A COMPARISON OF TWO TESTS OF LANGUAGE PERFORMANCE BY AN ADULT APHASIC POPULATION

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ABSTRACT

A COMPARISON OF TWO TESTS OF LANGUAGE PERFORMANCE BY AN ADULT APHASIC POPULATION

by Carol Ann Hall Olsen

The purpose of this study was to determine if the subtests of the Language Modalities Test for Aphasia correlated with the subtests of the Illinois Test of Psycholinguistic Abilities. These two tests will be referred to in this abstract as the LMTA and the ITPA respectively.

The subjects participating in this study were ten patients randomly chosen from the aphasic patient files of the Hearing and Speech Department of the Rehabilitation Medical Center at Sparrow Hospital in Lansing, Michigan, and the Hearing and Speech Department at the Ingham County Hospital and Rehabilitation Center in Okemos, Michigan. Each subject was given both the LMTA and ITPA. The tests were administered in counter-balanced order so that the learning effect might be controlled. Only one test was administered in a session in order to minimize patient fatigue.

There were six male and four female subjects participating in this study. The age range was thirty-one to seventy-four, with a mean age of 63.3.

The LMTA measures the linguistic function in the following areas:

1. Oral response to visual, and auditory stimuli
2. Graphic response to visual, and auditory stimuli
3. Matching of auditory or visual stimuli to picture alternatives[1]

while the ITPA assesses the ability to:

1. Understand the spoken word
2. Understand the picture and written words
3. Relate words in a meaningful way
4. Relate meaningful visual symbols
5. Express one's ideas in spoken words
6. Express one's ideas in gestures
7. Predict future linguistic events from past experience
8. Repeat a sequence of symbols previously heard
9. Reproduce a sequence of symbols previously seen[2]

The findings of this study tend to indicate that there were sixteen out of forty-five correlations which showed a significant statistical correlation.

It would appear that from these results the LMTA and the ITPA are measuring the same aspects of linguistic function in some areas. For example, the "vocal encoding" (the ability to describe simple objects verbally) subtest of the ITPA correlates significantly with three different subtests of the LMTA. The first is the "oral response to visual stimuli," in which the person names pictures, reads

words, numbers, and sentences. These two tasks involve essentially the same task of "naming" objects. The second high correlation of the "vocal encoding" subtest is with that of "graphic response to visual stimuli" which involves writing the names of pictures, and copying words and geometric forms. Thus people who name objects, pictures, etc., are usually able to write the name of them. The third high correlation of the "vocal encoding" subtest is with the "graphic response to auditory stimuli" which involves writing spoken words and numbers. Therefore, it appears that if an individual can name something and write the name of it, he usually has no trouble with writing the name after hearing the spoken word. The highest correlation, however, was between the "visual decoding" subtest of the ITPA and the "matching of visual and auditory stimuli with picture alternatives" on the LMTA. The "visual decoding" (the ability to comprehend pictures and written words) subtest involves essentially a matching technique in which the subject selects from a set of pictures the one which is most identical to a previously exposed stimulus picture. It would appear that these two subtests to some extent involve the same ability--that of matching.

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[1]Joseph M. Wepman and Lyle V. Jones, LMTA: Manual of Administration and Scoring (Chicaog 37, Illinois: Education-Industry Service), p. 32.

[2]James J. McCarthy and Samuel A. Kirk, ITPA: Examiner's Manual (Urbana, Illinois: University of Illinois), pp. 4-7.

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CHAPTER I

STATEMENT OF THE PROBLEM

Introduction

Since the Illinois Test of Psycholinguistic Abilities and the Language Modalities Test for Aphasia are both tests to assess language performance, it appears that there might be some similarities between the two tests.

A survey of the literature revealed that both of these tests were constructed from theoretical models of the communication process. Therefore, if the tests are measuring similar aspects of linguistic function, the conceptual models must also be similar.

The Illinois Test of Psycholinguistic Abilities was designed to assess the linguistic function of children with low mental ages, particularly of pre-school age. The Language Modalities Test for Aphasia was designed for any individual over ten years of age who is known to have medically diagnosed brain damage. The present study will attempt to determine the relationship between the performance of aphasic adults on the subtests of the Language Modalities Test for Aphasia and the Illinois Test of Psycholinguistic Abilities.

> A Clinician will be able to see some similarities between what we have termed auditory decoding defects and such terms as word deafness, sensory or receptive aphasia, auditory agnosia, and so forth. There may be some similarity between our visual decoding defects and visual agnosia or some forms of dyslexia. Likewise, there is a suggested relationship between what Wepman calls aphasia and our concepts of auditory-vocal association deficiency, and between vocal encoding defects and expressive aphasia--or, in Wepman's terms, apraxia.[1]

In this study that follows, an attempt was made to investigate the areas of linguistic deficiency as measured by the Language Modalities Test for Aphasia and correlate them with those measured by the Illinois Test of Psycholinguistic Abilities.

Statement of Problem and Purpose of Study

Since there seems to be some similarity between the construction of these two tests, (e.g., both came from models of the communication process, and both are tests for linguistic assessment) perhaps they are measuring similar areas of language performance. The Illinois Test of Psycholinguistic Abilities has been used on aphasic children as an instrument of differential diagnosis;[2] therefore, it may be possible to use it to assess the language performance of adults.

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[1]James J. McCarthy and Samuel A. Kirk, Illinois Test of Psycholinguistic Abilities: Examiner's Manual (Urbana, Illinois: University of Illinois Press), p. 7.

[2]James L. Olson, et al., "A Comparison of Receptive Aphasic, Expressive Aphasic, and Deaf Children on the Illinois Test of Psycholinguistic Abilities," Selected Studies on the Illinois Test of Psycholinguistic Abilities (Urbana, Illinois: University of Illinois, 1963), pp. 46-69.

The purpose of this study was to determine the relationship between the Language Modalities Test for Aphasia and the Illinois Test of Psycholinguistic Abilities with regards to measuring various aspects of language. Are they measuring one or more things similarly or differently? Can one test or subtest be substituted for another? Does the Illinois Test of Psycholinguistic Abilities, a comprehensive language assessment device for children with low mental ages, measure the areas of language performance which are also being assessed by the Language Modalities Test for Aphasia?

This study attempted to determine if the scores obtained on the subtests of the Language Modalities Test for Aphasia correlated statistically with the scores obtained on the Illinois Test of Psycholinguistic Abilities. Each subtest score of the Language Modalities Test for Aphasia was correlated with each subtest score of the Illinois Test of Psycholinguistic Abilities.

Question

In examining the correlations of the Language Modalities Test for Aphasia subtest scores with the subtest scores of the Illinois Test of Psycholinguistic Abilities the following question was posed:

> What is the relationship between performance of brain-injured adults on the subtests of the Language Modalities Test for Aphasia and the Illinois Test of Psycholinguistic Abilities?

Importance of Study

In an attempt to evaluate more adequately both the verbal and non-verbal performance of brain-damaged individuals, factors in the communication process must be investigated. Further understanding and evaluation of these people can only be made possible through continual contribution of information. It is felt that the results of this study may indicate the extent to which these two tests can be used to evaluate the linguistic abilities of the aphasic patient, or if subtests on one test can be substituted for subtests on the other.

Definition of Terms

The following terms are used throughout this presentation and are considered to be significant for the purposes of this study:

> Aphasia: partial or complete loss of symbolic formulation and expression due to brain lesion.[3]
>
> Language: any and all means of expressing feeling, and thought; facial expression and gesture as well as spoken and written words.[4]

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[3]Kenneth S. Wood, "Terminology and Nomenclature," Handbook of Speech Pathology, ed. Lee Edward Travis (New York: Appleton-Century-Crofts, Inc., 1957), p. 50.

[4]Marion E. Breckenridge and Margaret N. Murphy, Growth and Development of the Young Child (Philadelphia and London: W. B. Saunders Company, 1963), p. 373.

Psycholinguistic Ability: a given process at a given level via a given channel.[5] (e.g., expression at the representational level via a vocal response).

Language Modalities Test for Aphasia: a test designed for brain damaged individuals which provides a balanced set of simple tasks requiring the subject to use a variety of abilities within the major sensory modalities of vision and audition, and the motor pathways of speech and writing.[6]

Illinois Test of Psycholinguistic Abilities: a diagnostic test designed to meet the need for a comprehensive instrument for the assessment of psycholinguistic development in children particularly those of preschool age.[7]

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[5]James J. McCarthy and Samuel A. Kirk, The Construction, Standardization, and Statistical Characteristics of the Illinois Test of Psycholinguistic Abilities (Urbana, Illinois: University of Illinois Press, 1963), p. 2.

[6]Joseph M. Wepman and Lyle V. Jones, Language Modalities Test for Aphasia: Manual of Administration and Scoring (Chicago 37, Illinois: Education-Industry Service), p. 32.

[7]James J. McCarthy and Samuel Kirk, Illinois Test of Psycholinguistic Abilities: Examiner's Manual (Urbana, Illinois: University of Illinois Press), pp. 4-7.

CHAPTER II

REVIEW OF THE LITERATURE

Development of Tests

Both of these tests were designed from a proposed theory or model of the communication process. The model of the Language Modalities Test for Aphasia was designed to describe a system of mental functions necessary for language acquisition and to classify the language impairment after the erruption of neural insult. The model for the Illinois Test of Psycholinguistic Abilities, developed by Professor C. E. Osgood,[8] was designed to list and define all of the essential psycholinguistic abilities so that tests could be constructed to assess them. The former test was planned to differentiate between input, and associative deficiencies of the aphasic patient, as well as provide standardized information on either the amount of language lost or the amount retained. The Illinois Test of Psycholinguistic Abilities was designed to assess the language development of exceptional children (those with low mental ages); however, it is utilized as an

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[8] C. E. Osgood, "A Psycholinguistic Analysis of the Language Process" (unpublished paper, University of Illinois, 1953), quoted by Dorothy I. Sievers, Construction, Standardization, and Statistical Characteristics of the Illinois Test of Psycholinguistic Abilities (Urbana, Illinois: University of Illinois Press, 1963), p. 1.

instrument for differential diagnosis. Whereas the Language Modalities Test for Aphasia is used for adult aphasic patients (it can be passed by an average ten year old child), the Illinois Test of Psycholinguistic Abilities was designed primarily for children from 2 1/2 - 9, particularly those of preschool age.

The model for the Language Modalities Test for Aphasia, designed by Wepman, Jones, Bock, and VanPelt[9] conceived of the neural linguistic function as distinguishing between two important language roles for the central nervous system. They were viewed as transmissive functions which were seen to be modality-bound, and integrative functions which were modality-linked to some degree but not bound by it. The input and output (transmissive functions) modalities produced the non-symbolic language processes while the integrative functions produced symbolic comprehension and language formulation processes. Dysfunction of the input and output modalities results in the agnosias and the apraxias, while impairment of the integrative functions results in the aphasias.

The diagram shows not only the role of the lower level of language function, but also the effects of internal and external feedback on the language process. It also illustrates the relatively independent functioning of all three levels.

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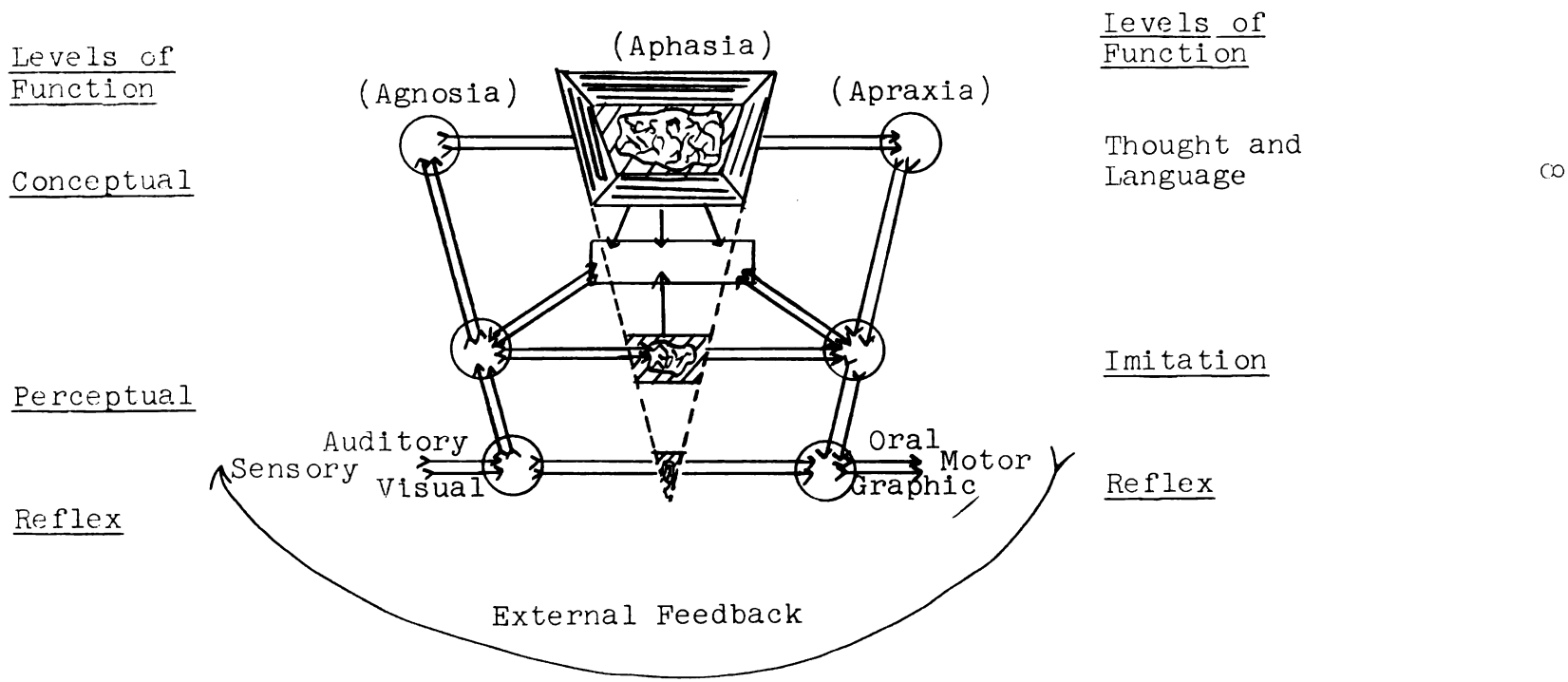
[9]Joseph M. Wepman, et al., "Studies in Aphasia: Background and Theoretical Formulations," Journal of Speech and Hearing Disorders, 25 (September, 1960), pp. 323-332.

An operational diagram of the levels of function of the central nervous system



[a]Wepman, et al., op. cit., p. 326.

If a stimulus is directed across the lowest part of this diagram, it is translated into motor acts, and reflex behavior follows. If the stimulus is transferred across the middle line, percepts are transmitted leaving a trace on the memory bank but having no meaning for the individual. This results in the echolalia of the young child. The central process at this level creates the transition from mode of reception to mode of response. This results in decoding and encoding in terms of previous experiences as well as the ability to copy or imitate. The highest level shows the symbolic system in man in which the stimulus affects the arousal of associations from the memory bank, and also the integrative process which involves associations resulting in language symbols.

According to Osgood, three major linguistic dimensions are necessary to specify a psycholinguistic ability; they are levels of organization, psycholinguistic processes, and channels of communication.[10] The levels of organization are subdivided into two areas: the representational level which deals with the individual's ability to decode, encode, and associate linguistic symbols; and the automatic-sequential level which deals with the non-meaningful use of linguistic symbols particularly retaining linguistic symbols for a long time and/or memorizing symbol sequences for a short period of time.

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[10]McCarthy and Kirk, op. cit., p. 2.

The psycholinguistic processes, which take into consideration the acquiring and use of language habits, are divided into three areas: decoding, which is the way the receiver interprets the stimuli, encoding, which is the means of expression either oral, graphic, or gestural, and association which is the ability to relate visual and auditory stimuli in a meaningful way.

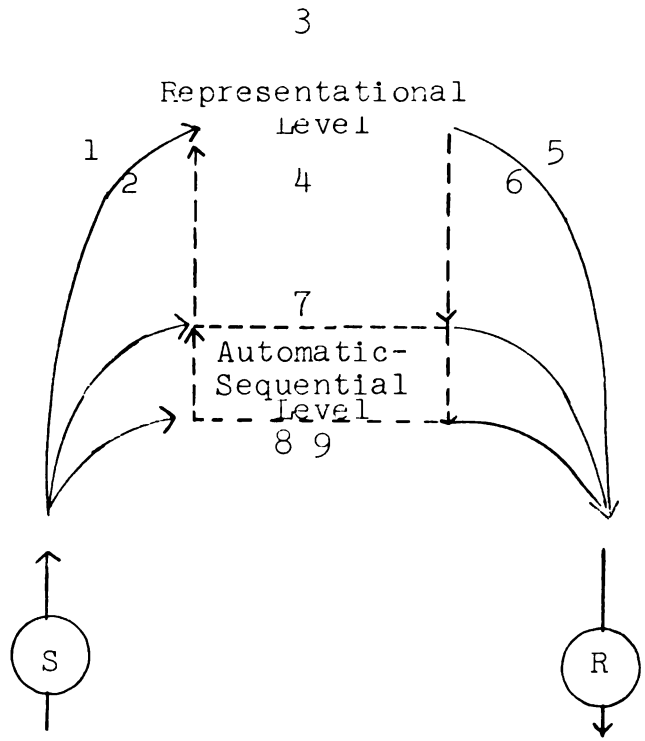
The channels of communication are the modalities or sensory-motor pathways over which language symbols are received and expressed. They are mode of reception and mode of response.

The diagram on the following page shows the mode of reception of the communication channel (auditory and visual stimuli) on the left, and the resulting mode of response (motor and vocal) on the right. There are three subtests which deal with non-meaningful uses of language symbols while the remaining six involve the ability to understand, relate, and express language symbols on a meaningful basis.

Perhaps now there can be a clearer understanding of the statement made in Chapter I concerning the parallel between the terms used by Wepman and those used by Kirk. For simplification they are listed here:

	Wepman	Osgood
1.	Input transmissive ability	Decoding ability
2.	Agnosia	Loss of decoding ability

A Model of Psycholinguistic Abilities



Representational Level

1. Auditory Deocding
2. Visual Decoding
3. Auditory-Vocal Association
4. Visual-Motor Association
5. Vocal Encoding
6. Motor Encoding

Automatic-Sequential Level

1. Auditory-Vocal Automatic
2. Auditory-Vocal Sequencing
3. Visual-Motor Sequencing

[a]McCarthy and Kirk, op. cit., p. 5.

3.	Integration	Association
4.	Aphasia	Loss of association ability
5.	Output transmissive ability	Encoding
6.	Apraxia	Loss of encoding abilility

Test Construction, Standardization, and Statistical Characteristics

Language Modalities Test for Aphasia

The Language Modalities Test for Aphasia was constructed to provide both visual and auditory stimuli to which an oral, graphic, or gestural response is necessary. There were four types of responses (oral, graphic, and two types of matching) necessary for both the presentation of visual stimuli, and the presentation of auditory stimuli. (There was a fifth response, a third type of matching; however, since this was included only in the screening section, and was not included in the computation of the actual test scores, it has been eliminated from this discussion).

The types of responses utilized for the various stimuli are listed below:

1. Visual Stimuli
   Reads or names
   Writes word or name
   Matches word to picture or pictures to word
   Matches word to word or picture to picture
2. Auditory Stimuli
   Repeats after examiner
   Writes word spoken by examiner

Matches spoken word to picture
Matches spoken word to printed word[11]

These responses are in turn evaluated according to two six-point scales--one for oral (A) and graphic (B) responses, and one for tell-a-story items. Essentially these two scales are the same, however, the tell-a-story items are scored more leniently. The following is an interpretation of the scoring for the two scales:

Category 1. Correct Responses

These indicate retained or recovered correct responses.

Category 2. Phonemic Errors

These errors indicate the extent of the subject's non-symbolic transmissive problem, thus indicating a retained, although imperfect, capacity to deal with stimuli regardless of his ability to use other modalities. (e.g., articulation errors due to apraxia).

Category 3. Grammatical Errors

These errors are due to improper grammatical inflection such as tense or plurality, and those due to addition, deletion, or substitution of syntactic words.

Category 4. Semantic Errors

These errors are made when the subject deletes, or adds words of major substantive meaning. (e.g., mouse substituted for the word fork).

Category 5. Jargon, Unintelligible, or Illegible Response

Errors here indicate that some or all of the responses fail to convey meaning to the examiner. (e.g., unintelligible oral responses, or illegible graphic responses).

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[11]Lyle V. Jones and Joseph M. Wepman, "Dimensions of Language Performance in Aphasia," Journal of Speech and Hearing Research, 4 (September, 1961), p. 221.

Category 6. No Response or Unrelated Response

> Errors in this category are those in which the subject has failed to respond or has avoided a response to the stimulus.[12]

One point is received for Category 1, two points are received for Category 2 . . . and six points are received for Category 6. This means that the higher the score, the more severely involved is the individual. The Language Modalities Test for Aphasia consists of two forms, I and II, with parallel items of scaled difficulty. The beginning items (numbered i-xi) form a screening section which is the same on both forms. It is then followed by two different cycles of test items, each presenting a series of 23 stimulus items: 12 visual stimuli, 9 auditory stimuli, and 2 story-telling pictures. For purposes of this study, an entire test consisted of:

1. 28 oral (A) responses to visual stimuli (the tell-a-story responses were included in this category for scoring purposes)
2. 6 graphic (B) responses to visual stimuli
3. 60 matching (C & D) responses to both visual and auditory stimuli (these were added together to facilitate scoring procedures)
4. 18 oral (A) responses to auditory stimuli
5. 12 graphic (B) responses to auditory stimuli

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[12] Wepman and Jones, op. cit., pp. 20-34.

These response categories are in keeping with the factor analysis results listed in the Language Modalities Test for Aphasia: Manual of Administration and Scoring.[13]

The standardization procedures of the Language Modalities Test for Aphasia were based on the test performances of 168 selected subjects from 19 different hospitals and clinics throughout the northeastern United States. Subjects were selected if:

1. The medical record displayed attested medical diagnosis of brain damage.
2. The hospital or clinic record noted language disability consequent to brain damage.
3. Subjects displayed no more than mild dysarthria.[14]

For purposes of scoring categories on the Language Modalities Test for Aphasia in regards to the form of errors it is considered not only important to know the mode of stimulus, but also the form of response for which errors occur. "These are qualitative data, however, and cannot be factor analyzed."[15] Therefore,

> to derive quantitative indices of performance for purposes of data analysis, the scoring categories for oral and written responses were analyzed by the method of optimal scaling. This method depends upon selecting scale values for the response categories which maximize the correlation ratio for the sum of squares between patients to the total sum of squares computed from these scale values. The reason for this method is to

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[13] Ibid., p. 32.

[14] Jones and Wepman, op. cit., p. 222.

[15] Ibid.

discriminate highly among the subjects on the basis of their performances.[16]

The results of factor analysis of the Language Modalities Test for Aphasia showed that certain factors appear among the item classes included in the analysis. They are best defined by:

1. Oral response to visually presented stimuli
2. Oral response to aurally presented stimuli
3. Written response to aurally presented stimuli
4. Written response to visually presented stimuli
5. Matching of aural or visual stimuli to picture alternatives
6. A further distinct factor emphasizing the modality-free nature of matching tasks presuming the comprehension of language signs rather than only reproduction of signs.[17]

Correlations were also computed representing inter-score reliability from the 6,000 responses obtained during the standardization procedure. Each response was scored twice, once by members of the research group at the Speech and Language Clinic, the University of Chicago, and once by members of the research group at the Psychometric Laboratory, University of North Carolina. No consultation was held by the two groups of scorers. The values obtained for the reliability coefficients ranged from .878 to .960.[18]

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[16] Ibid., p. 223.

[17] Ibid., p. 224.

[18] Wepman and Jones, op. cit., p. 44.

Illinois Test of Psycholinguistic Abilities

The Illinois Test of Psycholinguistic Abilities was constructed to provide an adequate language assessment of children with low mental ages, particularly those of the pre-school child. There are a total of nine psycholinguistic abilities to be tested and they are assessed in the following manner:

1. Auditory decoding: the ability to understand the spoken word; measured by a controlled vocabulary test in which the subject conveys "yes" or "no" to a series of questions scaled in difficulty.
2. Visual decoding: the ability to understand pictures and printed words; measured by picture identification in which the subject selects from among a set of pictures, the one which is most nearly identical to a previously exposed stimulus picture.
3. Auditory-vocal association: the ability to relate spoken words in a meaningful way; measured by an analogies test in which the subject must complete a test statement by supplying an analogous word (e.g., SOUP IS HOT, ICE CREAM IS _____).
4. Visual-motor association: ability to relate meaningful visual symbols; measured by having the subject select from among a set of pictures the one which relates meaningfully to a given stimulus picture.
5. Vocal encoding: the ability to express ideas in spoken words; measured by asking the subject to describe simple objects.
6. Motor encoding: the ability to express ideas in gestures; measured by showing the subject an object and asking him to supply the motion appropriate for manipulating.
7. Auditory-vocal automatic: ability to predict future linguistic events from past experience; measured by having the subject supply the last word to a test statement (e.g., FATHER IS OPENING THE CAN. NOW THE CAN HAS BEEN _____).
8. Auditory-vocal sequencing: the ability to correctly repeat a sequence of symbols previously heard; measured by a modified digit repetition test.
9. Visual-motor sequencing: the ability to correctly reproduce a sequence of symbols previously seen; measured by requiring the subject to duplicate the

> order of a sequence of pictures or geometrical designs presented to the subject and then removed.[19]

The general plan of standardization for the Illinois Test of Psycholinguistic Abilities was to obtain norms on a sufficiently large number of randomly selected, linguistically normal children. Over 1100 children between the ages of 2-0 and 9-0 were tested, 700 of whom were ultimately included in the final sample.[20]

For the standardization of this test, the school children were tested in special rooms set aside for this purpose at their respective schools. The preschool children sometimes were brought to school for the testing, however, the examiners would usually go to the child's home.

The Stanford-Binct, Form L (1937 revision) was administered to each subject during the first testing session, and then one day was allowed before the next testing session in order to avoid fatigue.

> Two forms of reliability were computed for the Illinois Test of Psycholinguistic Abilities battery, internal consistency reliability and stability reliability. Since each test of the Illinois Test of Psycholinguistic Abilities battery was designed to assess a specific psychological factor, internal consistency reliability coefficients by age and test were computed to show the homogeniety of the items within the tests. These internal consistency coefficients ranged from .50 to .86.[21]

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[19] McCarthy and Kirk, op. cit., pp. 4-7.

[20] McCarthy and Kirk, Construction, Standardization and Statistical Characteristics of the Illinois Test of Psycholinguistic Abilities, op. cit., p. 14.

[21] Ibid., p. 28.

Because the test-retest method of estimating stability is so costly, the number of cases was limited by selecting an entire age group somewhere near the center of the age range. Since the test-retest stability coefficients were obtained under conditions including a long test-retest interval and a restricted age range, the stability coefficients are minimal estimates. They ranged from .18 to .86.[22]

Split-half reliability coefficients were also computed for the Illinois Test of Psycholinguistic Abilities, according to each age group, each subtest, and then an overall split-half reliability coefficient was computed not only for each age group and each subtest but also for all age groups and all subtests thus giving the Illinois Test of Psycholinguistic Abilities total. "The individual subtest split-half reliability coefficients ranged from .39 to .94. The same data showed twelve individual group coefficients ranging from the .50's to the .70's, with an overall coefficient in the 90's."[23]

The authors of the Illinois Test of Psycholinguistic Abilities discuss the types of validity demonstrations required of this test. In order to show the validity of this test, the test constructor must demonstrate that the test is valid for the purposes for which it was intended. The authors assume that the Illinois Test of Psycholinguistic

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[22] Ibid., p. 31.

[23] Ibid., pp. 31-32.

Abilities will be used to diagnose linguistic problems and to assess treatment over a period of time. Each of the types of validity analyzed by Cronbach[24] were discussed as well as demonstrated. They included concurrent validity, predictive validity, content validity, and construct validity, as well as an important subtype which the authors call diagnostic validity.

> Since both concurrent and predictive validity determine the correlation between the Illinois Test of Psycholinguistic Abilities test scores and certain linguistic categories, the only difference between the two is largely a matter of timing. The concurrent criteria are obtained at the time the test scores are obtained while the predictive data is obtained at a later time . . . Two variables obtained from the standardization data were examined in this regard--mental age and social class . . . There should be a substantial correlation between the Illinois Test of Psycholinguistic Abilities raw score and mental age and social; however, the data suggests that the Illinois Test of Psycholinguistic Abilities scores depend substantially, but not entirely on mental age. The influence of social class, particularly before the age of 6-6, was less marked.[25]

In attempting to answer the question relative to the content validity of the test (e.g., How representative is the content of the test of the task being sampled?) the discussion was divided into two aspects:

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[24]Lee Cronbach, Essentials of Psychological Testing: Second Edition (New York: Harper and Brothers, 1960), quoted by James McCarthy and Samuel Kirk, The Construction, Standardization, and Statistical Characteristics of the Illinois Test of Psycholinguistic Abilities (Urbana, Illinois: University of Illinois Press, 1963), p. 35.

[25]McCarthy and Kirk, Statistical Characteristics of the Illinois Test of Psycholinguistic Abilities, op. cit., pp. 35-36.

> (a) How thoroughly did the Illinois Test of Psycholinguistic Abilities cover all areas of psycholinguistic ability?, and (b) How representative are the items actually selected from the infinite number of items that could be used for the test?[26]

The authors seem to feel that there is no way to prove the completeness of this battery, only ways to show the lack of completeness for given purposes. They feel that the completeness of the Illinois Test of Psycholinguistic Abilities battery should be subjected to empirical check.

To determine how representative the chosen test items were, three prestandardization studies were made in which the items were given to small groups of children at different age levels; the results were subjected to an item analysis, which correlated items with the total score for that test and with each other. The internal consistency estimates seem to be consistent with acceptable validity estimates, thus indicating the homogeniety of the items within the tests. A factor analysis of the standardization data also tended to show a heterogeneity of tests in the battery.

According to Cronbach "construct validity is an analysis of the meaning of test scores in terms of psychological concepts, which requires a knowledge of which factors influence the test scores and which do not."[27] Although no

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[26] Ibid., p. 36.

[27] James J. McCarthy and Samuel A. Kirk, The Construction, Standardization, and Statistical Characteristics of the Illinois Test of Psycholinguistic Abilities (Urbana, Illinois: University of Illinois Press, 1963), p. 38, quoting from Lee Cronbach, Essentials of Psychological Testing: Second Edition (New York: Harper and Brothers, 1960).

such studies have been done for the Illinois Test of Psycholinguistic Abilities, the authors postulate a number of factors which might influence the test scores (e.g., mental age, chronological age, social class, racial and cultural influences, and time).

McCarthy and Kirk discuss separately the concept of diagnostic validity of the Illinois Test of Psycholinguistic Abilities, even though it may be a special class of concurrent validity. They are concerned with the differential and educational diagnostic aspects of this test, although some studies have been done in this area, (e.g., Olson in 1963).[28]

Statistics are also available on the correlation of the test variables (e.g., social class and mental age) and also on the test intercorrelations (e.g., overall table and age group tables).

The test intercorrelations were factor-analyzed. This analysis shows neither the correctness of the theory nor the validity of the test.

> When the overall intercorrelation table of tests was subjected to analysis of variance and rotation, a general linguistic factor seemed to account for 80% of the common variance. General expressive ability (encoding) accounted for approximately 4% of the common variance, while specific factors including immediate recall of auditory, and visual symbols (Auditory-Vocal and Visual Motor Sequencing), expression of ideas by gesture (Motor Encoding) and the ability to relate meaningful visual stimuli (Visual-Motor Association) each account for about

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[28]Olson, et al., op. cit., pp. 46-69.

3% of the variance. In total, these factors accounted for about 95% of the variance.[29]

Related Areas of Study

A survey of the literature indicated a study by Olson[30] in which he used the Illinois Test of Psycholinguistic Abilities as a diagnostic instrument to assess the language of deaf, receptive aphasic, and expressive aphasic children ages 5 years through 9 years and 6 months. The purpose of this study was to compare these three behavior patterns, and it was hypothesized that these comparisons would show differing response patterns thus pointing the way toward a relatively clear cut method of differential diagnosis. The results show that the deaf and receptive aphasic groups present relatively stable linguistic deficiencies, predominantly in the auditory decoding channel, but that the expressive aphasic group was not easily predictable. The author seems to feel that the Illinois Test of Psycholinguistic Abilities is more meaningful than former tests have been, since it is designed diagnostically and educationally to assess specific abilities.

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[29] McCarthy and Kirk, Statistical Characteristics of the Illinois Test of Psycholinguistic Abilities, op. cit., p. 63.

[30] Olson, et al., op. cit., pp. 46-49.

Another study completed by Schuell, Jenkins, and Carroll[31] reported of a factor analysis computed on another test for aphasia--the Minnesota Test for Differential Diagnosis of Aphasia. The results tend to confirm the findings of Jones and Wepman[32] that additional variables along with brain damage must play a role in aphasic behavior, and must be considered in the evaluation and treatment of aphasic patients as well as in the formulation of theories of models.

A study by Doehring and Reitan concerning the "concept attainment of human adults with lateralized cerebral lesions"[33] involved the administration of two tests to a brain damaged population. The two tests were the Halstead Category Test and the Wechsler-Bellevue Intelligence Test.

The purpose of this study was to support or contradict the hypothesis "that there is one dominant hemisphere which subserves all complex intellectual abilities and that the two cerebral hemispheres are equivalent in function."[34]

This study differed from the present one, however, in that hypotheses were attempted to be either proved or

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[31]Hildred Schuell, James Jenkins, and John Carroll, "A Factor Analysis of the Minnesota Test for Differential Diagnosis of Aphasia," Journal of Speech and Hearing Research, 5 (December, 1962), pp. 349-369.

[32]Jones and Wepman, "Dimensions of Language Performance in Aphasia," op. cit., pp. 220-232.

[33]D. G. Doehring and R. M. Reitan, "Concept Attainment of Human Adults with Lateral Cerebral Lesions," Perceptual and Motor Skills, 14 (September, 1962), pp. 27-33.

[34]Ibid.

disproved, and there was also a control group of normal subjects in the former study.

CHAPTER III

SUBJECTS, EQUIPMENT, AND TESTING PROCEDURES

Subjects

The subjects participating in this study were ten aphasic patients randomly selected from the aphasic patient list in the Hearing and Speech Department at Sparrow Hospital in Lansing, Michigan, and the aphasic patient list from the Hearing and Speech Department at Ingham County Hospital and Rehabilitation Center in Okemos, Michigan. There were six male subjects and four female subjects participating in this study. All subjects had previously suffered cerebro-vascular accidents, with the exception of one subject who had a medically diagnosed brain tumor but who exhibited aphasic symptoms as measured by the Language Modalities Test for Aphasia. At least six months had elapsed from the time each subject had suffered the initial trauma until the time they participated in this study. To qualify as a participant, the subject had to miss one or more items on the screening test of the Language Modalities Test for Aphasia. The scores obtained in this section of the test were not used in the statistical computations for this study.

The ages of the subjects ranged from thirty-one to seventy-four, with a mean age of 63.3. The average age for all the female subjects was 59.25, and the average age for all the male subjects was 66.0.

One subject was in her thirties, one subject was in his forties, four subjects were in their sixties, and four subjects were in their seventies. Seven subjects were patients at the Ingham County Hospital and Rehabilitation Center while three subjects lived in private homes.

Equipment

The Illinois Test of Psycholinguistic Abilities and the Language Modalities Test for Aphasia were used for obtaining the raw data for this study. Other materials needed for testing were pencils for both the subject and the investigator to use, an electrical outlet required for the projector of the Language Modalities Test for Aphasia, a stopwatch required for administering the "visual motor" and the "auditory vocal sequencing" subtests of the Illinois Test of Psycholinguistic Abilities, and a desk or table for the administration of both tests. Because of the use of a filmstrip, it was also necessary to administer the Language Modalities Test for Aphasia in a darkened room.

Procedure

The subjects were chosen with the knowledge and co-operation of the hospital Hearing and Speech Supervisors. In addition, for those subjects who were hospitalized at the Ingham County Hospital and Rehabilitation Center, the nursing and social service staff were informed of the nature of this study.

There was no particular time established for testing; however, all testing was performed between the hours of eight o'clock in the morning and five o'clock in the afternoon. Prior to gathering this data, permission for the subjects to be used for this study was obtained from the subjects themselves at the Ingham County Hospital and Rehabilitation Center. For those people who were not at this hospital, both tests were administered at the subject's convenience in their own homes. This, of course, was accomplished only after obtaining permission from the subject and the closest relative.

In order to control any learning effect the tests were administered in counter-balanced order. Five subjects were given the Language Modalities Test for Aphasia first, followed by the Illinois Test of Psycholinguistic Abilities, while the remaining five subjects took the Illinois Test of Psycholinguistic Abilities first followed by the Language Modalities Test for Aphasia.

The tests administered at the Ingham County Hospital and Rehabilitation Center were given in the room utilized for

speech therapy. Each subject was brought to the room by an orderly and was wheeled to a large desk. While administering the Language Modalities Test for Aphasia, the window blinds were drawn to reduce the amount of light in the room, thus making the filmstrip more easily seen. For those subjects who did not reside at this hospital, the tests were administered at a large table in a convenient location to minimize distractions. At no time during the tests were there any outside significant interruptions. In order to begin testing, the tests have to be organized in some fashion (e.g., the Language Modalities Test for Aphasia filmstrip has to be set up, and the Illinois Test of Psycholinguistic Abilities requires the assembling of materials). While this was being done, rapport was established with the subject by making general conversation.

The subject was then given the general directions for taking the tests (e.g., "Some of these tasks are going to be more difficult than others, but do the best you can, and please don't become upset with your performance. Listen carefully to what the examiner says and then follow the directions.") Explicit directions for the test were then given as the test was being administered. No more than one test was given at a time, since the Language Modalities Test for Aphasia took approximately two hours to administer. In some instances, three sessions were necessary before the

entire test battery was given. This, of course, was determined by the length of time the subject took to respond.

Because of the type of population used for this study, it was necessary to make some allowances in the testing procedures of both the Illinois Test for Psycholinguistic Abilities and the Language Modalities Test for Aphasia. Nine of the ten subjects used for this study were patients with diagnosed brain damage accompanied by hemiplegia and some type of dysphasia; therefore, some of the administration and scoring procedures were violated. These are seen in the following examples.

One of the characteristics of most of the subjects was a relatively short memory span. When administering the "vocal encoding" subtest (the ability to verbally describe objects), it was necessary to question the subject as to the characteristics of a certain object, because the subjects could not remember what types of information they should give. For example, when asked to describe what the object was, some patients would give one or two word responses, and then forget that more information was desired. Their attention span was short and they would become interested in looking around the room, forgetting about the task at hand. Therefore, it was necessary to question the subjects even after the demonstration item had been administered, since they could not remember what type and how much information to give.

In terms of scoring, credit was given when it was felt that the subject knew the correct answer. For example, on the "motor encoding" subtest of the Illinois Test of Psycholinguistic Abilities one subject knew what a trombone was, blew through her lips, and made sliding actions with her one good hand. To receive credit, however, the subject was to "hold" the trombone with her other hand. This was impossible since her arm was paralyzed. Another subject was severely dysarthric, thus making lenient scoring necessary on the "auditory-vocal sequencing" subtest, which requires a subject to correctly repeat a sequence of symbols previously heard. This was assessed by a digit repetition test and it was difficult to understand in some instances whether the right word was spoken. Therefore if the inflection was correct, the answer was considered to be correct.

Since there was no limit to the possible score on the "vocal encoding" subtest, the ceiling used was thirty-seven points. This was the highest number of points that anyone in the standardization group received for this test, and no one in this study came within ten points of this limit. Therefore, for purposes of this subtest, thirty-seven was the total number of possible points anyone could receive.

In order to facilitate quantifying the data, it was also necessary to make some changes in the scoring procedures of the Language Modalities Test for Aphasia. It was felt that both #1 and #2 responses (correct responses, and

responses having pronunciation spelling, or incoordinate writing errors), along with the self-corrected responses that applied to #3, #4, #5, and #6 responses (responses of grammatical and syntactic errors, semantic errors, jargon errors, and no response) should be considered as correct responses.

The criterion values for both tests, were the percent correct items for each subtest. To compute the percent of items correct, the total number of possible correct points for each subtest was divided into the total number of obtained points. The quotient was the percentage of items that were correct for that particular subtest. This calculation was used for the subtests of both the Language Modalities Test for Aphasia and the Illinois Test of Psycholinguistic Abilities.

A Pearson-Product Moment Correlation Coefficient was used to determine the extent of relationship between the subtest scores. Since there were five subtests on the Language Modalities Test for Aphasia and nine subtests on the Illinois Test for Psycholinguistic Abilities, it was necessary to compute forty-five correlations.

CHAPTER IV

RESULTS AND ANALYSIS

Introduction

As indicated in Chapter I, a relatively high correlation between the Illinois Test of Psycholinguistic Abilities subtest scores and the subtest scores of the Language Modalities Test for Aphasia might indicate that these two tests, which were designed to evaluate language functioning, were measuring some aspects of language performance similarly. This study was concerned with determining whether such a correlation between the Language Modalities Test for Aphasia and the Illinois Test of Psycholinguistic Abilities existed.

Analysis

The question this study attempts to answer is: What is the relationship between the performance of brain injured adults on the subtest of the Language Modalities Test for Aphasia and the Illinois Test of Psycholinguistic Abilities? This question was answered by employing a statistic called the Pearson Product-Moment Correlation. Prior to this, however, both the Language Modalities Test for Aphasia and the

Illinois Test of Psycholinguistic Abilities were administered to each of the ten subjects. The nine subtests of the Illinois Test of Psycholinguistic Abilities and the five subtests of the Language Modalities Test for Aphasia were then then scored and the raw score was converted to a percentage. (This figure is the number of correct answers obtained divided by the total number of possible answers). These percentage scores for both tests were listed on the front page of the Illinois Test of Psycholinguistic Abilities Record Form in order to facilitate the recording procedure. This meant that in the "Test Summary" section the first two column headings were crossed-out and the words "Percent correct ITPA" and "Percent correct LMTA" were inserted. Thus the raw score for each of the subtests of the Illinois Test of Psycholinguistic Abilities was not listed on the profile form, and the language age and standard score were not computed.

To determine the relationship or association between pairs of values in two distributions the Pearson Product-Moment Correlation statistic was used. This statistic obtains "some single numerical value from the data which will permit a meaningful interpretation of the relationship existing between the variables."[35]

> It is a single value used to represent the relationship between two sets of data representing continuous variables, which have been collected for the same

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[35]James E. Wert, Charles O. Neidt and J. Stanley Ahmann, Statistical Methods in Educational and Psychological Research (New York: Appleton-Century-Crofts, Inc., 1954), p. 74.

> individual or which can be paired in some manner. In other words it represents the extent to which changes in one variable are accompanied by equal changes in another, or the degree to which the data when plotted would fall into a straight line.[36]

For purposes of this study the coefficient of correlation was used to indicate "the extent to which values of one variable may be predicted from known values of another variable."[37]

The formula which was used in the calculation of the correlation coefficient is as follows:

$$r = \frac{\sum xy - \frac{(\sum x)(\sum y)}{N}}{\sqrt{\left(\sum x^2 - \frac{(\sum x)^2}{N}\right)\left(\sum y^2 - \frac{(\sum y)^2}{N}\right)}}$$

The formula is as stated by Blalock.[38] The resulting coefficients are contained in Table 1.

The correlation in this study were spread over a wide range. The spread was from -.02 (between the "oral response (A) to auditorily presented stimuli" of the Language Modalities Test for Aphasia with the "auditory-vocal automatic" subtest of the Illinois Test of Psycholinguistic Abilities) to .98 (between the "matching responses (C & D) to both visually and auditorily presented stimuli" of the Language

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[36] Ibid.

[37] Ibid., p. 76.

[38] Hubert M. Blalock, Social Statistics (New York: McGraw-Hill Book Company, Inc., 1960), p. 289.

TABLE 1.--Composite Pearson-Product Moment Correlation Coefficients obtained from raw scores on the subtests of the Language Modalities Test for Aphasia as correlated with the subtest scores of the Illinois Test of Psycholinguistic Abilities.

	ITPA Subtests[a]								
LMTA Subtests[b]	1	2	3	4	5	6	7	8	9
1	.47	.58	.48	.71	.47	.89	.21	.26	.44
2	.48	.78	.65	.64	.72	.92	.24	.52	.62
3	.08	.98	.78	.33	.79	.62	.20	.82	.72
4	-.02	-.07	-.05	.22	-.09	.18	.02	-.13	.01
5	.43	.81	.66	.74	.71	.91	.22	.54	.60

[a]ITPA Subtests: 1. Auditory-Vocal automatic
2. Visual decoding
3. Motor encoding
4. Auditory-vocal association
5. Visual-motor sequencing
6. Vocal encoding
7. Auditory-vocal sequencing
8. Visual-motor association
9. Auditory decoding

[b]LMTA Subtests: 1. Oral response to visual stimuli
2. Graphic response to visual stimuli
3. Matching aural and visual stimuli to pictures
4. Oral response to aural stimuli
5. Graphic response to aural stimuli

Modalities Test for Aphasia with the "visual decoding" subtest of the Illinois Test of Psycholinguistic Abilities.) The mean correlation coefficient was .47.

From a total of ten responses to each of the nine subtests of the Illinois Test of Psycholinguistic Abilities there was a total of thirteen complete subtest failures involving six of the nine subtests. These failures occurred in the following subtests: auditory-vocal automatic, motor encoding, auditory-vocal association, visual motor sequencing, auditory vocal sequencing, and visual motor association. From a total of ten responses to each of the five subtests of the Language Modalities Test for Aphasia there was a total of fourteen complete subtest failures. Seven involved the oral response (A) to the visually presented stimuli, and seven involved the graphic response (B) to the auditorily presented stimuli.

Discussion of Results

The statistical analysis performed in this study indicated that although the mean correlation between the Language Modalities Test for Aphasia and the Illinois Test of Psycholinguistic Abilities was not high enough to be considered significant, there were some definite subtest scores which correlated significantly.

According to Edwards[39] for a population of eight (N-2), the correlation (r) must exceed .63 at the .05 level of significance in order to be different from a zero correlation.

The highest correlation was .98, which was between the "matching responses" (C & D) of the Language Modalities Test for Aphasia and the "visual decoding" subtest of the Illinois Test of Psycholinguistic Abilities. The matching responses are assessed by having the subject match visual and auditory stimuli to picture alternatives. On the Illinois Test of Psycholinguistic Abilities, the visual decoding is assessed by having the subject locate, among several alternative (comparison) pictures, the one which is perceptually identical to the previously viewed stimulus picture. There appears to be good reason for this high correlation. Essentially these tasks both involve a type of matching technique, therefore they seem to be similarly measuring an aspect of language.

The next highest correlation was .92, which was between the "graphic response (B) to visual stimuli" on the Language Modalities Test for Aphasia and the "vocal encoding" subtest of the Illinois Test of Psycholinguistic Abilities. The graphic response of the Language Modalities Test for Aphasia is assessed by the subject writing names of pictures, copying words and geometric forms, while the vocal encoding

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[39]Allen L. Edwards, Statistical Methods for the Behavioral Sciences (New York: Rinehart and Company, Inc., 1960), p. 502.

of the Illinois Test of Psycholinguistic Abilities is assessed by having the subject describe a simple object. This correlation coefficient does not determine if these two subtests are measuring the same task. However, from this figure it would appear that speaking and writing are both related not only to the graphic response but also to vocal encoding.

The third highest correlation was .91 which was between the "matching responses (C & D) of auditory stimuli to picture alternatives" and the "vocal encoding" subtest of the Illinois Test of Psycholinguistic Abilities. The "matching responses" of the Language Modalities Test for Aphasia were assessed by having the subject match pictures, numbers, or words to either visual or auditorily presented stimuli. The vocal encoding subtest of the Illinois Test of Psycholinguistic Abilities is assessed as described in the previous paragraph. It would appear from this correlation that the ability to match picture alternatives from previous visual or auditory stimuli is related to the ability to describe an object, picture, etc.

The lowest correlation was .01 which was between the "auditory decoding" subtest of the Illinois Test of Psycholinguistic Abilities and the oral response to auditory presented stimuli on the Language Modalities Test for Aphasia. The auditory decoding is assessed by administering a type of controlled vocabulary test to the subject, requiring an oral, or gestural response of "yes" or "no". The figure .01

suggests little or no correlation between the ability to convey "yes" or "no," and the ability to verbally repeat a word.

A -.02 correlation was obtained between the oral response to auditory stimuli on the Language Modalities Test for Aphasia and the "auditory-vocal automatic" subtest of the Illinois Test of Psycholinguistic Abilities. The Illinois Test of Psycholinguistic Abilities subtest is assessed by having the subject supply the last word to a test statement (e.g., MOTHER IS WRAPPING THE GIFT. NOW THE GIFT HAS BEEN _____). This -.02 correlation suggests little or no relationship between the ability to verbally repeat a word, and the ability to predict future language statements from past experience.

It is interesting to note that three significant correlations were obtained between the "vocal encoding" subtest of the Illinois Test of Psycholinguistic Abilities and three subtests of the Language Modalities Test for Aphasia. They are oral response to visual stimuli, graphic response to visual stimuli, and graphic response to auditory stimuli. This would suggest that the "vocal encoding" subtest of the Illinois Test of Psycholinguistic Abilities seems to be most closely correlated with what the Language Modalities Test for Aphasia measures.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

Using the Illinois Test of Psycholinguistic Abilities to assess the linguistic performance of people with known brain damage is but one of many ways to obtain a diagnosis. A survey of the literature indicates a parallel in the measured area of linguistic function between a psycholinguistic test designed measure the language performance of young children, particularly the preschool child, and a test of language assessment designed for brain damaged individuals.

In this study it was attempted to discern if these two tests of language function (the Language Modalities Test for Aphasia and the Illinois Test of Psycholinguistic Abilities) were measuring the same aspects of linguistic performance. If it were possible to show that a correlation existed, one would be able to predict the performance of an individual on certain subtests of one test from a subtest score obtained on another test. The purpose of this study therefore was to determine if such a correlation existed.

The Language Modalities Test for Aphasia and the Illinois Test of Psycholinguistic Abilities were administered

to a sample of ten people with known brain damage. Seven of the subjects were patients at the Ingham County Hospital and Rehabilitation Center while three of the subjects lived in their own homes.

The results of this study indicate that while the mean correlation between tests was .47, there were some subtest correlations which were found to be significant. This is in accordance with Edwards[40] which indicates that for a population of this size any correlation of .63 or over is considered significant from a zero correlation.

Conclusions

Within the experimental confines of this investigation the following conclusions are made:

1. The Illinois Test of Psycholinguistic Abilities appears to test more areas of language function in adults than does the Language Modalities Test for Aphasia. The Language Modalities Test for Aphasia is correlated most highly with the "vocal encoding" subtest of the Illinois Test of Psycholinguistic Abilities; therefore, the Language Modalities Test for Aphasia is a narrower test since 3/5 of the test is measuring an aspect of language similar to one subtest of the Illinois Test of Psycholinguistic Abilities.

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[40] Ibid.

2. The Illinois Test of Psycholinguistic Abilities is quite useful in measuring the language function of aphasic adults, however, certain portions should be revised to typify adult activities.
3. The ability to name pictures and read words, numbers and sentences is related to the ability to:
   a. complete a test statement by supplying an analagous word.
   b. describe simple objects
4. The ability to write names of pictures, and copy words and geometric forms is related to the ability to:
   a. select from a set of pictures the one which is most nearly identical to a previously exposed picture.
   b. express ideas in gestures.
   c. complete a test statement by supplying an analagous word.
   d. correctly reproduce a sequence of symbols previously seen.
   e. vocally describe simple objects.
5. The ability to match visual and auditory stimuli to picture alternatives is related to the ability to:
   a. select from a set of pictures one which is most identical to a previously exposed picture.
   b. express ideas in gestures.

c. correctly reproduce a sequence of symbols previously seen.

d. select from among a set of pictures the one which relates most meaningfully to a given stimulus picture.

e. answer "yes" or "no" appropriately by voice or gesture to a series of graded vocabulary questions.

6. The ability to write spoken words and numbers is related to the ability to:

a. select from a set of pictures one which is most nearly identical to a previously exposed picture.

b. express ideas in gestures.

c. complete a test statement by supplying an analagous word.

d. correctly reproduce a series of symbols previously seen.

e. vocally describe simple objects.

7. The ability to name pictures and read words, numbers, and sentences is not related to the ability to:

a. predict future linguistic events from past experiences by supplying the last word to a test statement.

b. select from a set of pictures the one which is most identical to a previously exposed picture.

c. express ideas in gestures.

d. correctly reproduce a sequence of symbols previously seen.

e. correctly repeat a sequence of symbols previously heard.

f. select from a set of pictures one which relates most meaningfully to a given picture.

g. answer "yes" or "no" appropriately by voice or gesture to a series of graded vocabulary questions.

8. The ability to write the names of pictures, and copy words, and geometric forms is not related to the ability to:

a. Predict future linguistic events from past experiences by supplying the last word to a test statement.

b. correctly repeat a sequence of symbols previously heard.

c. select from a set of pictures the one which relates most meaningfully to a given picture.

d. answer "yes" or "no" appropriately by voice or gesture to a series of graded vocabulary questions.

9. The ability to match auditory and visual stimuli to picture alternatives is not related to the ability to:

a. predict future linguistic events from past experiences by supplying the last word to a test statement.

b. complete a test statement by supplying an alan-agous word.

c. vocally describing simple objects.

d. correctly reproduce a sequence of symbols previously seen.

10. The ability to repeat spoken words, numbers, and sentences is not related to the ability to:

a. predict future linguistic events from past experiences by supplying the last word to a test statement.

b. select from a set of pictures the one which is more nearly identical to a previously exposed picture.

c. express ideas in gestures.

d. complete a test statement by supplying an analagous word.

e. correctly reproducing a sequence of symbols seen previously.

f. vocally describe simple objects.

g. correctly reproduce a sequence of symbols heard previously.

h. select from a set of pictures the one which most meaningfully relates to a given picture.

i. answer "yes" or "no" appropriately by voice or gesture to a series of graded vocabulary questions.

11. The ability to write spoken words and numbers is not related to the ability to:

    a. predict future linguistic events from past experiences by supplying the last word to a test statement.

    b. correctly repeat a sequence of symbols previously heard.

    c. select from a set of pictures the one which relates most meaningfully to a given picture.

    d. answer "yes" or "no" appropriately by gesture or voice to a series of graded vocabulary questions.

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APPENDIX

APPENDIX A.--The raw data obtained from the subtests of both the Language Modalities Test for Aphasia and the Illinois Test of Psycholinguistic Abilities, expressed in percentage of items corrected.

Subtests	Language Modalities Test for Aphasia					Illinois Test of Psycholinguistic Abilities									Subtests
	Oral Response to Visual Stimuli	Graphic Response to Visual Stimuli	Matching Visual and Auditory Stimuli to Picture Alternatives	Oral Response to Auditory Stimuli	Graphic Response to Auditory Stimuli	Auditory-Vocal Automatic	Visual Decoding	Motor Encoding	Auditory-Vocal Association	Visual-Motor Sequencing	Vocal Encoding	Auditory-Vocal Sequencing	Visual-Motor Association	Auditory Decoding	
1	17.86	0	0	53.33	77.78	0	33.33	0	3.85	26.67	2.70	32.50	0	19.44	1
2	59.29	0	0	35	89.89	59.09	12.50	25.93	50	0	16.22	57.50	3.57	2.78	2
3	75	100	91.67	95	66.67	54.55	83.33	74.07	73.08	63.33	43.24	32.50	82.14	72.22	3
4	10.71	0	0	56.67	83.33	18.18	45.45	29.63	26.92	0	2.70	67.50	71.43	69.44	4
5	89.29	83.33	75	81.67	100	86.36	79.17	29.63	96.15	30	29.73	55	53.57	83.33	5
6	42.86	0	0	36.67	66.67	0	8.33	14.81	7.69	0	10.81	15	21.43	19.44	6
7	28.57	0	0	66.67	38.89	4.55	54.17	48.15	0	33.33	13.51	10	60.71	58.33	7
8	28.57	0	0	21.67	88.89	40.91	8.33	0	46.15	0	13.51	0	0	2.78	8
9	39.29	16.67	8.33	35	100	95.45	8.33	14.29	63.38	26.67	18.92	55	0	72.22	9
10	10.71	0	0	50	77.78	63.64	25	22.22	30.78	26.67	8.11	15	50	36.11	10