly and the Frostig Developmental Test of Visual Perception eye-hand coordination subtest, and between the Wechsler Intelligence Scale for Children coding subtest and
<table>
<thead>
<tr>
<th>Wechsler Intelligence Scale for Children</th>
<th>Illinois Test of Psycholinguistic Abilities</th>
<th>Prostig Developmental Test of Visual Perception</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Visual Motor Ass'n</td>
</tr>
<tr>
<td>Performance</td>
<td>.4959</td>
<td>.3800</td>
</tr>
<tr>
<td>Block Design</td>
<td>.1517</td>
<td>.2620</td>
</tr>
<tr>
<td>Object Assembly</td>
<td>.1899</td>
<td>.1786</td>
</tr>
<tr>
<td>Coding</td>
<td>.4041</td>
<td>.2720</td>
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</tbody>
</table>
all of the subtests of the **Frostig Developmental Test of Visual Perception**.

Table II shows that there were no correlation coefficients which were not within the .95 confidence interval. A correlation is significant when the $r$ factor is not within the limits of the .95 confidence interval. There were no significant correlations found among the selected subtests of the **Illinois Test of Psycholinguistic Abilities** and the **Frostig Developmental Test of Visual Perception**, when compared to the **Wechsler Intelligence Scale for Children** subtests.

Table III shows the correlation coefficients of the **Illinois Test of Psycholinguistic Abilities** subtests and the **Frostig Developmental Test of Visual Perception** subtests. There were no significant correlations found between any of the test items. A negative correlation was found between the **Illinois Test of Psycholinguistic Abilities** "visual-motor sequencing subtest" and the **Frostig Developmental Test of Visual Perception** "eye-hand coordination subtest." Table IV reaffirms the findings of Table III in that there were no significant correlations found between the selected items from the **Illinois Test of Psycholinguistic Abilities** and the **Frostig Developmental Test of Visual Perception**. All of the correlation coefficients were within the .95 confidence interval.
### TABLE II

PEARSON R AND .95 CONFIDENCE INTERVAL OF WECHSLER INTELLIGENCE SCALE FOR CHILDREN WITH OTHER SUBTESTS

<table>
<thead>
<tr>
<th>Wechsler Intelligence Scale for Children</th>
<th>Illinois Test of Psycholinguistic Abilities</th>
<th>Frostig Developmental Test of Visual Perception</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Visual Motor Sequencing</td>
</tr>
<tr>
<td>Performance</td>
<td>r=.50</td>
<td>r=.17</td>
</tr>
<tr>
<td></td>
<td>I=.18/.73</td>
<td>I=-.20/.49</td>
</tr>
<tr>
<td>Block Design</td>
<td>r=.15</td>
<td>r=.00</td>
</tr>
<tr>
<td></td>
<td>I=-.22/.48</td>
<td>I=-.35/.35</td>
</tr>
<tr>
<td>Object Assembly</td>
<td>r=.19</td>
<td>r=.10</td>
</tr>
<tr>
<td></td>
<td>I=-.18/.51</td>
<td>I=-.26/.44</td>
</tr>
<tr>
<td>Coding</td>
<td>r=.40</td>
<td>r=.33</td>
</tr>
<tr>
<td></td>
<td>I=.05/.66</td>
<td>I=-.04/.61</td>
</tr>
</tbody>
</table>
### TABLE III

**CORRELATION COEFFICIENTS OF ILLINOIS TEST OF PSYCHOLINGUISTIC ABILITIES SUBTESTS WITH THE FROSTIG DEVELOPMENTAL TEST OF VISUAL PERCEPTION**

<table>
<thead>
<tr>
<th>Illinois Test of Psycholinguistic Abilities</th>
<th>Frostig Developmental Test of Visual Perception</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Test I</td>
</tr>
<tr>
<td>Total</td>
<td>0.4332</td>
</tr>
<tr>
<td>Visual Motor Sequencing</td>
<td>-0.0140</td>
</tr>
<tr>
<td>Visual Motor Association</td>
<td>0.1512</td>
</tr>
</tbody>
</table>

### TABLE IV

**PEARSON R AND .95 CONFIDENCE INTERVAL OF ILLINOIS TEST OF PSYCHOLINGUISTIC ABILITIES SUBTESTS AND FROSTIG DEVELOPMENTAL TEST OF VISUAL PERCEPTION SUBTESTS**

<table>
<thead>
<tr>
<th>Illinois Test of Psycholinguistic Abilities</th>
<th>Frostig Developmental Test of Visual Perception</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Test I</td>
</tr>
<tr>
<td>Total</td>
<td>( r = 0.43 )</td>
</tr>
<tr>
<td></td>
<td>( I = 0.09/.68 )</td>
</tr>
<tr>
<td>Visual Motor Sequencing</td>
<td>( r = -0.01 )</td>
</tr>
<tr>
<td></td>
<td>( I = 0.09/.68 )</td>
</tr>
<tr>
<td>Visual Motor Association</td>
<td>( r = 0.15 )</td>
</tr>
<tr>
<td></td>
<td>( I = -0.22/.48 )</td>
</tr>
</tbody>
</table>
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CHAPTER IV

DISCUSSION

Casual inspection of the visual-motor subtests of the three tests seems to indicate that they are all measuring the same general process. However, the results obtained from this study do not reveal such a relationship. Since all of the Pearson $r$ factors remained within the 195 confidence interval, as shown in Table II and Table IV, there were no significant correlations found among the three tests for this population. The Pearson $r$ factors would be significant only if they were not within the .95 confidence interval.

The results obtained seem to indicate that the three tests measure different visual-motor processes. Although the subtests vary in only one manner, this variation seems to be enough to result in no significant correlations being obtained among the tests. For example, the block design subtest of the Wechsler Intelligence Scale for Children, the visual-motor sequencing subtest of the Illinois Test of Psycholinguistic Abilities and the spatial relationships subtest of the Frostig Developmental Test of Visual Perception require the child to reproduce or copy a geometric design. Only the visual-motor sequencing test requires the child to remember the design. The block design and the spatial relationships tests differ only in that the child
has guidelines to aid him on the spatial relationships test and the block design test uses color clues. Although these tests measure copying or reproduction ability, they seem to be measuring different aspects of the visual-motor process.

Summary and Conclusions

The purpose of this study was to determine whether or not the Illinois Test of Psycholinguistic Abilities could be used as a predictor of performance on visual-motor tasks of the Wechsler Intelligence Scale for Children and the Frostig Developmental Test of Visual Perception by a child who has learning problems. The study was conducted to ascertain whether the same visual-motor processes were being measured by the visual-motor subtests of the three tests. If a high correlation existed between the similar subtest items of the three tests and if such a relationship existed between the subtest scores and the subject's overall scores, these subtests might provide a very useful predictor of what individual children could be expected to achieve with any of the three tools.

Thirty children used in this study were selected from the students referred to the Pupil Appraisal Center of North Texas for evaluation of their learning disabilities. The ages of the children ranged from six years nine months to nine years three months, with a mean age of eight years three months. From the Pupil Appraisal Center of North Texas files
the scaled scores and raw scores for the ten subtest scores were obtained. The subtests used in this study were the performance scaled score, block design, object assembly, and coding from the Wechsler Intelligence Scale for Children; total score, visual-motor association, and the visual-motor sequencing subtests from the Illinois Test of Psycholinguistic Abilities, and the total score, the eye-hand coordination, and the spatial relationships subtests from the Frostig Developmental Test of Visual Perception. Each child's score for each item was compared individually with his other nine subtest scores. By comparing the test scores in this manner, the relationship between the subtest items and the total test score and the relationship between each of the subtest items was revealed. Correlations between the scores were obtained using the services of the North Texas State University Computer Center. The mean and standard deviation for each test item were also obtained from the computer.

There were no significant positive correlations found among the three tests. Negative correlations were found between the Illinois Test of Psycholinguistic Abilities visual-motor sequencing subtest and the Frostig Developmental Test of Visual Perception eye-hand coordination subtest, and between the Wechsler Intelligence Scale for Children block design subtest and the Frostig Developmental Test of Visual Perception total test item. A negative correlation was also
found between the Wechsler Intelligence Scale for Children coding subtest and all three subtest items of the Frostig Developmental Test of Visual Perception, and between the Wechsler Intelligence Scale for Children object assembly subtest and the Frostig Developmental Test of Visual Perception eye-hand coordination subtest. However, Table II and Table IV indicate that these negative correlations are not within the range necessary for them to be considered significant as computed by the Fisher's z function. To be significant, these correlations must not be within the .95 confidence interval, but all of the correlation coefficients are found within this interval.

From the investigation it may be concluded that the results of no one of the visual-motor subtests may be used as a predictor of the scores to be derived with either of the other two tests considered for a population similar to the one used in this study.
BIBLIOGRAPHY

Books


Articles


Bilovshy, David and Jack Share, "The ITPA and Down's Syndrome: An Exploratory Study," American Journal of Mental Deficiency, LXXI (July, 1965), 78-82.

Black, Allan H. and Leo J. Davis, Jr., "Relationship Between Intelligence and Sensori-motor Proficiency in Retardates," American Journal of Mental Deficiency, LXXI (July, 1966), 55-59.


Olson, Arthur V., "Relation of Achievement Test Scores and Specific Reading Abilities to the Frostig Developmental Test of Visual Perception," Perceptual and Motor Skills, XX (November, 1966), 179-184.


Reports


Unpublished Materials

Butt, Francis, "The Relationship of Language and Articulation Ability to Reading Ability," unpublished master's thesis, Department of Speech and Drama, North Texas State University, Denton, Texas, 1968.

McCallon, Earl L., Computer Program Descriptions for Educational Data, North Texas State University, Denton, Texas, n.d.