DRAWING DISABILITY: ITS RELATION TO UPPER EXTREMITY DRESSING IN ADULT HEMIPLEGICS

A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF MASTER OF SCIENCE

IN THE GRADUATE SCHOOL OF THE

TEXAS WOMAN'S UNIVERSITY

SCHOOL OF

OCCUPATIONAL THERAPY

BY

MARY K. HUBBELL, O.T.R.

DENTON, TEXAS

DECEMBER, 1979

The Graduate School

Texas Woman's University

Denton, Texas

November 1979

We hereby recommend that the Thesis prepared under our supervision by Mary K. Hubbell entitled Drawing Disability: Its Relation to Upper Extremity Dressing in Adult Hemiplegics

be accepted as fulfilling this part of the requirements for the Degree of Master of Arts.

Committee:

Grace C. Gilkeson M.A.
Chairman

Deane E. Robertson, M.D.

William P. Thaxton, M.D.

Accepted:

Margaret J. Ferrell
Dean of The Graduate School

ACKNOWLEDGMENTS

This author wishes to express appreciation to the administrations and occupational therapy departments of St. Anthony Center and Rosewood General Hospital in Houston, Texas. I am grateful for their generous help in collecting data for this study.

I am indebted to Mrs. Irene Robertson and Mr. William Hanten who provided needed technical guidance for this paper.

I am particularly grateful to my thesis chairman, Mrs. Grace Gilkeson, whose invaluable advice and continual encouragement made the completion of this thesis possible.

M.K.H.

TABLE OF CONTENTS

CHAPTER I

INTRODUCTION TO THESIS

Because of advanced medical technology, many more persons are living into an age period when strokes are more likely to occur. New medical equipment and increased technical knowledge significantly increase the chance for stroke victims to survive the acute phases of cerebral vascular insults. An epidemiologic study conducted by the Joint Committee for Strokes (1) concluded:

> No single health problem places heavier demands upon a wider range of community services than does stroke. In the United States, strokes rank third as a cause of disability. At any one time, there are likely to be as many as two and a half million persons in the nation who have suffered strokes to varying degrees of severity, and during one year another one half million new strokes occur.

The implication of this statement by the Joint Committee for Strokes clearly reveals the magnitude of the problem of accomodating stroke victims in rehabilitation programs.

These growing numbers of patients with cerebral vascular insults are contributing to the overtaxation of rehabilitation facilities; however, the problem is not easily resolved. An enigma emerges when attempting to provide the essential rehabilitation facilities and

personnel while controlling the soaring costs of hospitalization and.rehabilitation.

The increasing patient population with strokes in rehabilitation settings and the need for cost control in rehabilitation services necessitates a reappraisal of existing programs. The evaluation tools, treatment techniques, and sequence of the treatment programs need to be scrutinized in order that the highly trained rehabilitation staff may utilize their time effectively and efficiently on treatment which is timely and appropriate to the needs of these patients.

A stroke, whether the cause be thrombus, embolus, hemorrhage or multiple lesions, results in damage to the brain. Clinical symptomatology varies greatly, depending on the location of the lesion in the cerebral hemisphere. However, regardless of the location of the lesion in the brain, the resultant effect is impairment, in varying degrees, of the patients' abilities to perform activities of daily living.

Adult stroke patients make up a major percentage of the caseload of many occupational therapists. Traditionally, the role of occupational therapists has been to increase, as soon as possible, the victims' abilities to function independently in all activities of daily living.

Typically, dressing is one of the first of these tasks to be evaluated and attempted.

At present, the standard procedure for evaluating patients' dressing abilities is to observe each patient's performance in a requested task. This kind of evaluation is time-consuming and often inconvenient as it requires isolating each patient to ensure the patient's right to privacy. If the results of the evaluation indicate a deficiency in the patient's ability to dress independently, dressing training is undertaken.

A common training approach to this rehabilitation goal of independence in dressing is to teach the patient to dress himself through repetitious drilling, provision of adaptive equipment, and instruction in simplified techniques of one-handed dressing. Such an approach is often frustrating to both the patient and the therapist because it is so often ineffective, as noted from the experiences such as those described by Marmo (2).

Marmo (2), MacDonald (3), and others (4) suggest that many occupational therapists have consumed hours of valuable treatment time in the evaluations and dressing training of hemiplegic stroke patients, only to have them remain dependent in spite of all efforts. Futile attempts of this nature are negative psychologically and economically unsound for both the patients and the therapists.

Teaching dressing in the manner described above, although sometimes successful, represents little systematic thinking or rationale in evaluation and treatment planning for stroke victims. The problem of the stroke victims' inabilities to dress themselves independently due to brain damage suffered from the cerebral vascular insults remains unattended.

The more specific the treatment regimen, the greater the possibility that efficient and effective rehabilitation could be instituted for stroke victims. A specific treatment regimen depends to a large extent on precise evaluations of the patients before any therapies are undertaken.

An alternative approach to evaluating patients' dressing abilities has been tested in this study. This approach attempts to develop a simple and convenient diagnostic tool to evaluate stroke victims' readiness to begin dressing activities. Such a diagnostic tool would circumvent the necessity of the time-consuming and often inconvenient method of evaluating dressing skills via observation. By assessing the victims' potentialities for performing dressing activities, the sometimes futile and often frustrating dressing activities which are beyond the patients' abilities to integrate on a cerebral level, can thus be avoided. Instead, for these patients, pre-dressing activities could

be instituted with a greater likelihood of eventual independence in dressing.

Statement of Purpose

As noted in the introduction, many occupational therapists using the traditional methods for evaluating and training stroke victims in dressing activities are spending valuable therapy hours which are in many instances frustrating and ineffective. The traditional approaches to the rehabilitation goal of independence in dressing are not appropriate for all stroke victims. The readiness of stroke patients for dressing is dependent to some extent upon having at least a minimal capacity for sensory integration (2, 3, 5). Certain activities which require sensory integration, e.g.; drawing activities, are believed to correlate with dressing abilities. Many stroke victims lack the sensory integration necessary for drawing and dressing activities. Therefore, the traditional evaluations and dressing training approaches, for these stroke patients, address themselves only to the symptom of the problem (the patients' inabilities to dress themselves) and not to the cause of the problem (the patients' lack of sensory integration).

In order for therapies to be directed at the cause of the problem and not the symptom of the problem, there

appeared the need to develop a more efficient and convenient diagnostic tool. A diagnostic tool which assessed those aspects of the stroke victims' sensory integration which are related to dressing abilities would then be utilized prior to initiating any treatment regimens.

Using the information obtained from assessments of aspects of sensory integration relevant to dressing abilities, pre-dressing activities could be instituted when necessary, or the traditional methods could be applied where sensory integration was adequate for dressing. By instituting pre-dressing activities aimed at improving sensory integration, a greater possibility exists that the final goal of independence in dressing will be achieved for those victims with impaired sensory integration. In both instances, the traditional approaches and the sensory integrative approach, treatment would be addressed to the cause of the problem. Therapy time would therefore be used more appropriately and effectively. The sometimes futile and often frustrating dressing activities which are beyond many of the stroke victims' abilities to integrate on a cerebral level could thus be avoided.

The purpose of this study was to develop a simple, convenient and effective diagnostic tool which would assess drawing disability, an aspect of the stroke victims' sensory integration which is believed to be related to dressing

abilities. Using this evaluation tool a differentiation was made between those patients who are capable of dressing without the assistance of others and those patients who are incapable of this performance. By differentiating those stroke patients whose sensory integration enables them to dress independently from those patients who lack the sensory integration necessary to perform dressing tasks, more specific and appropriate treatment regimens could be utilized for both groups of patients.

A test of patients' abilities to copy drawings was utilized as a measure of sensory integration related to dressing abilities (6, 7, 8, 9, 10). Observations of the patients' abilities to dress their upper extremities were recorded concurrently with drawing ability tests. Lower extremity items such as trousers, shoes, and socks were not included in the dressing evaluation of this study in order to avoid the introduction of balance and ability to bend as variables.

It was hypothesized that difficulty in drawing, as evidenced by low scores on the test for copying drawings, would be predictive of those patients who were unable to dress their upper extremities without the assistance of others.

Definitions

Activities of daily living, as defined by Boynton (11), implies the basic skill of independence in areas of wheelchair management, feeding, grooming, personal hygiene, dressing and transfers between wheelchair and bed, chair, toilet, tub, and automobile.

Constructional apraxia is impairment in producing designs in two or three dimensions, by copying, drawing or constructing whether upon command or spontaneously (6).

Constructional tasks as defined by Benton and Fogel (12), are those activities which have in common the characteristic that they require a subject to assemble, join, or articulate parts to form a single unitary structure.

Drawing disability, as defined by Warrington, et al (13), involves difficulty in drawing or copying that is not attributable to generalized intellectual deterioration, impaired comprehension of instructions, visual failure or motor disorder of the preferred hand. The term drawing disability as here used does not imply difficulty in any task other than drawing.

Perception is defined according to the concept of Eisenson (14) as "The intellectual process by which meaning is derived from a given stimulus situation. It may be considered the organizational process through which the

individual is enabled to understand the significance of what does on about him."

Stroke (cerebral vascular insult) is destruction of brain substance as a result of intracerebral hemorrhage, thrombus, embolism, or vascular insufficiency (15).

Sensory integration is the neurological process of organizing and processing, or perceiving, sensations for use (5).

Limitations and Assumptions

Due to the resultant damage to the brain after a cerebral vascular insult, many stroke patients are unable to dress themselves independently. This descriptive research study has been conducted to assist occupational therapists in differentiating those stroke patients whose brain damage is too severe to allow them to perform upper extremity dressing from those stroke patients whose cerebral integration is sufficient to allow them to perform dressing activities.

For the purpose of developing a diagnostic tool, it was necessary to select a variable which had been recognized and verified in research studies (6, 7, 8, 9, 10, 16, 17, 18) as a predictor for successful stroke rehabilitation candidates. Age of the stroke patient, diagnosis of left versus right hemiplegia, and sex all failed to show a definite relation to eventual independence in self-care

activities (7, 8, 17, 19) and were therefore not selected as independent variables in this study.

Many predictors of successful stroke rehabilitation candidates have been documented in research studies (6, 7, 8, 10, 16, 17, 18, 20, 21). Among the predictors established with a significant negative correlation to dressing abilities were perceptual dysfunction (6, 7, 8, 9, 10), previous cerebral vascular disease (7, 17), low self-care admission status, time between onset of the stroke and treatment (17), and homonymous hemianopsia when accompanied by a motor deficit (8).

In this study, it was intended that an evaluation tool be used that would measure the stroke patients' actual dressing abilities at a particular point in time. No attempt was made to exclude patients who had received previous rehabilitation training in dressing activities prior to this series of evaluations, since this study was to measure the actual existing potential for independence in dressing at that particular point in time.

For this same reason, all the above identified predictors with negative correlations to dressing abilities, except perceptual dysfunction and homonymous hemianopsia when accompanied by a motor deficit, were not considered relevant to this study. For the purpose of this study of dressing potential, perceptual dysfunction, which is a sensory

integrative process, will be discussed in the Review of the Literature, chapter II. Of the predictors established for successful stroke rehabilitation candidates, homonymous hemianopsia remains as a possible uncontrolled variable. However, it is assumed that homonymous hemianopsia would have nearly equal disabling effects in both the drawing and the dressing evaluations. Therefore, homonymous hemianopsia was eliminated as a variable for the purpose of this study.

An additional assumption was made that the sample population from the two rehabilitation settings utilized in this study was representative of stroke patients seen in other occupational therapy departments which maintain a rehabilitation environment for treatment of stroke victims. This was assumed to be true because the stroke patients evaluated in this study were referred to the respective rehabilitation settings by several different physicians who had managed the acute phases of the stroke crises in various local hospitals prior to the victims' admissions to the extended care facilities for rehabilitation.

The patients' motivations to complete each aspect of this study to the best of their abilities could have been an additional limiting factor. It was assumed that the criteria for the selection of the sample population, as described in chapter III, Methodology, and the patients' requirements to signify in writing or verbally their

willingness to participate in this study, assured the raters that the patients were performing the requested tasks to the best of their abilities.

Both evaluations utilized in this study, the drawing abilities test and the dressing abilities test, are tasks which can be expected of children between the ages of four and six years (22). It was assumed that extensive testing of intellectual functions was unnecessary for the purposes of this study. The data obtained from this study was intended to reflect a correlation between abilities to dress and abilities to draw. No implications regarding intellectual functional abilities are intended to be inferred from the conclusions.

A final consideration of import to this study is the incidence and the severity of "drawing disability" in the right-sided lesions as compared to the incidence and severity of "drawing disability" in the left-sided lesions. Drawing difficulties have been said to be more frequent and severe in those patients with right-sided hemispheric lesions, as reported by Piercy, et al. (23), and Piercy and Smyth (24). However, Warrington, et al. (13), in their study of thirty-one right-sided and thirty-one left-sided cerebral lesions, found that the two patient groups did not differ significantly in the overall severity and incidence of drawing dysfunction. Warrington, et al. took special care in matching

the two groups. Conclusions from this study suggested that the previous studies (23, 25) had possible invalidity because the drawings had been rated by the examiners and had thereby introduced the Rosenthal factor. An additional assertion stated that the previous studies had found increased incidence and severity in the left hemiplegic patients because of an artifact in patient selection for the studies.

Piercy, et al. (23), in discussion of the results of their study, supported Warrington's contention that the possibility exists that the higher incidence and severity of "drawing disability" in the right hemisperic lesions could be due to the fact that the right and left-sided cerebral lesion groups are presupposed to be comparable when, in fact, those studies have usually excluded from the patient population sampled, those patients with the severe handicap of profound aphasia and/or paralysis of the preferred hand.

CHAPTER II

A REVIEW OF THE LITERATURE

A review of the literature indicated that for the past several years the problem of providing rehabilitation services to increasing numbers of stroke patients has been recognized and investigated.

Prior to 1962, most literature regarding stroke patients was concerned with the symptomatology manifested in the victims. Following this period, however, there began consumer demands for cost benefit analysis, the assurance of proper utilization of existing rehabilitation facilities, and justification for the funds projected for additional agencies and personnel. These demands provided the impetus for researchers to develop criteria which would predict which stroke patients could successfully be rehabilitated (6, 7, 8, 10, 16, 17, 18, 20, 21).

The initial task of the researchers was to define successful rehabilitation outcome. Researchers (6, 7, 8, 10, 16, 17, 18, 20, 21) independently utilized self-care in activities of daily living as a measurable objective in the treatment programs for patients with cerebral vascular insults. In these studies, the effectiveness of respective rehabilitation programs involved, in some part,

the attainment by the patients of varying levels of independence in self-care. It is assumed, then, that by achieving a functional level of self-care, a goal in the rehabilitation of stroke patients will be realized to a meaningful extent by alleviating the social, psychological, and financial burdens assessed on dependent stroke victims, their families, and/or society.

It is recognized that complete independence in self-care for all stroke victims is unrealistic. The Joint Committee for Strokes (26) has provided guidelines which suggest that at least fifty percent of all stroke victims do have the potential to achieve such independence, and only ten percent will remain so severely disabled as to require institutionalization for total care. With these facts in mind, it appears that the rehabilitation goal of varying levels of self-care for stroke patients is a tenable one for ninety percent of the victims of cerebral vascular insults.

In an attempt to satisfy the consumer demands and to meet the needs of the growing numbers of stroke patients, numerous research studies (6, 7, 8 , 10, 16, 17, 20, 21) have been devoted to determining the prognostic values of a number of demographic, physical, and mental characteristics of patients with cerebral vascular insults. These possible predictors (as previously identified on pages 9 and 10)

were investigated in order that the outcome of rehabilitation efforts might be predicted with greater accuracy.

An additional benefit can clearly be derived from the identification of such predictors. Predictors from these studies may also provide clues to areas of therapeutic intervention which could improve the efficiency of the rehabilitators and subsequently the patients' functional prognoses. It is with evaluation and therapeutic intervention in mind that the variables established for the prediction of successful stroke rehabilitation candidates were utilized.

One of the predictors identified in the previously mentioned studies (6, 7, 8, 10, 16, 17, 18, 20, 21) was perceptual dysfunction, which is a sensory integrative process. An elaboration of perceptual dysfunction and its correlation to dressing abilities will be made.

Defective execution of constructional tasks, a perceptual problem, is generally recognized as a disability which frequently results from a cerebral vascular lesion (13, 23, 24, 25, 27). Numerous research studies have been conducted in an attempt to relate these disturbances of constructional tasks to success or failure in activities of daily living (6, 7, 8, 9, 10). The results of these research studies suggest that a negative correlation does exist between such low performances in construction

praxis and eventual independence in activities of daily living.

Lorenze and Cancro (6) were among the first researchers to investigate the possibility of a correlation between perceptual dysfunction and specific tasks in activities of daily living, dressing skills included. Other studies (8, 9 , 16, 17) followed and concurred with Lorenze and Cancro's findings that there does exist a negative correlation between perceptual dysfunction and eventual independence in activities of daily living.

As a measure of perception in the study by Lorenze and Cancro (6) the block design and object assembly subtest of the Wechsler Scale (28) was utilized. The block design and object assembly subtest of the Wechsler Scale allows for the evaluation of perceptual organization of a constructional nature (29).

The results of this study (6) of forty-one adult hemiplegic patients revealed that the stroke patients who achieved low scores on this constructional task tended to fail in dressing. The obtained correlation of .82 was significant, and strongly suggested that a positive relationship between the degree of disturbance of constructional apraxia and dressing capabilities did exist.

Williams (10), utilizing copying ability to measure perception, concurred with the findings of Lorenze

and Cancro. In Williams' study, having difficulties with copying ability, a constructional task, also appeared indicative of dressing failure. Williams used a drawing test with one hundred and thirty-six adult hemiplegic patients and concluded that eighty-six percent of the patients who did normal drawings were independent in dressing at discharge from the rehabilitation program. The remaining sixteen percent, who did normal drawings at discharge from the rehabilitation program, continued to be dependent in dressing. In contrast, of the patients who did abnormal drawings only thirty-four percent were independent in dressing at discharge, while sixty-six percent of this group remained dependent in dressing.

A rating scale for the drawings evaluated in the Williams (10) study was established by checking for patterns of deviation from a group of drawings done by previous patients on whom the original conjecture of relationship between drawing disabilities and dressing disabilities was based. The sample scale utilized and exemplified pictures can be seen in Appendices A and B. Examples of the stimulus cards used in the Williams study and in the present study are provided in Appendices C, D, and E.

In the Williams (10) research, a total of thirty-five right and left hemiplegic patients were able to reproduce drawings rated as normal. Of these thirty-five subjects,

sixty percent were independent in upper extremity dressing at the time of initial evaluations, and forty percent were dependent in upper extremeity dressing. In contrast, on the one hundred and eighteen subject who did abnormal drawings, only sixteen percent were independent in dressing at the time of initial evaluations while eighty-six percent were dependent in dressing the upper extremities.

As previously stated, defective execution of constructional tasks is generally recognized as a disability which may result from a cerebral lesion (13, 30). However, there is no empirical evidence regarding the exact nature of the disability. As evidenced by the descriptions of studies related previously (6 , 10), constructional praxis is a broad concept which has been applied to a number of rather different activities. However, these activities differ from each other in many significant respects, e.g., in complexity, in the type of movement and the degree of motor dexterity required in achieving the task, in the demands made on the higher intellectual functions, and in whether they involve construction in two or three dimensions.

The implicit assumption that had previously been accepted by some researchers (6 , 7 , 8 , 9 , 10) was that a common disability underlies failure in activities requiring constructional abilities. This assumption has been refuted by the more recent research of Benton and Fogel (12).

For instance, the results of the study by Benton and Fogel revealed that there was only negligible association between the performance levels of two-and three-dimensional constructional activities. For one hundred brain damaged patients, the Phi coefficient between two-and three-dimensional tasks was .02 ($p<.05$). It was their contention that this negligible association was probably not higher than that which is found between any two performances of any two activities in a group of brain-damaged adult patients.

Because of their convenience, drawing tasks are often employed as tests of constructional praxis (12, 16, 25, 28, 31). In drawing tests, the patient is required to copy figures, designs, or representations of varying degrees of complexity. It appears accepted without debate that the drawings of hemiplegic patients are reflective of some degree of constructional apraxias (16, 23, 28, 32). However, constructional deficits which are not reflected in the simpler tasks of two-dimensional designs are many times reflected on the more complex three-dimensional designs (12). Therefore, the copying of two-dimensional designs as a single test, will not distinguish the less severely involved patients with constructional apraxias from the patients who have a severe dysfunction in constructional praxis.

In addition, it was felt by some (12, 28, 31) that the constructional apraxias, as exhibited in the various

constructional tasks, were actually assessing two different characteristics of constructional dysfunction. The findings of McFie and Zangwill (33), Piercy and Smyth (25), and Gainotti and Tiacci (31) advanced the hypothesis that two different mechanisms are responsible for the constructive troubles found in the right and the left hemisperhic lesions. The right-sided lesions are considered to produce a visuo-spatial deficit and the left-sided lesions are considered to be more of an executive defect.

Because of the ambiguity surrounding the validity of specific constructional tasks, and the controversy regarding the underlying mechanisms responsible for the deficits, the term "drawing disability" will be used instead of constructional apraxia in this study. For the purposes of this study, as in the studies of Warrington, et al. (10) and Gainotti, et al. (31), the term "drawing disability" will be used so as not to prejudge the mechanisms underlying the clinical appearance. "Drawing disability", as previously defined on page 8, implies difficulty in drawing or copying that is not attributable to generalized intellectual deterioration, impaired comprehension of instructions, visual failure, or motor disorder of the preferred hand. The term "drawing disability" as here used does not imply difficulty in any task other than drawing.

However, ambiguity surrounds the term "drawing disability". As with constructional apraxia, there have been numerous attempts by researchers to establish hemispheric dominance for drawing abilities. As previously noted, "drawing disability" may result from a unilateral lesion in either cerebral hemisphere (30). It is also purported that "drawing disability" could have bilateral, though not necessarily equal, representation of a unitary underlying cerebral function (24). Alternatively, the two hemispheres might make separate and different contributions to the complex drawing process as suggested with constructional apraxias. Researchers (23, 27) who strongly believe that the disorder is separate and different contend that the right cerebral hemisphere, as with constructional apraxias, is supplying the perceptual function of a visuospatial nature, and the left cerebral hemisphere provides the executive component to the task. For support of their hypothesis, the researchers (23, 27) rely on the predominant error types found among the drawings of the victims of right and left hemispheric lesions.

As stated earlier in the Review of the Literature, it is not the purpose of this study to investigate the cerebral dominance or the mechanisms responsible for "drawing disability". However, some of these studies (6, 23) are of value to this paper as the predominant error

types found in "drawing disabilities" of the right and the left hemiplegics are useful in evaluating the drawings per se.

CHAPTER III

METHODOLOGY

Subjects

The target population of this study was all stroke patients who required evaluations of dressing abilities in occupational therapy departments. Because of necessity, a sample of convenience was employed in an attempt to depict the target population. The study was conducted in occupational therapy departments of two extended care facilities located in the southwestern United States. The extended care facilities were selected as subject rehabilitation settings because victims of cerebral vascular insults are often found as residents of these facilities.

The sample population consisted of forty-three adult stroke patients with confirmed diagnoses of unilateral cerebral vascular insults. The patients' medical records were utilized to obtain documented diagnoses. In the majority of the subjects utilized in this study, there was insufficient information available in the medical records to note the specific sites or causes of the cerebral vascular lesions.

All available cases with unilateral lesions were assessed regardless of evidence of "drawing disability" or

the side of the brain in which the lesions occurred. Patients diagnosed as having bilateral lesions were excluded from the study on the basis of clinical examination, as well as medical histories.

Coincidentally, as indicated through the subjects' verbal histories or medical records, all patients utilized in this study were determined to have right hand dominance.

A description of the subject population can be found in table 1. Twenty of the subjects had lesions in the left cerebral hemisphere, and twenty-three subjects had lesions in the right cerebral hemisphere. Of the total subject population, seventeen were males and twenty-six were females. The ages ranged from forty-five years to eighty-five years. The time elapsed, since onset of the cerebral vascular insults to the date of the evaluations of dressing and drawing abilities, ranged from less than one month to three years. The mean time elapsed since the onset of the disabilities to the evaluations was 4.3 months. The median time elapsed from the onset of the cerebral vascular insults to the evaluations was 2.0 months. All of the subjects had right hand dominance.

TABLE 1

DESCRIPTION OF SUBJECT POPULATION

Total # of hemiplegic subjects- -	43
Right hemiplegics - - - - - - - -	20 (47%)
Left hemiplegics- - - - - - - - -	23 (53%)
Males - - - - - - - - - - - - - -	17 (40%)
Females - - - - - - - - - - - - -	26 (60%)
Age range - - - - - - - - - - - -	44-85 yrs.
Mean age- - - - - - - - - - - - -	69 yrs.
Time elapsed since onset- - - - -	1-36 mos.
Mean time elapsed since onset - -	4.3 mos.
Median time elapsed since onset -	2.0 mos.
Right hand dominance- - - - - - -	43
Left hand dominance - - - - - - -	0

Materials

All subjects involved in this study were capable of understanding the oral directions for the tests as evidenced by their abilities to respond correctly to a modified version of the Auditory Reception Subtest of the Illinois Test of Psycholinguistic Abilities (34). The concept of the Auditory Reception Subtest of the Illinois Test of Psycholinguistic Abilities was employed in this study in order to screen patients whose low performances

could possibly be attributed to, and secondary to, inabilities to understand what was being requested of them.

The Auditory Reception Subtest (34) assesses the abilities of persons to derive meaning from verbally presented material. The receptive, rather than the expressive, is sampled; therefore, the responses are kept at the simple level of a verbal "yes" or "no" or shaking the head to indicate "yes" or "no".

For the purposes of this study, the concept of the Auditory Reception Subtest of the Illinois Test of Psycholinguistic Abilities (34) was utilized as a screening device to eliminate those patients who were incapable of understanding the directions for the tests administered. In order to qualify as a subject for this study, the patients were required to respond correctly to all ten of the questions. An example of the ten questions asked can be seen in Appendix F.

Drawing abilities were assessed by asking the subjects to copy, as exactly as possible, a design of a house, a clock, and a flower from stimulus papers. See Appendix G, Procedure for Administration of the Drawing Ability Test. These drawings are exemplified in Appendices C, D, and E. All drawings were of a two-dimensional nature.

Evaluation of the stroke victims' abilities to dress their upper extremities was made, using a modified version of the criteria described in the Donaldson, Greshm, and Wagner (35) evaluation of activities of daily living. For the purposes of this study, two of the eight categories from this activities of daily living evaluation were eliminated. The categories omitted were: "not evaluated" and "not applicable". The Donaldson, et al. evaluation was further modified by including a three-minute time limit in two categories to provide an increased objective measurement to further delineate the categories describing the levels of performances in upper extremity dressing. The six remaining categories utilized in this study allowed for discrimination of dressing abilities ranging from independent to totally dependent upon others for dressing their upper extremities. The five specific upper extremity dressing tasks are listed on the form used to record the subjects' performances, Appendix H. The criteria for each of the six categories can be seen in Appendix I, Procedure for Administration and Criteria for Scoring of the Upper Extremity Dressing Evaluation.

Procedure

The subjects included in this study were asked to perform two tasks: (1) copying three separate drawings from stimulus papers (see Appendices C, D, and E), and

(2) dressing their upper extremities without the assistance of others (see Appendices G and H). The copying tasks were performed at the time during the patients' treatment programs when the registered occupational therapist or the certified occupational therapy assistant would usually evaluate dressing skills. The drawing abilities tests and the observations of dressing skills were given within a maximum of three days of each other. This was done to ensure that all correlations obtained were reflective of the patients' abilities at a given point in time. The results of these evaluations were recorded, and the composite scores for each of the tests were derived as related below.

Scores for the dressing evaluations were deduced by assigning the corresponding numerical values that were appropriate to the description of the patients' performances on each of the five dressing tasks. Numerical values for all five of the requested upper extremity dressing tasks were recorded (see Appendix H, Form Used to Record Subject Performance in Upper Extremity Dressing). The numerical values for all five requested dressing tasks were assessed, and the composite scores ranged from a maximum of five points for those patients who were independent in dressing the upper extremities to zero points for those patients who were dependent upon others for dressing.

Composite scores for all five of the requested upper extremity dressing tasks were derived by assigning the lowest numerical value describing the subjects' performances. For example, if a subject received a zero on any one of the five requested dressing tasks, the composite score for dressing would be zero.

The patients were then divided into two groups: those independent in dressing their upper extremities and those who were dependent upon others for dressing. Any subject receiving a numerical value of three or less (3-0) on any one of the five dressing tasks requested was considered to be dependent upon others for assistance in dressing their upper extremities. Conversely, all subjects receiving numerical values of at least four (4-5) on all five of the requested dressing tasks were considered to be independent in upper extremity dressing.

Due to the number of subjects required to make this investigation meaningful, it was necessary to utilize several different evaluators to obtain the data required from the time-consuming dressing evaluations. In order to meet the time completion of this study, and to minimize the possibility of inconsistency in measurement of the evaluation tools, the procedures for the administration and the scoring each of these tools were reviewed with each rater prior the subjects' evaluations.

Composite scores for all five of the requested upper extremity dressing tasks were derived by assigning the lowest numerical value describing the subjects' performances. For example, if a subject received a zero on any one of the five requested dressing tasks, the composite score for dressing would be zero.

The patients were then divided into two groups: those independent in dressing their upper extremities and those who were dependent upon others for dressing. Any subject receiving a numerical value of three or less (3-0) on any one of the five dressing tasks requested was considered to be dependent upon others for assistance in dressing their upper extremities. Conversely, all subjects receiving numerical values of at least four (4-5) on all five of the requested dressing tasks were considered to be independent in upper extremity dressing.

Due to the number of subjects required to make this investigation meaningful, it was necessary to utilize several different evaluators to obtain the data required from the time-consuming dressing evaluations. In order to meet the time completion of this study, and to minimize the possibility of inconsistency in measurement of the evaluation tools, the procedures for the administration and the scoring of each of these tools were reviewed with each rater prior to the subjects' evaluations.

The dressing ratings made by the evaluators were compared with ratings made at the same time by the author. This was done in order to obtain an estimate of interrater reliability. Therefore, comparisons using different raters' observations could be made with assurance that each of the evaluators was seeing and noting the same behaviours. Twenty of the forty-three observations were made concurrently with six different evaluators in dressing evaluations. The author and the raters assigned numerical values which appropriately described the subjects' performances with 100% agreement. This was possible as the criteria involved in rating dressing skills varied distinctly and concretely for each numerical value. An example of the criteria utilized in this study for evaluating dressing skills can be seen in Appendix I.

The author devised a method for scoring the drawings. This system of scoring entailed noting the presence or absence of a number of qualitative and quantitative features of the drawings of hemiplegic patients. The qualitative and quantitative features were the predominant errors noted in hemiplegic drawings as adduced from the studies of Rezikoff and Tomblen (36), Paterson and Zangwill (25), Hacaen and Assal (32), Piercy, Hacaen and DeAuriaguerra (23), and Gainotti and Tiacci (31).

Gainotti and Tiacci (31), in their study of the patterns of drawing disability in the right and the left hemiplegic patients, confirmed earlier findings regarding the following characteristics peculiar to a specific hemisphere. Predominant errors which were significant ($p<.01$) for the right hemispheric lesions were unilateral spatial neglect, orientation of the drawing on the paper, alterations in spatial relations, increased number of lines ($p<.05$), and the inclusion of irrelevant graphic material. The characteristic errors of the left cerebral hemisphere, found to be significant to at least $p<.05$ alpha level, were simplification of the drawing, increased number of right angles, and difficulty in drawing angles. The types of errors which did not show significant association with laterality of the lesion included an increased number of acute angles, scrawlings, and perseverations.

Utilizing the above characteristics of predominant drawing errors, a system for scoring the drawings of hemiplegic patients used in this study was devised. This system of scoring entailed assigning twenty points to each recognizable picture. Thereafter, one point was subtracted for each predominant error, as defined in the criteria for scoring the drawings as seen in Appendix J, Hubbell Procedure for Administration and Scoring of the Drawing Abilities Test.

No points (or subtraction for errors) were given to unrecognizable pictures.

Scores for the drawing tests had a potential range from zero (0) points for three unrecognizable pictures to a maximum of sixty (60) points for three recognizable pictures without predomimant errors usually found in drawings by adult hemiplegic patients. The sum total of the three drawings provided the composite score for the drawing evaluations.

The scoring by this devised method was designed to be a simple, convenient, and appropriate evaluation tool which would assist occupational therapists in assessing drawing disability, an aspect of the patients' sensory integration, in order to discriminate between patients whose sensory integration is sufficient to allow them to dress their upper extremities, and patients who are unable to dress themselves independently because of sensory dysfunction.

The subsequent scores were computed in an attempt to support the hypothesis of this paper, that patients having severe dysfunction in drawing were also dependent upon others for assistance in dressing their upper extremities.

Each of the three drawings by each subject was evaluated using the criteria described by the author in

Appendix J. A composite drawing score for each subject was derived by adding the total points on the three drawings. Using the subjects' research identification numbers to record the scores, the author evaluated the one hundred and twenty-nine drawings a second time. Using the author's resultant composite scores from both evaluations of the forty-three subjects' drawings as the Y variable and the X variable, a correlation coefficient was computed using a Pearson product-moment formula. This coefficient of stability for the drawing scores was computed as $r = .98904802$, indicating that the reliability for scoring the drawings appeared to be substantial.

CHAPTER IV

DATA COLLECTION AND ANALYSIS

Data collection

The data were collected during a six-month period of time, on patients who met the criteria previously mentioned for the subject population, and included research identification numbers, dates of onset of the strokes, sides affected, hand dominances, and performance scores of the dressing and drawing tests.

Data analysis

The data were collected, and a Pearson product-moment correlation coefficient between the dressing and the drawing scores was computed using all continuous data. The significance level of the Pearson product-moment coefficient was pre-established at the $p<.05$ alpha level. A regression line analysis was then computed in order that the dressing scores might be predicted from known drawing scores.

CHAPTER V

RESULTS

Over a six-month period of time, forty-three adult patients with confirmed diagnoses of unilateral cerebral vascular insults were evaluated as to dressing and drawing abilities.

All subjects were evaluated in upper extremity dressing, using the procedure and scoring system shown in Appendix I. Within a time period of three days the subjects were asked to copy three drawings. Examples of the drawings may be seen in Appendices C, D, and E. The procedure for requesting this task, and the criteria for scoring the drawings by the author's devised method, were reviewed with each evaluator prior to the testings.

The drawing scores ranged from fifty-seven points to twelve points. The number of subjects receiving specific scores and the subjects' levels of performance in upper extremity dressing can be seen in table 2.

TABLE 2

DRAWING SCORES AND LEVELS OF PERFORMANCES IN UPPER EXTREMITY DRESSING

Drawing scores	57-50	49-41	40-12
# Independent	8	10	0
# Dependent	0	10	15

Twenty (47%) of the subjects utilized in this study received composite scores for drawing of forty-five or above. Of this group, 98 percent were independent in dressing their upper extremities at the time of evaluations. All subjects receiving a score of fifty or above on the drawing evaluations were independent.

Twenty-three subjects (53%) received a drawing score of forty-four or below. Of these twenty-three subjects, all but two (9%) were dependent upon others for assistance in dressing their upper extremities. None of the subjects receiving a score of forty or below on the drawing test were independent in upper extremity dressing.

A Pearson product-moment coefficient of correlation was computed for the dressing and the drawing scores. The correlation was .61141375, significant at the .005 alpha level.

The statistical procedure utilized to predict dressing skills and thereby accomplish the task of this paper, was regression analysis. The purpose of regression analysis was to estimate the dressing scores (the stroke patients' abilities to dress their upper extremities independently) from known values of drawing scores (the stroke patients' abilities to copy recognizable pictures without evidence of the predominant errors usually found in the drawings of stroke victims).

A regression line equation was computed for the drawing and dressing scores yielding b = .08748096 and a = -.581620561. These values, when substituted in the regression line equation, $y_c = a + bX$, can be utilized to predict dressing abilities.

CHAPTER VI

DISCUSSION AND CONCLUSIONS

Very few studies have been done to correlate the results of tests of perception with actual functional abilities and disabilities. The relationship between adequate skills to accomplish the task of upper extremity dressing and drawing skills, a perceptual function, has been investigated in forty-three adult hemiplegic patients.

From the obtained correlation between dressing and drawing abilities it would appear that hemiplegics who do poorly on the drawing tests tend to be dependent upon others for assistance in upper extremity dressing. This positive correlation supports the hypothesis of this paper and is in accordance with Williams' (10) and Lorenze and Cancro's (6) original suggestion that independence in activities of daily living requires adequate perceptual integration.

Feigenson, et al. (8, 9), in their studies of factors influencing outcome of stroke rehabilitation, concluded that a program aimed at identifying and treating perceptual dysfunction did improve the functional status of patients at discharge from their respective rehabilitation programs. This study likewise stresses the need,

when analyzing a specific disability such as failure in dressing, for evaluating first the influence of general factors, such as the degree of involvement of the nervous system due to the brain lesion, prior to undertaking remediation of the dressing inabilities.

By assessing the stroke patients' potentialities for performing dressing activities, the sometimes futile and often frustrating dressing activities which are beyond many of the stroke patients' abilities to integrate on a cerebral level could thus be avoided. Instead, for these patients pre-dressing activities could be instituted with a greater likelihood of eventual independence in upper extremity dressing. Drawing without errors seems to indicate a higher capacity for patients to relearn dressing activities, either by themselves or from a therapist.

The validity of the drawing test utilized in this study has not been examined. For this reason, a low performance score on this test is not conclusive evidence that the subjects have a particular deficit in drawing. Additional studies testing the validity of the drawing evaluation with a test considered to be valid is necessary to substantiate the findings of this paper.

Additionally, correlations between impaired drawing ability and impaired performance of the rather complex clinical activity of dressing the upper extremities can

reflect a shared underlying deficit. However, the poor performance on the complex activity of dressing may result from a variety of specific as well as non-specific deficits. A total test score on dressing does not discriminate between specific and non-specific deficits.

Observing the data, it appears that those patients whose drawing scores compute to a dressing score of 3.0 or above have a greater potential to achieve independence in dressing their upper extremities than those patients whose drawing scores are computed less than 3.0. Conversely, those patients receiving a computed dressing score of less than 3.0 would be more likely to gain from pre-dressing activities directed toward improving sensory integration than by providing adaptive equipment, instruction in one-handed dressing or repetitious drillings.

APPENDIX A

SCORING OF THE COPYING ABILITY TEST AS DESCRIBED BY WILLIAMS*

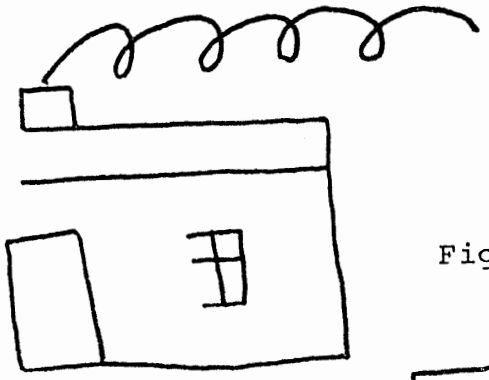
Scoring

1. Half drawings, lateral right half or lateral left half (Figure 4).
2. Omission or addition of parts. Partial pictures (Figures 5 and 6).
3. Unrecognizable pictures (Figure 7).
4. All or parts of the picture in poor relationship or proportion (Figure 8).
5. Normal drawings.

*Source: Nancy Williams. "Correlation Between Copying Ability and Dressing Activities in Hemiplegia". American Journal of Physical Medicine 47 (1967) 1334.

APPENDIX B

EXAMPLES OF SUBJECT DRAWINGS USED FOR COMPARISON
IN SCORING COPYING ABILITY ACCORDING
TO THE CRITERIA USED IN THE
WILLIAMS STUDY (10)**



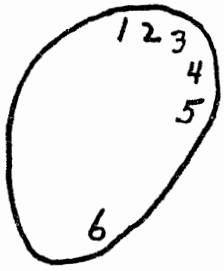


Figure 4

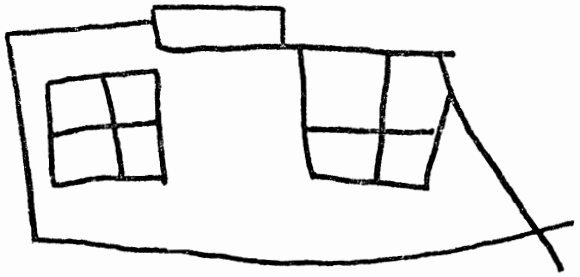


Figure 5

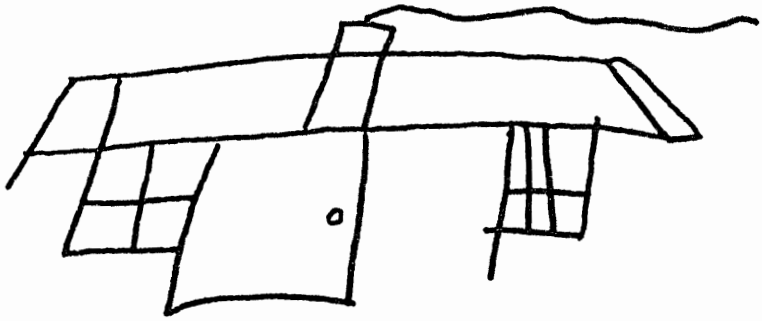


Figure 6

APPENDIX B

(Continued)

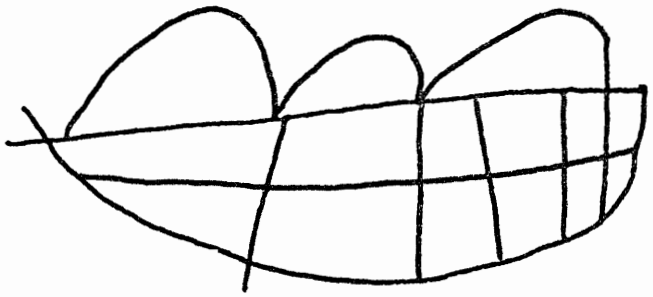


Figure 7

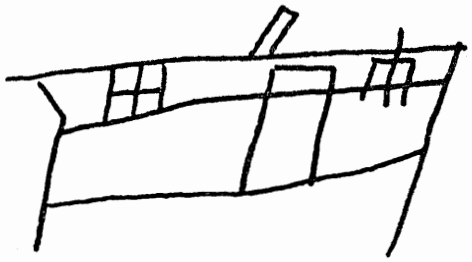
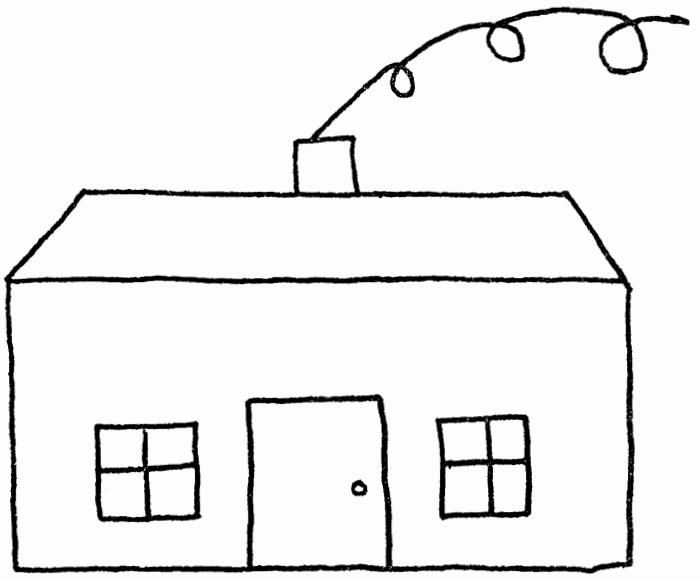


Figure 8

**Source: Nancy Williams. "Correlation Between Copying Ability and Dressing Activities in Hemiplegia". American Journal of Physical Medicine 47 (1967): 1334.

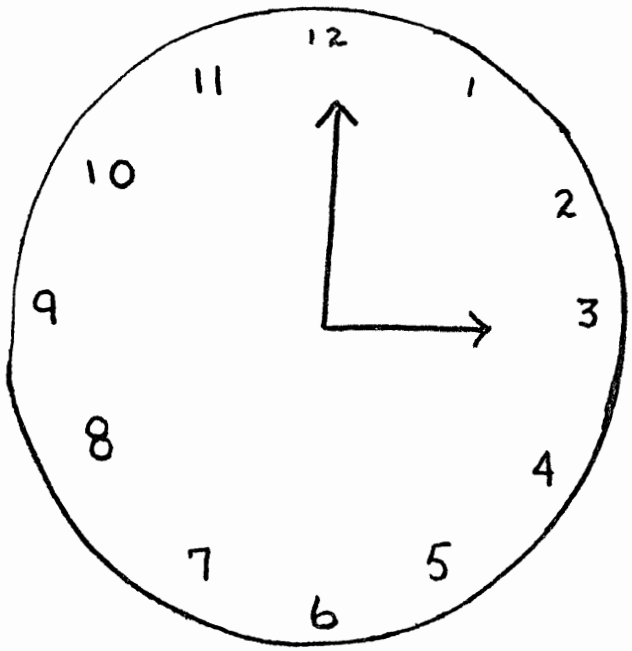
APPENDIX C

STIMULUS CARD FOR EVALUATION
OF DRAWING ABILITY



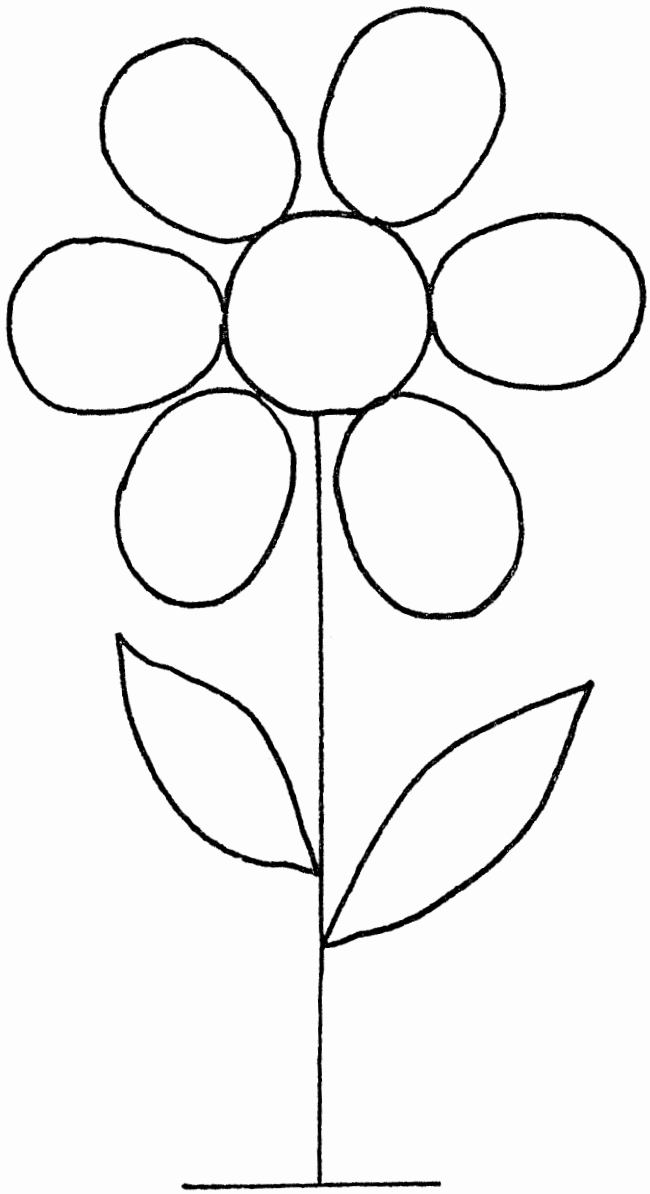
APPENDIX D

STIMULUS CARD FOR EVALUATION
OF DRAWING ABILITY



APPENDIX E

STIMULUS CARD FOR EVALUATION
OF DRAWING ABILITY



APPENDIX F

EXAMPLE OF THE TEN QUESTIONS ASKED TO ASCERTAIN THE SUBJECTS' AUDITORY RECEPTION

Instructions

"I am going to ask you some questions, to see if you have any trouble understanding what I tell you. Some of the questions may seem silly, but please answer all questions with a 'yes' or 'no'."

Procedure

Ask the patient to respond to the following questions by verbally answering "yes" or "no" or by shaking the head "yes" or "no".

1. Is grass green?
2. Do you live in Texas?
3. Does it snow in the summer?
4. Can you ride in an automobile?
5. Do cats bark?
6. Can you swim in the sky?
7. Do you bake food in an oven?
8. Do you use a spoon to write?
9. Do you have a birthday?
10. Can birds fly?

APPENDIX G

PROCEDURE FOR ADMINISTRATION OF THE DRAWING ABILITY TEST

Instructions

"I would like you to copy these three drawings. This is not a test of your artistic abilities. This is a way of evaluating your vision to see if your stroke has caused any problems with your eyesight, that may be interferring with your rehabilitation program. Try to copy the pictures as exactly as possible. Take as much time as you need."

Procedure

1. Position the patient comfortably at a table or desk.
2. Provide a blank sheet of paper and a sharpened pencil.
3. Give instructions to the patient.
4. Present the pictures one at a time, the house first, the clock second, and the flower third.
5. After each picture, when the patient appears to have finished that drawing, ask the patient if he has finished.
6. Remove the picture.
7. Present the next picture.

APPENDIX H

FORM USED TO RECORD SUBJECT PERFORMANCE
IN UPPER EXTREMITY DRESSING

Subject's name _____ Hospital number _____

Therapist_____ Date _____

1. Puts T shirt on (pullover garment)- - - - - - _____

2. Takes T shirt off (pullover garment)- - - - - _____

3. Puts shirt on - - - - - - - - - - - - - - - - - _____

4. Buttons shirt, except for top button and
   button on the affected extremity sleeve - - - _____

5. Takes shirt off - - - - - - - - - - - - - - - - _____

   Composite score - - - - - - - - - - - - - - - - _____

APPENDIX I

PROCEDURE FOR ADMINISTRATION AND CRITERIA FOR SCORING OF THE UPPER EXTREMITY DRESSING EVALUATION

Instructions

"I would like to see if you are able to dress yourself. Please put on and take off this T shirt (pullover garment). Please put on and button this shirt; then take it off. Take as much time as you need."

Procedure

1. Position the patient comfortably at a table or desk.
2. Give instructions to the patient.
3. Hand the patient the folded T shirt.
4. Evaluate and record the patient's performance.
5. Hand the patient the folded, unbuttoned shirt.
6. Evaluate and record the patient's performance.

Scoring***

5. The patient is able to and does perform the activity.
4. The patient is able to and does perform the activity, but requires the assistance of an assistive device and is able to and does apply the device himself.
3. The patient performs the activity, but someone must be in the room with him, for encouragement, safety, supervision, or to provide verbal direction. Verbal direction

APPENDIX I

(Continued)

is provided after a three minute period without success. There is no physical contact between the patient and the person with him. Assistance is offered after three minutes.

2. The patient performs part of the activity, but someone must be with him to assist with the activity. Physical assistance is provided after a three minute period following verbal direction. There is physical contact between the patient and the assistant, but no lifting is involved. Example: straightening the garment. Assistance is offered after three minutes.

1. Similar to "2" but the assistance requires lifting part or all of the patient. For example, lifting the patient's arm to allow access to the sleeve of the shirt.

0. The patient does not perform any part of the activity. It is done for him by someone else.

***Source: Modified version of Donaldson, S.W.; Wagner, A. B.; and Gresham, G. E. "A Unified Activities of Daily Living Form". Archives of Physical Medicine & Rehabilitation 54 (1973): 175-179.

APPENDIX J

HUBBELL PROCEDURE FOR ADMINISTRATION
AND SCORING OF THE DRAWING
ABILITIES TEST

Instructions

"I would like you to copy these three drawings. This is not a test of your artistic abilities. This is a way of evaluating your vision to see if your stroke has caused any problems with your eyesight that may be interferring with your rehabilitation program. Try to copy the pictures as exactly as you are able. Take as much time as you need."

Procedure

1. Position the patient comfortably at a table or desk.
2. Provide a blank sheet of paper and a sharpened pencil.
3. Give instructions to the patient.
4. Present the pictures one at a time, the house first, the clock second, and the flower third.
5. After each picture, when the patient appears to have finished the drawing, ask the patient if he is finished.
6. Remove the picture.
7. Present the next picture.

Scoring

Qualitative and Quantitative Features	Criteria
20 pts. - recognizable copy	Picture can be identified

APPENDIX J

(Continued)

Qualitative and Quantitative Features	Criteria
	without the use of the stimulus card.
0 pts. - unrecognizable copy	Picture cannot be identified without the use of a stimulus card.
-1 pt. - scrawling	Tendency to limit graphic task to scrawling.
-1 pt. - perseveration	Tendency to overscore lines already drawn, or reproduce part of the design already drawn, addition of lines not part of the design, additional parts of the design, e.g., windows, numbers, petals, etc.
-1 pt. - irrelevant graphic material	Tendency to add irrelevant drawings or script, e.g., sidewalk, grass, signature, etc.
-1 pt. - unilateral spatial neglect	Neglect for or failure to

APPENDIX J

(Continued)

Qualitative and Quantitative Features	Criteria
	close the left/right side of the house, roof, windows, or door; or Failure to include numbers on the right/left side of the clock, failure to close circle on the right/left side of the clock; or Failure to draw three petals on the right/left side of the flower, failure to draw leaf on the right/left side of the flower.
-1 pt. - oversimplification	Omission of whole parts of the design, e.g., petal, number, window, door, door-knob, chimney, smoke. (Do not subtract if there has been a previous subtraction

APPENDIX J

(Continued)

Qualitative and Quantitative Features	Criteria
	for unilateral spatial neglect for the same item.)
-1 pt. - increased number of right angles	Failure to draw acute/obtuse angles on roof or leaves.
-1 pt. - increased number of acute/obtuse angles	Failure to draw right angles in house, windows, door, chimney, hands of clock, or base of flower.
-1 pt. - difficulty in drawing angles	Tendency to reproduce angles as simple curved lines, house corners, windows, chimney, door.
-1 pt. - difficulty in drawing curved lines	Tendency to make angular configurations in flower petals, clock, smoke, or doorknob.

APPENDIX J

(Continued)

Qualitative and Quantitative Features	Criteria
-1 pt. - orientation of drawing	Tendency to orient drawing diagonally on the paper, inappropriate diagonal lines.
-1 pt. - drawing not symetrical	Noticeable difference in size of the parts of the design which should be symetrical. E.g., petals, leaves, windows, numbers. Increased difficulty spacing parts on right/left side of house, flower, or clock.
-1 pt. - alterations in spatial relations	Individual parts of the design overlap, the details are outside of the structure, e.g., windows overlap roof or side of house, flower petals overlap.
-1 pt. - unjoined lines	More than one-eighth of an inch.

APPENDIX J

(Continued)

Qualitative and Quantitative Features	Criteria
-1 pt. - crossing lines	More than one-eighth of an inch.

LIST OF REFERENCES

1. Dyken, M.; Fang, H.; and McDowell, H. "Epidemiology for Stroke Facilities Planning". Stroke 3 (1972): 362.

2. Marmo, Nikki. "A New Look at the Brain Damaged Adult". American Journal of Occupational Therapy 14 (1960): 75-79.

3. MacDonald, J. "An Investigation of Body Scheme in Adults with Cerebral Vascular Accidents". American Journal of Occupational Therapy 28 (1974): 202-206.

4. St. Anthony Center Occupational Therapy Staff. St. Anthony Center, Houston, Texas. Interview, March 1978.

5. Ayres, Jean. Sensory Integration and Learning Disorders. Los Angeles: Western Psychological Services, 1972.

6. Cancro, Ralph, and Lorenze, Edward J. "Dysfunction in Visual Perception with Hemiplegia: Its Relation to Activities of Daily Living". Archives of Physical Medicine and Rehabilitation 43 (1962): 514-517.

7. Lehmann, J. F.; DeLateur, B. J.; Fowler, R. S.; Warren, C. G.; Arnhold, R.; Schertzer, G.; Hurka, R.; Whitmore, J. J.; Masock, A. J.; and Chambers, K. H. "Stroke Rehabilitation: Outcome and Prediction". Archives of Physical Medicine and Rehabilitation 54 (1973): 175-179.

8. Feigenson, Joel; McDowell, Fletcher H.; Meese, Philip; McCarthy, Mary L.; and Greenberg, Susan G. "Factors Influencing Outcome and Length of Stay in a Stroke Rehabilitation Unit". Stroke, part I, 8 (1977): 651-656.

9. Feigenson, Joel; McDowell, Fletcher H.; Meese, Philip; McCarthy, Mary L.; and Greenberg, Susan G. "Factors Influencing Outcome and Length of Stay in a Stroke Rehabilitation Unit". Stroke, part II, 8 (1977): 657-662.

10. Williams, Nancy. "Correlation between Copying Ability and Dressing Activities in Hemiplegia". American Journal of Occupational Therapy 46 (1967): 1332-1340.

11. Boynton, H. "Approaches to Independent Living". Study Course IV, Third International Congress World Federation of Occupational Therapists 4 (1962): 65.

12. Benton, Arthur L., and Fogel, Max L. "Three-Dimensional Constructional Praxis". Archives of Neurology 7 (1962: 347-354.

13. Warrington, Elizabeth K.; James, Merle; and Kinsbourne, M. "Drawing Disability in Relation to Laterality of Cerebral Lesion". Brain 89 (1966): 53-82.

14. Eisenson, J. Examining for Aphasia. New York: The Psychological Corporation, 1954, p. 23.

15. Merck Manual Rahway, N. J.: Merck Sharp and Dohme Research Laboratories, 1961.

16. Bach, Philip; Huston, Janet; and Tracy, H. W. "The Use of the Self-Portrait Method in the Evaluation of Hemiplegic Patients". Southern Medical Journal 64 (1971): 1475-1480.

17. Bourestom, Norman C. "Predictors of Long-Term Recovery in Cerebrovascular Disease". Archives of Physical Medicine and Rehabilitation 48 (1967): 415-419.

18. Braun, R.; Caldwell, C.; and Wilson, C. "Evaluation and Treatment of the Upper Extremity in the Hemiplegic Stroke Patient". Clinical Orthopeadics 63 (1969): 69-93.

19. Gersten, Jerome; Jung, Arlene; and Brooks, Carole. "Perceptual Deficits in Patients with Left and Right Hemiparesis". American Journal of Physical Medicine 51 (1972): 79-85.

20. Shafer, Stephen; Bruun, Bertel; Brown, Roy; and Richter, Ralph. "Stroke: Early Portents of Functional Recovery in Black Patients". Archives of Physical Medicine and Rehabilitation 55 (1974): 264-268.

21. Granger, Carl; Greer, David; Liset, Elizabeth; Coulombe, Joan; and O'Brien, Elizabeth. "Measurement of Outcomes of Care for Stroke Patients". Stroke 6 (1975): 34-41.

22. American Occupational Therapy Association. Watch Me Grow. Rockville, Maryland: AOTA Foundation, 1977.

23. Piercy, Malcolm; Hecaen, H.; and DeAjuriaguerra, J. "Constructional Apraxia Associated with Unilateral Cerebral Lesions - Left and Right Sided Cases Compared". Brain 83 (1960): 225-242.

24. Piercy, Malcolm, and Smyth, V. O. "Right Hemisphere Dominance for Certain Non-Verbal Intellectual Skills". Brain 85.(1962): 775-790.

25. Patterson, Andrew, and Zangwill, O. L. "Disorders of Visual Space Perception of the Right Cerebral Hemisphere". Brain 67 (1944): 331-357.

26. Joint Committee for Strokes. "Epidemiology for Stroke Facilities Planning". Stroke 3 (1972): 362.

27. Arrigoni, Giacomina, and De Renzi, Ennio. "Constructional Apraxia and Hemispheric Locus of Lesion". Cortex 1 (1964): 170-197.

28. Wechsler, D. The Measurement of Adult Intelligence. 3rd ed. Baltimore: Williams and Williams Co., 1944.

29. Cohen, J. "Factor-Analytically Based Rationale for Wechsler Adult Intelligence Scale". Journal of Consulting Psychology 21 (1957): 451-457.

30. Critchley, M. The Parietal Lobes. London: Hafner Press, 1953.

31. Gainotti, Guido, and Tiacci, Camillo. "Patterns of Drawing Disability in Right and Left Hemispheric Patients". Neuropsychologia 8 (1970): 379-384.

32. Assal, G., and Hecean, H. "A Comparison of Constructive Deficits Following Right and Left Hemispheric Lesions". Neuropsychologia 8 (1970): 289-303.

33. McFie, J., and Zangwill, O. L. "Visual-Constructive Disabilities Associated with Lesions of the Left Cerebral Hemisphere". Brain 83 (1960): 243-260.

34. Illinois Test of Psycholinguistic Abilities. Urbana, Illinois, 1968.

35. Donaldson, W.; Greshm, G.; and Wagner, C. "A Unified Activities of Daily Living Evaluation Form". Archives of Physical Medicine and Rehabilitation 54 (1973): 175-179.

36. Reznikoff, M., and Tomblem, D. "The Use of Human Figure Drawings in the Diagnosis of Organic Pathology". Journal of Consulting Psychology 20 (1965): 467-470.

BIBLIOGRAPHY

Barton, M., and Butters, N. "Effect of Parietal Lobe Damage on the Performance of Reversible Operations in Space". Neuropsychologia 8 (1970): 205-214.

Bertrand, C.; Hacean, H.; and Penfield, W. "Syndrome of Apractognosia due to Lesions of the Minor Cerebral Hemisphere". Archives of Neurology and Psychiatry 75 (1956): 400-434.

Brain, R. "Visual Disorientation with Special Reference to Lesions of the Right Cerebral Hemisphere". Brain 64 (1941): 244-272, 265-266.

Cancro, R.; Lorenze, E.; and Sokoloff, M. "Psychologic Studies in Geriatric Hemiplegia". American Geriatrics Society Journal 9 (1961): 39-47.

Cermak, S., and Henderson, A. "Problems of Perceptual Deficits in Occupational Therapy". Class Notes and Handouts, O.T. 712, Boston University, 1973.

Freishat, B., Siev, E. Perceptual Dysfunction in the Adult Stroke Patient. Thorofare, N. J.: Charles B. Slack, Inc., 1976.

McFie, J.; Piercy, M.; and Zangwill, O. "Visual Spatial Agnosia Associated with Lesions of the Right Cerebral Hemisphere". Brain 73 (1950): 167-190.

Shao, S. Statistics for Business and Economics. 2nd ed. Columbus, Ohio: Charles E. Merrill Publishing Co., 1972.

Hamburg, M. Statistical Analysis for Decision Making. New York: Harcourt, Brace & World, Inc., 1970.

Bonini, C., and Spurr, W. Statistical Analysis for Business Decisions. Homewood, Illinois: Richard D. Irwin, Inc., 1969.