ASSESSMENT OF GESTURAL AND PANTOMIMIC DEFICIT IN APHASIC PATIENTS

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Pantomime and gesture have often been described as a primary modality of communication. A review of the literature, however, reveals that there is considerable disagreement regarding how such communication is affected by brain damage. Most of the articles referring to gestural language in the aphasic patient have been concerned with defining subcategories of aphasia or with isolated observations about the effect of aphasia on gesture (Schuell, 1969; Geschwind, 1963). There have been few studies designed to look at the problem directly. Osgood and Miron (1963) have analyzed a large number of available aphasia tests and pointed out that there is a redundancy between current test items. This analysis revealed that auditory, visual, and verbal modalities have received the greatest amount of consideration while only three subtests in the seventeen complete test batteries were designed to assess pantomimic ability (Eisenson, 1954; Bastian, 1898).

Not only is there a lack of information concerning how gesture is affected by brain damage, there is also some confusion regarding the various forms of deficit. Critchley (1970) has discussed the nature of gesture in the context of normal communication. He mentioned the ambiguity of the word gesture, since it is often used synonymously with the terms pantomime, gesticulation, facial expression, and the sign language of the deaf. In this discussion, he described pantomime as the condition "...when one person communicates with another by resorting wholly to bodily movements (as with a thumbs up sign, a salute or a wave of the hand)."

Some authors contrast pantomime and gesticulation. Pantomime is a form of gesture which replaces speech, whereas gesticulation, though the same general type of movement, accompanies speech. This specification of terms was made by Goodglass and Kaplan (1963), however, they described pantomime as a more improvised series of movements than other forms of gesture.

In order to reduce confusion, the following definitions are used in this paper:

Pantomime: A condition in which one person uses a volitional series of sequential limb or body movements, unaccompanied by speech in an apparent attempt to communicate.

Gesticulation: A volitional or nonvolitional group of random or sequential body movements accompanied by speech.

Gesture: A single unit of body movement which may serve as a sign, carrying a specific meaning. If it is a non-conventional gesture and is preceded or followed by other such movements, it may be considered as gesticulation or pantomime.

Two general concepts have been discussed in the literature. One view suggests that impaired ability to use pantomime is a component of the total aphasic syndrome which has been referred to as a form of "asymbolia," a concept introduced by Finkelnberg (Wilson, 1914) and advanced by Goldstein (1948), Critchley (1969), and Jackson (1878). Such a generalized concept of gestural deficit has not received any appreciable support in the aphasia literature.

A second, more frequently supported, concept was discussed by Hacaen (1963), who noted that Liepmann called gestural deficit "ideokinetic apraxia." Liepmann (1905) defined this term as:

> An incapacity for action though mobility is unharmed; the inability to mobilize parts of the body for a definite purpose; or disturbance of movements learned by experience, by example or by learning.

Liepmann, studying left brain damaged aphasics, left brain damaged nonaphasics, right brain damaged nonaphasics, and demented patients, suggested that the left hemisphere is dominant for pantomimic ability. His theory has since been modified by several authors; however, little evidence has been presented which verify his belief (Denny-Brown, 1958; Goodglass and Kaplan, 1963; Geschwind, 1963; Hecaen, 1963).

The work of Goodglass and Kaplan (1963) is the best controlled and most significant study of gesture and pantomime. These investigators sampled gestural and pantomimic responses of twenty male aphasic patients with various etiologies who were described as "mixed, predominantly expressive, ranging in severity from moderately severe to mild" (p. 708). Subjects were selected using three subtests of the Boston Veterans Administration Hospital Test of Aphasia which sampled narrative and conversational speech, object naming, and auditory comprehension. Forty-five items were utilized in testing five types of gestural movements, and responses were scored as Adequate, Partially Adequate, and Totally Inadequate.

Four qualitative categories were added to this basic system in an attempt to differentiate types of pantomimic responses. These qualitative categories included the following:

Gestural enhancement -- dramatizing or emphasizing a gestural movement by accompanying the required movement with additional expressive facial and/or bodily movements.

Pantomimed context -- pantomiming a situational setting in which the required movement is embedded.

Vocal overflow -- in spite of instruction to refrain from verbalizing, the subject accompanies the gesture with an explanatory or exclamatory vocalization, as in saying 'good-bye' while waving good-bye.

Body-part as object (BPO) -- subject used part of his body to serve as the object as in hammering with a fist, or stirring sugar with an index finger.

Total scores for simple gesture and pantomime were represented as a percentage, which consisted of a "ratio of adequate responses". Complex pantomime scores were represented by the sum of identifiable elements produced by subjects for each sequence. The authors reported the following conclusions:

1. Aphasics have a gestural deficiency which is best understood as an apraxic disorder consequent to a left hemisphere lesion (the concept of a general communication disorder is not supported).

    a. Aphasics were inferior in gestural ability to their intellectual counterparts in a non-aphasic, brain injured control group at each level of intellectual efficiency.

    b. Aphasics were less able to profit from the opportunity to imitate than were nonaphasic controls.

    c. When the influence of auditory comprehension was controlled, gestural ability was not related to the severity of aphasia.

    d. In the absence of aphasia, left hemisphere lesions produced more impaired gestural movements than right hemisphere lesions.

2. Gestural ability is impaired in direct relation to the loss of intellectual efficiency in brain injured patients, whether aphasic or otherwise.

The Goodglass and Kaplan article represents a landmark in the study of gesture and pantomime. It is the most ambitious and scientific attempt to describe gestural ability in the aphasic patient. However, some problems are inherent in the methodology of their work.

Of major concern to clinical aphasiologists is precise description of patients included in research studies. Descriptive information allows the clinician to generalize research data to his patients, however, this information is lacking in most studies reported. Porch (1967) has shown that responses of aphasics can be reliably quantified using psychometric testing procedures. Such an approach allows the researcher to specify the severity of aphasia based on a percentile ranking of a large random sample of brain damaged patients. It is unfortunate that Goodglass and Kaplan (1963) employed a less precise method of categorizing their patients into categories of "moderately severe" to "mild." Therefore, it is difficult for readers to generalize their findings to specific patients.

A second problem which may have influenced Goodglass and Kaplan's results was the test used to select patients. As mentioned earlier, only three subtests of the Boston V.A. Hospital Test of Aphasia were used to determine the presence and severity of aphasia. This unstandardized procedure may have lowered the reliability and validity of the test results, creating a greater chance for error in the selection and categorizing of subjects. Employment of unstandardized methods increases the possibility of overlooking communicative problems in certain patients. As Schuell stated, "It is necessary to use tests that cover a wide range of language behavior and a wide range of difficulty in each modality tested" (1969). A more complete approach to testing patients is desirable when attempting to provide an accurate description of the aphasic involvement.

The third problem in the Goodglass and Kaplan study was the exclusion of severe aphasic patients. Although the aphasic group had inferior scores on the gestural tasks, the authors were unable to account for this observation relative to the severity of aphasia. Since severe patients were eliminated from the study, some important information was excluded from the results.

On the basis of this appraisal of the literature, three basic issues seemed appropriate for further examination:

1. Can a test battery be developed which reliably measures gestural performance in aphasic patients?

2. Is there a relationship between gestural deficit and severity of aphasia, or is gestural deficit independent of aphasia?

3. Does an alternative explanation of gestural deficit, such as apraxia, adequately describe the impairment?

Methods and Procedures

Selection and Ordering of Tasks

Six tasks were designed to examine gestural and pantomime abilities in a heterogeneous sample of aphasic patients. Each task was centered around ten commonly used and easily manipulated objects. The use of homogeneous test items, a method suggested by Head (1926), used by Chesher (1937), and later adopted by Porch (1967), has proven advantageous in making intersubtest and cross modality comparisons of subject performance. Such a method assures that variation of scores within a subtest and between subtests is not a product of unfamiliar and difficult stimuli. Based on this rationale, ten items, also contained in the Porch Index of Communicative Ability (PICA) (1967) were selected for this study. These items included a toothbrush, cigarette, pen, knife, fork, quarter, pencil, matches, key and comb.

Since some pantomime tasks were designed to investigate the aphasic patient's ability to gesture with objects, as opposed to pretended action without objects, it was first necessary to examine tactual recognition of the test items. In order to determine this ability in aphasics and normal controls, two preliminary subtests were designed, hereafter referred to as P1 and P2. For purposes of maximizing tactile input and eliminating visual interference for these tasks, a test blind was constructed.

The test blind was made from 1/4 inch plywood and painted dull black. It was 15 inches high, 24 inches long, and 16 1/2 inches deep. An 18 inch by 7 1/2 inch aperture in the front permitted maximal lateral movement for either arm without changing the patient's seating position. A double black curtain covered the opening, blocked the visual path, and prevented the patient from seeing the object being placed in his hand. An additional opening at each end (7 1/2 by 10 inches) and similarly curtained allowed the tester to hand objects to the patient. Another important feature of this apparatus was the 24 by 8 1/2 inch surface above the 18 inch aperture. This provided sufficient space for the 18 inch by 8 inch cardboard card which contained plastic stimulus pictures of PICA objects. Similar test blinds have been utilized by DeRenzi and Scotti (1969) and Gazzaniga and Sperry (1967). After subjects demonstrated minimal ability to respond to P1 and P2, they were administered six gestural subtests designed to examine pantomime ability. Ordering of the two tactile tasks and six gestural tasks proceeded in a logical sequence beginning with P1, a subtest giving minimal information about the task, and continuing through G6 which gives maximal information about the task. Other standardized tests have utilized this approach for task organization (Porch, 1967).

The 16-point multidimensional scoring system used in the PICA (Porch, 1967) was employed to evaluate performance on all experimental gestural tasks. This permitted quantification of a patient's responses and provided a sensitive scoring system for making comparisons among subtests within the battery. In addition, performance on the gestural battery could be compared with performance on the PICA, permitting a comparison between a patient's gestural ability and his overall communicative ability.

Task Standardization

Perceptual Test One (P1): This subtest requires the patient to name the object which is placed in his hand. He is not allowed to see the object, and ample time is given for a response. The purpose of this test is to determine the patient's recognition of objects and his ability to name them when they are presented tactually.

Perceptual Test Two (P2): P2 requires the patient to identify the object placed in his hand, by pointing to a picture of the object which has been attached to the cardboard card on the test blind directly in front of him. A tactile-visual association task of this nature was necessary for the examination of these input modalities which are so critical to the remainder of the gestural battery. Therefore, the patient is not required to respond verbally, since verbal output is frequently impaired in aphasic patients.

Gestural Test One (G1): Subjects were required to pantomime the function of the objects without receiving extensive auditory or tactual information about the task. As the examiner points to the picture, he asks the patient to pretend he is using the object and cautions him not to talk about the object or its function. Klein and Mayer-Gross (1957) consider tasks of this nature to be more exacting tests of apraxia than gesturing with real objects. Goodglass and Kaplan (1963) also noted that talking during pantomimic tasks seems to be a manifestation of a patient's incapacity to separate a pretended action from his immediate involvement in the task. The restrictions of this task, therefore, are of interest contrasted with responses observed under conditions that allow the patient to talk or to use actual objects during pantomime.

Gestural Test Two (G2): G2 was designed to investigate the notion that manipulation of real objects may be a less exacting test of limb apraxia than pretended actions without the object. Less restrictions are placed on the patient. Additional tactual information as well as visual stimuli are available to him during this task. As in G1, the patient was not allowed to talk, but he was given the actual object to use in pantomime. A subtest of this nature seemed necessary when contrasting task complexity, examining for apraxia, and comparing subtest scores with the overall level of aphasia.

Gestural Test Three (G3): In this subtest, ten pictures were presented one at a time to patients. Each 4 x 6 photograph showed a person posing in a functional position generally associated with one of the ten test objects. The subject was required to point to a picture of the object represented in the functional position picture. This task was useful in examining the patient's ability to associate a gesture with a specific object. Such a task may be regarded as an appropriate method of analyzing prerequisite abilities for pantomime. This test is not unlike visual and auditory association tasks found in several tests, except it requires the patient to associate a gesture with the object used. Several auditory-verbal, visual-verbal, and auditory tasks have been devised which permit examiners to make inferences about language competency. Since there is a lack of information about gestural language competency in the adult aphasic, a task of this nature should be useful in making inferences about the aphasic patient's competency with gestural language. This may serve to clarify a patient's receptive abilities contrasted with his expressive abilities.

Gestural Test Four (G4): The examiner pantomimes the function of each object, and the patient is required to indicate which object was used in the pretended action by pointing to a picture of that object. This exercise is analogous to the common auditory task of having the patient point to objects after they are named. Although similar to G3, this task gives maximal information about the function of the objects, because the stimuli consist of the entire sequence of movements for pantomimic expression. Therefore, this task is a good test of gestural recognition and is a useful supplement to G3 in helping the examiner make judgments about the patient's understanding of nonverbal, symbolic communication.

Fordyce and Jones (1966) gave oral instructions for a set of manual tasks and pantomimed instructions for a similar set of tasks. Their right hemiplegic patients scored significantly higher when instructed by pantomime. These observations may have implications in the treatment of brain damaged patients. More detailed exploration, using standardized testing methods, similar to those employed in the Fordyce and Jones study must be developed. One purpose of this subtest and the other components of this battery is to investigate this area further.

Gestural Test Five (G5): Previous tasks were designed to sample the patient's ability to identify objects and gestural movement using tactual and visual input and to use pantomimic expression when presented with tactual and visual information. G5 was included in the battery to examine gross, auditory processing of verbal instructions for pantomimic performance. Patients were asked to pretend they are "cleaning the teeth," "smoking," etc. As with all other tasks, patient performance can be compared to performance on tasks included in this battery and to scores on an aphasia battery. This task provides maximal auditory information about the task and asks the patient to perform a specific action.

Gestural Test Six (G6): Imitative tasks are common tests of apraxia. In G6, the examiner pantomimes the function of an object, and the patient is required to imitate the pantomime. Goodglass and Kaplan (1963) used pantomime in an attempt to detect limb apraxia. They found their aphasic group had a lower rate of improvement than controls on an imitative task of pantomimed action with objects. Since their tasks employed a wide range of heterogeneous items, a slow rate of improvement may have been a result of the stimuli. It may also be a result of the methods used for scoring patient responses. A scoring system more sensitive to change may have revealed minimal changes in patient behavior. G6 employs the same stimuli used throughout the test, and the patient is restricted from using the objects or talking during the task. This task and G1 are similar with respect to the restrictions placed upon patients and, therefore, permit a comparison among measures within the test battery.

Standardization of Procedures

In order to standardize testing procedures, 25 volunteers from the orthopedic wards, the escort service, hospital visitors, and outpatients receiving treatment for alcoholism in the Albuquerque Veterans Administration Hospital served as controls. Each control was given the experimental, gestural test battery and the PICA. Means and standard deviations were computed for all measures and are shown in Table 1. The

TABLE 1. Performance by the normal standardization group on the PICA and the experimental, gestural battery

MEASURE	Mean	Standard Deviation
PICA Overall Score	14.79	.21
Gestural Tests 1 - 6	14.79	.25
Perceptual Tests 1 & 2	14.98	.04

standardization group was comprised of 19 males and six females. They had a mean age of 39.36 years with a standard deviation of 16 years, and they had a mean of 13.36 years of education with a standard deviation of 1.84 years.

The control group had little difficulty with the PICA and experimental gestural tasks, since the mean scores were at least 14.7; normal performance on the PICA is 14.5 to 15.0. The small standard deviations also indicate all normals performed approximately the same.

Selection of Subjects

Twenty-eight brain injured patients, ranging in severity from the twelfth to the ninety-first percentile on the PICA, were tested over a four-month period. This group included 24 males and four females. Seven subjects were bilingual. The mean age was 50.6 years with a standard deviation of 14.55. Mean years of education was 12.07 with a standard deviation of 2.78. Three etiological categories were represented - CVA, trauma, and post surgical. Twenty-three patients had right hemiplegia and five patients had no reported involvement of the limbs. Subjects ranged in months post onset from one month to 114 months with a mean of 25.39 and a standard deviation of 28.25.

Results

Analysis of the experimental battery revealed a range of ability in the aphasic sample indicated by the wide range of scores, large standard deviations and subtest scores ranked in order of difficulty on a task continuum. Patient variables of age, education, and months post onset did not appear to influence test scores. The stability study demonstrated good test-retest reliability. Therefore, the experimental battery appears to be adequate for testing gestural ability of aphasic patients. Thus, the first purpose of the study was accomplished.

Relationship Between Experimental Gestural Scores and Aphasia

The second major concern of this study was the relationship of gestural ability to the severity of aphasia. Goodglass and Kaplan (1963) suggested that gestural deficits are independent of the severity of aphasia. Therefore, correlation coefficients were computed to determine the relationship between PICA scores and gestural scores. In this way, severity of aphasia could be compared with gestural competency.

Relationship Between PICA and Experimental Tests

Coefficients of correlation representing the relationship of PICA overall scores to modality and experimental scores indicate a positive relationship significant at the .001 level. Table 2 reveals strong, positive relationships between PICA modality scores and experimental subtest scores. All of these relationships with the exception of the PICA overall and modality scores to P2 are significant at the .001 level. P2 and the modality scores have a positive relationship which is significant beyond the .01 level.

Relatationship Between PICA Subtests and Experimental Subtests

Table 3 indicates that PICA gestural subtests are positively related with experimental subtests. All coefficients were significant at the .01 level except PICA Subtests VI and VIII with P2. These coefficients, however, show a positive relationship significant at the .05 level. As expected, PICA Subtests VII and XI were least related to the six gestural tests, since they are visual matching tasks which patients with left hemisphere lesions have little difficulty performing. All patients in the experimental group had the least difficulty with these tasks and P2.

Correlation coefficients for experimental scores and PICA verbal subtest scores are shown in Table 4. A slightly less emphatic relationship was found than for PICA gestural subtest scores. This is to be expected, since verbal tests are generally more difficult for aphasic patients than gestural tests. However, the coefficients obtained show a positive relationship significant beyond the .01 level of confidence for most comparisons. Verbal Subtests I and XII were least related to P2 which is the tactile-visual matching test and was expected to be least related to left hemisphere damage. On the other hand, P1 had the highest coefficients, indicative of its similarity to all PICA verbal subtests.

Correlation coefficients shown in Table 5 reveal relationships among PICA graphic subtests and the experimental gestural battery. Smaller correlations were expected, since graphic tasks are traditionally more difficult for aphasic patients than gestural tasks. All of the correlations are positive, and most are significant at the .01 level. Again, P2 revealed smaller correlations. This finding is understandable in view of the relative difficulty among these tasks. Graphic subtests A, B, C, and D are the most difficult tasks for aphasic patients in the PICA battery. Therefore, it is understandable that they are least related to P2 which proved to be an easy task for aphasic patients.

TABLE 2. Correlation Matrix for PICA Overall and Modality Scores and Experimental Test Scores.

	OA	Ges.	Vb.	Gp.	Ges.1-6	P1&P2	P1	P2	G1	G2	G3	G4	G5	G6
OA	-	.94	.93	.88	.91	.90	.90	.53*	.84	.86	.78	.89	.84	.77
Ges.	-	-	.90	.72	.92	.84	.83	.48*	.85	.88	.79	.92	.83	.76
Vb.	-	-	-	.70	.86	.93	.95	.44*	.83	.77	.68	.83	.82	.72
Gp.	-	-	-	-	.74	.72	.72	.50*	.67	.70	.65	.69	.69	.66
Ges.1-6	-	-	-	-	-	.84	.81	.65	.92	.93	.84	.84	.94	.91
P1&P2	-	-	-	-	-	-	.93	.64	.73	.77	.72	.86	.82	.72
P1	-	-	-	-	-	-	-	.43*	.74	.70	.71	.78	.76	.69
P2	-	-	-	-	-	-	-	-	.47	.66	.54	.57	.70	.66
G1	-	-	-	-	-	-	-	-	-	.87	.67	.70	.86	.85
G2	-	-	-	-	-	-	-	-	-	-	.74	.79	.83	.79
G3	-	-	-	-	-	-	-	-	-	-	-	.76	.73	.74
G4	-	-	-	-	-	-	-	-	-	-	-	-	.77	.64
G5	-	-	-	-	-	-	-	-	-	-	-	-	-	.89
G6	-	-	-	-	-	-	-	-	-	-	-	-	-	-

* Significant at the .01 level.
** Unstarred coefficients are significant at the .001 level.

TABLE 3. Correlation Matrix for PICA Gestural Subtest Scores and Experimental Test Scores.

PICA Gestural Tests	Experimental Tests							
	P1	P2	G1	G2	G3	G4	G5	G6
II	.49	.40	.76	.83	.53	.64	.65	.64
III	.52	.49	.75	.82	.49	.64	.71	.66
V	.87	.42	.78	.73	.71	.90	.81	.75
VI	.79	.49	.77	.80	.76	.88	.72	.65
VII	.85	.45	.75	.73	.63	.81	.79	.67
VIII	.52	.36*	.63	.65	.60	.66	.52	.65
X	.75	.49	.67	.78	.84	.81	.67	.65
XI	.52	.30*	.52	.70	.67	.60	.48	.45

* Significant beyond the .05 level.

All others significant beyond the .01 level.

TABLE 4. Correlation Matrix for PICA Verbal Subtest Scores and Experimental Test Scores.

PICA Verbal Tests	Experimental Tests							
	P1	P2	G1	G2	G3	G4	G5	G6
I	.90	.37*	.81	.69	.57	.75	.78	.68
IV	.95	.47	.79	.71	.69	.86	.81	.72
IX	.96	.42	.79	.77	.69	.82	.80	.69
XII	.76	.36*	.73	.67	.52	.61	.64	.62

* Significant beyond .05 level.

All others significant beyond the .01 level.

TABLE 5. Correlation Matrix for PICA Graphic Subtest Scores and Experimental Test Scores

PICA Graphic Tests	Experimental Tests							
	P1	P2	G1	G2	G3	G4	G5	G6
A	.59	.35*	.54	.57	.48	.50	.58	.48
B	.60	.42*	.47	.49	.52	.55	.51	.50
C	.66	.31*	.53	.54	.57	.58	.56	.53
D	.71	.38*	.62	.60	.59	.63	.64	.60
E	.63	.62	.74	.79	.67	.62	.68	.69
F	.49	.68	.55	.64	.48	.70	.61	.60

* Significant beyond the .05 level.

All others significant beyond the .01 level.

A Possible Explanation of Gestural Deficit in Aphasic Patients

A third major concern of the present study was to investigate gestural deficit and its apparent relationship to aphasia. Goodglass and Kaplan (1963) concluded that gestural deficit in aphasic patients is best understood as an apraxia disorder. They based their conclusion on the observation that patients failed to improve their gestural performances when given the opportunity to imitate pantomime. A multi-dimensional scoring system would appear to be more valuable in making observations of this nature, since it is more sensitive to change than a plus-minus scoring system. If improvement is noted on imitative gestural tasks, then gestural deficit may be considered a function of aphasia. On the other hand, if gestural deficit does not improve on imitative tasks, apraxia may explain the disorder. Therefore, it would seem reasonable to test patients on imitative tasks, use a scoring system that is sensitive to change, and compare the results with those obtained on a non-imitative task.

Results of this method of attempting to distinguish apraxia from aphasia based on the scores obtained from two experimental tests are reported in Table 6. G1, a non-imitative task, was contrasted with G6, an imitative task, since both subtests were similar in that the patient was not allowed to talk or to use the actual object when pantomiming its function. While these tasks were similar in the restrictions they placed upon subjects, the results suggest a difference in task difficulty. Subtest scores for G1 are lower than G6 scores for all twenty-eight patients. This not only suggests a difference in task difficulty, but indicates improvement on the imitative task. A t-test comparing G1 and G6 performance indicates a difference significant beyond the .01 level and provides evidence which is considerably different from the conclusions of Goodglass and Kaplan. It would appear that gestural deficit in aphasic patients is not a result of limb apraxia. In view of the strong relationship of the experimental tasks to the overall level of aphasia and improvement of gestural performance on G6, it would appear that gestural deficits are associated with aphasia.

Summary and Conclusions

Several issues arose from a review of the literature on gestural communication. Particular emphasis was placed on the work of Goodglass and Kaplan (1963). Analysis of the literature suggested a need for further examination of gestural deficits in aphasic patients, which subsequently lead to the following three phases of investigation.

1. Development and verification of a gestural test battery.

TABLE 6. Differences Between Scores on G1 and G6.

Patient	G1	G6	Mean Difference
1	13.80	14.90	-1.10
2	12.50	14.00	-1.50
3	12.60	14.10	-1.50
4	9.70	12.40	-2.70
5	12.70	13.80	-1.10
6	14.80	15.00	- .20
7	10.70	14.00	-3.30
8	8.10	10.90	-2.80
9	12.70	14.00	-1.30
10	14.10	14.70	- .60
11	9.60	10.50	- .90
12	9.50	14.10	- .60
13	11.00	13.70	-2.70
14	11.70	12.70	- .50
15	9.30	9.50	- .20
16	12.20	13.60	-1.40
17	6.30	8.00	-1.70
18	9.70	14.60	-4.90
19	8.30	11.00	-2.70
20	11.10	13.40	-2.30
21	7.20	8.10	- .90
22	8.50	10.30	-1.80
23	4.80	9.60	-4.80
24	7.50	8.30	- .80
25	3.20	9.40	-6.20
26	2.50	4.60	-2.10
27	3.80	10.60	-6.80
28	4.00	5.00	-1.00
Mean	9.35	11.58	2.08
S.D.	3.45	2.95	1.73

2. Relationship between the severity of aphasia and gestural ability.

3. An explanation of gestural deficit.

Development and Verification of Gestural Test Battery

After demonstrating the relative ease with which normals performed the experimental task, 28 aphasic patients with varying degrees of communicative involvement were tested on the PICA and experimental batteries. Sixteen of these subjects were retested after a one-week interval. Condition One patients were given the PICA followed by the administration of experimental gestural battery, and eight subjects in Condition Two received the experimental test first followed by the PICA. Following testing of all patients, the data were analyzed to examine the issues raised in the review of the literature.

Characteristics of the Test Battery

Recognizing the limits of the present study in the area of test development, certain critical issues were investigated. The major findings of this investigation were as follows:

1. Distribution of patients' scores indicated that tasks selected for the experimental test battery varied in difficulty. The subtest means, large standard deviations, and wide range of scores indicated the experimental tasks were successful in differentiating among individual patients on the basis of their abilities in tactile recognition and gestural skills.

2. The test-retest study on Condition One subjects suggested a high degree of test stability. Condition Two test-retest patients appeared less stable than Condition One patients. Condition One appeared most stable, although this may be, in part, a function of sampling error. The test-retest differences were so small under this condition that it is probable that it is the preferred order of administration of the two batteries.

3. An assessment of task difficulty was studied by ranking mean scores for each task and comparing the positions on a continuum. Results of this procedure indicated that tasks were widely dispersed along a continuum in terms of their difficulty.

4. Patient variables were correlated with test scores to examine their possible influence upon gestural performance. While education and months post onset did not seem to influence gestural performance, age appeared to have a minor, negative affect on scores. Generally, these variables were not a major influence on test performance.

Aphasia and Gestural Ability

Another major purpose of the present study was to investigate the relationship between gestural ability and aphasia as measured by experimental test results and PICA scores. In order to examine these relationships, correlation coefficients were computed. Results of this anlaysis suggested a high positive relationship among PICA and experimental test scores.

1. PICA modality scores were significantly correlated with overall scores on the experimental test battery. These coefficients were significant at the .001 level of confidence.

2. The relationship of each experimental subtest was positively correlated with PICA overall and modality scores. These correlations were significant at the .001 level of confidence.

3. Experimental subtests were compared with each other to determine the intersubtest relationship of the battery. All experimental subtests were significantly correlated with each other beyond the .01 level of confidence.

4. Each PICA subtest was also positively correlated to each experimental subtest. With the exception of P2, all correlations were significant beyond the .001 level. PICA subtests were significantly correlated with P2 beyond the .01 level.

An Explanation of Gestural Deficit

A third major concern of the present study was to investigate whether apraxia explains gestural deficit in the aphasic patient. Therefore, a t-test was utilized to examine the differences between performance on a non-imitative pantomimic task which was similar to an imitative pantomime task. All patients improved on the imitative pantomime task. This difference was significant at the .01 level of confidence. Improvement on the imitative task suggests that gestural deficit is best understood as part of the total communicative involvement of aphasic patients and not a function of apraxia.

Additional Findings

Several other observations were made in addition to those reported above. While some of these additional observations were not subjected to statistical tests or failed to reveal significant results, they may be of interest for future research.

Substitution of Body-Part as Object (BPO)

Goodglass and Kaplan (1963) observed that aphasic patients had a greater propensity than non-aphasic brain damaged patients to use a body-part as an object during pantomime. They also noted that the use of BPO seemed to be influenced by the severity of aphasia. Results of the present study support this conclusion. Correlation coefficients comparing the number of times BPO occurred to patient variables, PICA scores, and experimental scores revealed no significant relationships, however. The most interesting finding is the frequency with which BPO occurred. It was noted that BPO occurred 112 times out of a possible 1,120 possible responses. The mean number of BPO's for the group of 28 aphasic patients was 4.00. Goodglass and Kaplan (1963) also reported that BPO occurred at a rate of about one out of every five responses.

It would appear that while certain variables of aphasia are not related to the use of BPO, the presence of brain damage increases the likelihood that this type of response will occur during pantomimic tasks. Perhaps, tasks of this nature can be used to help detect the presence of brain damage. Although no evidence was found to suggest a positive relationship between the severity of aphasia and BPO, it was of interest to find that none of the 25 normal controls used BPO. It would seem that this type of response is unique and apparently necessary for certain aphasic patients. Possibly, with larger samples of aphasic patients, certain important individual characteristics will be discovered that can be related to the use of BPO. Goodglass and Kaplan (1963) also noted that BPO was observed in their experimentation with children. This is another area which should be examined in greater detail in future research.

Effects of Tactile Input on Naming Ability

A comparison was made of patient scores on P1 and Subtest IV of the PICA. Both of these tasks required the patient to name each of the ten test objects, however, they differ with respect to the input modality utilized. P1 was designed to maximize tactile input and eliminate visual input. The patient was unable to see the object placed in his hand since it had been inserted into the test blind. Subtest IV of the PICA gives the patient the opportunity to touch each object, however, the visual modality is the primary input modality for this task. Since Subtest IV allows the patient to use tactile and visual modalities simultaneously, it is often difficult to determine which modality is most helpful to the patient. Therefore, P1 was designed to isolate the tactile input modality. This method provided a way of comparing the scores obtained from each of these subtests.

Generally, patients performed at about the same response level for P1 as they did for Subtest IV. Two exceptions to this pattern were observed. Three patients had higher scores on P1 than on Subtest IV, and two patients had higher scores on Subtest IV than on P1. These findings seem to reflect a need for a more detailed analysis of verbal naming behavior and how it is influenced by the various input modalities. It is conceivable that with a larger sample of patients a group of aphasics may emerge who respond better to tactile input than to visual or auditory input. This finding would naturally have important implications in planning treatment.

Recognition of Pantomime and Gesture

It was interesting to compare the scores obtained from patients on G3 and G4 to tasks requiring gestural expression. Recognition of gesture was required on G3, since this task required patients to match a picture of a person posing in a position which indicated the function of each test object to a picture of that object. Recognition of pantomime was determined by asking the patient to point to a picture of the object whose function was demonstrated by the examiner on G4. A comparison among the two tasks and PICA scores indicated that aphasics have less difficulty with tasks of gestural recognition than tasks which require pantomimic, verbal, and graphic output. It was also noted that these two tasks are often easier for aphasic patients than tasks involving the auditory modality. This observation supports the conclusions of Fordyce and Jones (1966) who suggested that aphasics perform better on certain manual tasks when given pantomimed instructions instead of auditory instructions.

Several implications for future diagnostic and therapeutic work may be derived from this finding. Diagnostically, the use of gesture and pantomime recognition may help to analyze language competency or intelligence in the aphasic patient. Therapeutically, it may help patients if task instructions are presented using the visual gestural systems rather than using complicated, and often frustrating, verbal instructions.

Interaction of Etiology and Gestural Ability

Comparisons of test scores to etiological categories failed to provide any valuable information. Etiology did not appear to influence gestural performance. Severity of aphasia rather than the cause of aphasia seemed to exert more influence on gestural performance. This however, may be the result of the limited sample of subjects. Since the present study used 23 CVA patients and only five trauma and surgical patients, the sample did not represent sufficient etiological categories to permit meaningful analyses. Analysis of the performance by the 23 CVA patients confirmed Porch's (1967) observation that the gestural modality is the most functional output system for the majority of aphasic patients, and the gestural modality is the first to recover in CVA patients.

More information on the relationship between gestural ability and etiology of aphasia is needed. These seemingly important dimensions of aphasia may have prognostic implications that would advance present knowledge on treatment, diagnosis, and recovery of the aphasic patient. Porch (1967) has suggested that different etiologies show different patterns of recovery. It would, therefore, seem plausible to investigate how different etiologies influence recovery of gestural ability. Since there is already some indication that gestural ability is the first modality to recover in CVA patients, it is conceivable that gestural ability may be the best early prognostic indicator in determining how the patient will eventually function in his overall communicative ability. If additional research indicates that measurement of gestural ability helps to determine later recovery of patients, stimulation of this output modality early post onset may be important in treating CVA patients. These speculations naturally lead to the need for investigating the interaction between other etiological categories and gestural ability.

Effects of Prohibiting Speech During Pantomime

Goodglass and Kaplan (1963) noted that aphasic patients had a tendency to talk during pantomime even though they were instructed not to speak. The authors called this "vocal overflow." Vocal overflow may provide cues for the patient which help him in expressing ideas through pantomime. In order to analyze the effects of vocal overflow upon pantomimic expression, a comparison was made using scores obtained on G2 and PICA Subtests II and III. G2 was a test of pantomimic expression which allowed the patient to use the actual test objects but prohibited him for talking during the task. PICA Subtests II and III are similar to G2 except the patient is allowed to talk during the task.

The results of this analysis indicate that, as a group, patients performed these tasks with about equal ability.

Some patients, however, had less difficulty pantomiming the functions of test objects when they were instructed not to talk, as in G2. In other cases, patients performed better on Subtests II and III where they were permitted to talk during the task. Although these differences occurred only in a few patients, the fact that performance may be influenced by talking or not talking indicates a need for additional study. Perhaps patients who rely on talking during pantomime have difficulty initiating and sequencing limb movements necessary for certain manual tasks, such as dressing, eating, driving a motor vehicle, or writing.

Conclusions

The major objectives of this study were realized. The experimental battery was successful in sorting patients in terms of gestural ability and task difficulty. Secondly, the results indicated that there is a strong positive relationship between gestural ability and the severity of aphasia as determined by experimental and PICA test scores. A third finding indicated that limb apraxia may not be an accurate description of gestural deficit in the majority of aphasic patients since they improve on imitative gestural tasks. In view of these findings, the following conclusions seem tenable:

1. Gestural and pantomimic ability can be explored in detail with the procedures used in this study. Until the experimental test is subjected to additional analysis of test design, it may serve as a temporary method of testing gestural deficit.

2. Gestural ability is related to the overall severity of aphasia and is not independent of general communicative behavior.

3. Gestural deficit in aphasic patients may be best explained as part of the total communicative deficit and not as a result of limb apraxia.

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