THE EFFECT OF WORD FREQUENCY ON VERBAL PERSEVERATION IN DYSPHASIA

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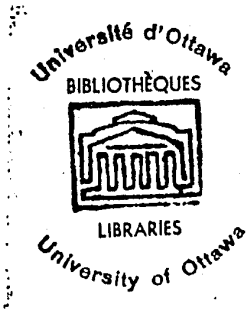

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CURRICULUM STUDIORUM

Donna Jean Blakeley was born in Saskatoon, Saskatchewan on May 10, 1950. She received the Bachelor of Arts degree in Psychology from the University of Calgary in 1971.

ABSTRACT OF: The Effect of Word Frequency on Verbal Perseveration in Dysphasia.

Eight dysphasics read two 29 word lists. Both lists consisted of long nouns of high: concreteness, imagery, and meaningfulness. Words on one list were all of a high frequency (100 or more occurrences per million). Words on the other list occurred only from one to ten times per million on the Thorndike-Lorge word frequency list. Rates of verbal perseveration, number of correct responses and response latencies were examined on the two lists. The only significant difference was found on the number of correct responses. Subjects made more errors on the low frequency list. This conforms with prior results noted in the literature. The lack of significant difference for response latencies was contrary to prior findings. These results may have been due to a higher number of "no responses" on the low frequency list, and the quickness with which misperceptions of words were given. Only two subjects perseverated at all on either list. The low abstraction of the words and the lack of switching from one level of word difficulty to another were possible explanations for the results. Subjects were given the Boston Diagnostic Aphasia Examination and the Wide Range Achievement Test - Reading. The occurrence of perseveration on these tests was examined and classified. Two broad types of perseveration were noted (as well as 15 sub-categories). One type was of an intrusive nature whereby past responses interfered

with or impinged on new responses, whether they be verbal or motor. The other was a form of modified responding which served an adaptive purpose. Correlations were calculated on the number of perseverative errors made on seven sub-tests of the Boston and the Wide Range Achievement Test - Reading. Significant positive correlations were found between three tests involving naming tasks. This was probably due to their similarity in nature. A significant negative correlation existed between the Wide Range Achievement Test - Reading and one of the naming tests. Perseveration tests have usually been found to have low positive correlations, sometimes reaching significance.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

In broad terms, the purpose of this study is to gain an understanding of the phenomena of perseveration as demonstrated in dysphasia. Perseveration is an unintentional, and inappropriate repetition, be it verbal, motor, sensory or ideational of a word, act, sensation or thought. Dysphasia is an impairment of language functions, be it expressive or receptive, which results from neurological trauma, disease, or degeneration.

Two approaches to the study of perseveration were undertaken in this study. The first was precise in nature and was limited to the examination of the effect of word frequency on verbal perseveration in dysphasia. Word frequency is the commonality or rarity with which a word is used in a language. Verbal perseveration is the inappropriate repetition of a word when the stimulus which elicited the response is no longer present and a new stimulus requiring a new response has been presented. Word frequency was chosen for study because it can be varied systematically and it has been found to be an important variable in language functioning in normals. Verbal perseveration was examined on an oral reading test because such a task allows both a quantitative and a qualitative analysis of results.

The second approach was more general in nature and involved a content analysis of perseveration of any type which could be detected on a broad range of tasks. It involved the grouping of instances of perseveration into common classes

and an examination of possible functions the perseverations might have served.

Chapter I of this thesis will consist of a review of the literature on perseveration. Section 1 of this chapter will present a brief history of the development of the concept of perseveration, and Section 2 will examine the breadth of its occurrence in different populations sampled in previous studies. Physiological and neurological pathology associated with perseveration will be the subject of Section 3, while Section 4 will demonstrate the relationship between brain pathology in animals and perseveration, as well as illustrating the fact that perseveration is observed through common psychological phenomena such as the learning of new tasks. The development of the concept of perseveration as observed in pathological states in humans eventually lead to the postulation of the concept of perseveration as an individual difference in normals. Differences between people in verbal, ideational, motoric and sensory functions which could be assumed to result from differences at a more basic physiological level (eg. neural, muscular) were thought to be basic in nature and to have a quantifiable effect on performance. Two schools of thought, one agreeing with the concept that perseveration was an individual difference that would prove to be as important as intelligence and one that

diverged from this view will be presented in Section 5. Section 6 serves to illustrate the fact that although perseveration is associated with abnormal physiological conditions, the importance of psychological variables in its elicitation should not be overlooked. The results of studies on the effect of word frequency on the language performance of both dysphasics and normals will be presented in Sections 7 and 8, respectively. In Section 9, some overall conclusions from the survey of the literature are drawn.

Chapters II, III, and IV will present the experimental problem, hypotheses and design. The results of the study are presented and discussed in the next two chapters, and conclusions are drawn. The final chapter is concerned with specific areas in which further research would be useful, as suggested from the results of the present study.

CHAPTER I

REVIEW OF THE LITERATURE

1. Terminology

The concept of perseveration was first developed as a result of the observation of this phenomena in cases of psychological and neurological abnormality. Hence, it was originally viewed as being pathological in nature. This section presents some of the terminology generated to label various forms of the phenomena, in its verbal, motor, and ideational expressions. It consists of a brief history of the development of the concept of perseveration much of which has been reviewed by Hudson (1968).

In 1879, Hughlings Jackson noticed patients repeating words and phrases in their speech in an inapropriate manner and he used the term "barrel organism" to describe this phenomena. Pick, in 1892, adopted the term "pseudo-apraxia" to describe a phenomena similar to apraxia in which the patient acted in a repetitious manner while naming and using objects. Neisser, in 1894, was the first to use the term "perseveration" to describe these kinds of phenomena collectively. Later, in 1905, Liepman differentiated three kinds of perseveration: "intentional, clonic, and tonic." An example of intentional perseveration would be if a person wanting to

perform a new act instead repeated an old one. If he kept on repeating an act once it was initiated, then the term clonic perseveration would apply. An example of this would be if a person were asked to draw a circle and instead of drawing one, drew many. An example of tonic perseveration cited by Hudson is a person grasping an object and then not being able to relax his hand. Wilson and Walshe, in 1914, stated that since both intentional and clonic perseveration involved the persistance of an activity, they should both be subsumed under the term "active perseveration." Since they viewed perseveration as being properly limited to psychical phenomena, they excluded tonic perseveration as a form of perseveration, and preferred to call it "tonic innervation" in order to indicate that it was actually a motor disturbance. Wilson and Walshe developed the term "passive perseveration" to indicate a phenomena recorded by Pick in 1905. He had noticed that after the completion of an act, some patients stayed in a "fixed attitude" for a long while.

Verbal perseveration falls under the category of intentional perseveration, in that an old response is given when a new response is required. Hudson summarizes some of the different views on the nature of intentional perseveration. For example, Wilson and Walshe, in 1908, stated that intentional perseveration occurred because the person got so absorbed in one idea that other ideas failed his attention.

Pick, in 1903, thought it occurred when a first idea passively dominated because of a lessened intensity of later ideas. In 1899, Von Solder pointed to an active, rather than a passive "preponderance" of the first idea. In 1905, Liepman stated that there was a blockage in the "sensory preparation of movement" so that a new stimulus lead to the old idea again. Luria, in 1965, stated that it involved disrupted motor function and that it resulted from an impaired "programme of action."

Whether perseveration is expressed motorically or verbally, it reflects a neural recircuiting process. This is turn reflects a faulty inhibatory function. In normal processes, inhibition of one act may come about by the opening of a new circuit. In ideation, this can be actively controlled. A person can decide to "go on" to a new thought or to think the old one again. On a motoric level, one can decide whether or not to repeat an act. When there is no longer the ability to will the repetition or inhibition of an act, then there is obviously a fault present in the controlling function.

The next section will deal with some cases of neurological and psychological abnormality other than dysphasia in which perseveration has been noted to occur.

2. Occurrence of Perseveration in Conditions Other Than Dysphasia

Perseveration has come to be viewed as a symptom of brain damage (Halpern, 1965; Chess, 1972; Allison and Hurwitz, 1967). This section will establish that it has been associated with abnormal psychological states and improper language functioning as well as with brain damage.

In a post-hoc clinical study which lacked experimental controls and was probably not free from experimenter bias,Chess (1972), a child psychiatrist, selected 88 neurologically damaged children out of 1400 cases and compared then to 88 children without brain damage matched by age, sex and year of initial referral. All cases were selected from a pool of children referred to her child psychiatry practice over a period of 19 years. She compared the children on kind and frequency of complaints that had lead to referral. She examined six factors thought to be connected with brain damage : hyperactivity,short attention span, distractibility, mood oscillation, high impulsivity, and perseveration. Of theses factors, only perseveration was statistically significant as a measure which could separate the brain damaged from the non-brain damaged children. Examples of the sort of behaviors considered

as perseverative are :

1. repeats the same things over and over again.
2. repetitive questions.
3. keeps a paper with the date on it always (p.305).

None of these would necessarily be indicative of perseveration. Depending on the circumstances of occurrence, the first example could be stereotypic behavior, such as when a child repeats an act it has just mastered over and over again. The second could be the result of the child not attending to the answers given, and thus re-asking questions. The third could be an example of obsessive behavior. Of the three examples, the first would most likely be a true measure of perseveration. The difference between perseveration and stereotypic behavior is that the latter represents a severly restricted behavioral repetoire which leads to the repetition of behaviors because of the paucity of available responses.

In an earlier study which used a limited population sample but in which extensive testing was carried out, Ewen (1930) found evidence of perseveration in "insane" epileptics. He studied ten normals and twenty epileptics. The epileptics

were all characterized by the occurrence of grand mal seizures and were certifiably psychotic. Ewen gave Ss six tests of perseveration: sensory (rotating color discs), motor (writing reversed strokes), and ideational (naming different animals and an inkblot test). He found that the epileptics perseverated more than the normals on all tests.

The factor of sub-normal intelligence has been found to bear a relationship to perseveration. Collins (1948) studied the relationship between perseveration and intelligence. In his study, 23 girls and 23 boys were divided into three groups by Binet IQ : (below average, average, and above average) and were administered four perseveration tests. A negative correlation was found between IQ and perseveration scores. Consequently, Collins concluded that perseveration tests should not be used as measures of personality traits such as " character integration " since the individuals' results will be biased by their level of intelligence.

Strauss and Werner (1942) found that the type of perseveration present in their Ss could be used to differentiate between children who were retarded because of brain injury (exogenous retardation) and those in whom there was no brain injury (endogenous retardation). The exogenous children tended to "repetitive" and "delayed" perseveration. They also perseverated more than did the endogenous children. An example of repetitive perseveration would be if the child was shown a series of pictures of different objects and asked to name each one. If picture #2 was a boat and the child said "boat," then when presented with pictures #3 and 4 also said "boat," this would be repetitive perseveration. Delayed perseveration would be if the repetition of "boat" occurred two or more pictures after the initial presentation of the picture of the boat.

A phenomena considered to be related to perseveration that can less clearly be related to brain functioning than mental retardation is stuttering. Of three studies of the relationship between stuttering and perseveration, two support the hypothesis that stuttering is a kind of perseveration, one does not. Eisenson (1937) conducted a study of 30 stutterers and 30 non-stutterers; all male and matched for chronological age, mental age, and school environment.

All Ss were between the ages of ten and sixteen. Subjects took 15 perseveration tests of a motor (eg. writing letters, drawing horizontal and vertical lines) and a mental kind (eg. addition and multiplication). All were of an "X-Y-XY" type in which first one task was performed, then a variation of that task requiring a new response, and finally the two tasks were performed in a randomly mixed order. Perseveration was considered to cause the completion of fewer items in the new task and consisted of giving an old response to the new task. Eisenson found that the stutterers perseverated more than the non-stutterers and made more mistakes. The non-stutterers finished more test items.

An explanation for these results would be found in the neural excitation hypothesis, that is, in perseverators, neurons tend to stay excited once stimulated rather than "disengaging." In speech, this leads to the retention of the old verbal response rather than the initiation of the next sound.

Eisenson and Winslow (1938) later conducted an experiment with older subjects. They studied male college students, of which 15 were stutterers, and 20 were not. The measure of perseveration was a perceptual one. Cards with different colored squares on them were briefly presented on a tachistoscope. The subject was to say how many different colors he saw and write down as many of them as he could. Perseveration

was considered to have occurred if S wrote down the names of colors that had actually been presented on previous cards. Results indicated that stutterers made more perseverative errors than non-stutterers. This was interpreted as the stutterers having a tendency to react to stimuli when the stimuli were no longer present.

Much later (1962), Martin studied motor perseveration in 52 stutterers who had no physical handicaps and 109 non-stutterers. Subjects were again young; age range being from 8 to 13. Four tests of motor perseveration were given. Subjects were divided into three groups by age and results were compared. Martin found no significant differences on the variable: stutterers - non-stutterers or any effects due to age or sex. The results were considered to conflict with Eisenson's theory that 50-60% of all stutterers belong to an organic group who stutter because of perseverative tendencies. The remainder stutter because of psychogenic reasons. Martin eliminated subjects who had central nervous system or motor defects. It is not clear if this would eliminate any Ss who would have belonged under Eisenson's category of "motor" stutterers.

The types of perseveration tests used in these studies were different. It has been noted by Shevach (1937) that an individual who could be considered a perseverator may perseverate highly on some tests and not at all on others. One

would not necessarily expect stutterers to perseverate in all sorts of different perseveration tests.

Perseveration has been related to abnormal psychological conditions, such as schizophrenia, that could be said to have corresponding abnormal physiological characteristics. Working with 20 schizophrenics and dementias, Freeman and Gathercole (1966), using 16 perseveration tests, found three main kinds of perseveration: 1.compulsive repetition 2.impairment of switching, and, 3.ideational perseveration. None of these three formed what could be called a unitary trait. Freeman and Gathercole point out that perseveration would seem to be test-specific. One should not generalize from the results of one test to another kind of perseveration. This is an important point to remember, for perseveration is measured by divergent tests in all sorts of populations, be they normal, dysphasic or psychiatric. Freeman and Gathercole also observed that when perseveration occurs "constantly and extensively" it can in itself be a primary indicator of schizophrenia, rather than just a secondary symptom.

Stephenson (1932) provided further evidence that the presence of perseveration indicated poorer psychological state in a psychiatric population. Stephenson tested, and then re-tested hospitalized patients and found that at retest if their psychological state was much the same then

test-re-test correlations were high: -.86. However, if that state had changed, and for the worse, perseveration scores tended to be higher. If the person's condition had changed for the better, re-test scores were lower.

If perseveration was related to an abnormal neuro-psychological state, then one might expect it to be affected by chemicals causing physiological changes in the body. Levita (1961) investigated this factor but failed to reach any conclusive results. He performed a study to find out whether the tranquilizers chloropromazine and promazine would have any effect on perseveration in 34 schizophrenic outpatients. He used motoric measures of perseveration on three groups of subjects, one of which received doses of chlorpromazine, one of promazine, and one a placebo. A double blend procedure was utilized over a three month treatment period. Levita found no change in perseveration due to the drugs and concluded that the dosages (50-400 mg. per day) may have been too small to elicit an effect. Unless tranquilization were to improve inhibitory functions, perseveration would not be affected.

Just as extreme perseveration is indicative of poor psychological functioning, so is extreme non-perseveration. Pinard (1932a) gave four perseveration tests to patients at the Maudsley Hospital. He had two staff members rate each

patient on a list of 17 psychopathic characteristics. He found that patients who were extreme perseverators (on the four tests) tended to be rated as: "melancholic, suspicious, and paranoid," while the extreme non-perseverators were characterized by: "hysteria and mania." 236 patients who were leaving the hospital were given the perseveration tests. Pinard found that both extreme perseverators and extreme non-perseverators tended to: "lack self control and perseverance," and to be "unreliable, obstinate, touchy, and difficult" Pinard notes that the results of his study should be interpreted cautiously. Some criticisms would be that the views of the staff could easily have biased the results. The staff's rating would not necessarily be accurate. In another study of the same type with 116 patients, Pinard (1932b) also found extreme perseverators and extreme non-perseverators to be difficult and unreliable.

Studies on brain damaged and mentally retarded children and epileptics illustrate that perseveration may be viewed as symptomatic of brain pathology. The study on exogenous and endogenously retarded children shows that qualitative differences in perseveration occur with different types of mental dysfunction. Perseveration may result from brain damage in that a certain necessary process, such as inhibition, is not possible, or because damage limits intellectual processes in such a way that gross over-simplification of ideation results and similar responses are given to different stimuli.

3. Neurological and Physiological Correlates

Attempts have been made to associate damage to certain areas of the brain with perseveration in humans. Some areas of the brain thought to be important in perseveration are: the temporal lobes, the premotor area, the subcortical nucleii, an area extending from the premotor area to the frontal lobes, and the frontal lobes in particular.

Over the years, different etiologies of perseveration, including the neurological, have been proposed. Pick (1973) pointed out that perseveration occurs mostly with lesions of the left temporal lobe. However, he notes that it can occur in association with lesions of the right hemisphere even in right-handed people. Luria (1970) described perseveration of motor patterns and the difficulty of shifting from one pattern to another in patients with lesions of the premotor area of the brain especially when the damage is in the dominant hemisphere. He stated that motor perseveration is particularly strong if the lesion is anterior to the premotor area and extends into the underlying white matter. He also noticed this effect in conjunction with lesions of the subcortical nucleii or the fibres connecting the nucleii to the premotor area. He stated that perseveration is also often induced as a result of postoperative edema or hemorrhage.

A possible reason for the linking of motor perseveration with damage to the premotor area may be found in Luria's explanation of the function of this area:

> In view of current neurological principles we may look upon the premotor area as an important component of the cortical motor analyzer; it plays a special role in the smooth execution of complex serial movements. According to all available evidence the function of this area consists of the transformation of individual impulses arising in other afferent cortical areas into complex dynamic patterns, each component of which is easily denervated once it is completed thus making way for the succeeding component. Only thus is it possible to generate patterned unitary movements. (p. 172).

Luria pointed out that the individual units of a complex act are part of a "unitary series" and are stimulated by one impulse rather than many. Each unit is denervated as the next one starts. When this coordinating function of the premotor area is disrupted by lesions, then this does not occur and perseveration of motor acts results. Perseveration of words will occur when the lesion extends from the premotor area through to the subcortical structures. Luria stated that if the lesion is restricted to the premotor cortical area, repetition of either the first or last syllable of a given word before the next word is said is more likely to occur. In addition, if the lesion extends from the premotor area to the frontal cortex, there may be perseveration of whole sentences as well as of individual words. In effect, Luria is saying that damage to different structures generally produces perseveration of specific kinds which may be differentiated from each other.

It is possible for an individual to be aware of the fact that he is perseverating, but not be able to stop it. This fact may be illustrated in the case, cited by Brickner (1940), of an epileptic woman who suffered from both grand and petit mal seizures. During surgical operation, an electrical exploration of the Penfield type was carried out on her brain. The stimulation of a specific section of "area six" produced verbal perseveration. The woman was requested to say the alphabet. Whenever the electrical stimulation was turned on, she kept repeating whichever letter she had been saying at that moment. The surgeons noticed some distortion of the sounds and that she was speaking more slowly than usual. After the operation, the patient reported that while she had been aware of the repetitions she was making, she had been unable to control them.

Allison and Hurwitz (1967) studied 24 dysphasics. Perseveration was viewed as being involuntary in nature and related to intentional psychomotor and some habitual activities. They cite MacNalty's definition of perseveration, which is: "the continuation or recurrence of an experience or activity without the appropriate exciting stimulus" (p.429). Perseveration was examined on ten different types of tests ranging from motor to verbal to creative tasks. Of the 24 patients, 16 perseverated on at least some of the tests and 11 perseverated only on the linguistic tasks. None perseverated

on all tasks. Many of those that did perseverate (13 out of the 16) had little or no spontaneous speech. Autopsies were later performed on nine of the subjects and of these, only three had lesions of the left temporal lobe. Of the eight subjects who had tumors, two were perseverators while of the sixteen subjects who had suffered from C.V.A's, fourteen were perseverators. Significantly, it should be noted that Allison and Hurwitz proposed that the kind of lesions most likely to produce perseveration in the context of dysphasia would be those involving not only the speech cortex, but also either the upper brain stem or the connections between the limbic system and the speech cortex.

GSR Habituation

If perseveration involves reacting to a stimulus for an abnormally long period of time after it has been removed, then this should be reflected in slower GSR habituation rates. Mays (1934) compared GSR habituation in 16 normals with that of 20 male catatonic dementia praecox hospital patients. The stimuli used to elicit the GSR responses were patterns of bells and buzzers, some of which were followed by the presentation of an obnoxious stimuli (a car horn blowing very loudly). There were two testing sessions. A lack of GSR habituation was considered to be perseveration. The catatonics perseverated twice as much as the normal group. Their initial responses

to the car horn were smaller than those of the normals but the level of intensity of the response remained the same over the session and from one session to the next. Unfortunately, no statistical analysis was made on the data because of the small number of measures made in the study.

Shipley (1934) found schizophrenics perseverated more than: normals, psychoneurotics, and manic depressives: A combination of four measures was used in this study. They were:

1. resistance to adaptation (a lack of response decrement with repeated stimulation)
2. conditionability (attachment of the response to extraneous stimuli repeatedly presented with the adequate one)
3. a lack of experimental extinction (a lack of decrement of a conditioned response with repeated unreinforced stimulation)
4. irradiation (carrying over of the response to other extraneous stimuli) (p. 736-744)

Whether these criteria measure perseveration is a moot point. The first is a measure of habituation and the second is indicative of a learning process. The third involves learning and habituation, while the fourth relates to overgeneralization. The link between these phenomena and perseveration is a theoretical one. Given that perseveration is the repetitious responding to a stimulus which is no longer present, a continuation of any particular inappropriate response on any of the four measures would be an expected manifestation of perseveration caused by a dysfunction at a neurological and physiological level.

Further tentative evidence of the relationship of perseveration to physiological and psychological states may be found in Angyal's (1949) work. He presented combinations of letters tachistoscopically to normals, schizophrenics and psychoneurotics and had them record the letters they could recall seeing. Out of 112 patients tested, seven perseverated. Perseveration was the reporting of letters not actually presented at the time, but in actual fact, earlier in the series. All of these seven subjects had psychomotor symptoms such as convulsions, tics and speech disorders. The author stated that the sample size was too small to justify firm conclusions about the correlation between perseveration as a psychomotor condition and the other psychomotor symptoms. To check this, it would have been necessary to pick out every member of the S pool that had convulsions, tics, or speech disorders and determine whether they perseverated more than the other Ss.

The studies presented in this section have related perseveration to different areas of the brain. The three studies quoted at the end of the section attempted to relate the concept of perseveration to physiological processes reflected in the GSR and to the phenomena of habituation, generalization, and extinction. From these studies it would appear that there is some very tentative evidence for the existence of a unitary phenomena, which collectively would be indicated by a lack of

habituation to a stimulus once presented; a tendency to over-generalize a stimulus to a variety of responses once it is absorbed; and, a failure to extinguish S-R connections once established.

4. Ablation Studies in Animals

Studies and observation of case histories have shown that perseveration may be associated with different areas of the human brain. The questions which arise from this are whether damage to particular areas of the brain would consistently produce perseveration and whether different areas of the brain produce qualitatively different kinds of perseveration. As a result of the difficulty in predicting through tests specifically which areas of a person's brain are damaged, ablation studies on animals are of particular importance here. Studies of this nature will be dealt with in this section.

The temporal and frontal lobes and the premotor area have been associated with perseveration in humans. The importance of the involvement of the connections between the limbic system and speech areas has been pointed out. Ablation studies of perseveration in animals have examined many different areas of the brain, but have tended to concentrate on the limbic system and the frontal lobes. The results of some of these experiments, broken down by the area of the brain studied, will be presented here.

Prefrontal

Settlage, Butler and Odoi (1956) noted perseverative tendencies in monkeys in whom the prefrontal areas of the brain had been removed bilaterally. Four monkeys overlearned an object-quality discrimination task and four overlearned a position discrimination task. Pre-frontal lobectomies were then performed on two monkeys from each group. After 50 days S's were tested in task reversal situations. For example, S's that previously had learned to do a position discrimination task had to learn to inhibit this response and learn to make an object-quality discrimination in order to get a food reward. The pre-frontal monkeys did less well than the non-operated group and had difficulty replacing the old response pattern with a new one. This is similar to the sort of difficulty experienced by dysphasics in a study by Leicester, Sidman, Stoddard and Mohr (1971). They found dysphasic S's to repeat previously reinforced responses even when new response contingencies were in effect.

Frontal

Perseverative tendencies have been noted in monkeys with frontal damage as well. Milner, Ettlinger, Morton and Moffett (1968) report a study by Ettlinger et al in 1966 in which monkeys with lateral frontal ablations were compared with control groups of posterior, parietal, collosal and

unoperated monkeys on a tactile performance task. Subjects were reinforced for alternating their choice of one of two foodwells. The frontal group made more long runs of the same response than did the other group and their average percentage of correct responses was lower.

Battig, Rosvold and Mishkin (1960) noted a similar disability in alternation responses in four frontal monkeys tested postoperatively on the Wisconsin General Testing Apparatus (WGTA). However, in an automatic apparatus, their performance on an alternation task was not distinguishable from a control group of four normal monkeys. The authors attribute this to the fact that on the automatic task, the inter-trial delay was increased gradually from two to ten seconds and the Ss were not screened off from the stimulus during the delay period. From this, it may be concluded that even though the ability to learn alternation behavior is decreased by damage to the frontal lobes, the disability is situation-specific and can be improved by a gradual increase of the interval between responses, and a constant contact with the stimulus.

Exposure to Nuclear Radiation

The tendency to stay with a given response rather than switching to a new response which would result in reinforcement has been noted to result from exposure to nuclear radiation as well as the type of lesions noted in the previous

studies. McDowell and Lynn Brown (1965a) found, in a study using four control and thirteen previously radiated rhesus monkeys, that the higher the radiation dosage had been, the higher was the rate of perseveration. There were three different categories of exposure to radiation: 1) no exposure 2) middle level: 273,299,355rem and 3) highest level: 397, 439, 512 rem. The monkeys' whole bodies were exposed to the radiation. The authors do not state whether this would effect all or just specific parts of their brains. During each trial of testing, S was allowed to pick one foodwell of three varying in size, shape and color. Two measures of perseveration were used: 1) the average number of runs per day, - a run being more than one choice of the same foodwell, and 2) the average maximum run length per day, defined as the highest number of successive choices of the same well.

In another study with four control and eight whole body irradiated female monkeys exposed to different levels of radiation, McDowell and Lynn Brown (1965b) established the important role that non-reinforced responses play in a response perseveration learning task. In a discrimination learning task, Ss were better able to learn to pick the same unreinforced stimulus on a second trial than they were to learn not to pick the stimulus they hadn't picked on the first trial when it was paired on the second trial with a

novel stimulus. In both cases, the tendency lay in the direction of choosing a familiar stimulus, even if its' choice had not previously been reinforced. The results of this study are used by the authors to establish the fact that there is a factor of increased attraction to non-reinforced cues and that, by inference, in some circumstances, familiarity can play as important a role as reinforcement does.

Caudate Nucleus

The role of the caudate nucleus in perseveration has been studied in relationship to delayed alternation tasks. Damage to this area has been found to lead to inferior performances on such tasks in rats and monkeys.

Rosvold and Delgado (1956) implanted electrodes in different areas of the frontal lobes of 14 monkeys. Ss had previously been trained on a delayed alternation task. After electrocoagulation of parts of the head of the caudate nucleus, performance of the delayed alternation task was impaired. Similar results were found by Rosvold, Mishkin and Szwarcbart (1958) in a study utilizing 23 monkeys; six of which had caudate lesions and six which had lesions in the colliculus. Of the remaining Ss, six were unoperated controls and twelve were Ss in which lesions had been accidentally made in the areas around the caudate and the colliculus, and whose results were similar to the control animals. Using a WGTA, Ss were

trained on an alternation task postoperatively. Ss with lesions in the head of the caudate nucleus, the medial thalamus, and the splenium were deficient in this task. In Battig, Rosvold and Mishkin's (1960) study mentioned previously, four monkeys with lesions in the head of the caudate nucleus were impaired on the WGTA.

In a study of eight rats with bilateral lesions to 15% of the caudate nucleus, Mikulas and Isaacson (1965) noted a deficiency in the performance of delayed response tasks. In a four choice apparatus, caudate rats tended to make a dominant response and chose one door significantly more often.

Hippocampus

Perseverative tendencies have also been noted in hippocampectomized rats. Kimble, Kirkby and Stein (1966) compared nine bilaterally hippocampectomized rats (hippocampus and overlying cortex removed) with ten rats that had only cortical damage (cortex overlying hippocampus removed) on the ability to inhibit a spontaneous response and a conditioned approach response, both in a passive shock avoidance situation. They found no difference between groups for the spontaneous task but there was a difference for the conditioned task. The hippocampectomized rats were significantly poorer at inhibiting the conditioned response.

Jarrard, Isaacson and Wickelgren (1964) found that hippocampally ablated rats were slower than non-operated controls and controls with only the cortex overlying the hippocampus removed to extinguish a conditioned response. Of 36 subjects, 12 were hippocampal, 12 cortical, and 12 unoperated. Subjects were reinforced for traversing a runway.

Septal

Dalland (1970) found that while rats with hippocampal lesions (n=6) perseverated responses, those with septal lesions (n=7) perseverated stimuli in a T-maze. Control rats (n=14) alternated stimuli. Montgomery (1952) also found normal rats to alternate stimulus choices in a cross maze. In Dalland's study, Ss were tested in a T-maze with reversible arms; one painted black, one white. The arms of the maze were alternated between trials. Perseveration of a stimulus entailed alternation of body turns (ie. turning to the right rather than to the left on the second trial in a T-maze) in order to choose the same stimulus. Perseveration of a response meant repeating the same turn (ie. to the right on the second as well as the first trial) and choice of different stimuli (ie. going to the black arm on the first trial and the white arm on the second).

In a later study, Dalland (1974) found septal rats to perseverate stimuli in spontaneous alternation situations. He

further differentiated this to a perseveration of stimuli within a maze (intra-maze), eg. the color of the maze arm rather than extra-maze stimuli, eg. the position of the goal box relative to objects in the testing room. He explains this result by an increased approach response in septal rats to stimuli once they have been chosen.

Schwartzbaum, Kellicutt and Spieth (1964) found that bilateral lesions of the septal nucleii (n=6) actually increased the rates of bar pressing under non-reinforced conditions while producing a slight decrease in responding to reinforced stimuli in rats. Rats with these lesions also had longer extinction rates than control (n=5) and cingulate (n=5) Ss. In another experiment in the same study using nine controls and five rats with bilateral septal lesions, they found the septal rats to make more perseverative errors during a visual discrimination task.

La Vaque (1966) conducted a study with ten rats with bilateral septal lesions and ten controls to test the hypothesis that septal damage results in a disability to inhibit responses. He hypothesized that such damage would result in poor extinction of a conditioned avoidance response. Ss learned a conditioned avoidance response (CAR) to a 90% avoidance level, and then extinction was begun. While eight of ten controls met the extinction criterion within the first extinction session, nine of ten septals had not reached the

criterion after six sessions.

Zucker (1965) performed a series of experiments with sixteen cats with septal-limbic lesions and eight control Ss. Half of the experimental group, which were later found to have the most extensive damage to the limbic structures, were deficient on passive avoidance behavior. These Ss were also deficient on a successive-discrimination task, but not on a simultaneous-discrimination task. It was hypothesized that the septal-limbic areas depress response increment following a reinforcement. Damage to these structures results in an inappropriately strong increment in response strength following reinforcement.

In a study with 28 cats, McCleary (1961) established that lesions in different areas of the limbic system resulted in different deficiencies. Bilateral lesions in the subcallosal area resulted in poor passive avoidance behavior, whereas cats with bilateral lesions in the cingulate gyrus were deficient in active avoidance.

In two experiments, using 128 and 36 rats, respectively, Butters (1966) found that inter-peritoneal injections of .5 mg/kg dosages of LSD-25 resulted in perseveration of dominant preferred responses, not in perseveration of responses that were dominant at the time of injection.

The ablation studies presented in this section provide direct evidence for the supposition that damage to specific areas of the

brain consistently results in perseveration. The types of tasks used as measures of perseveration related to specific areas damaged are summarized in Table 14 located in Appendix 4.

5. Perseveration as an Individual Difference

This section will deal with the development of the concept of perseveration as an individual difference characteristic of the normal population. If perseveration is viewed as occurring on a continuum of degree of intensity and degredation of functioning, members of the normal population would fall on the left side of the scale, followed towards the right by normals who were extreme perseverators, with the psychiatric and brain damaged groups on the far right of the scale.

Perseveration originated as a term indicating a morbid phenomena (Hudson,1968) and later was viewed as a pervasive characteristic of all people. Everyone experienced some degree of perseveration. The value in examining this area in the literature lies in gathering general principles which can be applied to the type of perseveration which occurs in dysphasia.

Levine's View

Abraham S. Levine (1955a) examined the status of the concept of perseveration and related it to Spearman's concept of mental inertia; established that it contributed to both positive and negative transfer effects; differentiated it from persistance; and followed the transformation of the concept of perseveration into that of rigidity.

Mental set Levine traces the beginning of written notions of the concept that later came to be called perseveration to Plato. Plato made a typology of two kinds of men: deep (orderly, constant), and shallow (haphazard). Levine can see this as relating to the different ability to maintain a set.

In 1894, a psychiatrist by the name of Neisser first used the term perseveration. By it he meant: "...the persistent repetition or continuance of an activity once begun such as the repeated writing or speaking of a given word in an unsuitable context." (Levine, 1955a)

Secondary Function

Secondary function Later, in 1902, the psychiatrist Otto Gross used a similar sort of concept described as "secondary function". He established the term "primary function" as being the activity of a sensory motor process that occurs while stimulation is going on. However, the discontinuance of a stimulus doesn't parallel in time the termination of an individuals' reaction to it, processing of it, etc. This second period of activity is called the secondary function and thus relates to the concept of perseveration. Secondary function differs from person to person in intensity and duration. The primary function determines the sort of mental associations or "thema" that will exist during the secondary function. Abstraction was then viewed as the mental part of the process

of secondary function in which ideas originating in the primary function are sustained through time. Generalization, synthesis and creativity would be dependent on secondary function. Gross developed a typology of personality types using these two factors. A moderately high amount of secondary function was beneficial, as this type of person would be "more profound, less at the mercy of changing and disparate stimuli, more constant, steadfast, and reliable..." (Levine, 1955a). Too much secondary function would be undesireable and result in a "deep-narrow" type. This person would have difficulty handling stimuli, would have prolonged emotions, drift towards ideas that had high emotional impact, and ideationally, tend to have extensive, deep-rooted systems of thought that while self-cohesive related poorly to one another. The person with weak secondary functions would be a "shallow-broad" type. This sort would be very much able to handle stimulation, show "cunning and courage", however, idea systems would be limited and profoundness would be lacking. Emotions would be intense but labile.

Later, Jung in 1923 and Roback in 1931 used Gross' typology and related the existance of excessive secondary function to paranoia, depression, and compulsions, and, linked the psychopathic deviate behavior syndrome to the shallow-broad typology.

Directional energy concept In 1900, Muller and Pilzecker studied perseveration experimentally. They felt that "every idea has its perseverative tendency that diminishes quickly with

time" (Levine, 1955a). This is a directional energy concept whereby ideas move out of consciousness and if they aren't replaced by a more forceful existing idea, they then move back into unconsciousness. Ideas have a tendency to move both in and out of consciousness. Muller thought that a mental process would have this kind of tendency over a period of days. Muller and Pilzecker showed that if a syllable was given as a correct verbal response in a task, it would tend to be given as a response again to the same task for several days even when it was no longer the correct response. Muller found that there were large individual differences on this factor, and felt that these formed the foundation for other, broader individual differences.

Mental inertia Spearman, in 1932, viewed perseveration as a very broad factor which encompassed neurological, mental, motor, sensory, and behavioral aspects of man. He related his concept of a general factor which pervaded all human activity. If this "g" factor was "mental energy," then perseveration - "p" was mental inertia - the tendency for mental processes to retain their existance after the stimuli or circumstances which initiated them have ceased to be.

Perseveration redefined as rigidity Mental inertia, Levine points out, had negative connotations whereas previously, perseveration had been thought of as a desireable phenomena. Darroch in 1938, Cattell in 1946 and Walker, Staines and Kenna

in 1943 examined what "p" tests developed by Spearman's school were really measuring. As a result of their work, perseveration was redefined as a type of a rigidity.

Tests of perseveration Levine divided perseveration tests into three types: motor, sensory and ideational. He states that there are two types of motor tests: creative effort and alternation. In the creative effort tests, S performs a task that is well established (eg. write S's as quickly as possible) then performs a conflicting, less established task (eg. write mirror image ƨ ƨƨ as quickly as possible). Both tasks are done for a set period of time. Perseveration would be measured as a diminuition of production on the second task. The alternation test would be similar to this except a third section is added where the performance of the two conflicting tasks is altered (eg. SƨSƨ) for a set period of time. An example of this would be:

a) write SSS etc for 30 seconds
b) write ƨƨƨ etc for 30 seconds
c) write SSS etc for 30 seconds
d) write ƨƨƨ etc for 30 seconds
e) write SƨSƨSƨ etc for 60 seconds

Perseveration would cause a lowered level of performance at "e" compared to "a to d". This design is supposed to take into account the inherent differences in difficulty in performing the two tasks, since writing mirror image S's (ƨƨ) is more difficult to do than writing S's in the usual manner.

Examples of sensory tests Levine cites would be the color and flicker fusion tests. An early sensory perseveration test

was color fusion. S watched a disc with red and green sectors rotate faster and faster and noted when the two colors fused into grey. This was thought to happen because the color sensations persisted after the color stimulus was no longer being received. This phenomena was considered to be a form of perseveration. The measure of perseveration was how slowly the disc was turning when S saw a grey color rather than red and green when watching the rotating disc.

An example of an ideational test would be color naming, where S first names colors properly, then reverses the names of certain colors eg. call "red" colored squares "blue".

Levine points out that one would expect to find low intercorrelations between such tests because they are very short and affected by fatigue and practice.

Darroch, in 1938, Walker, Staines and Kenna (1945) and Cattell, in 1946, thought that of all "p" tests, creative effort motor tests of perseveration show the most functional unity. On alternation tests (eg. SƧSƧ), once the effect of difference in difficulty in doing the second task compared to the lesser difficulty of the first task is taken out, no correlation is evident. So, the main focus is the difficulty of changing old habits for new - or, "dispositional rigidity." As a factor, dispositional rigidity demonstrates functional unity.

Levine thought that the lack of evidence for mental inertia on motor tests of "p" may be due to the fact that in some cases an alternation task (eg. S2S2) may be more of a challenge and more interesting to subjects than the part of the test where only one process (eg. SSSS) is involved. He notes a study performed by Jerisild, in 1927 on university students in which such results were found.

He also points out that the flicker fusion test, which is supposed to measure mental inertia, actually loads on a disposition rigidity factor. He states that in such a sensory perseveration task it is actually very difficult or impossible to form a mental set as one could in a motor test. From this it would seem that one has no control over one's responses.

Positive and negative transfer Levine views dispositional rigidity as a form of negative transfer, wherein an old stimulus is paired with a new response. Positive transfer occurs when a new stimulus is paired with an old response. If a person has a lot of mental inertia, Levine (1955a) postulates that they should experience both positive and negative transfer. Examples of the beneficial results of positive transfer he gives would be: the ability to "abstract, generalize and perceive relationships more readily", the person experiencing positive transfer would "be characterized by greater originality and creativity." Undesireable results of negative transfer would be being: "...more susceptible to habit or response interference, that is,

retroactive inhibition and proactive inhibition" (p. 117). Levine points out that the commonly used tests of perseveration are constructed in such a way that they just measure negative transfer and not positive transfer. Consequently, one sees the undesireable effects of perseveration, and not the desireable effects.

Central factor In another article (1955b) Levine substitutes the term "central factor" for perseveration because of the divergency of meaning the old term had come to have. He defines central factor as: "the capacity for establishing and maintaining set." Sets are usually defined as: "tendencies," "dispositions," or "readiness" and their effect on behavior is one of "facilitation" "selection" "determination" or "guidance" (p. 249).

A Unitary Concept of Perseveration

Walker, Staines and Kenna (1943) believed there wasn't enough experimental evidence to support the concept of perseveration as a general factor. Most of the studies that had found support for a general "p" factor were done under Spearman. Most didn't report tetrad analysis of data for groups of "p" tests. One that did (Wynn Jone's) only used four tests; all motor. The studies are also criticized on the grounds that any general factor found on the "p" tests are assumed to indicate perseveration, whereas such a factor could be derived

from a different source such as dispositional rigidity (Walker et al 1945).

Walker et al (1943) noted that Kelly, in 1928, criticized the studies of Spearman's student, Lankes because his inter-correlations weren't high enough to justify definite conclusions and the number of subjects was low (n=47). Additionally comprehensive works (Jasper in 1931,Hargreaves in 1927,Hamilton and Walker, Staines and Kenna in 1941) all found a lack of evidence for a general factor. It should be noted that Walker, Staines and Kenna used a very large sample, of 205 university students.

Another criticism of Walker et al's is that the effect of perseveration had been assumed to arise when one task precedes another and the lag in the mental energy of the first interferes with the second. They did a study in which instead of a new activity (eg.222) following a more established one (eg. SSS), the order was reversed. The production on the less established activity was still lower. They point out that had the new activity been given after the old, this would have been considered to be a measure of perseveration, yet the effects are from disposition rigidity. They also corrected the scoring method previously developed and found that this reduced the inter-correlation on the battery of tests, so that no general factor was found. This correction factor took into account the difference in time it took to perform the new task in an alter-nation test when comparing the production on the alternating

part with production on the pure task part. This difference is just due to different rate of production, not alternating effects. They examined Stephenson's finding that on "p" tests, where both activities are as well established, perseveration effects will only be measured if one task is more difficult than the other. Walker et al attribute this to the interference effect.

Walker et al (1943) quote a list Dashiell made in 1940 of the vast number of concepts he thought were actually related to perseveration

> ...influence of the warning signal in reaction time studies; the errors of 'adaptation' and 'expectation' in psychophysics; the influence of 'set' upon speed of association, the 'warming - up' period in the work curve; the interference of conflicting habits; the phenomena of 'Aufgabe' and 'Einstellang'; the delayed reaction; Krechevsky's notion of 'hypothesis'; the role of the subjects attitude in conditioning experiments, and in the reproduction of visually perceived forms; the superior recall of interrupted as compared with finished tasks, and the incubation' of ideas. (p. 38 in Walker et al 1943)

Degree of completion of a task is another factor Walker et al thought might affect "p" scores. If a first activity is not completed before a second is begun, there would be continuance and interference effects on the second task.

Multifactor views of perseveration Weisgerber (1955) factor analyzed a perseveration questionnaire given to a large group. One hundred profiles of university students were selected. Weisgerber found four factors and labelled them: "I. a tendency to aimless perseveration, II perseveration of

sensory and imaginal impressions, III perseveration of emotions and feeling states, and IV, a tendency to worry." Weisgerber points out that this doesn't necessarily mean that there are only four factors of perseveration, but rather that the inter-correlations on the questionnaire can be explained by four factors.

Kendig and Shevach, (1937) classed perseveration into three types: continuance, recurrence, and fixation. Interference effects would be classed under continuance effects. Fixation would arise when a set of reactions of behaviors are "learned too well" and the person cannot change to meet new circumstances.

Shevach, (1937) performed a series of seven experiments on sensory perseveration on six groups of subjects. Subjects ranged from 12 children to one group of 11 and one group of 30 Harvard university students, to 17 unemployed adults to 13 friends of the experimenter. The Thurstone, Woodward and Bernreuter personality inventories were used in some of the experiments. A great variety of sensory perseveration tests were used: lifting weights, electric shock, negative after movement, light adaptation, negative after image, adaptive tensive sense, sound pendulum, illusionary cubes, sensitivity to electrical stimulation and thermal equilibrium. From all these experiments, three of which were re-tests, Shevach found "marked individual differences" on the separate tests. For

some subjects, sensory perseveration was a general trait, in others, the amount of perseveration was different for different tests. Psychoneurotic tendencies were related to variability in the amount of perseveration. For a specific test and a specific individual, the amount of perseveration is constant over time. Perseveration tends to be test-specific in neurotics but a general characteristic in "stable" subjects. If emotional reactions are elicited by the tests, this factor of generality can be broken down in stable individuals. For naive individuals, and children, perseveration tended to be a weak general characteristic.

I. Kendig (1937) pointed out, based on past experiments by her and Shevach that there are two types of "conative reaction." One is of a compulsive, long lasting emotional nature, whereas the other is more "casual" as for example, "a general tendency to repeat." This tendency could occur rhythmically but diminishes quickly and no emotions appear to be involved. Kendig believes these to be separate phenomena having different theoretical implications. The concept of a trace in the nervous system has been used to explain how sensations or concepts could be reactivated in the mind. The "law of repetition" from learning theory states that once an event has occurred, there is a tendency for repetition. Holt, in 1931, (Kendig, 1937) posited a circular reflex which would

lead to repetition. According to this model, once a movement is initiated, proprioceptive stimulation arises from the movement. The neural circuit used for the first movement is again used for the proprioceptive stimuli. This reinforces the circuit. A disequilibrium theory, (Kendig 1937) could also be used to explain perseverative tendencies. Tension is created with the giving of a response. After the stimulus which elicited the response is no longer there, the residual tension is released by a repetition of the response.

Central factor As a result of the many meanings the term perseveration had come to have, Levine (1955b) preferred to use the term "central factor;" defined as: "the ability to establish and maintain set." This view was supported by many writers in the field and is contradictory to the view of Spearman and his London school.

B. Spearman's View of Perseveration

The initial work which attempted to establish perseveration as an individual difference was done by Spearman and his school. This section deals with his view of the phenomena as presented in his books: The Abilities of Man: Their Nature and Measurement (1927), and, Human Ability - a Continuation of the Abilities of Man (1951). Spearman proposed that the establishment of the measurement of perseveration as an individual difference would be as significant a step forward as had been the measurement of intelligence. While Spearman's "g" was a quantity of

mental energy, perseveration was the degree of "inertia" of this energy. Spearman (1927) developed a law of inertia which was: "...cognitive processes always both begin and cease more gradually than their (apparent) causes" (p. 291). This law, together with the law of dispositions ("... cognitive events by ocurring establish dispositions which facilitate their recurrence" p. 271) formed a tendency to retentivity: "The occurrence of any cognitive event produces a tendency for it to occur afterwards" p. 271). Perseveration was one aspect of a group of forces and was directly related to the "g" factor.

Spearman considered that there was experimental evidence to support the existance of the phenomena of perseveration as an important characteristic on which all individuals could be measured and rated. He quotes Wiersma's 1906 studies on sensory after - images. In these studies, a subject watched revolving red and green discs and noted when the colors fused into grey. The fusion was felt to occur because S experienced the after - images of the two colors together as the discs revolved faster and faster. This lingering after - image was thought to be a form of perseveration. The slower the disc was revolving at the time of fusion, the higher a perseverator the subject was. Wiersma also examined the S's rate of light adaptation on moving from a bright room to a dark room. This would be viewed as secondary function (perseveration). Another

secondary function measure he examined would now be called a measure of refractory period. A strong electric current was passed through S's hand. The time taken to become sensitive to weaker currents was measured as a form of perseveration. Using these three tests, Wiersma studied 9 normals, 11 "maniacs" and 18 melancholics. He found the "maniacs" to have less secondary function than the normals. The melancholics had higher secondary function than the normals.

Unitary function of perseveration Spearman next quotes Heyman and Brugman's work in 1913. They tested 15 students on six perseveration tests (fusion of colors, light adaptation, limen for flicker, limen for sound after a loud noise, pronunciation of difficult words, motor perseveration) and tests of: intelligence, memory, imagination and concentration. The average intercorrelation of the six tests of perseveration was .28. Correlations of a pool of the six perseveration tests and the four other tests were:

FIGURE ONE

CORRELATIONS - PERSEVERATION AND OTHER FACTORS

	Intellect	Imagination	Memory	Concentration
Perseveration	.14	-.02	.03	-.18

Spearman states that these results are difficult to interpret, as there was no measure of attenuation made.

Spearman cites the work of Wynn Jones as proving a group factor of perseveration.

> The definite evidence so far lacking, however, that perseveration normally constitutes any functional unit or group factor, was eventually supplied by Wynn Jones (p. 295).

Four perseveration tests were administered to 77 children around the age of 12. The tests were: Sƨ test (write SS normally, then as would look in a mirror), digits test (write normally, then write starting stroke backwards), mirror drawing and copying printed text (first normally, then without dotting the "i's "or crossing the "t's"). He found an average intercorrelation of .492 for the tests. There was significant evidence for a group factor on the tests that was not due to motor dexterity.

Spearman then examines Lanke's work. In 1914 he tested 47 college students on nine measures of perseveration. They were:

1. natural rate of finger tapping - the slower the rate, the higher was "p".
2. letter writing - S wrote a series of six letters, first alphabetically, then in reverse order.
3. cancellations - S cancels one letter from a list, then a different letter, then the first letter again.
4. fusion of color - S observes a two-colored revolving disc which revolves at an increasing rate of speed until he perceives only one color.
5. drawings - S describes the content of various drawings, half of which were presented successively for six seconds each; half of which were presented in alternating spatial positions: to the left for two seconds, to the right for two seconds, to the left for two seconds etc. for a total of 12 seconds.
6. narratives - S heard a passage presented two or three times and then answered questions about the content; S then heard a new passage only once and answered questions about the content.

7. associative reaction - S gave associations to words, some words recurring at set intervals.
8. essays - S wrote five essays a sitting for five sessions, taking four minutes for some and forty seconds for others.
9. perseveration questionnaire

Lankes found small, but significant correlations between the tests. Ss had been tested extensively on character measures by another experimenter, Webb. There was a negative correlation of -.26 (-.40 corrected for attenuation) between the perseveration tests and Webb's character measures. Lankes held the view that it was possible for individuals to modify, and thus somewhat deny expression, their tendencies toward perseveration.

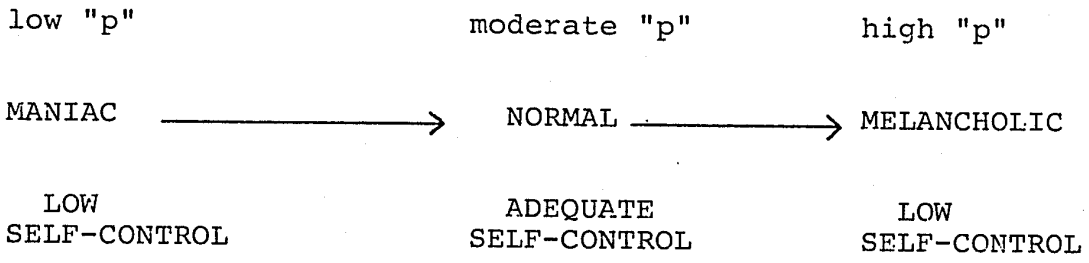
Spearman used prior experimental findings to link personality, self-control and perseveration. The relationships noted may be represented diagramatically (see Figure One). It should be noted that on moving along the dimension from "maniac" to "normal," both perseveration and self-control increase, and there is a positive correlation between perseveration and personality. However, on moving from "normal" to "melancholic," perseveration increases while self-control decreases, producing a negative correlation between perseveration and personality.

Spearman next studies Bernstein's work. In 1924 he tested 130 children on ten perseveration tests. They were:

1. finger tapping.
2. S's drawn mirror - wise (22).
3. digits drawn backwards (88).
4. reversly ordered letters (eg. dcab).

FIGURE TWO

PERSONALITY, SELF-CONTROL, AND PERSEVERATION



5. "it" test (writing words without dotting the "i's" or crossing the "t's").
6. re-writing six different letters mirror-wise.
7. "triangle test" (triangles drawn with the apex up, then down eg. △△△ ▽▽▽)
8. copying a passage reversing capital and small letters (eg. tHE dUKE).
9. copying four rows of geometrical patterns switching horizontal and vertical lines.
10. copying a passage writing an "a" after all "e's".

In addition to this, the children were observed at school. The experimenter noted signs of perseveration such as difficulty switching from one lesson to another. Ss also received several tests of "g." Bernstein found a high correlation (.51) between a pool of the perseveration tests and the observations of perseveration in the classroom. Spearman thought this was very significant, since correlations of tests of "g" and estimates of intelligence are often only around this figure so this correlation of the "p" tests and estimates of perseveration can be considered to be high and significant. Spearman thought that the inter-correlations of the "p" tests derived from one factor. He also thought that "p" is not produced when S is forced to work quickly (as opposed to leisurely) or when tests are presented in a mixed (alternating) order (as opposed to ordered presentation), but rather, when a second task is mutually conflicting with a first task (eg. writing S2S2) or when two tasks are presented each of which is very broad in nature so the switching from one to the other is of necessity an elaborate process.

From his examination of these studies, Spearman concludes that there is a unitary factor of perseveration. He points out that perseveration should not be confused with perseverance at a task or a disposition to repeat or remember an activity. Perseveration varies independently of "g"; it is the amount of inertia of "g" (g is mental energy). Spearman emphasizes these differences in the passage below

> And herewith an explanation may be afforded of the seeming paradox, that the persistence involved in perseveration is so widely unlike that involved in dispositions; for naturally enough, the power of switching the energy from one to another system of neurons has nothing to do with the susceptibility of these neurons to retain engrams afterwards (p. 306)

In Human Ability - A Continuation of the Abilities of Man, (1951) a later work written with Wynn Jones, Spearman states that Cattell, in 1931 developed the theory that perseveration measured on a test is the result of two factors - disposition rigidity and will. He has a formula: $p = (D-W)$. "P" is perseveration, "d" is inherent disposition rigidity and "w" is "the marshalled force of the ego - the will - trying to overcome this lag or rigidity" (p. 160). Cattell felt that "p" was most evident in motor tests but also occurs in any switching activity.

Defense of criticisms of perseveration Spearman and Wynn Jones answer to a number of criticisms of perseveration. They note a study by Jaspers in 1931. Jaspers thought that there was no "broad group factor" of perseveration, but rather, a narrow factor of motor perseveration. Jasper used 15 measures of "p". Spearman and Wynn Jones criticized many of these tests. They say the questionnaire Jasper used was more relevant to introversion than perseveration. They point out that two of the tests he used were measures of "simple" reaction time; two of "choice" reaction time; on one test, S's were required to trace a star using mirror vision; another test was a measure of fluency, not perseveration (nouns and town test). These criticisms take away from the validity of Jasper's findings.

Conclusions Levine and Spearman's Views

In this section, two conflicting views of perseveration were presented - those of Spearman and those of Levine. The small amount of research in the area of perseveration in the psychological journals today would seem to indicate that interest in the area has dwindled. Schools of thought were established in the first half of this century, either supporting the existance of perseveration as a pervasive phenomena in the population or supporting the opinion that perseveration is a weak factor at

most, and one which lacks functional unity. People may perseverate on one kind of test, but not on another. The anti-perseveration school views the intercorrelations of "p" tests as being, after all only moderate, even though they reach statistical significance in some studies. Factors previously examined as perseveration are now studied under different guises in the normal population. Sensory perseveration is now regarded as a lack of habituation to stimuli. Motor perseveration would be thought of more in terms of a lack of inhibition. Perseveration on learning tests would be looked at in terms of lack of extinction. The emphasis in research today is more on these other phenomena which explain the behavior that could be operationally defined as perseveration.

The Relationship of the Study of Perseveration in Non - Dysphasic Groups to Perseveration in Dysphasia

The perseveration observed in normals is perhaps a reflection of the same phenomena seen in an exaggerated form in dysphasia. Many psychologists in the first half of this century concerned themselves with the question of whether or not perseveration was a unitary trait worthy of study as an individual difference. One has only to look to dysphasic patients, many of whom perseverate in one form or another, to see evidence of the importance of this phenomena. The studies presented in Section 5 are concerned with establishing whether or not some individuals consistently perseverate more than others.

They examined sensory, motor, and ideational perseveration. Shevach (1937) has shown that even if a person does not perseverate uniformly on different measures of perseveration, such measures are consistent over time for each individual test. That is, if an individual perseverates strongly on a test of sensory perseveration but not on a motor test - he will tend to have the same results over a period of time. The closer these measures come to testing physiological functioning such as the refractory period of nerves, which is measured in tests of sensory perseveration, the closer the study moves to the phenomena of inhibition. The ablation studies on animals presented in Section 4 illustrated that damage to particular areas of the brain consistently lead to perseveration of specific types, which vary depending on the area involved. This is probably due to the different functions filled by the structures located in these areas. Whether the processing of stimuli is interrupted and the organism keeps responding to new stimuli with old responses or whether the function of the outputting of motor responses is damaged so that the organism gives old responses to new stimuli, the results are the same - perseveration. On a learning task, the organism may perseverate stimulus choices and change responses in order to do so, or perseverate responses and make the same stimulus choice in order to do so. For example, normal rats will spontaneously alternate their response choices in a maze, whereas brain damaged rats limit themselves to repetitious behavior.

Functionally, perseveration results from two main sources: a. the organism not being able to inhibit a first response, and b. the organism not having the capability of eliciting a new response. When perseveration occurs as a result of brain damage, the inability to learn an appropriate response often comes about because of faulty inhibition processes. For example, irradiated monkeys performed better when required to learn an approach task than one which involved inhibition. The mixture of results of perseveration tests on the normal population (Section 5) probably arose because an organism's ability to switch from one behavior to another varies not only with sensory refractory periods but also with fatigue, arousal level and psychological state, all of which affect concentration, and consequently, the rate at which automatic behaviors are established. It would be an error to focus solely on inhibition as a factor causing perseveration, as studies on motor perseveration have illustrated that switching from an established to a new response elicits perseverative responding.

Halpern (1965) found that word length and abstraction level affected perseveration rates. When dysphasics switched from reading a short to a long word or a concrete to an abstract word, they tended to perseverate. If perseveration was just due to an inability to inhibit a previous response, then there should be no differential rates of perseveration for long, short, concrete or abstract words. When the total body of literature on both brain damaged and non-brain damaged groups is examined, together with

the ablation studies, which demonstrate that damage to different areas of the brain produce different kinds of perseveration, it would seem evident that perseveration comes about as a result of some basic neural function which occurs in several different areas of the brain, and is probably based on a recircuiting process. All of the perseveration studied in brain damaged groups in humans tied in to language dysfunctions in one way or another - from the bizarre ideational processes occuring in schizophrenia, to the stuttering in Eisenson's (1937,1938) studies, to the mental retardation studied by Strauss and Werner (1942). Perseveration has been observed in both sensory and expressive dysphasics - which would point to perseveration being tied into damage in areas of the brain contributing to both expressive and receptive language functions. As Allison and Hurwitz (1967) have pointed out, it is natural to look for the source of perseveration in the areas of the brain connected with speech because of the association of perseveration with language disabilities. That perseveration occurs to some degree in the normal population is only further evidence that mechanisms which trigger it relate in some manner to the switching and alternation of behaviors, which can be broken down under conditions of stress and fatigue, and altered by an increase in attention and concentration, and a breakdown of habituated patterns of responses.

6. Non-Physiological Aspects of Perseveration in Dysphasia

Perseveration in dysphasics may be related to variables other than physiological ones, for example it could be a learned response.

Reinforcement

Leicester, Sidman, Stoddard and Mohr (1975) examined the kinds of errors 13 brain damaged patients, most of whom were dysphasic, made on matching-to-sample tasks. Of the errors that were perseverative, many were repetitions of previous responses that had been correct and consequently reinforced. Correct choices were rewarded with the ringing of chimes and receipt of a nickel. From this study, the authors concluded that the prior consequences of a response (reinforcement) played a role in the subsequent elicitation of the response.

Word Frequency - Halpern's Study

On tasks in which a dysphasic is required to read words out loud, different word variables have been found to affect the rate of perseveration. In a study which is of prime importance to this thesis, Halpern (1965) examined such effects. Subjects in his study were 33 dysphasics between the ages of 17 and 77 years. They were presented with words in one of three conditions: printed on a card (Visual); presented on a card and simultaneously read out loud by the experimenter (E) (Audio - Visual; or, read out loud by the experimenter (Audio). S's task was to say the

stimulus word. Perseveration was regarded as S saying a previous word when a new word was being presented. More perseveration occurred under the Visual condition. This was interpreted as occurring because in the Audio - Visual and Audio condition, S could repeat the word in an echolalic fashion. Long words produced more perseveration than short words. Part of speech and word frequency had no differential effect on perseveration. For the Visual modality, there was more perseveration with high and medium abstraction level words than with low, however, abstraction level had no effect for the Audio, and Audio - Visual modalities. This may also have been influenced by the echolalic repetition factor.

Criticisms of Halpern's Study

Words with the different characteristics: long, short; noun, verb, adjective; high, medium, low abstraction; and high, low frequency were presented randomly. Only the conditions Audio, Visual, and Audio - Visual were held constant, as there were three testing sessions: one Audio, one Visual, and one Audio - Visual. The same 72 words were used for each modality. Therefore, word characteristics that caused anxiety or fatigue and thus possibly lead to perseveration could have carried over their effect to other words that didn't have these characteristics. If S perseverated when a given word was presented to him, the characteristics of that word were assumed to have caused the perseveration. The effect of characteristics of prior words was disregarded.

Perseveration is usually measured by presenting the subject with first one task, then another. Allison and Hurwitz (1967) emphasized that perseveration should only be regarded as occurring if the first stimulus is not beyond S's level of capacity. They state:

> Also, in designing tests for perseveration (qua perseveration) the subject should be able to respond correctly to the first stimulus and neither the degree of comprehension nor the skill needed to react appropriately should be beyond his powers at the time tests are made (p. 429).

It should be noted that although Halpern's stimulus words were all at or below the Grade 5 level, he does not state the level of reading proficiency of his subjects. It is common for dysphasics to read at a much lower level than Grade Five. If that was the case for Halpern's S's, then some, or many of the words may have been beyond S's capacities.

Also, if a S is presented with a word that is above his level of capacity, he may respond by repeating a word within his capacity. If one adopts the view that perseveration is caused by an inability to inhibit a previous response, then it would be important to determine that the second stimulus is one to which the S could give an appropriate response, if it were not for the difficulty of inhibiting a previous response. A further examination of Halpern's study will be presented in a later section.

The Involuntary Nature of Perseveration

Beyn and Vlasenko (1974) state that verbal paraphasias, a class of errors of which perseveration is a type, are always

involuntary. This would concur with the theory that perseveration is linked to a reduction of inhibitory processes. They also point out that these errors are a systematic manifestation of the disorder the person has, and thus relate to the kind of disorder present. This systematic nature of verbal errors in dysphasia justifies the examination of the different characteristics of words that elicit differential rates of verbal perseverative responses.

7. The Effect of Word Frequency on the Verbal Performance of Dysphasics

This section will examine the effects word frequency has on the verbal performance of dysphasics. Word frequency refers to the commonality or rarity with which a particular word occurs in the English language. If word frequency is determined from the Thorndike and Lorge (1944) word list, it is rated as the number of occurrences of a particular word out of a million. Another popular source of word frequency data is the Kucera and Francis (1967) list. This rating gives the number of occurrences of a word out of a corpus of one million words sampled from written literature such as books and magazines.

Studies have shown that dysphasics make fewer reading, vocabulary and spelling errors on low frequency words than high frequency words. They find sounds that occur more commonly in the English language easier to say. High frequency words with special characteristics are overused by some groups of dysphasics.

Siegel (1959) conducted a study with 31 dysphasics on the effect of part of speech, level of abstraction and word length on error rates in the oral reading of words. Some of the results were contradictory to prior findings, so a post hoc analysis was performed on the word frequency of the stimulus words. Word frequency hadn't been counterbalanced with the three variables in the study, so Siegel's conclusions should

be interpreted cautiously, but the analysis showed that more errors were made on the infrequent than the frequent words. Frequency was measured on the Thorndike-Lorge list, which is the one in most common use today.

Schuell, Jenkins and Landis (1961) performed a study with 47 male and female dysphasic subjects. Ss had been diagnosed as dysphasic on the Minnesota Test for the Differential Diagnosis of Aphasia. The Ammons Full Range Picture Vocabulary Test, Form A was administered. Frequency of the words were determined by the Thorndike-Lorge list. E said a word and S was required to pick the picture which best illustrated the word's meaning. Ss made more mistakes on infrequent than frequent words.

Bricker, Schuell, and Jenkins (1964), studied the effect of word frequency (Thorndike-Lorge) on spelling errors. The spelling subtest of the Wide Range Achievement Test was given to 64 aphasics (all males except one). The ability to write was a criteria used to select subjects. Ss made more spelling errors on words of low frequency.

Filby, Edwards and Seacat (1963) required ten dysphasics and ten normals to do a task in which one word was matched with one of two sample words. All were simultaneously presented visually. This was done with 81 different sets of words. Filby found that word frequency had no effect on error rate in this task, for either the dysphasics or the control group. An important difference between this study and those previously cited is that

the stimulus words were presented throughout the choice period. Responses could be made by a prolonged visual comparison of the physical characteristics of the words. Bricker et al (1964) have criticized this study on the grounds that it does not differentiate between the dysphasics and normals. They propose that any task which does not differentiate between these two groups could hardly be considered to be a test of language abilities.

Word frequency also affects other aspects of performance in dysphasia. Trost and Canter (1974) studied ten Broca's dysphasics with apraxia of speech. They found that these dysphasics had more difficulty with infrequent than frequent phonemes.

Goodglass, Hyde, and Blumstein (1969), in a study with 17 Broca's and 21 fluent dysphasics, found that the fluent dysphasics overused high frequency "non-picturable" nouns. They used more non-picturable and abstract nouns than Broca's dysphasics for words of a Thorndike-Lorge frequency of over 100 occurrences per million. Non-picturable nouns were defined as:

> "...those which cannot be assumed to elicit a similar visual image in the minds of most speakers - either because they are abstract or because they refer to a class of object which may include specific objects of diverse appearance. Non-picturable words may be presumed to have been learned by repeatedly hearing them used in context: eg. Animal is a non-picturable word but Bird is picturable (104-119).

Spreen (1968) stressed that dysphasics do tend to make verbal errors in the same type of situations that elicit errors

in normals. He also states that dysphasics do not cease to use rare words, however, there is what he calls a "shift" in the frequency range. Words that occur rarely in normal speech occur even more rarely in dysphasic speech. Similar results were found by Howes (1964).

This section has attempted to establish word frequency as an important variable in the language performance of dysphasics.

8. Language and Word Frequency Effects in Normals

Considerable work has been done with normals to define the effect of word frequency on different verbal tasks. Since dysphasia is imposed over the pre-morbid language functions, it would be expected that some principles affecting normal language functions would still be maintained although language functioning was moved down on the scale of performance. The task to be used in the present study is a visual word recognition (oral reading) task. Data have been collected on the effect word frequency has on recognition thresholds in normals and will be presented in this section.

McGinnies, Comer and Lacey (1952) presented 24 words tachistoscopically to 17 university students and calculated threshold values for recognition of the words. For words of 5-11 letters long with frequencies of 10-400 occurrences per million, and of a "neutral tone," the duration threshold decreased as a linear function of word frequency and increased as a function of word length. There was an interaction between frequency and length. The relationship between threshold and frequency was stronger for long words than for short. The variation of threshold with length was more marked for low frequency words.

Doehring (1962) examined the effect of word value (high goodness, low goodness) and word frequency on visual duration thresholds. Twenty subjects were presented four lists of words over four testing sessions. Within each list, there was a set

of words in which Thorndike-Lorge frequency was held constant and goodness varied. Over the four testing sessions, the thresholds of frequent words were lower than those for infrequent words.

Howes and Solomon (1951) conducted two studies on 20 subjects. They presented 60 words tachistoscopically in the first study and 1[illegible] words in the second. An ascending method of limits was used. Visual duration threshold of the words bore a linear function to the logarithm of the Thorndike-Lorge frequency of the words. Product-moment correlations between word frequency and threshold values in the 60 word study ranged from -.68 to -.75. A correction factor increased the range to -.76 to -.83.

Solomon and Howes (1951), in another study, presented 60 words tachistoscopically to 19 subjects. Thirty words were of a low frequency, thirty of a high frequency. Words represented six different areas of interest as indicated on the Allport-Vernon study of values. The duration threshold of frequent words was again found to be shorter than that of infrequent words.

Solomon and Postman (1952) had five university students read nonsense words presented in a pack of 100 cards. Words occurred with different frequencies in the pack (from 1-25). Words were then presented tachistoscopically and recognition thresholds determined. The higher the frequency of occurrence of the word in the first part of the experiment, the lower was the duration threshold of recognition. Thirty more students were group tested. They silently read the words after E said them.

The words were then presented on a projector, 18 times each with the intensity of illumination increasing in 2.5v steps. The threshold was the number of trials to recognition of the word. Frequency bore the same relationship to recognition threshold as in Part 1 of this study.

King-Ellison and Jenkins (1954) found a very high correlation (-0.99) between frequency of prior exposure (spelling and pronouncing) of 5 letter paralogs and average tachistoscopic exposure time required for recognition of the paralog. Fifteen students were used as subjects. They were told that the paralogs were Turkish words.

Postman and Rosenzweig (1956) used 150 university students in an experiment on the effects of preliminary training on audio and visual discrimination of syllables and three letter words. They found frequency of past exercise to be related to threshold values for words presented visually under different levels of illumination and auditorily with different levels of masking noise.

Word frequency has been found to relate to recognition threshold values in many studies. People recognize high frequency words more quickly and under less illumination when the words are presented visually. This effect holds, even if frequency is induced experimentally in nonsense words. The results for the paralog study help somewhat to contradict the findings of the study quoted next.

Most word frequency studies assume that the differential results obtained for high and low frequency words were due to the different frequencies only. In three studies, Landauer and Streeter (1973) found that high and low frequency words differ on other aspects as well as frequency. They used Kucera and Francis' (1967) word list and found that common words are more easily confused with other words than rare words. By confusing one letter in a common word, it looks like another word. Landauer and Streeter refer to these other words as "neighbor" words. The neighbor words of common words have a higher frequency than do those of high frequency words. Phoneme and grapheme distributions of common and rare words are different. Phonemes from common words which constitute one syllable words by themselves are more "intelligible" than those of rare words.

Whether high frequency words are more easily recognized because of the familiarity of the phonemes which constitute them or because of their greater degree of familiarity as a unit, the fact that they are recognized more easily is not altered.

Moreover, as Goldiamond (1958) noted in a review of some of the literature pertaining to word frequency, Postman and Conger, in 1954, found subjects to have a tendency to respond with higher frequency words when presented with low frequency stimulus words. This would bear a special implication to the cause of verbal perseveration in dysphasics if it were to favor the occurrence of perseveration of high rather than low frequency words.

CHAPTER II

THE PROBLEM

If the perseveration of dysphasics was to be studied on a broad range of tasks, it would be expected that the same sort of perseveration that occurs occasionally in the normal population would occur, only in a more extreme form.

Studies using error rate as the dependent measure have found that both dysphasics and normals make more mistakes on words which occur infrequently in the English language than on frequently occurring words. It is assumed, therefore, that these words are of a more "difficult" nature. Halpern, using perseveration as the dependent measure, conducted a study wherein he found that word frequency had no effect on the rate of verbal perseveration in dysphasics. From this it could possibly be concluded that the cause of verbal perseveration in dysphasia is elsewhere than in the commonality of words. However, certain criticisms may be made of Halpern's study. Four word characteristics were varied in each session; 72 words with their different characteristics were presented in a mixed order in the same list. Consequently, interactions of stimulus word characteristics may have occurred. For example, if word No. 10 a high abstract, long noun of high frequency was presented to S and instead of saying it, S said a word earlier presented (eg. Word 9, a medium abstract, short verb of low

frequency), the perseverative response would have been tallied as being caused by the characteristics of Word No. 10 (high abstraction, long, noun, and high frequency). Perseveration on Word 10 may possibly have been due not to its characteristics but rather to fatigue or anxiety, or just an attraction to Word 9. In Dalland's (1974) study of perseveration in rats, a stimulus attraction factor was shown. It is hypothesized that Halpern's findings are correct, but this could possibly be clarified in a study with a different design. Word characteristics were all counterbalanced in Halpern's study. Consequently, the effects of some variables that could perhaps lead to perseveration, could be eliminated by this design. If one stimulus characteristic played a stronger role in producing perseveration, it could mask the effect of word frequency in producing perseveration. For example, each word was classed as being either long or short and frequent or infrequent. For a moment, accept the proposition that long words produce significantly more perseveration than short words, and that this is a very strong factor in perseveration. Examine the case of four words selected from Halpern's list. They are:

		ACCORDING TO ASSUMPTION:
GOBLIN	- long-infrequent	-causes perseveration
HEAVEN	- long-frequent	-causes perseveration
GOAL	- short-infrequent	-no perseveration
ART	- short-frequent	-no perseveration

If long words lead to more perseveration, and short words reduce perseveration, then "goblin" and "heaven" would likely be perseverated and "goal" and "art" would not. Now, if the frequency rate on the frequency - infrequency dimension is tallied, it can be seen that for the infrequent words, there is one case with perseveration, and one case without. For the frequent words, the same would hold true. Thus, there would be no difference in the rate of perseveration of frequent and infrequent words, assuming of course, that the long - short dimension was much stronger.

Word studies have shown that dysphasics make more verbal errors on low frequency than high frequency words. From this, one would assume that if their ability to correctly pronounce the words on the high frequency list was compared to their ability on the low frequency list, more correct responses would occur on the high frequency list. That is, Ss would make more errors, perseverative and non-perseverative on the low frequency list.

Studies with normals have shown that the recognition threshold of familiar words presented tachistoscopically is lower than that for less common words. If latency times were calculated for the time that passes between E presenting a

printed word and S starting to make a verbal response, a shorter latency for high frequency as compared with low frequency words would be expected.

From the numerous studies on perseveration in the normal population, it would seem that perseveration is not a strong unitary phenomena in normal people. Intercorrelations between different measures of perseveration are generally low, but sometimes significant. It can be said that if a person perseverates even highly, on one perseveration test, he may not perseverate on others. Tests of perseveration measure divergent activities (eg. motoric, sensory, ideational). From the ablation and radiation studies in animals, and the noted occurrence of perseveration in cases of brain pathology in humans, one would expect brain damage associated with dysphasia to sometimes involve perseveration as well. Indeed, the existance of perseveration in cases of dysphasia has been recorded by many noteable authors. However, examining perseveration in the normal population, one would expect to find only moderately low intercorrelations between different measures of perseveration in dysphasics.

Much data of theoretical relevance have been presented in the survey of the literature. This material will be used in a content analysis of the perseveration occurring

on the tests used in the present study.

CHAPTER III

SUMMARY AND HYPOTHESES

The following are four main points given expression earlier. Halpern's study indicated that word frequency did not have a significant effect on the verbal perseveration of dysphasics on an oral reading task. Dysphasics have been shown to make more verbal errors on low frequency than high frequency words. Visual word recognition thresholds have been found to be lower for high frequency than low frequency words in normals. Generally, perseveration tests on normals have demonstrated low to moderate intercorrelations that sometimes reach statistical significance. One might expect the same sort of relationship to hold for perseveration in dysphasia. The above four conclusions can be tested experimentally and may be expressed in the form of the following null hypotheses:

1. there is no difference on rates of verbal perseveration by dysphasics on two word lists; one consisting of high frequency words, the other of low frequency words.

2. there is no difference on the total number of correct responses made by dysphasics on a high and a low word frequency list.

3. there is no difference in the response latencies of dysphasics reading a high and a low word frequency list orally.

4. there is no correlation between dysphasic's perseveration scores on eight different tests (seven subtests of the BDAE and the WRAT-R).

CHAPTER IV

THE DESIGN

1. The Subjects

Prescreening

A total of sixteen dysphasics were screened for this study. Of these, eight were selected for inclusion in the experimental group. These subjects were all classified as perseverators, as they perseverated at least once on the pre-test package which had been chosen as the selection tool. This measure consisted of: the Wide Range Achievement Test - Reading (WRAT-R) and seven subtests of the Boston Diagnostic Aphasia Examination (BDAE). Of the eight subjects eliminated, as may be seen in Table 2, four were rejected because of a lack of occurrence of any perseveration at all. Three perseverated nominally, but not on the selection tests. Another perseverated on the pre-tests, of which only three were administered, but further testing was not possible. Initially, speech therapists at two local hospitals were requested to refer any English speaking patients over 16 years of age who matched a short written description of perseveration (see Appendix I) to the examiner. As a result of the low number of subjects thus gathered, another hospital was included and the therapists were asked to refer for testing any dysphasics who could read. The relevant characteristics of all 16 Ss are presented in Tables 1 and 2. Table 3 illustrates the severity

of dysfunction of the eight perseverators and the areas of the brain affected.

The Selected Subjects

As may be observed in Table 3, the brain pathology in six of the eight perseverators could have been in any area fed by the left middle cerebral (n=3) and left internal carotid arteries (n=3). The left temporal lobe is fed by the left middle cerebral artery, which is a branch of the left internal carotid artery. Both Broca's and Wernicke's speech areas are fed by the left middle cerebral artery (all Ss were right handed). Therefore, it would be possible for these subjects to have damage in either of these two areas. Since the two remaining subjects had diffuse damage covering the left hemisphere, this statement would hold for them as well.

TABLE I

SUBJECTS INCLUDED IN THE STUDY

SUBJECT	SEX	AGE	EDUCATION	DATE OF RECORDED ONSET* AND NATURE OF DISABILITY
#1	F	61	GRADE 12	-V -C.V.A. - L. middle cerebral a. thrombosis -R. hemi. and R. visual field defect.
#2	M	25	B.A.	-W -Traumatic left carotid occlusion -R. spasticity arm and leg - lef vocal cord paralyzed - right compensating in part
#3	F	75	GRADE 8	-V -Extreme stenosis and calcification at origin of L. internal carotid artery.

*V = less than 6 months.
W = more than 6 months, less than a year.
X = between 2-3 years.
Y = between 4-5 years.
Z = greater than 5 years.

TABLE I (CONT'D)

#4	M	66	HIGHSCHOOL	-V -Anneurysm on L. carotid artery clipped. -R. -hemi. -R. hemionopsia.
#5	M	62	LAW DEGREE	-V -Probable L. middle cerebral artery occlusion. -Residual weakness R. hand.
#6	M	26	P.H.D.	-V -A.V. malformation of brain -Subarachnoid hemorrhage. -Recovering R. hemi.
#7	M	46	GRADE 11	-Z -Recurrent brain tumors and seizure for past 16 years (cancer).
#8	M	44	GRADE 7	-W -Cerebral ischemic attack -Recovering R. hem

TABLE 2

SUBJECTS NOT INCLUDED IN THE STUDY

TESTS ADMINISTERED	REASON FOR EXCLUSION	SUBJECT	SEX	AGE	EDUCATION	DATE OF RECORDED ONSET AND NATURE OF DISABILITY
Pre-Test Package	No Perseveration	#1	M	48	(tradesman)	-Y -C.V.A. L. carotid occlusion. -R. hemi.
Pre-Test Package	No perseveration	#2	M	63	(office supervisor)	-Y -L. middle cerebral artery emboli - myocardid infarct. -R. hemi.
Pre-Test Package (*Word Frequency Test Lost on Tape)	No perseveration	#3	M	63	Law Degree	-X -L. Cerebral infarction.
Pre-Test Package	No perseveration	#4	M	44	Technical Training	-X -L. posterior frontal lesion of traumatic origin -Ventriculo strial and peritoneal shunt -Prior case of paralysis both legs - dating from a case of polio at 18 yrs. of age.

TABLE 2 (CONT'D)

SUBJECTS NOT INCLUDED IN THE STUDY

Total Test Package	Few instances of perseveration-but not on pre-test	#5	M	51 Grade 12	-W -C.V.A. -R. hemi. -recovered except for some numbness in R. side of face.
Total Test Package	Few instances of perseveration-but not on pre-test	#6	M	21 Grade 13	-V -Ruptured L. middle cerebral anneurysm. -R. hemi. - partially recovered
Total Test Package	One instance of perseveration-but not on pre-test	#7	M	54 Grade 10	-W -C.V.A. - L. frontal - parietal deficit -Flaccidity - R. arm.
Three Pre-Tests	Several instances of perseveration on pre-test. Underwent an operation the day after initiation of testing. After recovery, her verbal skills were much improved - no noticeable perseveration in free speech. Subject refused further testing.	#8	F	mid 50's (housewife) - 60's	-V

TABLE 3

CHARACTERISTICS OF THE EXPERIMENTAL SUBJECTS

Subject	Area of Damage*	Severity Level*	Language Deficit Most Resembles: Wernicke	Broca	Mixed
1F	A	3	W		
5M	A	2			M Expressive* -Rec
8M	A	3			M
2M	B	1		B	
3F	B	3	W		
4M	B	2			M Receptive*-Exp.
6M	C	4			M Receptive*-Exp.
7M	C	1	W		

*Area of Damage:

A - left middle cerebral artery
B - left internal carotid artery
C - widespread dysfunction

*Severity Level: a lower number indicates a more severe language deficit. Range is from 0 to 5.

Note: Sample is biased, in as much as, all Ss had to be able to read in order to be included in the study.

2. The Tools

Three tests were used; the Reading subtest of the WRAT, the BDAE, and a Word Frequency List assembled for this study. The WRAT-R requires only that S pronounce a word correctly to receive credit. It gives a grade level of achievement. The B.D.A.E. consists of 29 objective subtests plus a subjective rating made by the examiner (E) on the S's speech characteristics and severity level. The occurrence of paraphasic errors is noted on seven of the subtests used as a selection device for this study. A paraphasic error is the replacement of one word with another. Perseveration is a type of paraphasic error in which the substituted word is repeatedly given. The 29 subtests are grouped under nine main headings:

1. Fluency
2. Auditory Comprehension
3. Naming
4. Oral Reading
5. Repetition
6. Automatic Speech
7. Reading Comprehension
8. Writing
9. Music

Ss scores are plotted on a Z chart. Standard scores were determined from a pool of 207 dysphasics (Goodglass and Kaplan, 1972).

Performance of the initial subject The subject (#4M) who had been chosen for initial study because he perseverated frequently, was found to perseverate on the seven subtests of the BDAE on which perseveration is rated as a standard procedure. He also perseverated noticeably on the WRAT-R. Since it was thought to be necessary to aquire a reading level for each subject and

the seven subtests of the BDAE were usually used to note paraphasic errors, the combination of these tests was thought to be an adequate selection tool.

Frequency lists Two 29 word lists were established for use in this study (see Table 4a). One list consisted of high frequency words with ratings of A (100 or more occurrences per million) on the Thorndike and Lorge Word List (1944). The other list contained only low frequency words. These words had frequencies of one to ten occurrences per million. Frequencies of the words were also noted on the Kucera and Francis (1967) list and words were rejected if they did not fall in a broadly determined frequency range on this list as well. The range of high frequency words on this list was 23-267; the low frequency range was 1-14. The words on both the High and Low frequency lists were standardized on all other available characteristics (see Table 4b-d). They were all long - over six letters and two syllables. They were all nouns. One word on the High Frequency list (street) had six letters but only one syllable.

TABLE 4a

LIST OF STIMULUS WORDS

High Frequency		Low Frequency	
1 corner	16 flower	1 tomahawk	16 revolver
2 gentleman	17 doctor	2 bungalow	17 glacier
3 picture	18 person	3 hurricane	18 alligator
4 building	19 garden	4 macaroni	19 leopard
5 mountain	20 butter	5 icebox	20 mosquito
6 circle	21 market	6 portal	21 bandit
7 street*	22 dollar	7 avalanche	22 tweezers
8 machine	23 railroad	8 lobster	23 daffodil
9 valley	24 letter	9 blister	24 lemonade
10 officer	25 forest	10 spinach	25 ambulance
11 animal	26 mother	11 poster	26 caravan
12 college	27 village	12 honeycomb	27 storeroom
13 teacher	28 cotton	13 acrobat	28 hairpin
14 window	29 newspaper	14 piston**	29 bouquet
15 material		15 bagpipe	

*only one syllable
**Grade 6 level (Canadian) Norms

TABLE 4b

RANGES OF WORD VARIABLES

	Thorndike-Lorge	Kucera-Francis	Abstractness-Concreteness	Imagery	Meaningfulness
LOW FREQUENCY LIST	1-9 Mode = 8	1-14 Mode = 1	6.15-7.00 Mode = 6's	5.10-6.87 Mode = 6's	5.48-7.84 Mode = 6's
HIGH FREQUENCY LIST	AA	23-267 Mode = (51-100)	6.00-7.00 Mode = 6's	5.07-6.77 Mode = 6's	4.88-9.12 Mode = 5's

TABLE 4-C

HIGH FREQUENCY LIST

	1 Canadian Grade	2 Thorndike-Lorge Frequency	3 Kucera-Francis Frequency	4 Abstractness Concreteness		5 Imagery		6 Meaning	
animal	1	AA	68-12-037*	6.75	0.69	6.10	1.40	7.00	2.70
building	Buckingham & Dolch H,KV,Ty3, P5,B4,T1,H1	AA	160-15-105	6.94	0.55	6.40	1.03	5.48	1.53
butter	1	AA	27-06-012	6.96	0.53	6.57	0.83	6.91	1.93
circle	2	AA	60-10-040	6.00	1.58	6.23	1.38	4.88	1.36
college	5	AA	267-13-078	6.38	1.09	6.20	1.00	7.28	2.07
corner	2	AA	115-15-064	6.65	0.72	6.13	1.07	5.67	2.17
cotton	2	AA	38-08-019	6.90	0.58	6.00	1.27	7.13	2.03
doctor	2	AA	100-11-044	6.62	0.85	6.40	1.06	7.32	2.06
dollar	2	AA	46-11-032	6.62	0.96	6.50	1.04	6.48	2.83
flower	1	AA	23-09-022	6.96	0.53	6.57	0.79	7.13	2.46
forest	2	AA	66-09-021	6.69	0.71	6.63	0.69	9.12	7.15
garden	1	AA	60-12-037	6.83	0.65	6.73	0.56	6.36	2.18
gentleman	B+D: F3,J5,Ty6, P5,B6,T1, H2	AA	28-12-025	6.42	0.84	6.20	0.86	5.80	2.04
letter	1	AA	145-15-070	6.94	0.55	6.37	1.03	5.96	1.88
machine	3	AA	103-11-036	6.75	0.69	6.00	1.14	5.88	2.19
market	2	AA	155-12-057	6.08	1.08	6.13	1.36	7.04	2.72
material	4	AA	174-12-094	6.10	1.25	5.07	1.92	5.92	2.83
mother	1	AA	216-13-089	6.52	0.95	6.67	0.73	5.83	1.58
mountain	2	AA	33-10-021	7.00	0.00	6.77	0.49	7.58	2.86
newspaper	B+D: KV,J7,Ty4, W6,P5,B6, T2,H2	AA	65-13-043	6.56	0.53	6.57	0.83	6.12	2.03
officer	B+D: F3,Ty4, P8,B7,T1, H3	AA	101-12-050	6.32	1.09	6.23	1.04	5.43	1.88
person	2	AA	175-15-119	6.51	0.85	5.83	1.42	5.68	2.69
picture	2	AA	162-14-098	6.75	0.69	6.20	1.20	7.16	1.91
railroad	B+D: KV,J2, Ty5,W5, P4,B6,T2, H2	AA	58-10-027	6.76	0.70	6.27	1.08	6.60	1.66
street	1	AA	244-14-111	6.62	0.87	6.57	0.97	7.48	2.80

TABLE 4-C (CONT'D)

teacher	1	AA	80-11-038	6.38	0.96	5.77	1.50	6.00 2.27
valley	2	AA	73-11-034	6.66	0.66	6.57	0.79	6.56 2.04
village	2	AA	72-13-048	6.69	0.79	6.50	0.71	5.32 2.52
window	1	AA	119-14-066	7.00	0.00	6.37	1.00	6.76 1.96
n=29								
Range:	Kg-5	AA	23-267	6.00-7.00		5.07-6.77		4.88-9.12
	Kg-2		1-50 - 6	6's - 27*		5's - 3		4's - 1
	1 - 10		51-100 - 10*					
	2 - 12*		101-150- 5	7's - 2		6's - 26*		5's - 10*
	3 - 3		151-200-5					6's - 8
	4 - 1		201-250-2					7's - 9
	5 - 1		251-300-1					9's - 1

*68=Frequency
12=No. of counts in which word occurred (N=15)
037=No. of samples in which word occurred (N=500)

TABLE 4-d

LOW FREQUENCY LIST

	1 Canadian Grade	2 Thorndike-Lorge Frequency	3 Kucera-Francis Frequency	4 Abstractness Concreteness		5 Imagery		6 Meaning	
acrobat	4	1	FR. acrobats	M	SD	M	SD	M	SD
alligator	5	6	1-01-001	6.38	0.99	6.53	0.75	5.67	1.95
ambulance	5	8	4-02-002	6.93	0.56	6.87	0.42	7.72	2.85
avalanche	5	4	6-03-004	7.00	0.00	6.67	0.53	7.52	2.65
bagpipe	bagpipes		1-01-001	6.38	1.15	6.27	1.04	6.72	2.19
	5	1							
bandit	4	5	1-01-001	6.96	0.53	6.43	0.94	7.00	1.71
blister	3	6	3-02-001	6.28	1.03	5.83	0.99	6.92	2.10
bouquet	5	8	3-03-003	6.67	0.71	6.53	0.61	7.13	1.20
bungalow	5	8	4-02-002	6.55	1.00	6.77	0.55	5.76	2.35
caravan	5	7	1-01-001	6.87	0.64	6.13	1.01	5.48	2.06
daffodil	3	3	8-03-04	6.15	1.12	5.83	1.05	6.52	2.79
glacier	5	8	1-01-001	7.00	0.00	6.47	1.04	6.96	2.49
hairpin	Buckingham & Dolch F3	1	1-01-001	6.93	0.56	6.07	1.29	7.21	1.32
honeycomb	B+D F3,T6	4	1-01-001 honeycombed	6.96	0.53	6.13	1.29	6.00	2.42
hurricane	5	7	1-01-001	6.50	0.79	6.23	0.94	5.78	2.05
icebox	B+D F2	1	8-05-006	6.52	0.81	6.33	0.93	7.04	2.21
lemonade	4	7	3-03-003	6.90	0.57	6.17	1.14	6.28	2.23
leopard	4	6	3-03-003 leopards	6.93	0.55	6.50	0.83	7.13	1.59
lobster	5	7	1-01-001	7.00	0.00	6.77	0.49	6.83	1.86
macaroni	4	2	1-01-001	6.96	0.53	6.57	0.70	6.84	1.97
mosquito	4	8	no entry	7.00	0.00	6.47	0.91	6.00	2.29
piston	6	5	1-01-001	6.96	0.53	6.53	1.29	7.84	2.15
portal	B+D F5,T6	7	7-01-001	6.87	0.60	5.37	1.87	7.40	2.97
poster	4	5	3-02-002	6.25	1.14	5.10	1.91	5.63	2.24
revolver	B+D F3,J4,Ty6,T9	9	4-03-003	6.96	0.53	6.33	1.09	6.20	2.20
spinach	3	8	14-05-008	6.96	0.53	6.70	0.58	7.40	2.61
storeroom	B+D F4	2	2-02-002	6.90	0.57	6.47	0.94	7.08	2.31
			1-01-001	6.73	0.70	5.87	1.29	6.52	2.02

THE DESIGN

TABLE 4-d (CONT'D)

tomahawk	4	3	no entry	6.87	0.65	6.57	0.79	6.44 1.83
tweezers	4	1	no entry	6.93	0.56	6.57	0.61	5.80 1.87
n=29								
Range:	3 - 6	1 - 9	1* - 14	6.15*-7.00		5.10 - 6.87*		5.48-7.84
	2's-1	1 - 5	no entry-3	6's - 25*		5's - 5		5's - 6
	3's-6	2 - 2	1 - 12*					
		3 - 2	2 - 1	7's - 4		6's - 24*		6's - 12*
	4's-10	4 - 2	3 - 5					7's - 11
	5's-11*	5 - 3	4 - 3					
		6 - 3	6 - 1					
	6's-1	7 - 5	7 - 1					
		8 - 6*	8 - 2					
		9 - 1	14 - 1					

Concreteness, imagery, meaningfulness All the words were selected from Paivio's (1968) list of 925 nouns classified according to concreteness, imagery, and meaningfulness. Concreteness was defined by Paivio as:

> Any word that refers to objects, materials, or persons should receive a high concreteness rating; any word that refers to an abstract concept that cannot be experienced by the senses should receive a high abstractness rating(p.5).

All the stimulus words chosen were concrete - on a scale of one to seven with seven being highly concrete and one being abstract, the words were listed as being between six and seven. Abstractness was controlled because it had been found to affect the rate of perseveration of dysphasics by Halpern (1965). Concreteness was regarded as the most important factor, (next to frequency), so words were selected first for falling within the 6-7 range on this variable. The words fell within limited ranges on two other variables. Imagery was rated on a scale from one (low imagery) to seven (high imagery). All the words fell between 4.13 and 6.87. Paivio defined imagery as:

> Any word which, in your estimation, arouses a mental image (ie. a mental picture, or sound, or other sensory experience) very quickly and easily should be given a high imagery rating; any word that arouses a mental image with difficulty or not at all should be given a low imagery rating (p.4).

All the words had meaningfulness values of 4.88 to 9.12. Paivio's Ss had been given 30 seconds to write associations to the words. The higher the number of associations, the higher the meaningfulness of the word. The following table indicates the ranges of the different variables for the two lists.

Grade level The words were at the Grade 5 level or lower on the Stothers, Jackson and Minker (1947) Canadian word list. Grade levels for words not on this list were determined from the Buckingham and Dolch (1936) list.

3. The Method

Repeated Measures A repeated measures design was used because of the small number of available subjects. Consequently, Ss acted as their own controls. Half the Ss received the High Frequency list first, and after a few moments interval, the Low Frequency list. The reverse procedure was followed for the other half of the Ss. The words were made up in black plastic lettering ½" high on 4x6" white index cards. If S failed to respond to a card, after approximately 20 seconds, a new card was presented. Care was taken to ensure that Ss requiring glasses to read wore them during testing. All testing was recorded on tape.

Order of Testing

The first subject tested, who also served as a pilot subject, was given the WRAT-R, the B.D.A.E, and then the Word Frequency list. Then, when Ss were referred by their therapists as perseverators, the following order of testing was used: WRAT-R, Word Frequency list, and lastly, the B.D.A.E. If S could not complete the testing in one session, as many testing sessions as needed were used. This was especially a consideration for Ss who were in-patients and close to the onset of their illness. This group tired very quickly, thus reducing their ability to respond to testing. In order to increase the number of Ss collected, a new procedure was adopted. The order of testing was changed so that in a first session, the WRAT-R was administered, then the seven subtests of the BDAE on which a perseveration count was usually

made (noted previously) and lastly, the Word Frequency list was given. If S perseverated on at least one of the seven sub-tests of the B.D.A.E. or on the WRAT, he was added to the pool of Ss, and in further sessions, the remainder of the B.D.A.E. was given according to standard procedures as outlined in the manual. The instructions for the WRAT-R were adjusted as much as was possible to suit each Ss level of understanding.

Definitions

Perseveration on the different tests was defined as:

1 WORD FREQUENCY LIST: S repeating a word or part of a word from a previously presented card in response to a new card.

2 WRAT-R - S repeating a previous word or part of a previous word when attempting a new word on the list. Inappropriate repetition of a particular word not related to a perfection of pronunciation was also counted as perseveration.

3 B.D.A.E. - the inappropriate repetition of a word to a new stimulus where it has been used previously as a response. Each time the word is repeated will count as one instance of perseveration. The first occurrence of the word is not included in the count.

IDEATIONAL PERSEVERATION - S repeating a thought or idea or response relevant to an old stimulus

MOTORIC PERSEVERATION - S repeating a motor response appropriate to a previous stimulus and inappropriate to the new stimulus.

Latency times were recorded with a stop-watch for the Word Frequency lists. Latency was defined as: the time that passed between E presenting the stimulus card (indicated by E tapping on the microphone as card was presented) and S starting to make a verbal response. Latency times were determined from the tapes of the testing sessions.

4. Statistical Analysis

Hypothesis #1

Hypothesis #1 was tested using a 2x2 analysis of variance (split plot factorial design). Factor A consisted of the High Frequency and Low Frequency word lists. This factor is repeated across subjects. Factor B was the order in which S took the Frequency lists: High-Low (HL) or Low-High (LH). The dependent measure is the number of perseverations Ss made on the two lists.

Hypothesis #2

Hypothesis #2 was tested with the same design. Factor A is once again a repeated measure across subjects, and consists of the High Frequency and Low Frequency lists. Factor B is again the order of list presentation - HL or LH. The dependent measure is the number of correct responses Ss made on the two lists.

Hypothesis #3

Hypothesis #3 again was analyzed with the same design. Factor A is repeated across Ss. It represents the two lists - High Frequency and Low Frequency. The order of list presentation is Factor B. The dependent measure is the average latency time for each S. Words for which no response was given were excluded from the count.

The level of significance for these three hypotheses was set at .05.

Hypothesis #4

Hypothesis #4 was tested using a correlation matrix (pearson's r). Two different sets of correlations were used. One gave the count for each subject on each test, and used the number of different words or ideas or motor responses that were perseverated. The other measure included all repetitions as seperate counts e.g. if the same word was repeated as a response on four occasions, four counts of perseveration were tallied. The first time a word is used, is not included in the count under any condition, since the first occurrence is not a repetition. For four counts of perseveration, the word would have been used five times. The significance of the correlations were tested using the following formula:

$$t = r \sqrt{\frac{N-2}{1-r^2}}$$

r = correlation N= number of Ss for which measures were given.

The critical value of "t" was determined from a table of "critical values of t." The level of significance was set at .05. These were considered to be two-tailed tests.

Correlations

In addition to the previous analyses, correlations (pearson's r) were calculated on the following measures:

1. grade level on WRAT-R and number of correct responses on the High Frequency list.
2. grade level on WRAT-R and number of correct responses on the Low Frequency list.

3. grade level on WRAT-R and total number of correct responses on the High and Low Frequency lists.

4. number of correct responses on the High Frequency list and latency on High Frequency list.

5. number of correct responses on the Low Frequency list and latency on Low Frequency list.

6. number of perseverations on the High Frequency list and latency on the High Frequency list.

7. number of perseverations on the Low Frequency list and latency on the Low Frequency list.

8. number of perseverations on the High Frequency list and number of perseverations on the Low Frequency list.

All tests were considered to be 1-tailed predictions. Level of significance was set at .05. The same formula as that used to test hypothesis #4 was used to determine the significance of the correlations.

CHAPTER V

PRESENTATION AND DISCUSSION OF RESULTS: HYPOTHESES #1 - 4

1. Hypothesis #1 - Word Frequency and Verbal Perseveration

Results

The analysis of variance showed no significant difference between the amount of perseverations on the High and Low word frequency lists (see Table 5 and Table 6). This is consistent with Halpern's findings. However, of the eight subjects, only two perseverated at all on the word lists. One (#4M) perseverated on both lists (once on the High, and five times on the Low). The other (#2M) perseverated once on the Low frequency list. Both Ss had quite severe dysphasic difficulties and pathology associated with the left internal carotid artery.

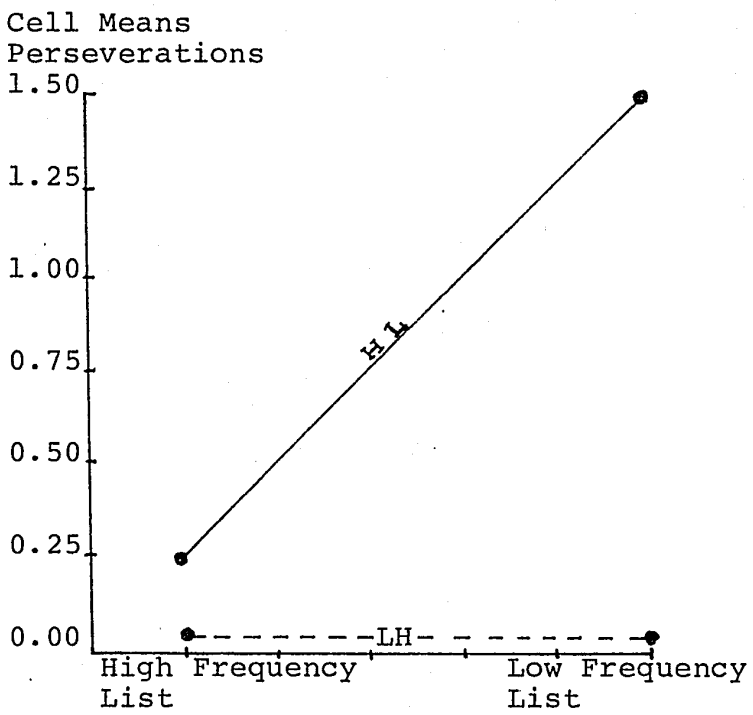
Associations

Subject #2M gave the response "avalanche" to the word "glacier". He had previously responsed correctly to the "avalanche" card. Avalanche and glacier could both be related through visual imagery as well as conceptually. This S tended to make this sort of error. Many of his mistakes were in the same conceptual category as the correct response eg. instead of naming "knuckles" on one test, he said "thumb" - both are parts of the hand. On the High Frequency list S #4M made an incorrect response to the card "street." He said "city" instead. Once again this is an association. On the

TABLE 5

NUMBER OF PERSEVERATIONS

(Hypothesis # 1)



-HL = High Frequency List first, then Low Frequency List
-LH = Low Frequency List first, then High Frequency List

-Cell Means = calculated for 4 subjects

TABLE 6

STATISTICAL DATA - HYPOTHESIS #1

Hypothesis #1
(NO SIGNIFICANCE)

NUMBER OF PERSEVERATIONS

B		A: HIGH (1)	A: LOW (2)
HL (1)	1F	0	0
	2M	0	1
	3F	0	0
	4M	1	5
LH (2)	5M	0	0
	6M	0	0
	7M	0	0
	8M	0	0

CELL MEANS

Level	1 of A and Level	1 of B :	.25
	2	1	1.50
	1	2	0.00
	2	2	0.00

ANOVA TABLE

Between Subjects:

B	1	3.0625	3.0625
R:B	6	12.375	2.0625

Within Subjects:

A	1	1.5625	1.5625
AB	1	1.5625	1.5625
RA:B	6	5.375	.8958333333

F - Values for fixed effects:

Source	Degrees of Freedom		F - value
B	1	6	1.484848485
A	1	6	1.744186047
AB	1	6	1.744186047

Critical Value
α = .05, DF=1,6
5.99

next card "machine" he said "street." This perseveration was a delayed reaction but it overroad his response to the "machine" card. On the Low Frequency list he made the same sort of error as the last S mentioned. Instead of "avalanche" he said "ice," which was the first syllable of the word presented two cards earlier (icebox). There is clearly an association here. On the fifteenth card he said "bogcat" for "bagpipe." Two cards earlier, he correctly said the word "acrobat." "Cat" may have been introduced because it rhymes with "bat." The nineteenth word was "leopard." To this card, S said "leopard cat," again an association and a perseveration of part of "bogcat." Then for the next word "mosquito" he said "moscat." He made a correct response to "bandit" but then for the 22, 23, and 24th words distorted "cat" to "cap" and added this to the end of each response (tweezers - heezlecap, daffodil - bottlecap, lemonade - lemoncap). Once begun, the response of "cat" and a distortion of it dominated his responding. This is consistent with the theory that perseveration is related to an inability to inhibit a response. The response may be easily elicited because it has associations of a conceptual, or ideational, or pictorial nature with a stimulus which elicits it. If this association is very strong, then it may take precedent over later stimuli. This may be facilitated if the response to the later stimulus is difficult to output at the time.

Abstraction and Word Length

Of the other six Ss, none perseverated on the lists. This could be due to several factors. Halpern found that on this

sort of task, words of medium and high abstraction levels produce more perseveration than words of low abstraction. All of the words on the two lists were of low abstraction - they were all concrete. This could indicate that the abstraction of Halpern's words lead to a lot of the perseveration he noted. He also found that long words produced more perseveration than short. On these lists, all the words were long, and yet little perseveration occurred. This could indicate that word length was not such an important factor in perseveration by itself, but rather acts in the presence of other factors.

Switching

Another factor present in Halpern's list was that of "switching." In the studies on perseveration in normals, switching from one task to another was an important factor. The switching on Halpern's list existed since words of high medium and low abstraction as well as long and short were presented in random order. This may result in the dysphasic S being presented with a hard word, an easier word, a hard word etc. When a harder task is presented (eg. high abstract long word after a low abstract short word) the S may "back out" of responding by giving an old, easier response. The words on the two lists were all nouns, long, high concrete, high on imagery, and high on meaningfulness. Halpern did not control for word meaningfulness or imagery, which may be important factors in eliciting perseveration.

Grade Levels

The grade levels of Ss were: 17, 5, 2, 7, 1, 7, 3, 7. The stimulus words were at or below the Grade 5 level. The grade levels of the two Ss who perseverated were "5" and "7". The Ss who had lower grade levels had less trouble reading the words on the Frequency lists than on the WRAT-R, probably because the words on the Frequency lists were presented individually, and in very large print. Halpern does not state the reading levels of his Ss, but if they had poor reading skills, this may have affected his results. Ss for the present study were accepted only if they could read, and this may well have had a biasing effect on the results.

2. Hypothesis #2 - Word Frequency and the Number of Correct Responses

Results

Previous studies have found that both dysphasics and normals make more errors on low frequency than high frequency words. The Ss in this study made significantly more errors on the Low Frequency list (see Table 7 and Table 8). There were not many more pronunciation errors on the Low Frequency list (LF=3, HF=2) but there were more literal paraphasic errors as may be seen on Table 9 (HF=4, LF=13).

Paraphasic Errors

A literal paraphasia is the addition of new sounds or a changing of the order of sounds in a word in which more than one half of the word is still correct. Examples would be saying "crosbat" instead of "acrobat" or "tomeahaw" instead of "tomahawk." Ss also made more verbal paraphasic errors, other than perseverative errors, on the Low Frequency list (LF=7, HF=4). A verbal paraphasic error consists of substituting one word for another, for example, saying "blustery" instead of "blister."

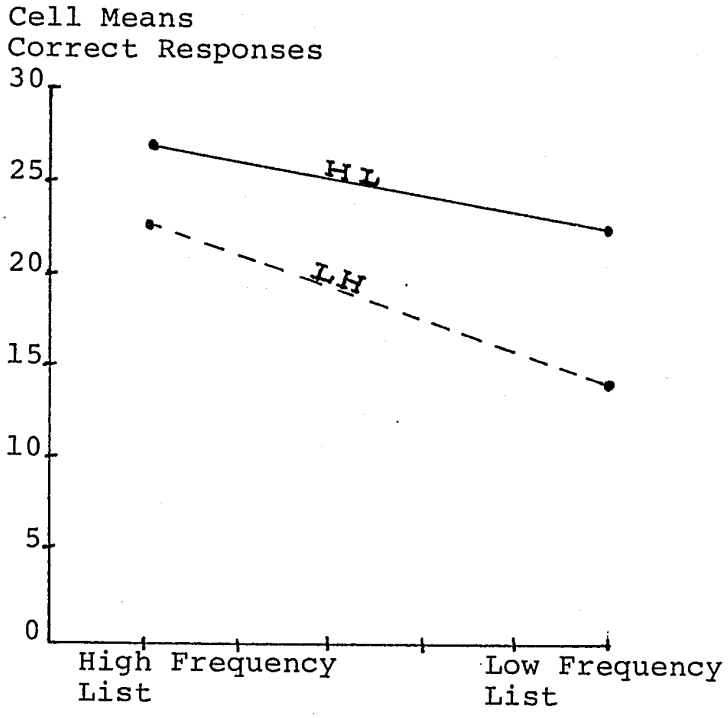
Inability to Respond

There were almost twice as many "no responses" on the Low Frequency List (LF=40, HF=18) and Ss could only say part of the stimulus word more often on this list (eg. "bliss" for "blister; LF=12, HF=6). Low frequency words would seem to be more difficult to handle, but low frequency (familiarity) does not lead to perseveration.

TABLE 7

NUMBER OF CORRECT RESPONSES

(Hypothesis #2)



-HL= High Frequency List first, then Low Frequency List
-LH= Low Frequency List first, then High Frequency List

-Cell Means = calculated for 4 subjects

TABLE 8

STATISTICAL DATA - HYPOTHESIS #2

Hypothesis #2
(SIGNIFICANT DIFFERENCE HIGH AND LOW FREQUENCY LISTS)

		NUMBER OF CORRECT RESPONSES A	
		HIGH (1)	LOW (2)
B HL(1)	1F	28	28
	2M	26	19
	3F	28	25
	4M	26	21
B LH(2)	5M	13	2
	6M	28	21
	7M	19	8
	8M	29	25

CELL MEANS

Level	1	of A and	Level	1	of B:	27.00
	2			1		23.25
	1			2		22.25
	2			2		14.00

ANOVA TABLE

Between Subjects:

B	1	196.00	196.000
R:B	6	546.75	91.125

Within Subjects:

A	1	144.00	144.000
AB	1	20.25	20.250
BA:B	6	30.75	5.125

F- Values for fixed effects:

Source	Degrees of Freedom		F-value
B	1	6	2.150891632
A	1	6	28.09756098*
AB	1	6	3.951219512

Critical Value
$\alpha = .05, DF = 1,6$
5.99

TABLE 9

ERRORS - WORD FREQUENCY LISTS

	HIGH	LOW
Just say part of the word	6	12
Mispronounce	0	2
Literal paraphasic	4	13
Neologistic	0	3
Verbal paraphasic (exclusive of perseverative)	2	3
Perseverative	1	6
Add association	3	1
No response	19	43
Lost from tape	0	1
	35	84

3. Hypothesis #3 - Word Frequency and Response Latency

Results

Studies of normal populations have found that the response latencies to low frequency words are shorter than those for high frequency words. This study has failed to show a significant difference between average latencies on the two lists, as illustrated in Tables 10 and 11. Also, latency showed no significant correlation with the number of correct responses made on the Low and High Frequency list (see Tables 13f;g). The lack of difference on the latencies could be due to the misperception or misinterpretation of words. A dysphasic may quickly and confidently say one word for another (eg. "boutique" for "bouquet").

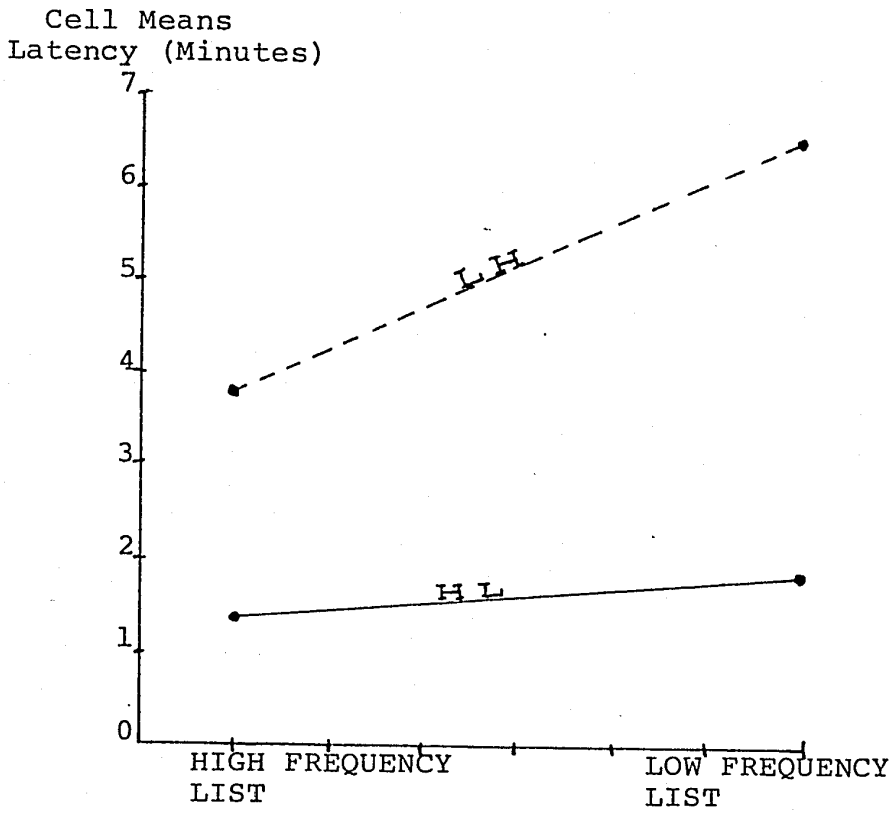
"No Response" Items

The average latencies were calculated for stimulus words for which a response was made. On the Low Frequency list, there were twice as many "no responses" than on the High Frequency list (HF=43,LF=19). An incorrect response was given with usual speed. The lack of significant results may have been partially due to the fact that the "no response" items were not assigned an arbitrary latency time, but rather, were omitted from the calculations. It could also have been due to the relative inexactitude of the measurement used. The experimenter timed latencies with a stopwatch, and they therefore include E's reaction time. As the stimulus cards were presented, E tapped on the microphone of the tape recorder. On examination of the

TABLE 10

AVERAGE LATENCIES (MINUTES)

(Hypothesis #3)



-HL= High Frequency List first, then Low Frequency List
-LH= Low Frequency List first, then High Frequency List

Cell Means = calculated for 4 subjects

TABLE 11

STATISTICAL DATA - HYPOTHESIS #3

Hypothesis #3
(NO SIGNIFICANCE)

AVERAGE LATENCIES

		A: HIGH (1)	A: LOW (2)
B	HL(1)		
	1F	.78	.90
	2M	1.23	1.82
	3F	1.90	2.11
	4M	1.60	2.60
	LH(2)		
	5M	2.19	2.46
	6M	1.35	3.00
	7M	10.43	19.74
	8M	.95	1.02

CELL MEANS

Level	1	of	A	and	Level	1 of B:	1.3775
	2					1	1.8575
	1					2	3.7300
	2					2	6.5550

ANOVA TABLE

Between Subjects

B	1	49.7025	49.70250000
R:B	6	267.7570	44.62616667

Within Subjects

A	1	10.923025	10.923025
AB	1	5.499025	5.499025
RA:B	6	29.019450	4.836575

F - values for fixed effects:

Source	Degrees of Freedom		F-value	Critical Value α=.05,DF=1.6
B	1	6	1.113752395	5.99
A	1	6	2.258421507	
AB	1	6	1.136966759	

tapes, this tap was used to signify the presentation of the card. This is not the most accurate possible manner of determining the time lapse between S looking at the stimulus card and beginning to respond, however, it should be noted that in order to be able to test bed-ridden patients, the use of more sophisticated measures must sometimes be sacrificed.

Order Effects

A significant effect was not found for the order in which subjects received the two lists (HL or LH) in regards to the number of perseverations, the number of correct responses and the average latency times on the two lists. This may be seen from the lack of significance of the F values of the "B" factor which respresents the order effect on Tables 6, 8, and 9, respectively. The order effects are presented graphically in Tables 5, 7, and 10.

4. Hypothesis #4 - Correlations Between Tests of Perseveration

Results

There were several significant correlations between six of the pre-selection tests (BDAE) and the WRAT-R (see Table 12). One test, "Repeating Phrases" was dropped from the correlations because none of the Ss perseverated on it. One set of correlations was calculated using only different occurrances of perseveration (see Table 13a). Of the 21 correlations, five were over .5. As a result of the low number of Ss, a very high correlation was required for significance. Only one correlation in this group was statistically significant. There was a +.92863 correlation between the perseveration scores on "Visual Confrontation Naming" and "Automatized Sequences." Research on the BDAE (Goodglass and Kaplan 1972) found in a factor analysis that these two tests shared a common factor which consisted of articulatory and grammatical fluency:

> Factor III is determined by scores in verbal agility, fluency, repetition and recitation. Visual confrontation naming and responsive naming also have high loading here (.54 and .61), as does severity (.64). This factor appears to represent the integrity of the mechanical automatisms of speech, and is inevitably associated with a mildness - severity dimension(p.23).

Frequency Recalculated

When the correlations were calculated including each perseveration of the same word as a new count of perseveration, (see Table 12b), the correlation between these two tests increased to +.96048. Of the 21 correlations, eight were over .5. Four were significant,

three were positive correlations and one was negative. There was a significant .86496 correlation between "Body Part Naming" and "Automized Sequences." On a second factor analysis of the BDAE, "Body Part Naming" doesn't occur on the chart entitled: "Rotated Loading of .40 or More for All Test Variables on Five Factors." "Body Part Naming" also had a significant correlation with Visual Confrontation Naming (.85096). There was a significant negative correlation between "Responsive Naming" and the WRAT-R. On the second factor analysis, "Responsive Naming" fell under factors three and four.

> FACTOR 3... This factor appears to represent the integrity of the mechanical automatisms of speech and is inevitably associated with a mildness-severity dimension.
>
> FACTOR 4... Thus we may consider this to be an auditory comprehension factor or perhaps, more broadly, a receptive language factor (p. 23).

Presence of the mechanical automatisms of speech along with poor receptive language skills would form a Wernicke's pattern of deficit. The perseveration scores on "Responsive Naming" were all either "1" or "0". The Ss with the highest perseveration scores on the WRAT-R (21 and 14) both had "0" scores on "Responsive Naming" - hence the high negative correlation. While both Ss perseverated to a high degree on the WRAT-R, their high grade levels on this test (grade 6.9) indicate that they attempted more items on the test (59 and 74). The more words attempted, the greater is the chance for perseveration to occur.

Unequal Test Length

Additionally, it must be taken into account that a comparison between the number of occurrences of perseveration on the two tests is not really a fair one since the opportunity for perseveration on "Responsive Naming", which consists of ten questions, is not as great as on the WRAT-R which consists of 74 words (test is stopped when S makes a criterion number of consecutive mistakes).

This is a consideration which must be made in interpreting all of the correlation matrix data. The tests are not equal in length and thus opportunity to perseverate. The correlations have b-en included since they are of interest in looking for pattern within the seven tests, and since these tests were used as a selection device. The positive correlations found could be due to the fact that "Visual Confrontation Naming, Body Part Naming, and Automized Sequences" were all naming tasks. The negative correlation was with a reading test, which represents a different sort of skill. There is some evidence for a unitary trait of perseveration on these tests which may occur when tests are similar in nature.

TABLE 12 - CORRELATIONS - MATRIXES

Hypothesis #4
a.CORRELATION MATRIX - PRE-TESTS ON B.D.A.E (7) and WRAT-R
Number of Different Occurrences of Perseveration.

x PRE-TEST REPEATING PHRASES DROPPED - NO PERSEVERATIONS SCORES

Subject:		1F	2M	3F	4M	5M	6M	7M	8M
Variable*	1	1	2	0	7	0	3	2	2
	2	2	4	7	11	4	0	4	2
	3	0	0	0	0	1	0	0	0
	4	0	1	1	0	1	0	1	0
	5	1	0	1	0	1	0	1	1
	6	2	2	3	8	2	0	1	1
	7	1	3	1	2	1	0	2	1

*VARIABLE	TEST
1	#3 - WRAT-R
2	#11-AUTOMATIZED SEQUENCES
3	#15-REPITION OF WORDS
4	#17-READING WORDS (SINGLE)
5	#18-RESPONSIVE NAMING
6	#19-VISUAL CONFRONTATION NAMING
7	#20-BODY PART NAMING

VARIABLE	ESTIMATES OF MEANS	ESTIMATED STANDARD DEVIATIONS
1	2.125	2.232071427
2	4.250	3.412163118
3	.125	.3535533906
4	.500	.5345224838
5	.625	.5175491695
6	2.375	2.445841953
7	1.375	.9161253813

CORRELATION MATRIX

VARIABLE	1	2	3	4	5	6	7
1	1.00000	0.50175	-0.38467	-0.53881	-0.69560	0.67054	0.25324
2	0.50175	1.00000	-0.02960	0.15665	-0.18201	0.92863	0.46842
3	-0.38467	-0.02960	0.99999	0.37796	0.29277	-0.06195	-0.16539
4	-0.53881	0.15665	0.37796	0.99999	0.25819	-0.16390	0.43759
5	-0.69560	-0.18201	0.29277	0.25819	0.99999	-0.32445	-0.26363
6	0.67054	*0.92863	-0.06195	-0.16390	-0.32445	1.00000	0.37456
7	0.25324	0.46842	-0.16539	0.43759	-0.26363	0.37456	0.99999

POSITIVE CORRELATIONS

FIRST: .92863* VISUAL CONFRONTATION NAMING and AUTOMATIZED SEQUENCES
SECOND: .67054 VISUAL CONFRONTATION NAMING and WRAT-R

$$t = .92863\sqrt{\frac{6}{1-(.92863)^2}} = 6.131066512^*$$
(SIGNIFICANT)

Critical Value
$\alpha = .05.$
DF= N-2=8-2=6
two-tailed
2.447

$$t = .67054\sqrt{\frac{6}{1-(.67054)^2}} = 2.213963867$$
(NOT SIGNIFICANT)

NEGATIVE CORRELATIONS

FIRST: -.69560 RESPONSIVE NAMING and WRAT-R

$$t = -.69560\sqrt{\frac{6}{1-(-.69560)^2}} = 2.371653128$$
(NOT SIGNIFICANT)

b. CORRELATION MATRIX - PRE-TESTS ON B.D.A.E.(7) and WRAT-R
Total Number of Perseverations - Including All Items of Runs

	SCORES							
Subject:	1F	2M	3F	4M	5M	6M	7M	8M
Variable 1	3	2	0	21	0	4	2	4
2	4	5	7	20	8	0	5	3
3	0	0	0	0	1	0	0	0
4	0	1	1	0	1	0	1	0
5	1	0	1	0	1	0	1	1
6	2	2	5	12	2	0	2	1
7	2	3	1	6	1	0	2	1

VARIABLE	ESTIMATES OF MEANS	ESTIMATED STANDARD DEVIATIONS
1	5.750	7.611082146
2	6.500	5.976143047
3	0.125	0.3535533906
4	0.500	0.5345224838
5	0.625	0.5175491695
6	3.250	3.807886553
7	2.000	1.8516402

CORRELATION MATRIX

VARIABLE	1	2	3	4	5	6	7
1	1.00000	0.51822	-0.30525	-0.66718	-0.71626	0.59396	0.54738
2	0.51822	1.00000	0.10141	-0.04472	-0.25403	0.96048	0.86496
3	-0.30525	0.10141	0.99999	0.37796	0.29277	-0.13263	-0.21821
4	-0.66718	-0.04472	0.37796	0.99999	0.25819	-0.14037	-0.14433
5	*-0.71626	-0.25403	0.29277	0.25819	0.99999	-0.30807	-0.44721
6	0.59396*	0.96048	-0.13263	-0.14037	-0.30807	1.0000	0.85096
7	0.54738*	0.86496	-0.21821	-0.14433	-0.44721*	0.85096	1.00000

POSITIVE CORRELATIONS

FIRST: +.96048* VISUAL CONFRONTATION NAMING and AUTOMATIZED SEQUENCES
SECOND: +.86496* BODY PART NAMING and AUTOMATIZED SEQUENCES
THIRD: +.85096* BODY PART NAMING and VISUAL CONFRONTATION NAMING
FOURTH: +.51822 WRAT-R and AUTOMATIZED SEQUENCES

$t = .96048\sqrt{\frac{6}{1-(.96048)^2}} = 8.452287777^*$

Critical Value
$\alpha = .05$
DF= N-2=8-2=6
two-tailed
2.447

$t = .86496\sqrt{\frac{6}{1-(.86496)^2}} = 4.221877947^*$

$t = .85096\sqrt{\frac{6}{1-(.85096)^2}} = 3.968577207^*$

$t = .51822\sqrt{\frac{6}{1-(.51822)^2}} = 1.484219241$ (NOT SIGNIFICANT)

NEGATIVE CORRELATIONS

FIRST: -.71626* RESPONSIVE NAMING and WRAT-R
SECOND: -.66718 READING WORDS (SINGLE) and WRAT-R

$t = -.71626\sqrt{\frac{6}{1-(-.71626)^2}} = -2.514169196^*$

$t = -.66718\sqrt{\frac{6}{1-(-.66718)^2}} = -2.193929613$ (NOT SIGNIFICANT)

TABLE 13

CORRELATIONS - Pearson's r

a. GRADE WRAT-R and HIGH - Number of Correct Responses

Subject	1F	2M	3F	4M	5M	6M	7M	8M
X-Scores (Grade)	17	5	2	7	1	7	3	7
Y-Scores (High)	28	26	28	26	13	28	19	29

R = .537616897

*Critical Value
$\alpha = .05, DF = N-2 = 8-2 = 6$,
1-tailed
1.943

$$t = .537616897 \sqrt{\frac{6}{1 - (.537616897)^2}} = 1.56179302$$

b. GRADE WRAT-R and LOW - Number of Correct Responses (SIGNIFICANT)

Subject	1F	2M	3F	4M	5M	6M	7M	8M
X-Scores (Grade)	17	5	2	7	1	7	3	7
Y-Scores (Low)	28	19	25	21	2	21	8	25

R = .6442343831

$$t = .6442343831 \sqrt{\frac{6}{1 - (.6442343831)^2}} = 2.063267906^*$$

c. GRADE WRAT-R and TOTAL (H L) - Number of Correct Responses

Subject	1F	2M	3F	4M	5M	6M	7M	8M
X-Scores (Grade)	17	5	2	7	1	7	3	7
Y-Scores (Total)	56	45	53	47	15	49	27	54

R = .6077306267

$$t = .6077306267 \sqrt{\frac{6}{1 - (.6077306267)^2}} = 1.874510446$$

d. HIGH - Number of Correct Responses and HIGH - Average Latencies

Subjects	1F	2M	3F	4M	5M	6M	7M	8M
X-Scores (Correct)	28	26	28	26	13	28	19	29
Y-Scores: Latencies	.78	1.23	1.90	1.60	2.19	1.35	10.43	.95

R = -.490667979

$$t = -.490667979 \sqrt{\frac{6}{1 - (-.490667979)^2}} = -1.379343303$$

e. LOW - Number of Correct Responses and LOW - Average Latencies

Subject	1F	2M	3F	4M	5M	6M	7M	8M
X-Scores (Correct)	28	19	25	21	2	21	8	25
Y-Scores: Latencies	.90	1.82	2.11	2.60	2.46	3.00	19.74	1.02

$R = -.5217782572$

$$t = -.5217782572 \sqrt{\frac{6}{1 - (-.5217782572)^2}} = -1.498204889$$

f. HIGH - Number of Perseverations and HIGH - Average Latencies

Subject	1F	2M	3F	4M	5M	6M	7M	8M
X-Scores (Perseverations)	0	0	0	1	0	0	0	0
Y-Scores: Latencies	.78	1.23	1.90	1.60	2.19	1.35	10.43	.95

$R = -.1198087973$

$$t = -.1198087973 \sqrt{\frac{6}{1 - (-.1198087973)^2}} = -.2955996206$$

g. LOW - Number of Perseverations and LOW - Average Latencies

Subject	1F	2M	3F	4M	5M	6M	7M	8M
X-Scores (Perseverations)	0	1	0	5	0	0	0	0
Y-Scores: Latencies	.90	1.82	2.11	2.60	2.46	3.00	19.74	1.02

$R = -.1343728687$

$$t = -.1343728687 \sqrt{\frac{6}{1 - (-.1343728687)^2}} = -.3321573376$$

h. HIGH - Number of Perseverations and LOW - Number of Perseverations

Subject	1F	2M	3F	4M	5M	6M	7M	8M
X-Scores (High)	0	0	0	1	0	0	0	0
Y-Scores (Low)	0	1	0	5	0	0	0	0

$R = .9798637101$

$$t = .9798637101 \sqrt{\frac{6}{1 - (.9798637101)^2}} = 12.0208013^*$$

5. Summary

This study failed to find a significant effect of word frequency on verbal perseveration on an oral reading task. The factors of abstraction level, word imagery and meaningfulness may be important variables in perseveration, as well as the factor of switching from one level of word difficulty to another. The dysphasics in the present study made more verbal errors on low frequency words, and therefore, it may be said that these words involve some sort of "difficulty" factor. Latencies were not found to be related to word frequency. This may have been due to the "misperception" of stimulus words. Further studies with more sophisticated measures of latency times would be needed to verify this finding. Of the six tests from the BDAE and the WRAT-R, four significant correlations were found between perseveration counts. It is possible that similar tasks tend to elicit similar amounts of perseveration.

6. Conclusions

The hypotheses tested in this part of the experiment were all related to very precise, quantifiable aspects of language behavior in dysphasia. However, perseveration as a phenomena has much broader effects. It is not just the mechanical repetition of words. Words form ideas. Ideas are an expression of feelings as well as thoughts. The effect of embarrassment, frustration, anger and fear are all bound in to the phenomena of perseveration in dysphasia. Perseveration may be triggered by these emotions or the occurrence of perseveration may arouse these emotions. The individual with such a language disability may often times perseverate without indicating that he is aware of what is occurring, especially in the early phases of dysphasia. However, this is not always the case, and especially when the individual is on the way to recovery of language abilities, he or she often indicates a realization of the occurrence of perseveration, often appearing to "fight" it and attempt to inhibit it.

The Need For a Content Analysis of the Results

While the question: "Does word frequency have an effect on verbal perseveration in dysphasia?" can only properly be answered through the use of formal experimental design and the attempt to control or at least account for extraneous variables, there is a wealth of material to be gained by an examination of the content of the extensive material gathered as a result of the administration of the BDAE. Originally, the administration of this test

was viewed as necessary because few patients in different hospitals and speech therapy clinics are administered the same diagnostic tests, and a standard by which to compare the language functioning of the Ss was needed. Also, the BDAE gives a profile of speech abilities which characterize different kinds of disabilities as Broca's or Wernickes and other diagnostic categories relating to clusters of disabilities. While, as has been seen from the results of this study, it is almost impossible to state in terms of certainties which specific area of the brain has been damaged, even when angiographic evidence has been found, it is useful to know if a subject's difficulties are mainly expressive or receptive or a mixture of both, for only by understanding what a subject can do linguistically is it possible to discuss the meaning of what he does do.

Since the BDAE consists of many kinds of language tasks, and at least a few Ss perseverated on most of the tasks, it was decided that this wealth of information should not be overlooked. By examining the results of these tests, as carefully recorded from tapes of the testing sessions, it was expected that much could be learned about perseveration in dysphasia.

CHAPTER VI

THE CONTENT ANALYSIS

1. Presentation of Results

The occurrence of perseveration on the sub-tests of the BDAE, the WRAT-R and the Word Frequency lists was examined. Four main kinds of perseveration were found and 15 sub-types were noted. This classification was for convenience in examining perseveration in this group of Ss and does not presume to be all inclusive nor to represent statistically seperable groupings. Each specific case of perseveration noted for each subject is given in Appendix 2C. Table 2A in the Appendix illustrates the number of Ss perseverating on each of the tests administered. It may be noted that the Pre-tests elicited perseveration in the highest number of subjects. This supports the use of these tests as a selection tool. One test, Animal Naming, elicited a high rate of perseveration and was not in the pre-test package. Table 2B lists examples, by category, of perseverations found across subjects.

Main Categories of Perseveration

Three of the main categories of perseveration are forms of intrusion of past responses or new responses. The fourth category pertains to responses that while inappropriate and probably not directly intentional in nature, represent an adaptive modification of the responses expected. These responses have the effect

of enabling the dysphasic to produce responses (inferior though they may be) at his own level of capabilities. They may be elicited by: a misunderstanding or misinterpretation of instructions, a feeling that "any" response or an incorrect response is better than "no response" at all, a social acquiescence to the request by the examiner for a response and the consequent production of a response that is not well monitored by the S, or, a desire to repeat a previously correct response even if it is to an inappropriate stimulus. This category also includes responses that become operationally defined as perseverative because of the difficulty in establishing clearly whether or not a response is an intentional or unintentional repetition and in distinguishing separate runs of responses. When in "difficulty" dysphasics may start a response over again several times. This sort of re-starting serves (whether intentional or not) to re-trigger the elicitation of the proper response. In a way, the S is re-presenting to himself a stimulus which is part of a sequence and normally elicits the next response. Since each S's perseverations are presented in context in Appendix 2C, the following will be a brief description of each sub-type of perseveration, and a representative example of each type will be given. The main categories are:

I. Intrusive.
II. Delayed perseveration - Intrusive.
III. Associations - Intrusive
IV. Modified Responding

Examples

I. INTRUSIVE

1. Repetitive

Two types of repetitive perseveration may be distinguished here. One could appropriately be called clonic. This is when a stimulus is presented and S repeats the same responses many times instead of just once. An example of this would be:

S. #4M TEST 3 On the WRAT-R, S's response to the first word "milk" was: "milk, milk, milk, milk."

Another type of repetitive perseveration would occur when S is given stimulus (ST) #1 and gives response (R) #1 and then a second stimulus is presented and S gives R #1 again. He has not switched to the new task. In some cases, he may be oblivious to the fact that he is not responding properly. Other times, he may indicate that he realizes after or during the response what he has been or is doing.

S #7M E. points to a number and asks S what it is.

ST	R
700	7000
1936	7000
42	7000

Wilson's concept of the absorption of S in one thing causing lack of attention to others is applicable here.

2. Confabulatory

This occurs when a blend is made between a new response and an old response. This could occur because of similarities between the two response sounds.

S#8M E points to picture - S writes its name.

ST	R
circle	circle
square	sirle

3. Response in visual field

Intrusion of one response upon another can occur if the different stimuli are all presented in the same visual field. It is difficult for some dysphasics to block out the "irrelevant" stimuli and focus on just the appropriate one. This is a possibility suggested by one S' (who had sensory dysphasia) statement that on the WRAT-R she found it difficult to look at just one word and not the rest.

S #2M S was reading along the third line of the WRAT-R and said "grieve" instead of "eliminate." "Grieve" was on the line above and one word over and falls in the visual field when one looks at "eliminate."

...theory contagious grieve...
... escape eliminate tranquility ...
...humiliate bibliography...

If S happened to focus on "grieve" while attempting "eliminate," he may not have been able to inhibit the verbal response to grieve. This is just conjecture at this point.

4. Add words of unknown origin

Some cases of perseveration seem to come from passing thoughts or be repetitions of neologistic distortions that one cannot easily relate to a hypothetical origin.

S #4M S twice inserted the word "Theodore" into the WRAT-R list.

Many thoughts normally pass through one's mind when one is

performing a task. Some may be completely extraneous to the task or be brought to mind because of some association made. Sometimes these "irrelevant" thoughts or words slip out into conversation. The classic example of this is "Freudian slips." In dysphasia, this sort of behavior occurs more often and in circumstances where a non-brain damaged person would be able to call forth his powers of concentration to prevent such mistakes.

5. Intrusive interference - motor

This occurs when a motor response is so strong that it replaces or interrupts another response. A good example of this is provided on the "Non-Verbal Agility" test.

> S #4M S was timed while he protruded and retracted his tongue. He was then asked to touch his upper, then his lower teeth with his tongue. A demonstration was provided, and on the practice, he could carry out this movement. However, when this performance was timed, he did the task, then stuck out his tongue, went back to the task, and then quickly stuck his tongue out several times.

6. Ideational

Sometimes one idea is repeated over and over. An example of this would be found in conversation.

> S #7M ...I was wi with with a chum of mine. I was with my chum and he was with...I was with more with my friend and uhm than with anybody else and uh...

Another occurs when the concept of one task is carried over to another task and interferes with it. This same S was asked to name some body parts and got "ear" and "nose" correct. The next response was perseverative. On the fourth item, when E pointed to "ankle", S in response pointed to the number "700" on one of the stimulus

cards used in the previous test. Pointing to pictures on the card was the response called for in that test. This same sort of response occurred on the Automatized Sequences task. When several Ss were asked to name the days of the week, they did so, but when asked to name the months of the year, they named the days of the week again. One case included a month in the sequence. This is a transfer of a whole response which consists of individual items in sequence. This could be related to Levine's (1955b) concept of a central factor (perseveration) being the capacity to maintain a mental set. In the cases cited, the mental set would be so strong that S had difficulty switching to a new set.

II. DELAYED PERSEVERATION - INTRUSIVE

7. Delayed corrective reaction

This occurred when a S made an incorrect response to a stimulus and when presented with the next stimulus didn't respond to it, but rather, gave the correct response for the previous stimulus. It isn't unusual for a person to continue thinking of something (eg. someone's name) if they haven't been able to output it when they wanted to. In the case of the dysphasic, when the response was available, it could be said later in an unexplained manner eg. in the middle of another task.

8. Delayed

This is perseveration when a different response has occurred and then an old response is repeated. This is a common sort of perseveration.

S #4M . Body Part Naming

ST	R
wrist	shoulder
thumb	obsolete
elbow	shoulder
eyebrow	obsolete

Ss sometimes indicate that they cannot (or have difficulty) stopping a response from coming back. The concept of a forceful impingement of a response applies here.

III. ASSOCIATIONS - INTRUSIVE

9. Associations along conceptual lines

A S may give an incorrect response that indicates a knowledge of the correct response. This occurs when incorrect responses are of the same class or concept as the correct response.

S #5M S reads a nine word list.

	ST	R
6th	purple	white
9th	brown	white, brown

Initially, S didn't give the correct response but said another color. These were the only two colors on the list.

10. Sounds

Perseveration may involve words that have the same sounds. The last S mentioned said "whistle" instead of "circle" for the second word. Then on the sixth word he said "white" instead of "purple." "White" and "whistle" have the same initial sounds. This may have acted in combination with the concept of color to elicit the response "white" instead of "purple." This could also relate to a perseveration of the sensory auditory stimulation of the sounds said by S. If sounds were retained for a long time they could impinge on other words.

11. Adds an association

An association may be made between a new stimulus and a previously presented stimulus or previous response. If the association is not inhibited, it may replace the correct response.

S #2M "Low" Word Frequency list. S reads words. When presented "glacier" S said "avalanche." "Avalanche" had been presented earlier. These two words could easily be linked conceptually and through visual imagery. They both fit into the concept and picture of a "snowy mountain" scene.

12. Triggerring

If a S is trying to say a sequence but gets stuck, he may repeat the last response he made in order to trigger the next response in the sequence. He may use the last response as a stimulus for himself to elicit the next response. He may go backwards in the sequence, and then forward again as the following case illustrates.

S #2M S is asked to say the months of the year and says

...May, June, July, August, July, June, July, August, September, September, October, November, December.

-July, June - goes backwards.
-July, August, September - goes forward and gets next response as well.
-September, October - repeats September and gets next part of the sequence.

Each month serves as the stimulus for the next month in the series.

13. Previous correct response

For many perseverations, it is difficult to see why the same response has been given to different stimuli. The response may be continually re-circuiting and be elicited because of associations not apparent to the observer, or, the response could re-circuit

until, by chance it is elicited. A likely explanation is the concept suggested by Leicester et al (1971) that some perseverations may occur because the dysphasic tends to repeat previously correct and positively reinforced responses. Positive reinforcement (eg. a nod or verbal response from E or self-knowledge that response was correct) increases the likelihood of a response recurring. In cases where the dysphasic is not able to give the correct answer, or cannot understand the question, the likelihood of a past correct answer being given is increased.

S #3F S is to point to named body parts.

ST	R
ankle	✓
2✓1x 2✓	
thigh	points to ankle, a previous correct response.

This would be an example of delayed perseveration as well. It should be noted that Ss also repeated previously wrong responses. In such cases it may be that because a response was wrong S was concerned about it and it stayed in mind, or it could be that S couldn't suppress it once it was aroused or the response could have a special "attraction" to the S.

14. Change word to suit sounds can say

Another form of modified responding occurs when S changes a word and adds sounds he can say. The sounds deleted may have been too difficult to say, or, it could be that a sound used often is more easily elicited and slips out when a blockage occurs.

S #6M WRAT-R - S replaced the "ance" ending of "protuberance" with "ation" (retubnation).

-S replaced "iat" in the middle of "ingratiating" with "ation" (ingredationing)

15. Filler

Perseverations can serve to "fill" a response requirement. If S can't respond appropriately, he may repeat the same responses over and over. A good example of this is found in the animal naming test where S is required to name different animals for 90 seconds. "Not responding" would occur in the embarrassing setting of the examiner sitting for 90 seconds with pen poised and stopwatch running, waiting to write down S's next response.

S #1F

FIRST 15"	15-30	30-45	45-60	60-75	75-90
dog	house	horse	hen	-	hen
cat	sheep	hen			hedge hog
sheep	pig	hat			
big horse					

2. Discussion

Repetitive vs. Delayed Perseveration

The terms "repetitive" and "delayed" seem to be apt ones in describing perseveration found on the tests used in this study. Repetitive perseveration would seem to occur because of an inability to inhibit a response once it is started, but could also occur when a subject does not try to meet the challenge of answering different questions or performing a different task. In one kind of case, the response would be quite spontaneous, as when one S read "milk, milk, milk, milk" on the WRAT-R. In another type of case, S responds to different questions with the same response. This is not necessarily intentional, but could also result from a lack of orientation to the new task. All perseverative responses could be classed as either "repetitive" or "delayed". In delayed perseveration, the same response is given intermittently. This sort of responding seems to be resultant from the response being elicited through verbal or ideational associations. An example of this would be when on a list of words the word "brown" elicits the response "purple" when purple was the only previous color on the list. Delayed perseveration may also be a case of giving "any" response just in order to be able to respond.

Ideational

Ideational perseveration is evident when conversation consists of a repetition of the same idea. It also occurs when the

concept of one task (involving a series of responses) replaces another whole series of responses.

Causes of Perseveration

It is very difficult to say why perseveration occurs. Since, in dysphasia, it occurs in the context of brain pathology, one would assume that there is some underlying pathological neural basis but there is also the possibility that the person pressed to the limits of his performance capacity consequently experiences normal verbal mistakes in an exaggerated form. Under the conditions of fatigue, anxiety, and a desire not to cease functioning on a verbal level, perseverative responses may be elicited. Under normal functioning, when an association is made to a stimulus, it sometimes slips out. Usually though, a person can monitor what he says and a decision is taken as to what will be said.

Reinforcement Studies on normals have shown that verbal reinforcement such as "uhhuh," or "yes" will increase the frequency of occurrence of desired verbal responses (eg. increase the number of times a subject says "I")in conversation. Positive reinforcement increases the likelihood of a response occurring again. If a dysphasic is in a situation where he doesn't understand how to do a task, or what the correct response would be, he might tend to repeat a correct response on the chance that it would suffice again. A S who has made an incorrect response and is aware of it may become concerned and think about the question while new questions are being asked. Since the old response is "in mind," it may be elicited again later.

Defective monitoring of output Returning to pathological neural processes, it would seem that some dysphasics have occassional difficulty monitoring their verbal or motor output. The ability to attend and concentrate on new tasks is lessened in dysphasia. Once a pattern of responding is elicited, inhibition of the pattern comes slowly. Defective monitoring may come about as a result of an attempt to overcome word finding difficulties by calling to mind associations to the desired word. In the word search process, some of these extraneous associations may be verbally elicited.

Models of Perseveration

Passive and active domination Early writers spoke of both a passive and active domination of perseverative responses. (Pick 1903, Von Solder, 1899 in Hudson 1968). Rats with septal brain damage were found to perseverate stimulus choices in a T-maze. This holding to one response in a choice situation would fit a passive domination model of perseveration. Once a choice is made, other possibilities have lesser attraction. It also fits the sort of perseveration in dysphasics where other possible choices are not attended to. An example would be ideational perseveration where one subject correctly answered the question: "What do we tell time with?" but when then asked "What do you do with a razor?" he spoke about setting an alarm clock for a certain time. The model of active domination seems to apply better when one response interferes with

(or replaces) another and leads to a confabulatory response. An example of the forceful impingement of a prior response occurred when on the "Non-Verbal Agility" test, a S started sticking out his tongue (previous response) instead of touching it to his upper and lower teeth. Finally, sticking out his tongue "won out" and replaced the correct response.

Blockage Leipman's (1905 in Hudson 1968) blockage of the sensory preparation of movement or Luria's (1965 in Hudson 1968) model of an impaired program of action (failure of response given to dennervate in preparation for next response) seem very apt in describing some cases of motor perseveration. A good example of this was the subject who wrote steealing. Once the "e" was written the neural circuits involved in the production of that particular part of the whole response should have dennervated, but perhaps didn't and this could be a possible reason why the motor response was carried out again.

Reinforcement Subjects often repeated previously correct responses so Leicester et al's (1971) concept finds easy application and seems to be a rational explanation for many perseverative responses. Perseverative studies on rats (La Vaque 1966 - septal, Kimble et al 1966 - hippocampectomized) and a study with schizophrenics (Shipley, 1934) found that once a response was conditioned, it tended to remain rather than extinguish.

Switching Spearman's concept of perseveration in normals being in part due to the very elaborateness of the process of

switching from one broad task to another is important when one considers that verbal tasks come automatically to most people but a dysphasic is often forced into the more difficult situation of a necessity to produce each element of the task separately rather than as an automatic "whole" response (consisting of many parts). The ability to automatically perform this function is often lessened in dysphasia. For example, instead of reading a word at a glance, the dysphasic may have to look at each letter of a word that is giving him difficulty.

Faulty Inhibition The inability to inhibit responses seemed to be especially illustrated on tasks where the stimuli for previous verbal responses were present and probably in S's visual field when a new response was asked for. An example of this occurs on the "Visual Confrontation Naming" test where numbers were presented in one area on a card and S was asked to name each one as E pointed to it. Ss often named adjacent numbers instead of the one pointed out. Perseveration studies with rats and monkeys have found a lack of ability to inhibit responses (Mikulas and Isaacson, 1965 - caudate nucleus rats), (McDowell and Lynn Brown, 1965 - irradiated monkeys). This seems to be an important factor in all kinds of perseveration in dysphasia, regardless of what triggerred the elicitation of the perseverative response. This frequent lack of inhibition of the response when it is inappropriate distinguishes the verbal and motor behavior of the dysphasic from "normal" behavior.

3. Summary and Conclusions

Any one case of perseveration could be explained by different models. Due to the complexity of human functioning, any one perseveration would probably be the result of the interaction of many different variables. The content analysis has been an attempt to give examples of hypothetical but reasonable explanations of perseverative behavior. The terms "delayed" and "repetitive" perseveration were found to be very useful in describing the kind of perseveration present. In addition to this distinction, responses that were of an "intrusive" nature were felt to be different from those that were a form of "modified responding" whereby responses were not given at the required level, but rather at the S's level of functioning. Intention is not necessarily implied here. Categories of responses illustrated are: 1. Intrusive-repetitive, confabulatory, responses in visual field, adding words of unknown origins, intrusive interference of motor responses, ideational perseveration; 2. Delayed Intrusive - delayed perseveration, delayed corrective reaction; 3. Associations - Intrusive- associations along conceptual lines, sounds, adds association; and, 4. Modified Responding -triggerring, previous correct response, change words to suit sound has been able to say, and, filler.

Perseveration, while seeming to be affected by physiological causes (inability to inhibit responses, faulty attention and concentration) also seem to be affected by psychological

phenomena such as: reinforcement, concern over mistakes, fatigue, anxiety, habit (tendency to use a perseverative response when S can't give a correct response). When it is realized that dysphasics are often "pushing the limits" of their verbal abilities, many kinds of mistakes "make sense." The reasons for perseveration are very complex, hypothetical, and are very probably interactive in nature.

CHAPTER VII

SUGGESTIONS FOR FURTHER RESEARCH

Following are nine areas in which further research would be useful on dysphasic populations. They derived from problems and questions which arose during the course of this study. If a large subject pool were available, it would be most useful to pre-screen the subjects for perseverative tendencies. With some dysphasics, perseveration would seem to occur most often close to the onset of the dysphasia. However, some dysphasics have long-term perseverative difficulties.

1. WORD FREQUENCY, GRADE LEVEL, AND VERBAL PERSEVERATION

It would be useful to repeat Halpern's study using his word list in the "Visual" modality to see if his high rates of verbal perseveration occur with a new sample. Grade level of subjects would be a relevant variable here.

2. ABSTRACTION LEVEL V.S. SWITCHING, AND VERBAL PERSEVERATION

In order to determine whether abstraction level or "switching" are more important factors in inducing perseverative responses, a study could be done using three word lists controlled for all extraneous word variables. One list would consist of "high abstract" words, another of "low." The third list would consist of "high and low" abstract words presented in a random order. Perseveration rates on the lists would be compared.

3. HIGH AND LOW WORD FREQUENCY AND RESPONSE LATENCY

A more sophistocated measure of latencies could be used in a repeat study to see if there is a difference in response latencies for high and low frequency lists. Tachistoscopic word presentation and an automatic timer set to start when S responds verbally would give more accurate measures of latencies.

4. IS PERSEVERATION A UNITARY MEASURE IN DYSPHASICS?

Batteries of tests such as those previously used to measure perseveration in normals (eg. cancellations, S2S2 test) could be administered to dysphasics.

5. EFFECT OF MANY POTENTIAL RESPONSES APPEARING SIMULTANEOUSLY IN VISUAL FIELD ON PERSEVERATION

A. The words from the WRAT-R could be presented to two different groups of subjects under the following conditions:

GROUP 1: words typed on a card in the same format as usually used on the WRAT - in rows. one below the other.

GROUP 2: words presented individually on cards.

The rate of perseveration would be examined for the two groups.

OR:

B. The number section of the "Visual Confrontation Naming" test of the BDAE could be given in two different ways to two groups of dysphasics.

GROUP 1: numbers presented in a small area on a card.

GROUP 2: numbers presented in a large area on a card (dispersed presentation).

The number of perseverative errors would be examined for the two groups.

6. EFFECT OF TIME INTERVALS ON PERSEVERATION

Rates of perseveration could be examined under conditions where forced response delays of different lengths were imposed (eg. S presented with a card for a set length of time. After card is removed, S must wait a set period of time (eg. after 15 seconds when a buzzer goes off) before saying the word. One would expect more perseveration to occur with longer response intervals. The effect of different intervals between the presentation of the stimuli could also be examined. Here, one would expect less perseveration with longer between - stimulus intervals.

7. EFFECT OF POSITIVE REINFORCEMENT ON VERBAL RESPONSES IN DYSPHASIA

Two groups of subjects would read the same list of words. One group would be reinforced positively for all correct responses (eg. examiner says "good") while the other group wouldn't receive any reinforcement. The dependent measures the number of correct responses and the number of perseverative responses. The determinating would be made whether or not reinforcement increases the number of correct responses and lessens total perseverative errors.

8. EFFECT OF CONCEPTUAL UNITS ON PERSEVERATION

The subjects are required to read a list of words. Words of say five different "classes" occur on the list in a random order.

Different classes could be numbers or colors or animals etc. One would see if there is more perseveration within or between classes.

9. APPROACH VERSUS INHIBITION TASKS

The design that the McDowell and Lynn Brown (1965) used in a study of perseveration in monkeys exposed to radiation could be adapted for use in an experiment with dysphasics to see if they would also do better in approach than inhibition tasks. Two groups of subjects would be used.

GROUP 1

1. Procedure "A" (Approach Task).

Trial 1 Subject is presented with cards with two different stimuli on them. S is asked to choose one.

eg. ○ □ S chooses square

Trial 2 Subjects choice on trial 1 is paired with a new stimulus. S is positively reinforced if he chooses the same stimulus as in previous trial.

eg. □ △ S positively reinforced if chooses square again.

- Subject does sets of trials until a criterion performance is reached, then the next procedure is commenced without informing S.

2. Procedure "B" (Inhibition Task)

Trial 1 Subject is presented with cards with two different stimuli on them.

eg. ○ □ S chooses circle.

Trial 2 Stimulus not chosen on Trial 1 is paired with a new stimulus.

GROUP 2

1. Procedure "B" (Inhibition Task)

Procedure "A" (Approach Task)

eg.  S is reinforced for choosing the "new" stimulus - that which was not presented on Trial 1 (eg. diamond)

-Subject does sets of trials until a criterion performance is reached.

Subjects' performances on procedure A (approach task) would be compared to performances on procedure B (inhibition task). One would expect dysphasics to do better on the approach than on the inhibition task since perseveration occurs in dysphasia and it seems to be related to an inability to inhibit responses.

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APPENDIX I

DESCRIPTION OF THE KIND OF SUBJECTS REQUESTED FOR REFERRAL TO THE STUDY

SUBJECT: "The Effect of Word Frequency on Verbal Perseveration in Dysphasia."

We are doing a study to see what effect, if any, word frequency has on the verbal perseveration of dysphasics. We would appreciate it very much if you could refer to us any of your patients who fit the following description.

Patients recommended to participate in this study should be diagnosed or suspected dysphasics. They will be administered the Boston Diagnostic Aphasia Examination (H. Goodglass and E.Kaplan) as a part of the study, so a definite diagnosis of dysphasia isn't necessary before we see them. They should also be perseverators, that is, they should have been noticed to perseverate on: naming objects, reading sentences, or reading single words during therapy or while taking the subtests of the: Schuell's, Porch, Boston, or other test for aphasia.

SAMPLES: <u>perseveration naming objects</u> -
Patient inappropriately repeats the name of an object previously asked for, when asked to name a new object. eg. Therapist points to a pen and asks patient to name it. Patient says "pen". Therapist now points to a box and asks patient to name it. Patient says "pen". etc.

<u>perseveration reading sentences</u> -
Patient inappropriately repeats a particular word in a sentence. The repeated word is either from the sentence itself or from a previous sentence. eg. Patient is asked to read the sentence: "He bought a new car." Patient reads: "He bought a bought car."

Perseveration reading single words -
Therapist asks the patient to read some words. Patient inappropriately repeats a word previously given when asked to read a new word. eg. Therapist points to the written word "brother." Patient says "brother". Therapist points to the word "tractor". Patient says "brother".

The patients should speak English. They may be either male or female, and 16 years of age or older. They should be suspected to read at the Grade Five level or higher. As a part of the study, they will be given the Wide Range Achievement Test (J. F. Jastak, S. W. Bijou, and S. R. Jastak). This test gives grade equivalents of reading levels, so the patients don't have to be specifically diagnosed as reading at the Grade Five level before you recommend them for the study. Just to give you an idea of the sort of words that are at the Grade Five level, here is a sample list taken from C. E. Stothers, R. W. B. Jackson, and F. W. Minker's A Canadian Word List, Grades 1 - 6. All these words are at the Grade Five level.

abandon	bachelor	cackle	dagger	
earnest	factor	gait	habitant	
icing	jackass	kangaroo	laboratory	
machinery	naked	obedience	padlock	
quantity	ransom	sable	tab	
umpire	vacant	wad	yacht	zeal

Once again, here are the characteristics of the kind of patient we are looking for:

1) dysphasic
2) perseverator
3) Grade Five or higher reading level
4) English speaking
5) male or female
6) 16 years of age or older.

Thank you very much for helping us out on this project.

APPENDIX II

a. Number of Subjects Perseverating on the Different Tests

Test: Number	Test: Name	Number of Ss Perseverating	Type of Task
1	High Frequency Word List	1	Verbal
2	Low Frequency Word List	2	Verbal
3	WRAT-R (Pre-test)	6	Verbal
5	Word Discrimination	2	Motor (pointing)
6	Body Part Identification	2	Motor (pointing)
9	Non-verbal Agility	2	Motor (movements: mouth and tongue)
10	Verbal Agility	1	Verbal
11	Automatized Sequences (Pre-test)	7	Verbal
12	Reciting	0	Verbal
15	Repetition of Words (Pre-test)	1	Verbal
16	Repeating Phrases (Pre-test)	0	Verbal
17	Reading Single Words (Pre-test)	4	Verbal
18	Responsive Naming (Pre-test)	5	Verbal
19	Visual Confrontation Naming (Pre-test)	7	Verbal
20	Body Part Naming (Pre-test)	7	Verbal
21	Animal Naming	6	Verbal
22	Oral Sentence Reading	2	Verbal
25	Comprehension of Oral Spelling	0	Verbal
26	Word-Picture Matching	1	Motor (pointing)
28	Mechanics of Writing	0	Motor (writing)
29	Recall of Written Symbols	3	Motor (writing)
30	Written Word Finding	3	Motor (writing)
31	Written Formulation	2	Motor (writing)

APPENDIX II

b. Examples of the Different Categories of Perseveration

CATEGORY	TEST	SUBJECT	AREA OF DAMAGE	SEVERITY LEVEL	TYPE
I. INTRUSIVE Repetitive.	3	4M	B	2	M
	6	7M	C	1	W
	11	8M	A	3	M
	15	5M	A	2	M
	19	4M	B	2	M
	19	8M	A	3	M
	20	4M	B	2	M
	26	3F	B	3	W
	30	1F	A	3	W
	31	1F	A	3	W
Confabulatory	2	4M	B	2	M
	3	8M	A	3	M
	10	5M	A	2	M
	22	4M	B	2	M
	30	8M	A	3	M
Response in Visual Field	3	2M	B	1	B
	3	7M	C	1	W
	17	3F	B	3	W
	17	7M	C	1	W
	19	2M	B	1	B
	19	3F	B	3	W
	19	7M	C	1	W
Add Words-Unknown Origin	3	4M	B	2	M
Intrusive Interference-Motor	9	4M	B	2	M
	9	7M	C	1	W
	29	1F	A	3	W
	29	2M	B	1	B
	29	5M	A	2	M
	31	1F	A	3	W
	31	8M	A	3	M

APPENDIX II

Ideational	4	4M	B	2	M
	4	7M	C	1	W
	11	1F	A	3	W
	11	3F	B	3	W
	11	4M	B	2	M
	18	1F	A	3	W
	18	7M	C	1	W
	18	8M	A	3	M
	19	1F	A	3	W
	19	3F	B	3	W
	19	4M	B	2	M
	19	4M	B	2	M
	20	7M	C	1	W
II. DELAYED INTRUSIVE					
Delayed	20	3F	B	3	W
	20	4M	B	2	M
	30	5M	A	2	M
Delayed Corrective Reaction	1	4M	B	2	M
III. ASSOCIATIONS-INTRUSIVE					
Along Conceptual Lines	2	2M	B	1	B
	2	4M	B	2	M
	17	2M	B	1	B
	17	5M	A	2	M
	18	3F	B	3	W
	18	5M	A	2	M
	19	5M	A	2	M
	20	2M	B	1	B
Sounds	2	4M	B	2	M
	17	5M	A	2	M
Adds Associations	2	4M	B	2	M
	5	2M	B	1	B
IV. MODIFIED RESPONDING					
Triggering	11	2M	B	1	B
	11	5M	A	2	M
	11	7M	C	1	W
	19	2M	B	1	B
Previous Correct Response	5	3F	B	3	W
	6	3F	B	3	W

APPENDIX II

Change Words to Suit Sounds Has Been Able To Say	3	1F	A	3	W
	3	6M	C	4	M
	3	8M	A	3	M
Filler	11	4M	B	2	M
	21	4M	B	2	M
	21	7M	C	1	W

APPENDIX II

c. Presentation of the Results For Each Subject

#1 F-HL

TEST.	A	B	C
1	-	-	-
2	-	-	-
3	✓	1	3(P)
5	-	-	-
6	-	-	-
9	-	-	-
10	-	-	-
11	✓	2	3(I),1(T)
12	-	-	-
15	-	-	-
16	-	-	-
17	-	-	-
18	✓	1	1 (I)
19	✓	2	1 (I),1
20	✓	1	2
21	✓	3	1,1,2
22	-	-	-
25	-	-	-
26	-	-	-
28	-	-	-
29	✓	2	1,1
30	✓	3	1(P),1(P),1(P)
31	✓	4	1,1,1,1

#1 F-HL

A= occurrence (✓) or absence (-) of perseveration the test.
B= no. of different occurrences of perseveration (ie. different words).
C= length of runs of perseveration.
P= part of a word perseverated.
I= ideational perseveration.
T= perseveration is a triggering device.
DO= perseveration due to disorientation or visual defect.

SUBJECT:	- #1F
AGE:	- 61
B.D.A.E.:	- Receptive, word finding difficulty. - Severity Level "3"
WRAT-R:	- Grade 17.1
HANDEDNESS:	- Right
LANGUAGES:	- ENGLISH
LOCALIZATION INFORMATION:	- C.V.A. approximately three months prior to testing. - left middle cerebral a.thrombosis. - right facial paresis and right flaccid hemiplegia. - right visual field defect.

#1F

:st: Test: umber Name	Item Number Stimulus-Question	Response	Type of Perseveration	Notes
3. WRAT-R (Pre).	14. contagious	✓(answered correctly)		-may have difficulty with word ending, so uses ending can say.
	30. unanimous	✓		
	37. contemptuous	✓		
	...			
	57 vehemence	vehemous	MODIFIED RESPONDING-Change words to suit sounds has been able to say.	
	... 1✓1x 7✓			
	67 ebullience	ebullious	P. part word.	
	68 misogyny	misogous	P. part word.	
1. AUTOMATIZED SEQUENCES (Pre).	1. Say the days of the week.	✓		
	2. Say the months of the year.	Monday, Sunday, Saturday	P. ideational.	-may have misunderstood instructions said days backwards.
	3. Count 1-21	✓		
	4. Say the alphabet	a b c d e f g h h...	P. repetitive	
3. RESPONSIVE NAMING (Pre).	4. What do you do with a pencil?	Write squares.		
	5. What do we cut paper with?	pencils, scissors.	P. ideational	
9. VISUAL CONFRONTATION NAMING (Pre).	objects 4✓			
	5. hammock	✓		
	6. cactus	I know it has a hammock on it. E? Hammock with...	P. ideational	-both stimuli had short vertical lines drawn on them hammock (a fringe cactus (prickles)
	numbers			
	1. 7	✓		
	2. 15	✓		
	3. 700	✓		

#1F

20.	BODY PART NAMING(Pre).	4. 1936 last question previous test	750,1936	P. confabulatory.	
		Point to your elbow.	✓		
		1. ear	✓		
		2. nose	✓		
		3. shoulder 3✓	elbow	P. delayed.	-shoulder, elbow, and knuckles are all joints.
		7. elbow	✓		
		9. knuckles	Out is elbow I don't know inside part.	P. delayed	-S may have confused "outside and inside with "top and bottom."
21.	ANIMAL NAMING	FIRST 15 dog cat sheep big horse	15-30 house sheep pig	30-45 45-60 60-75 75-90 horse hen - hen hen hedgehog hat	P. filler	-may be repeating old responses just to be able to say something
29.	RECALL OF WRITTEN SYMBOLS.	1.Write the alphabet	a b c d e f g h i j k k l m n o p q u s t u v x y z.		P. repetitive	-"u" isn't counted as perseverated since first "u" occurred before its place in the sequence.
		2.Write the numbers from 1 to 21.	... 13,14,15...		P. repetitive INTRUSIVE INTERFERENCE	-S noticed had written "14" twice and corrected it.

#1F

-old response not dennervated, carried out again
-lack of monitoring of output.

30. WRITTEN WORD FINDING

Write the name of this E. points to a picture.

4.	square	✓		
5.	15	✓		
6.	7	fift	P. part word repetitive	
8.	brown	quar, brownd	P. delayed,	-from "square"
9.	red	✓		
10.	drinking	drinkinng	P. repetitive	-response not

31. WRITTEN FORMULATION

Last word S wrote for last test was "smoking"
-S given picture depicting scene and asked to write as much as she could about the picture.

-first thing S wrote was "gmoking."

P. repetitive
INTRUSIVE INTERFERENCE
Motor

-failure to inhibit previous response
-S realized what she had done and pointed it out to E.

#2M-HL

	A	B	C
1	-	-	-
2	√	1	1
3	√	2	1,1
5	√	1	1
6	-	-	-
9	-	-	-
10	-	-	-
11	√	4	2(T),1(T),1(T),1(T)
12	-	-	-
15	-	-	-
16	-	-	-
17	√	1	1
18	-	-	-
19	√	2	1,1(T)
20	√	3	1,1,1
21	√	1	1
22	-	-	-
25	-	-	-
26	-	-	-
28	-	-	-
29	√	3	1,1,1
30	-	-	-
31	-	-	-

SUBJECT: -#2M
AGE: -25
B.D.A.E: -Expressive dysphasia
-Severity Level "1"
WRAT-R: -Grade 4.6
HANDEDNESS: -Right
LANGUAGES: -ENGLISH
LOCALIZATION INFORMATION:
-six months prior to testing - traumatic occlusion of left internal carotid artery (angiographic evidence).
-spasticity right arm and leg (able to walk with brace).
-left vocal cord paralyzed.
-palsy of X, XI, XII cranial nerves.
-three months prior to testing a large aneurysm fed by the left internal carotid artery was surgically clipped.

#2M

3. WRAT-R (Pre).	3. in 6. himself 15. grieve	✓ in ✓	INTRUSIVE - Response in visual field P. delayed	-"grieve" may have been in visual field while S was attempting "eliminate" S may not have been able to inhibit response
	21. eliminate	grieve	P. delayed	
11. AUTOMATIZED SEQUENCES (Pre).	Say the months of the year.	...June,July,August July, June,July, August,September, September,October	P. triggerring	-July,June-S stuck, goes backwards -July,August S goes forward and gets next month. September,Sept., Oct., S repeats Sept. to strengthen that step and triggers next month.
17. READING WORDS	6. purple 9. brown	✓ purple,brown	ASSOCIATIONS - INTRUSIVE Along conceptual lines. P. conceptual	-"purple" was only other color on list.
19. VISUAL CONFRONTATION NAMING.	E points to picture. What is this? letters 3. R 4. L	✓ R	P. INTRUSIVE - Response P. repetitive	-repeats previous correct response

#2M

19.		numbers 2. 15	14,14,15	P. triggerring	S knows "14" isn't desired response but uses it to trigger next number in sequence "15" which is correct response. Learn numbers in two ways - as a unit itself eg. "15" and as part of a whole series eg. "13,14,15,16."
20.	BODY PART NAMING	E.points to part on body and asks what it is.			
		1. ear	√		
		4. ankle	x E has S repeat "ankle"		
		6. thumb	√	ASSOCIATIONS-INTRUSIVE Along conceptual lines P. conceptual delayed	-"ear and eyebrow" parts of face. -"knuckles and thumb" parts of hand. -"shin and ankle" part of leg.
		8. eyebrow	ear		
		9. knuckles	thumb		
		10. shin	ankle		
2.	LOW FREQUENCY WORD LIST	7. avalanche	√	ASSOCIATIONS-INTRUSIVE Along conceptual lines. P. association	-"glacier and avlanche" related-imagery and conceptually.
		17. glacier	avalanche		

#2M

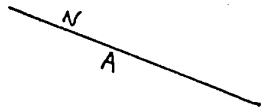
5.	WORD DISCRIMINATION	E: Show me the___. S must point to picture.			
		2. H	√		
		6. G	H	P. association	-"g and h" are next to each other in alphabet.

21.	ANIMAL NAMING	FIRST	15"	15-30	30-45	45-60	60-75	75-90	
		dog horse animal cheeta lion leopard mink	chickeny elk		monkey	cat	horse	donkey	P. filler
									INTRUSIVE-INTERFERENCE motor

29.	RECALL OF WRITTEN SYMBOLS	1. E: Write the alphabet	...m n o p ~~e~~ s r...	P. motor repetitive	-motor response did not de-nervate -S corrected himself
		2. Write the numbers from 1 to 21.	1 2 3 ~~3~~...	P. motor repetitive	-same as above

#3F-HL

	A	B	C
1	-	-	-
2	-	-	-
3	-	-	-
5		5	1,1,1,1,1
6		3	2,1
9	-	-	-
10	-	-	-
11		7	(1,1,1,1,1,1,1) (I)
12	-	-	-
15	-	-	-
16	-	-	-
17		1	1
18		1	1
19		3	1,3,1 (I)
20		1	1
21		1	1
22	-	-	-
25	-	-	-
26		1	1
28			
29			
30			
31			



SUBJECT: -#3F
AGE: -75
B.D.A.E: -Receptive dysphasia
-Severity Level "3"
WRAT-R: -Grade 2.2
HANDEDNESS: -Right
LANGUAGES: -ENGLISH
LOCALIZATION INFORMATION:
-degenerative calcification - cavernous portion of left internal carotid artery; extreme stenosis at the origin of the left internal carotid: (angiographic evidence).

#3F

11.	AUTOMATIZED SEQUENCES (Pre).	1. Say the days of the week. 2. Say the months of year.	✓ Monday, Tuesday Wednesday...	INTRUSIVE ideational	-S had sensory difficulties may have misunderstood instructions -S may have thought she was saying the month of the year.
17.	READING WORDS (Pre).	8. dripping 9. brown	✓ dripping, brown	INTRUSIVE-Response in visual field P. repetitive	-both words may have been in visual field.
18.	RESPONSIVE NAMING (Pre).	6. What color is grass? 9. What color is coal?	✓ brown, blue, green	ASSOCIATIONS Intrusive-along conceptual lines.	-only two questions dealing with color. Incorrect response is another color.
19.	VISUAL CONFRONTATION NAMING (Pre).	E What is this?			
		numbers			
		3. 700	✓		
		4. 1936	700, 800	INTRUSIVE-Response in visual field	-"700 and 1936" are adjacent on stimulus card.
		colors			
		2. brown	green	P. delayed	-Perseverated "green" on last test (#18) as well
		4. blue	green	P. delayed	
		5. gray	green	P. repetitive	
		body parts			
		1. ear	721	INTRUSIVE ideational	-response required on a previous test was to name a number
20.	BODY PART NAMING (Pre).	S asked to name body parts.			

#3F

	3. shoulder	elbow	P. delayed	-from last response of previous test.
	6. thumb	mouth x		
	9. knuckles	mouth	P. delayed	-previous incorrect.

5. WORD DISCRIMINATION — E: Show me the ___

objects			
4. feather	✓	MODIFIED RESPONDING Previous correct response P. delayed	
6. cactus	S points to picture of feather.		
forms			
1. circle	✓		
3. square	✓	MODIFIED RESPONDING Previous correct response P. repetitive	
4. triangle	S points to square.		
6. star	S points to circle.	P. delayed	
colors			
1. blue	✓		
6. purple	points to blue	P. delayed	-"purple and blue" are similar colors.
numbers			
3. 700	✓		
6. 7000	points to 700	P. delayed	-"7000 and 700" are similar.

6. BODY PART IDENTIFICATION — Point to your___.

1. ear	✓		
3. shoulder	Points to ear, then shoulder.	P. delayed	

#3F

6.		6. ankle	✓		
		12. thigh	ankle	P. delayed	
		RIGHT OR LEFT			
		1. right ear	✓		
		2. left shoulder	Points to left ear, then left shoulder.	P. repetitive	-same mistake as before (#1+3)

21.	ANIMAL NAMING	FIRST 15"	15-30	30-45	45-60	60-75	75-90		
		dog	pig	-	-	horse	trap	P. filler	
		cat							
		horse							
		sow							

26.	WORD-PICTURE MATCHING	E: which of these pictures is this word?			
		1. chair	Points to feather	INTRUSIVE	-repeats previous incorrect response. -may be dyspraxic and just responding randomly-only got 1 correct out of 6 responses
		2. circle	Points to feather	P. repetitive	

#4M-HL

	A	B	C
1		1	1
2		3	1(P),2(P),2(P)
3		7	3,7,1,5(P),1(P),1(P),2(P)
5	-	-	-
6	-	-	-
9		2	1,1
10	-	-	-
11		11	(2,2,1,1,1) (I), 4,1,2,2,3,1
12	-	-	-
15	-	-	-
16	-	-	-
17	-	-	-
18	-	-	-
19		8	2,1(1,2,1,1,1,3) (I)
20		2	4,2
21		3	1,4,4
22		6	1,2,2,2,2,2(I)
25	-	-	-
26	-	-	-
28	Not Able to Interpret		
29			
30			
31			

SUBJECT: -#4M
AGE: -66
B.D.A.E: -Receptive - expressive dysphasia
-Severity Level "2"
WRAT-R: -Grade 7.1
HANDEDNESS: -Right
LANGUAGES: -FRENCH,ENGLISH
LOCALIZATION INFORMATION:
-less than a month prior to testing a large aneurysm on left internal carotid artery was surgically clipped.
-III and VII nerve palsy.
-mild stenotic lesion of left, internal carotid artery above bifurcation (angiographic evidence).
-right paresis
-pytosis of left eye.

#4M

3. WRAT-R	1.	milk	milk,milk,milk milk	P. repetitive	-can't inhibit response once elicited
	2.	S inserted "table" into list 8 times		P. associations delayed	-unknown association but may have been because S was working at a portable table.
	3.	Inserted "Theodore" into list 2 times.		INTRUSIVE-Add words unknown origin.	
	4.	Inserted "celabusis" and variations 6 times.		P. neologistic	-S had an eye
	5.	Inserted "continuous" and variations 2 times.		P. association	problem may have had difficulty seeing words sometimes.
	6.	Inserted "communicate" and 2 times		P. association	
	7.	Inserted "colin" and variations 4 times.		P. neologistic	
4. CONVERSATION	-	E What is your full name?	___ ___ALDARA	INTRUSIVE	-this was not S's
	-	E What is your full address?	My full address is Aldara Street	Ideational	
	-	S speaking said...mahogany or mahogany			-S had previously been able to name kind of wood when he used that phrase.
	-	S asked to tell all he could see going on in a picture.			
			Well, here are cookies. Here be cookies...And well there's cookies...	filler	-S repeats fact that there are cookies over, and over.
			He's falling right off the cookie here.	P. ideational . intrusive	-S says "cookie" instead of "stool"

#4M

9. NON VERBAL AGILITY	S asked to do a task as fast as he can while E times him.			
	1. purse lips, release.	✓	INTRUSIVE-INTERFERENCE motor	
	3. retract lips, release	S repeats #1, then does #3		
	5. protrude and retract tongue.	✓	INTRUSIVE-INTERFERENCE motor	
	6. tongue to upper and lower teeth.	S repeats #5 intermittently with #6.		-previous task interfered and finally replaced new task.
1. AUTOMATIZED SEQUENCES	1. Say the days of the week.	✓		
	2. Say the months of the year.	Saturday,Monday Monday, September, Wednesday, Thursday,Saturday Sunday.	INTRUSIVE-ideational	-S said one month among the days shows he understands required task.
	4. Say the alphabet.	Alphabet. Alphabet. g.c. d. I want to say a.b.c.d.e. f. b.a.c.a.g. f.g.f.g.e.k.l. m.n.o.g.r.a.a. u.r.s.t.y.x.s. x.y.z.	MODIFIED RESPONDING filler	
9. VISUAL CONFRONTATION NAMING	Last question of previous test-Where do you go to buy medicine? S: haberdasher, hairdresser. E: What is this?			
	objects			
	6. cactus	hairdresser.		

	letters				
	4. L		hairdresser,L,T		
				P. intrusive delayed	
	numbers				
	2. 15		✓	INTRUSIVE-repetitive	
	3. 700		15, 1700		
	colors			INTRUSIVE	
	1. red		7-15,000-1500	ideational	
	2. brown		36,000		
	3. pink		?,000		
	4. blue		7,000		
	5 gray		14,000		
	body parts				
	1. ear				
	2. shoulder		15,000-14,000	INTRUSIVE	-got one response correct.
	3. elbow		14,000	ideational	
20. BODY PART NAMING	E. What is this?				
	3. shoulder		x	INTRUSIVE	
	4. ankle		shoulder	repetitive	-S tried to stop himself from saying shoulder but couldn't.
	5. wrist		shoulder		
	6. thumb		obsolete		
	7. elbow		shoulder, Oh damn oh shit, it's not ...shoulder.		
	8. eyebrow		obsolete	DELAYED - INTRUSIVE	
	9. knuckles		shoulder		
	10. shin		obsolete		

21. ANIMAL NAMING	FIRST 15"	15-30	30-45	45-60	60-75	75-90	
							MODIFIED RESPONDING
	cat	dog	dog	cat	-	-	filler
	dog	cat	cat				
	obsolete writing	dog	dog				
		cat					

22. ORAL SENTENCE READING	3. I got home from work.	✓	INTRUSIVE-confabulatory
	4. Near the table in the dining room.	Near the home table in the dining room.	

#4M

	6. Limes are sour.	Limes like are sour	INTRUSIVE	
	7. The spy fled to Greece.	sour lime, sour lime, sped fled home from.	confabulatory	
	8. The barn swallow captured a plump worm.	The home from, brown yellow.	P. confabulatory	
	9. The lawyer's closing argument convinced him.	brown worm	P. confabulatory	
	10. The phantom soared across the foggy heath.	The brown worm soared across the foggy hearth.	P. confabulatory	
1. HIGH FREQUENCY WORD LIST	7. street	city		
	8. machine	street	P. delayed corrective reaction	
2. LOW FREQUENCY WORD LIST	5. icebox	✓		
	7. avalanche	ice	P. associative	
	13. acrobat	✓	ASSOCIATION	
	15. bagpipe	bogcat		-Sounds: rhymes with bat
	19. leopard	leopard cat	ASSOCIATION-conceptual	
	20. mosquito	mo, moscat		
	22. tweezers	heezle cap	INTRUSIVE confabulatory	
	23. daffodil	battle cap		
	24. lemonade	lemon cap		

APPENDIX II

#5M-LH

	A	B	C
1	–	–	–
2	–	–	–
3	–	–	–
5	–	–	–
6	–	–	–
9	–	–	–
10	✓	1	1
11	✓	4	3,3,1,1
12	–	–	–
15	✓	1	1
16	–	–	–
17	✓	1	1
18	✓	1	1
19	✓	2	1,1
20	✓	1	1
21	N		
22		A	
25	–	–	–
26	–	–	–
28	–	–	–
29	✓	3	1,1,1
30	✓	1	1(P)
31	–	–	–

SUBJECT: -#5M
AGE: -62
B.D.A.E.: -Expressive - receptive dysphasia
-Severity Level "2"
WRAT-R: -Kindergarten 7
HANDEDNESS: -Right
LANGUAGES: -FRENCH, ENGLISH
LOCALIZATION INFORMATION:
-probable left middle cerebral artery occlusion.
-EEG: moderately severe disturbance in the left cerebral hemisphere, maximum over left fronto-temporal region.

#5M

11.	AUTOMATIZED SEQUENCES. (Pre)	1. Say the days of the week.	Sunday, Saturday S, Sunday, Saturday, S, S, Sunday, Monday, Thursday, Monsday S, Saturday S, Saturday, S, Friday Sunday, Friday.	P. triggerring	
15.	REPETITION OF WORDS (Pre).	S asked to repeat words after E. 8. 1776	17666 - 176 - 6 1766	P. repetitive	-S couldn't stop saying too many 6's.
17.	READING WORDS (Pre).	2. circle 6. purple 9. brown	whistle white white, brown	P. ASSOCIATIONS conceptual and sounds.	-both colors -"wh" sound in both
18.	RESPONSIVE NAMING (Pre).	9. What color is coal?	white	P. ASSOCIATION conceptual	-from previous test.
19.	VISUAL CONFRONTATION NAMING (Pre).	E: What is this? actions 3. drinking 6. dripping	X Repeat after E drinking. drink E says "dripping" S says drinking.	P. intrusive	-S couldn't repeat dripping-drinking came out. -sounds the same

#5M

19.		colors			
		2. brown	black	ASSOCIATION conceptual	-in a previous test S couldn't elicit "black" in answer to "What color is coal?"
		6. purple	black, purs	P. delayed	
20.	BODY PART NAMING	E: What is this?			
		8. eyebrow	eyes (perseverated from previous test)	P. delayed	-previous incorrect response
10.	VERBAL AGILITY	S asked to say word over and over while E times.			
		6. baseball player	baseball payer		
		7. caterpillar	caterplayer, pillar	P. confabulatory	-similar sounds.
29.	RECALL WRITTEN SYMBOLS	2. Write the numbers from 1 to 21.	...9 10 10 12 ...17 18 19	INTRUSIVE INTERFERENCE motor	-motor response didn't de-nervate
		3. E dictates: 7 - 15 - 42	S writes 7-15-32 42	INTRUSIVE INTERFERENCE motor	
30.	WRITTEN WORD FINDING	E points to picture.	S writes its name.		
		7. brown	✓	P. delayed INTRUSIVE	
		9. drinking	B Drunk	P. part word	-started to write "brown" again.

APPENDIX II

#6M-LH

	A	B	C
1	-	-	-
2	-	-	-
3	✓	3	1,6(P),7(P)
5	-	-	-
6	-	-	-
9	-	-	-
10	-	-	-
11	-	-	-
12	-	-	-
15	-	-	-
16	-	-	-
17	-	-	-
18	-	-	-
19	-	-	-
20	-	-	-
21	-	-	-
22	-	-	-
25	-	-	-
26	-	-	-
28	-	-	-
29	-	-	-
30	-	-	-
31	-	-	-

SUBJECT: -#6M
AGE: -26
B.D.A.E.: -Receptive - expressive dysphasia
-Severity Level "4"
WRAT-R: -Grade 6.9
HANDEDNESS: -Right
LANGUAGES: -ENGLISH
LOCALIZATION INFORMATION:
-A.V. malformation of brain - left temporal lobe.
-widespread dysfunction of left (dominant) hemisphere.

#6M

3. WRAT-R

			MODIFIED RESPONDING change words to suit sounds has been able to say.	
26.	deny			
40.	benign	be,deny	P. delayed	-S may be replacing difficult sounds with ones that are easier to say.
41.	desolate	res, resolate		
42.	protuberance	retur, retur, retubration, retubnation protub,re,ro, protuberation.	P. repetitive	
54.	ingratiating	ingredationing, ingredationing ...	P. delayed	
57.	vehemence	vehemation, vehemation vehemation.	P. delayed	

APPENDIX II

#7M-LH

	A	B	C
1.	-	-	-
2.	-	-	-
3.	✓	2	1,1(DO)
5.	-	-	-
6.	✓	2	3,1
9.	✓	2	1,1
10.	-	-	-
11.	✓	4	1(T),2(T),1(T),1(T)
12.	-	-	-
15.	-	-	-
16.	-	-	-
17.	✓	1	1
18.	✓	1	1(I)
19.	✓	1	2
20.	✓	2	1,1(I)
21.	✓	3	1,1,1
22.	✓	4	1,1,1,1
25.	-	-	-
26.	-	-	-
28.	-	-	-
29.			
30.			
31.			

SUBJECT: -#7M
AGE: -46
B.D.A.E.: -Receptive dysphasia; dyspraxia
-Severity Level "1"
WRAT-R: -Grade 3.2
HANDEDNESS: -Right
LANGUAGES: -ENGLISH
LOCALIZATION INFORMATION:
-sixteen year history of seizures
-EEG: diffuse disturbance of cortical function; focal severe abnormality - left fronto-centro-temporal regions, some extension - right frontal.
-history of tumors:
-right occipital tumor
-corpus callosum tumor
-extensive glioma of brain.

#7M

3.	WRAT(R)	6. himself	✓		
		7. between	✓		"himself and between" appear on line above "grieve and toughen."
		15. grieve	himself	P. Visual field	
		16. toughen	between		
11.	AUTOMATIZED SEQUENCES	1. Say the days of the week.	E assisted Sunday,Monday Monday...	MODIFIED RESPONDING triggering P. repetitive	
		4. Say the alphabet	...e f g g...	P. repetitive	
17.	READING WORDS	9. brown	✓	INTRUSIVE-Response in visual field.	
		10. smoking	brown	P. repetitive	
18.	RESPONSIVE NAMING	1. What do we tell time with?	alarm clock		
		2. What do you do with a razor?	Set the alarm for any it'll off at a certain time. You can set it so it doesn't go off before dinner.	P. ideational	
19.	VISUAL CONFRONTATION	E: What is this?			
		numbers			
		3. 700	7000	INTRUSIVE-Response in visual field.	-700 and 7000 are similar visually.
		4. 1936	7000	P. repetitive	
		5. 42	7000		
20.	BODY PART	E: What is this?(Points to body part)			
		3. shoulder	nose		
		4. ankle	S points to 700 on card.	P. ideational	-response from previous test.

#7M

4. CONVERSATION		...so we went to the hospital and so we went out to the hospital...and ah...went to the hospital and went to the and... -It wasn't that I was so sick and but I was wi with with a chum of mine. I was with my chum and he was with...I was with more with my friend and uhm than with anybody else and uh...	P. ideational	-S repeats same phrase over and over.
6. BODY PART IDENTIFICATION	E: point to your___.			
	1. ear	✓		
	2. nose	ear	P. repeptitive	
	3. shoulder	ear		
	6. ankle	✓		
	7. chest	ankle	P. repetitive	
	Right or Left			
	1. right ear	✓		
	2. left shoulder	right ear	P. repetitive	
9. NON-VERBAL AGILITY	S asked to do different movements while E timed.	mouth	INTRUSIVE INTERFERENCE motor	
	2. open and close mouth	✓	P. repetitive	
	3. retract lips, release	open and close mouth		
	5. protrude and retract tongue	✓	INTRUSIVE INTERFERENCE motor	

#7M

		6.	tongue to upper and lower teeth	protrude and retract tongue	P. repetitive
21.	ANIMAL NAMING		FIRST 15" 15-30 30-45 45-60 60-75 75-90		
			dog | house home | house home | farm animals | farm animals | -		P. filler
22.	ORAL SENTENCES READING	1.	You know how.	E assisted X You know...	P. confabulatory intrusive
		2.	Down to earth.	know to earth	
		3.	I got home from work.	go town from	
		4.	Near the table in the dining room.	I work	
		5.	They heard him speak on the radio last night.	They speak to to him on the radio from the table.	
		8.	The barn swallow captured a plump worm.	X The worm...	
		9.	The lawyers closing argument convinced him.		

"house and home" came from instructions S couldn't perform task.

#8M-LH

	A	B	C
1.	-	-	-
2.	-	-	-
3.	✓	2	3(P),1(P)
5.	-	-	-
6.	-	-	-
9.	-	-	-
10.	-	-	-
11.	✓	2	2,1
12.	-	-	-
15.	-	-	-
16.	-	-	-
17.	-	-	-
18.	✓	1	1(I)
19.	✓	1	1(P)
20.	✓	1	1
21.	✓	1	1
22.	-	-	-
25.	-	-	-
26.	-	-	-
28.	-	-	-
29.	-	-	-
30.	✓	2	1,1
31.	✓	1	1

SUBJECT:	-#8M
AGE:	-44
B.D.A.E.:	-Mixed dysphasia
	-Severity Level "3"
WRAT-R:	-Grade 6.8
HANDEDNESS:	-Right
LANGUAGES:	-ENGLISH,FRENCH
LOCALIZATION INFORMATION:	
	-C.V.A. left middle cerebral artery

#8M

3.	WRAT-R	21.	eliminate	eliminate	
		29.	bibliography	bibiography	P. part word
		30.	unanimous	aluminate	
		31.	predatory	prariograph	INTRUSIVE-Confabulatory
		42.	protuberance	prudenturate	MODIFIED RESPONDING
					Change word to sounds
		48.	enigmatic	emaginate	has been able to say.
11.	AUTOMATIZED SEQUENCES	4.	Say the alphabet.	...p q r s t r r p u v w...	P. delayed ("p") repetitive ("r")
18.	RESPONSIVE	5.	What do we cut paper with	✓	
		6.	What color is grass?	grass cutter green	P. ideational
19.	VISUAL		What is this? E points to picture		
		5.	hammock	✓	part word
		6.	cactus	ha, no-tree-no	P. repetitive
20.	BODY PART NAMING		E: What is this? E points to body part		
		6.	thumb	✓	
		9.	knuckles	finger,fingernail uh. That is your thumb...	P. delayed
21.	ANIMAL NAMING		FIRST 15 15-30 30-45 45-60 60-75 75-90		
			dog - caterpillar - horse sheep		P. filler
			cat	cow	
			horse	goat	
			fly		
30.	WRITTEN WORD		E points to picture. S writes its name.		
		3.	circle	✓	P. confabulatory
		4.	square	sirle	
		7.	brown	✓	
		8.	red	✓	

-replace sounds -with ones can say
-idea of cutting repeated.
-S stopped himself from saying hammock again.
-may have been triggering-after repeated "horse" got 3 more responses

#8M

30. 9. drinking browing,bring P. confabulatory

31. WRITTEN FORMULATION E: Write all you can about this picture.
...the girl ~~red~~ running... P. delayed -is from last test.
P. INTRUSIVE INTERFERENCE
motor

APPENDIX III

REPORTS ON LANGUAGE DISABILITIES OF SUBJECTS

APHASIA SEVERITY RATING SCALE

0. No usable speech or auditory comprehension.

1. All communication is through fragmentary expression; great need for inference, questioning and guessing by the listener. The range of information which can be exchanged is limited, and the listener carries the burden of communication.

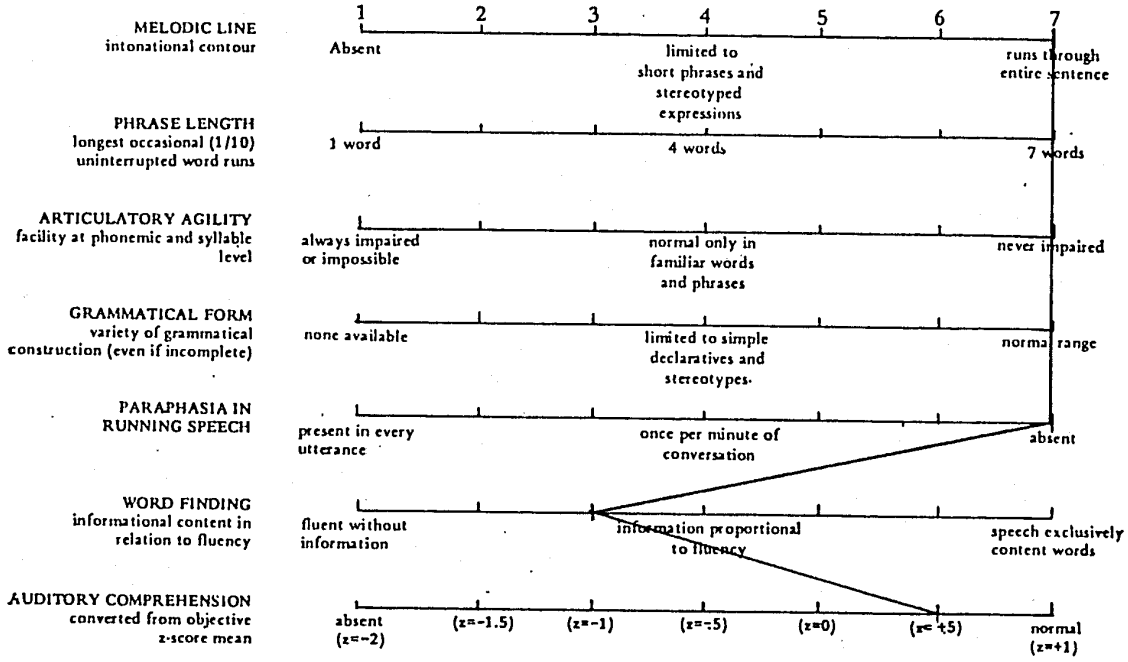
2. Conversation about familiar subjects is possible with help from the listener. There are frequent failures to convey the idea, but patient shares the burden of communication with the examiner.

(3.) The patient can discuss almost all everyday problems with little or no assistance. However, reduction of speech and/or comprehension make conversation about certain material difficult or impossible.

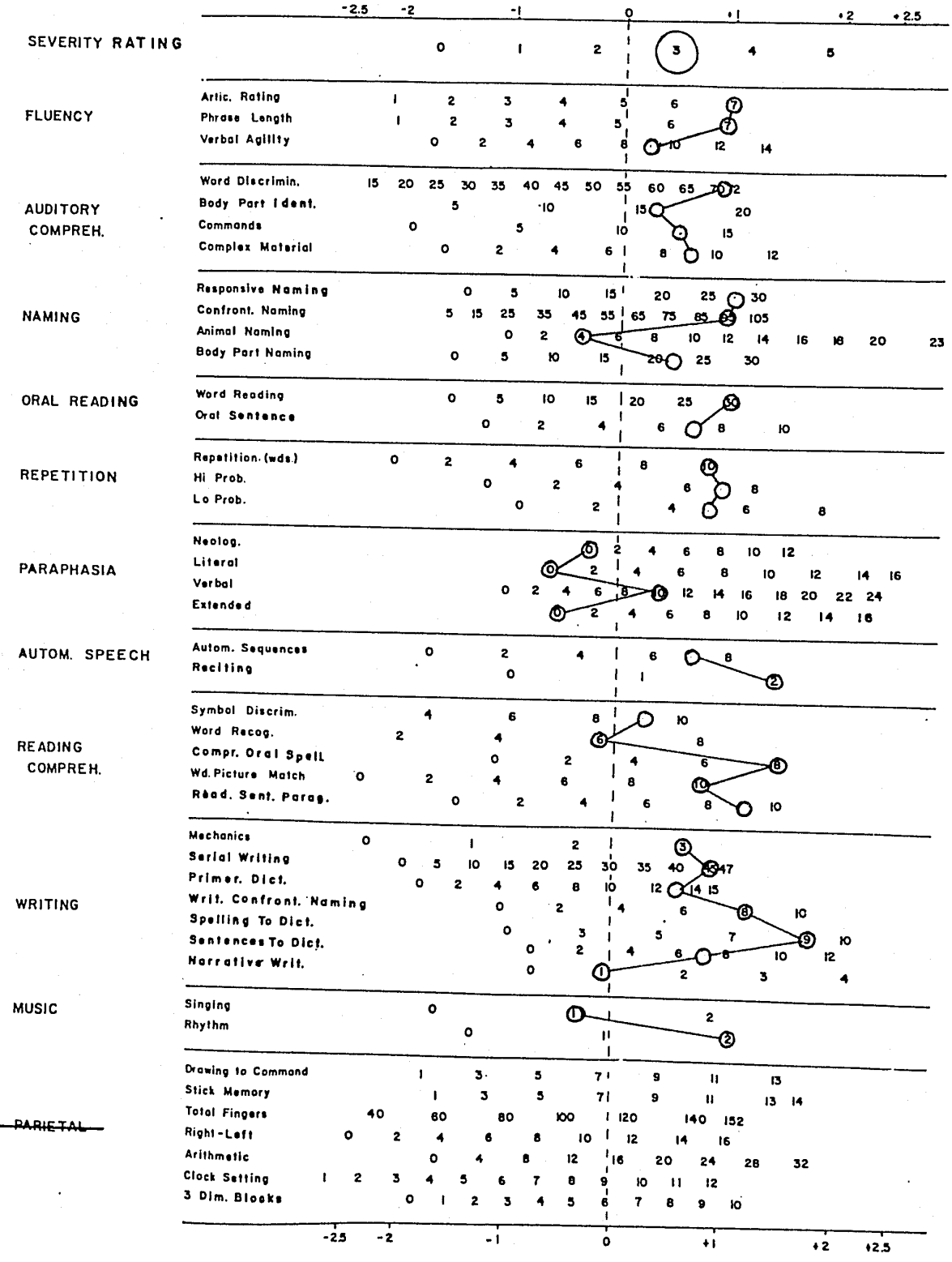
4. Some obvious loss of fluency in speech or facility of comprehension, without significant limitation on ideas expressed or form of expression.

5. Minimal discernible speech handicaps; patient may have subjective difficulties which are not apparent to listener.

RATING SCALE PROFILE OF SPEECH CHARACTERISTICS



Z-SCORE PROFILE OF APHASIA SUBSCORES



#1F
Tests:
BDAE

WRAT-R

Results:
-Severity Level "3"
-Receptive dysphasia
-Grade 17.1

(1F) has a receptive dysphasia of a moderate level. Her free speech is fluent, mainly limited by word finding difficulty while there is a mild impairment of auditory comprehension.

Auditory comprehension and the severity rating (level of impairment scale) are just lower than the fluency scores. The higher fluency consists of good articulation, long length of phrases used in free speech, and a fair ability to form words quickly. This sort of configuration goes along with Wernickes aphasia. Naming scores are not lower than fluency, which does not fit it. The only paraphasic errors present were perseverative rather than the usual occurrence of neologistic and literal paraphasias as well. Repetition of words and sentences were higher than would be expected, as were reading and writing skills.

However, the presence of a high rate of verbal paraphasic errors and a high ability to name pictures (visual confrontation naming) point away from the other alternative diagnosis - anomic aphasia. Also, fluency and auditory comprehension are not higher than the severity rating, as would be expected with anomic aphasia. (#1F) has characteristics of both Wernickes and anomic dysphasia.

Most of her test scores cluster around the first standard deviation on the Z chart, which means that compared to other aphasics, she has good language skills. Compared with the normal population, she is moderately impaired.

She has a clear indicator of brain damage - a low score in "animal naming," a test in which the patient is required to name as many different animals as possible in a short time limit. This low score represents a lack of fluency in making such associations. She also makes perseverative errors both in speech and writing, especially when tired.

On a reading test which just required correct pronunciation of single words (Wide Range Achievement Test) she did very well and scored at the Grade 17.1 level. She did very well reading words on the Boston test and good on reading sentences. However, she had only a fair performance on picking out a word said by the examiner from a list of similar looking words. She did well on understanding words spelled orally, matching pictures to words and reading and understanding sentences and paragraphs.

The mechanics of writing and writing to dictation were good. Narrative writing - making up sentences to tell a story about a picture - was poor. She wrote single words only.

She did very well repeating rhythms that were tapped out for her and repeating words and phrases.

She did fairly well carrying out oral commands, following complex material read to her, and less well pointing to different body parts. This was because of a confusion between her left and right sides. She did very well pointing to pictures of words said orally by the examiner. These four tests combine for a measure of auditory comprehension, and as mentioned earlier, were somewhat impaired compared with the normal population.

Naming skills were all good, except for the animal naming mentioned previously.

(#1F's) level of confidence on the test did not appear to match her level of ability, which on the whole was good. Her main difficulties on the test were: word finding and composing written sentences.

APHASIA SEVERITY RATING SCALE

0. No usable speech or auditory comprehension.

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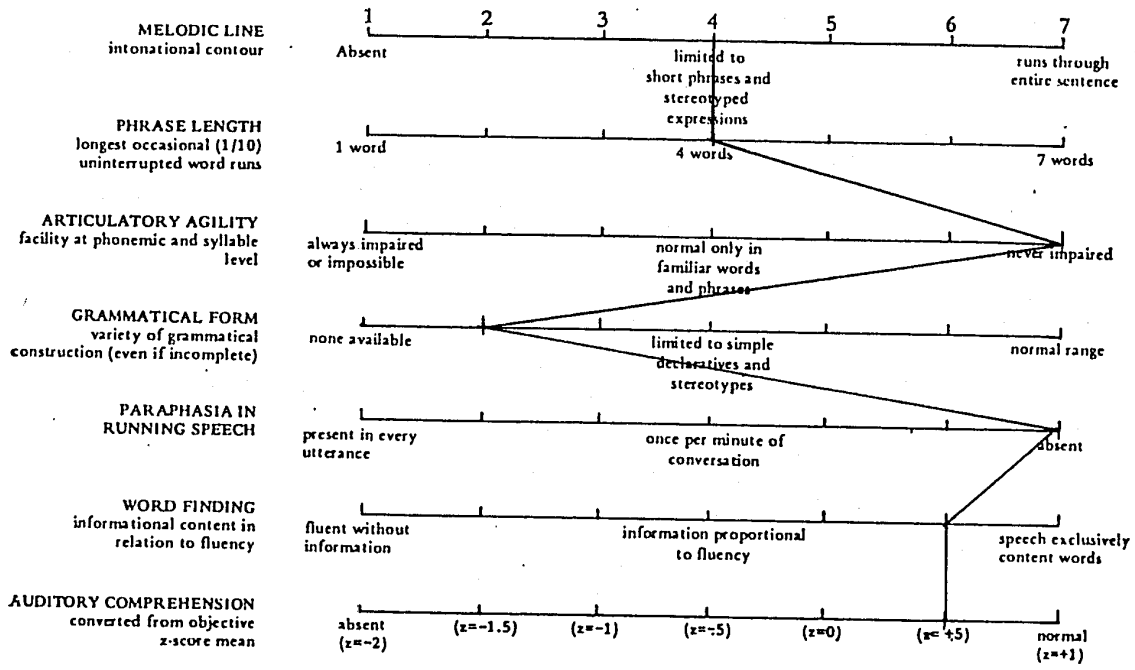
2. Conversation about familiar subjects is possible with help from the listener. There are frequent failures to convey the idea, but patient shares the burden of communication with the examiner.

3. The patient can discuss almost all everyday problems with little or no assistance. However, reduction of speech and/or comprehension make conversation about certain material difficult or impossible.

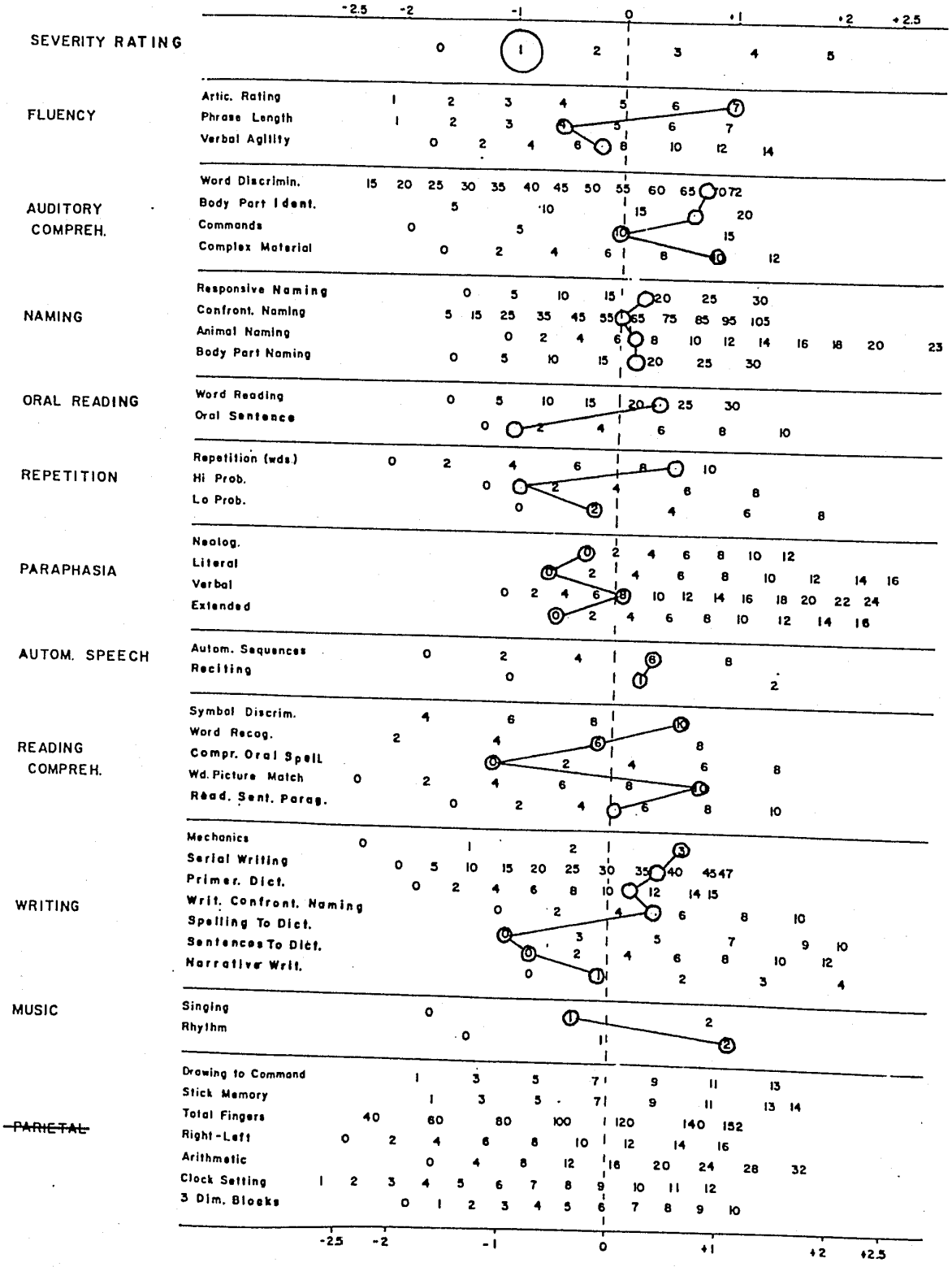
4. Some obvious loss of fluency in speech or facility of comprehension, without significant limitation on ideas expressed or form of expression.

5. Minimal discernible speech handicaps; patient may have subjective difficulties which are not apparent to listener.

RATING SCALE PROFILE OF SPEECH CHARACTERISTICS



Z-SCORE PROFILE OF APHASIA SUBSCORES



#2M
Tests:
BDAE

WRAT-R

Results:
-Severity Level "1"
-Expressive dysphasia
-Grade 4.6

#2M has severe expressive difficulty. His speech is mainly limited to one word communications. Occasionally, he will use a three or four word phrase. Articulation is good despite the left side of his tongue being paralyzed. However, his agility (quickness) at forming words is impaired. He makes no paraphasic errors in free speech. His auditory comprehension is near normal.

Most language skills are good compared to other dysphasics (most fall within the first S.D. on the Z - chart) and are moderately impaired compared to the normal population.

Naming skills are good. Oral reading and repetition of words is good but performance on sentences is poor.

Memory for automatic material such as the days of the week, numbers etc. is good, as is reciting of rhymes.

Silent reading skills are good but there is an extreme deficit recognizing words spelled orally by the Examiner, as can be seen in the example below.

Examiner spelled orally:	No. of letters
N - O	2
M - A - N	3
G - I - R - L	
W - H - I - P	
B - R - O - W - N (color*)	5
E - L - B - O - W	
F - I - F - T - E - E - N	7
W - H - I - S - K - E - Y	

#2M's response:	No. of letters
on (reversal)	2
how	3
-NO RESPONSE	
-NO RESPONSE	
black (color*)	5
NO RESPONSE	
shallow	7
-NO RESPONSE	

He has no difficulty with the mechanics of writing - he can form all letters. He did fairly well writing letters of the alphabet (17 correct) and the numbers from 1-21 (all correct). He could write single letters, numbers, and words to dictation, but on the written spelling section he couldn't write or spell orally the words "soft" or "belong." He could not write dictated sentences. When asked to write as much as he could about the events occurring in a picture, he wrote only single words. The expressive nature of his difficulty is emphasized by the fact that while he speaks in single words and writes single words, on the auditory comprehension section of the test, he could understand correctly long, complicated sentences.

In Broca's dysphasia, reading scores are usually one of the highest clusters on the Z - chart and writing the lowest. (#2M's) reading and writing scores are spread through the same levels (-1 to +1). Articulation is usually poor in Broca's dysphasia, but (#2M's) is fairly good. Otherwise, his patterns are basically the same as those found in Broca's dysphasia.

If he is "stuck" for a word when speaking, he can often bring the word to mind by: writing it; writing the first few letters of it; or even just holding pencil to paper as if he were going to write it. This suggests that he is using the motoric associations to the word to help elicit it.

APHASIA SEVERITY RATING SCALE

0. No usable speech or auditory comprehension.

1. All communication is through fragmentary expression; great need for inference, questioning and guessing by the listener. The range of information which can be exchanged is limited, and the listener carries the burden of communication.

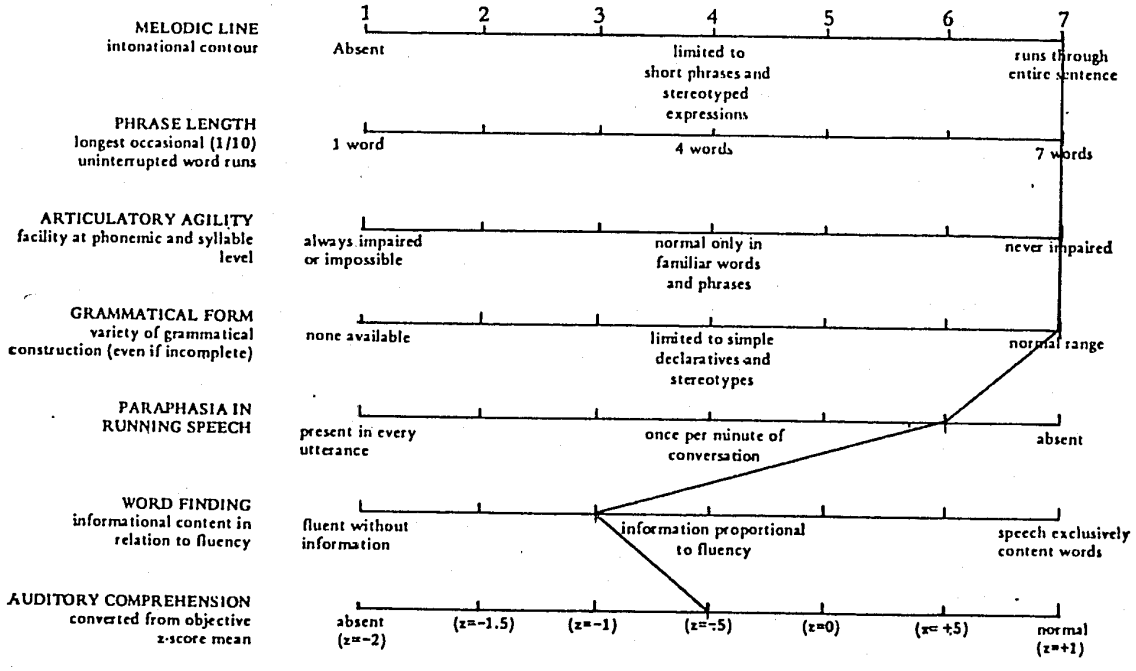
2. Conversation about familiar subjects is possible with help from the listener. There are frequent failures to convey the idea, but patient shares the burden of communication with the examiner.

(3.) The patient can discuss almost all everyday problems with little or no assistance. However, reduction of speech and/or comprehension make conversation about certain material difficult or impossible.

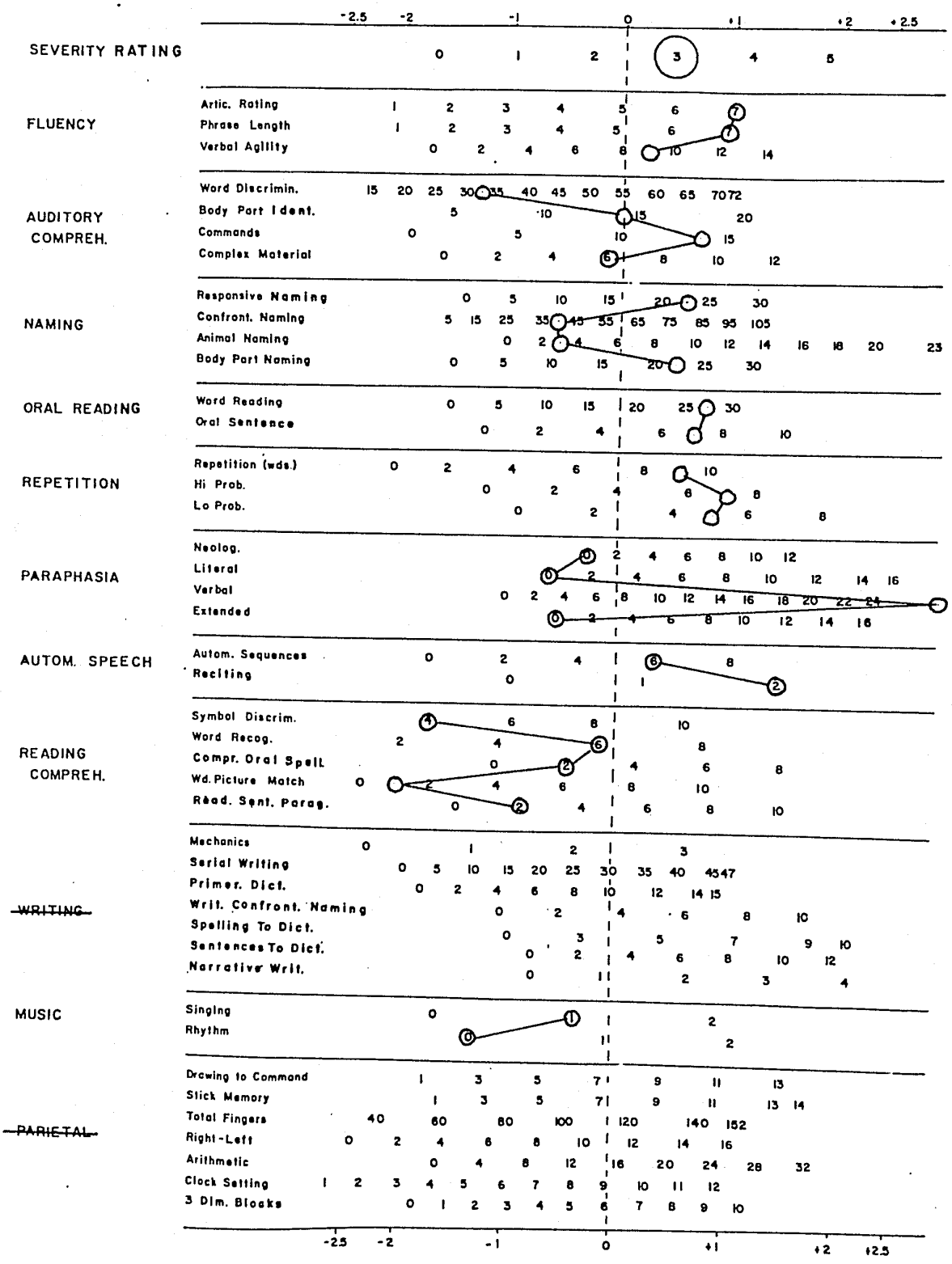
4. Some obvious loss of fluency in speech or facility of comprehension, without significant limitation on ideas expressed or form of expression.

5. Minimal discernible speech handicaps; patient may have subjective difficulties which are not apparent to listener.

RATING SCALE PROFILE OF SPEECH CHARACTERISTICS



Z-SCORE PROFILE OF APHASIA SUBSCORES



#3F
Tests:
BDAE

WRAT-R

Results:
-Severity Level "3"
-Receptive dysphasia
-Grade 2.2

(#3F) has a fluent dysphasia generally confirming to the Wernicke's pattern. She speaks smoothly in long, well articulated sentences and can use different grammatical forms. She makes only occasional verbal paraphasic errors in free speech. In contrast to this, on tasks that require specific verbal output (eg. naming tasks) she tends to substitute inappropriate but similar responses (eg. name one color for another) or repeat old responses. The ability to form words is moderately impaired. With a little assistance, (necessary because of her word finding difficulties) she can communicate her ideas adequately.

Overall, auditory comprehension is moderately impaired. (#3F) has difficulty matching words presented orally to their visual representations. Ability to point to body parts named orally was only fair and she was confused as to her left and right side. Her understanding of complex material read by the examiner was again only fair, while she was better at following commands. Her level of auditory comprehension is higher than a Wernicke's dysphasic's usually is. Also, her ability to repeat words and sentences is higher than her severity level. The opposite is usually the case in Wernicke's dysphasia.

She did very well repeating words and sentences but couldn't repeat simple rhythms tapped out by the examiner.

Memory for automatized sequences (eg. days of week, alphabet) was good and memory of rhymes was intact.

Naming skills ranged from fair to good. She had difficulty recognizing unfamiliar visual stimuli, such as pictures of objects.

She could read words and familiar sentences, but no new sentences. Reading comprehension was fair to very poor. She had difficulty picking out a word or letter from similar looking words or letters and matching words and pictures. Comprehension of oral spelling was fair. While she could repeat the individual letters of some of the words she couldn't say what words they made. She did "fair" picking out words presented orally from a list of words. (#3F) had difficulty "sorting stimuli out". On the Wide Range Achievement Test she only scored at the Grade 2.2 level but on this test the words are presented serially in rows. She stated her difficulty picking out one word from another. However, on another reading test in which words were presented singly on individual cards, she could read words that were at the Grade five level. (#3F) has difficulty discriminating visual stimuli and interpreting auditory stimuli.

APHASIA SEVERITY RATING SCALE

0. No usable speech or auditory comprehension.

1. All communication is through fragmentary expression; great need for inference, questioning and guessing by the listener. The range of information which can be exchanged is limited, and the listener carries the burden of communication.

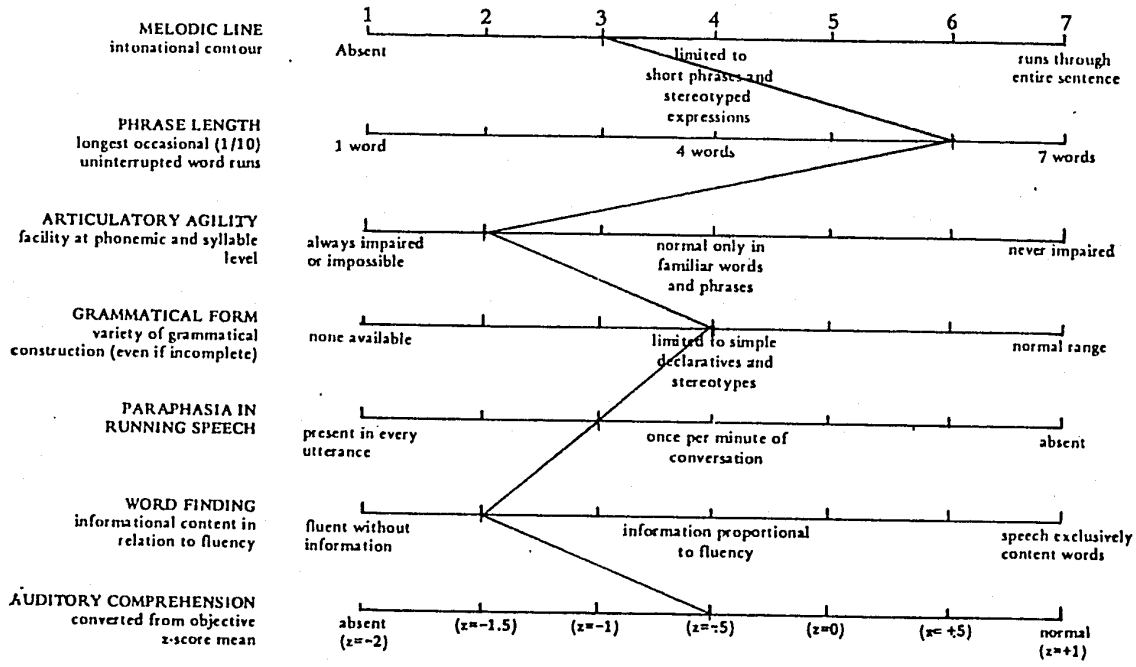
2. Conversation about familiar subjects is possible with help from the listener. There are frequent failures to convey the idea, but patient shares the burden of communication with the examiner.

3. The patient can discuss almost all everyday problems with little or no assistance. However, reduction of speech and/or comprehension make conversation about certain material difficult or impossible.

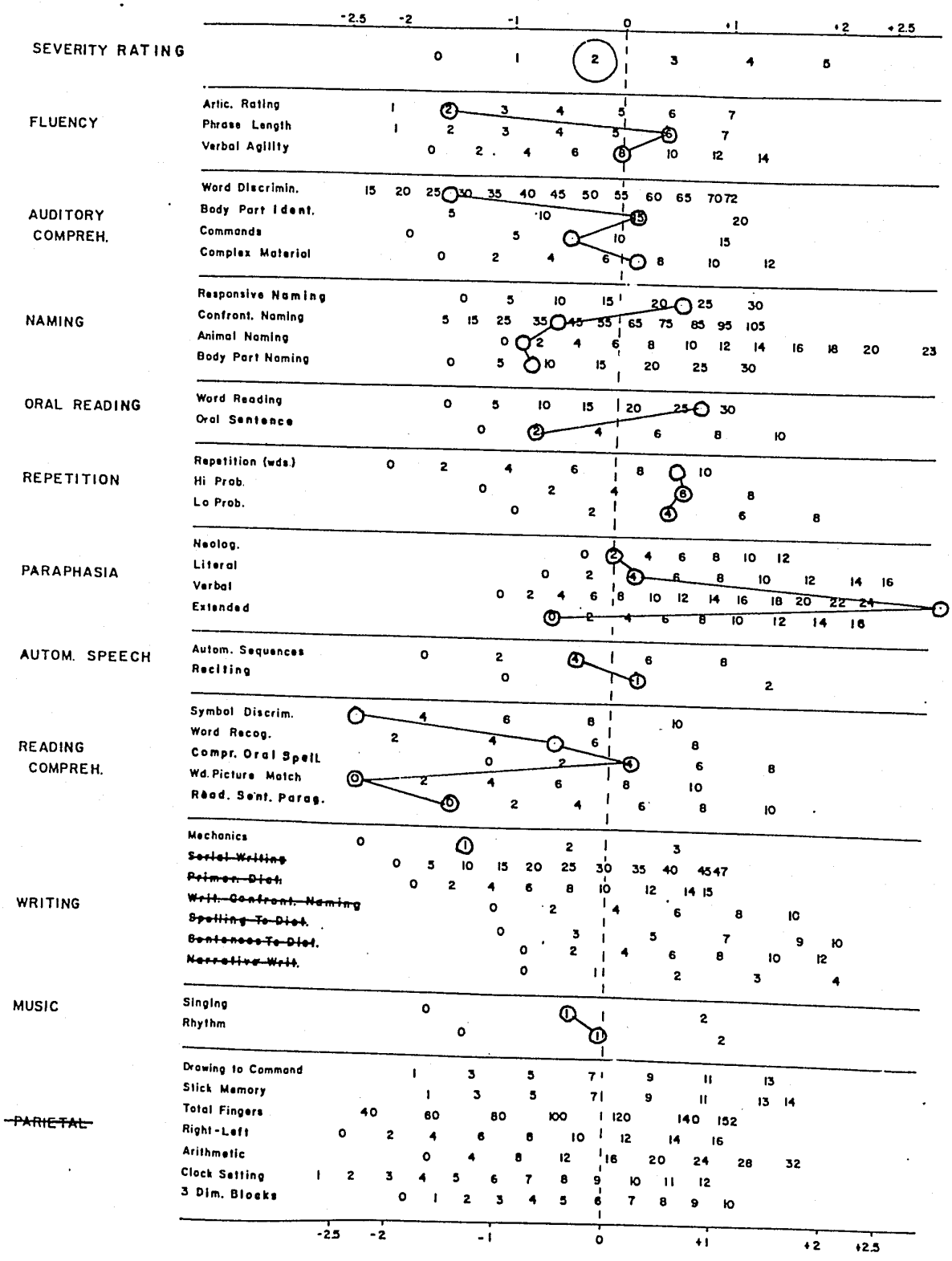
4. Some obvious loss of fluency in speech or facility of comprehension, without significant limitation on ideas expressed or form of expression.

5. Minimal discernible speech handicaps; patient may have subjective difficulties which are not apparent to listener.

RATING SCALE PROFILE OF SPEECH CHARACTERISTICS



Z-SCORE PROFILE OF APHASIA SUBSCORES



#4M
Tests:
BDAE

Results:
-Severity Level "2"
-Receptive-expressive dysphasia
-Grade 7.1

WRAT-R

This patient's communication skills are much hampered by perseverations of all types - verbal, ideational, and motor. Perseverations were especially predominant in the naming subtests. During peak performance, (#4M) is capable of forming long, grammatically correct sentences but has a stiff word articulation. Oral agility is impaired. During free speech, verbal performance often broke down into unintelligible, quiet statements. Responses in the structured testing situation were usually relevant but there was particularly poor performance throughout one day's testing session- probably due to fatigue and poor health.

Auditory comprehension is poor compared to higher repetition ability. Both automatic speech and music skills are impaired.

Reading comprehension is generally poor. Although this patient can function at the single word level for oral and silent reading, performance at the sentence level is poor. On the WRAT test, he is reading at the Grade 7.1 level. He has difficulty in comparison and discrimination tasks (symbol and word discrimination; word - picture matching; and, word discrimination).

APHASIA SEVERITY RATING SCALE

0. No usable speech or auditory comprehension.

1. All communication is through fragmentary expression; great need for inference, questioning and guessing by the listener. The range of information which can be exchanged is limited, and the listener carries the burden of communication.

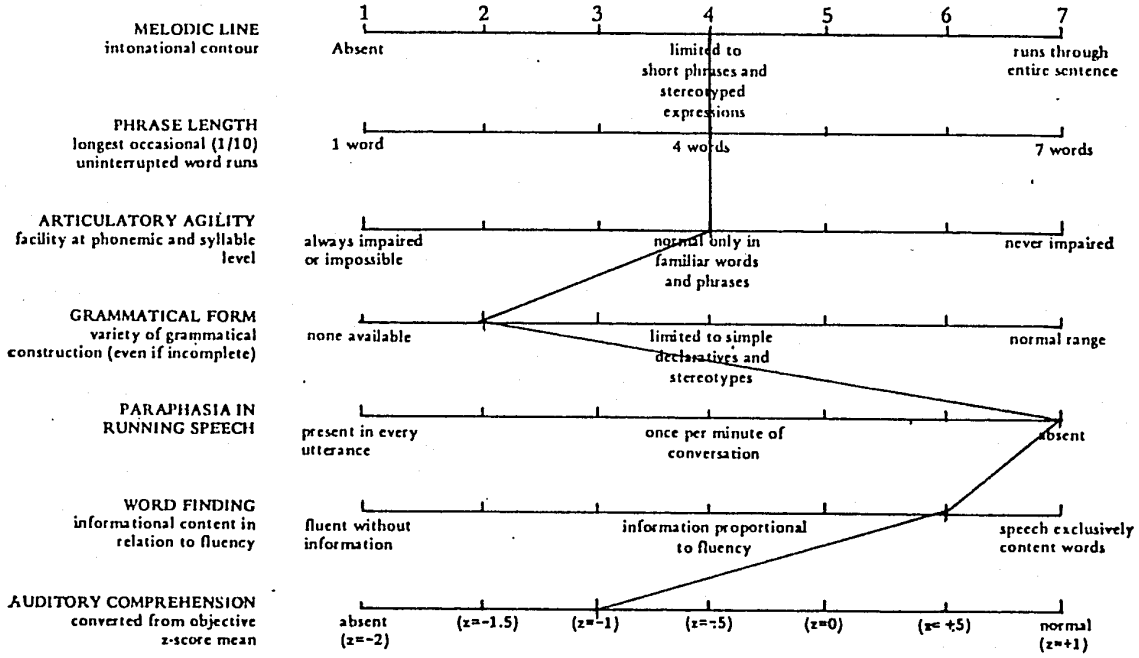
2. Conversation about familiar subjects is possible with help from the listener. There are frequent failures to convey the idea, but patient shares the burden of communication with the examiner.

3. The patient can discuss almost all everyday problems with little or no assistance. However, reduction of speech and/or comprehension make conversation about certain material difficult or impossible.

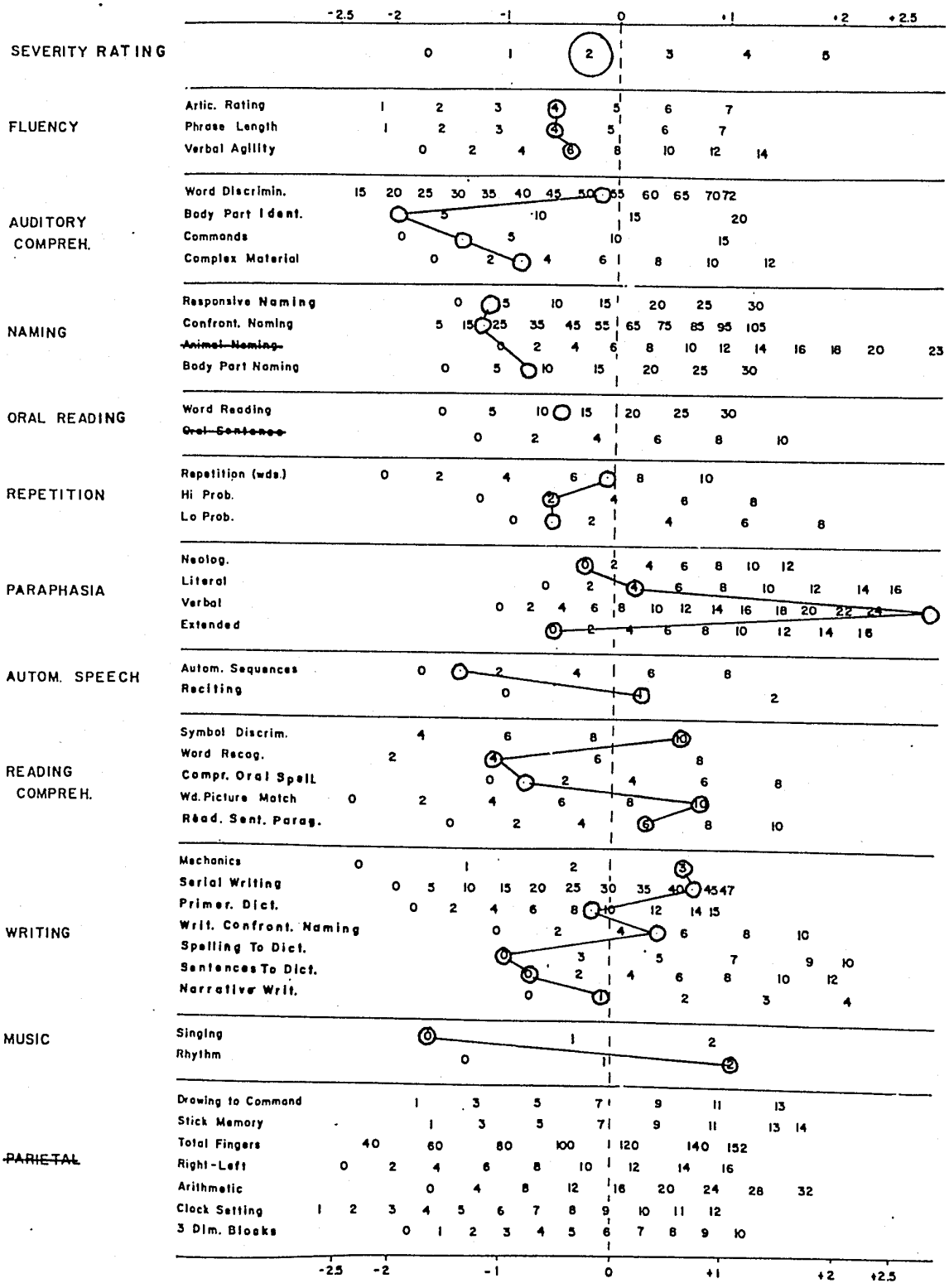
4. Some obvious loss of fluency in speech or facility of comprehension, without significant limitation on ideas expressed or form of expression.

5. Minimal discernible speech handicaps; patient may have subjective difficulties which are not apparent to listener.

RATING SCALE PROFILE OF SPEECH CHARACTERISTICS



Z-SCORE PROFILE OF APHASIA SUBSCORES



#5M
Tests:
BDAE

Results:
-Severity Level "2"
-Expressive -receptive dysphasia

WRAT-R

-Kindergarten .7

(#5M) has quite severe expressive and receptive difficulties. He can carry on conversations but requires much assistance selecting words. He can occasionally make phrases 3 or 4 words long. He has articulation difficulties. He cannot pronounce many words and is aware of this but self-initiated attempts to correct his responses often fail. Grammatical forms are limited. He doesn't make paraphasic errors in free speech.

Along with his expressive difficulties, his auditory comprehension is poor. He had poor performance pointing to body parts and following oral commands. He had only a fair performance following complex material presented orally. He did better picking out pictures that matched words presented through the auditory modality. He had a fair performance repeating words and sentences but was not at all impaired in repeating rhythms tapped out for him.

While he had only a fair performance reading words (and read at the Kg.7 level on the WRAT) his reading comprehension ranged from fair to good. Word recognition and comprehension of oral spelling were fair while symbol discrimination, word-picture matching and reading sentences and paragraphs were good. The latter test requires that the testee fill in a blank in a sentence from a variety of possible responses by pointing to the correct one. (#5M) could understand quite complex paragraphs as indicated by his correct choices.

Writing skills also ranged from poor to good. He couldn't spell words or write sentences to dictation. When asked to write all he could about a picture, he just wrote single words. He could write some dictated letters and words. He did well writing names of pictures and writing the alphabet and the numbers from 1 to 21.

APHASIA SEVERITY RATING SCALE

0. No usable speech or auditory comprehension.

1. All communication is through fragmentary expression; great need for inference, questioning and guessing by the listener. The range of information which can be exchanged is limited, and the listener carries the burden of communication.

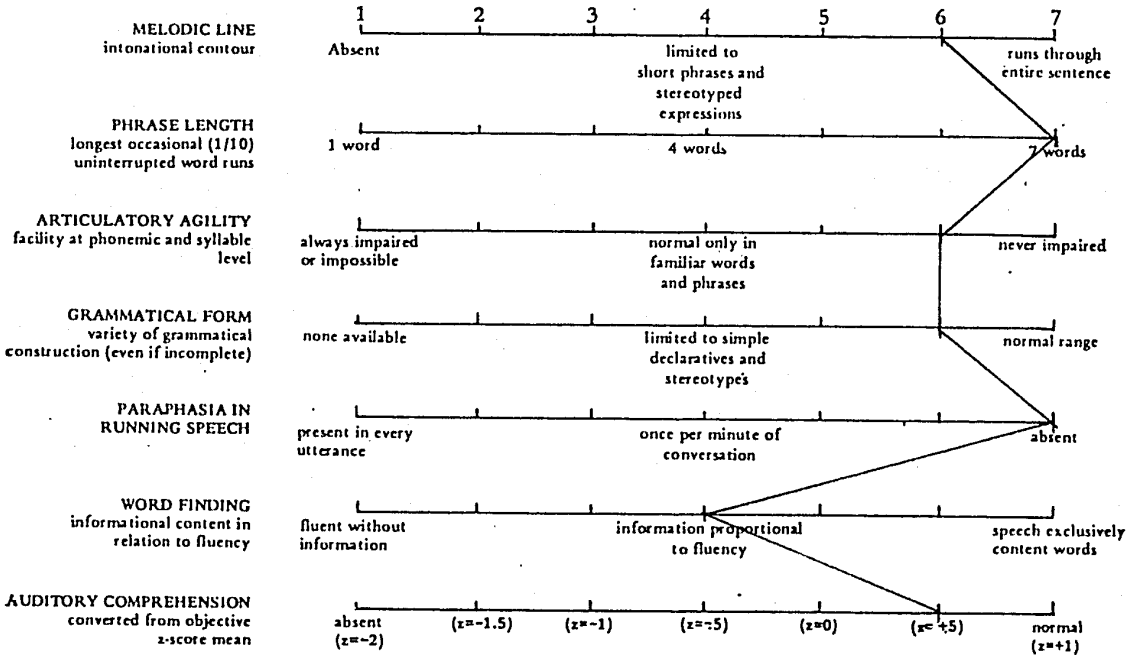
2. Conversation about familiar subjects is possible with help from the listener. There are frequent failures to convey the idea, but patient shares the burden of communication with the examiner.

3. The patient can discuss almost all everyday problems with little or no assistance. However, reduction of speech and/or comprehension make conversation about certain material difficult or impossible.

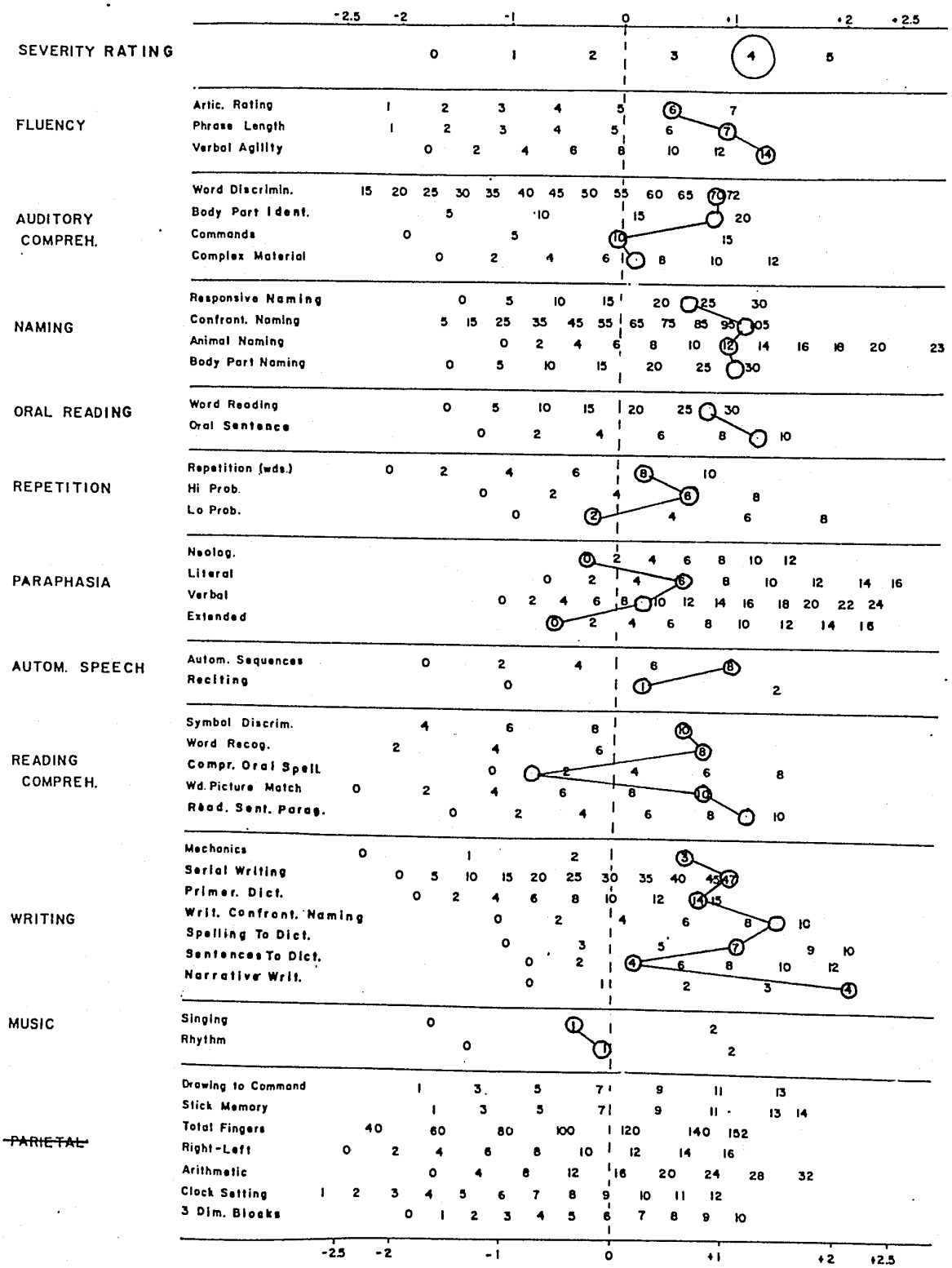
(4.) Some obvious loss of fluency in speech or facility of comprehension, without significant limitation on ideas expressed or form of expression.

5. Minimal discernible speech handicaps; patient may have subjective difficulties which are not apparent to listener.

RATING SCALE PROFILE OF SPEECH CHARACTERISTICS



Z-SCORE PROFILE OF APHASIA SUBSCORES



#6M
Tests:
BDAE

Results:
-Severity Level "4"
-Receptive-expressive dysphasia

WRAT-R
-Grade 6.9

(#6M) is quite fluent in free speech. He experiences more difficulty when a specific verbal output is required, then he tends to circumlocutory substitutions. His articulation is quite good and he can speak in flowing, grammatically correct and varied sentences. Overall auditory comprehension is good, but (#6M's) main problem is following complex material given through an auditory modality (eg. subtests: commands, complex material). This difficulty led to the majority of his poorer performances on the Boston (e.g. repeating low probability sentences, comprehending oral spelling, sentences to dictation). However, if auditory information is repeated several times, he comprehends it successfully.

Naming skills are good. Responsive naming was the lowest of the naming subtests.

Oral reading, reading comprehension and writing were all good, except for two subtests - comprehension of oral spelling and writing sentences to dictation. On these two subtests, (#6M) lost test points because of a need to have stimulus material repeated. On the Wide Range Achievement Test (visual word recognition), (#6M) is reading at the Grade 6.9 level. Repetition tests were generally lower than the other test clusters, with an especially poor performance on "low probability" sentences. On these tasks, (#6M) made literal and verbal paraphasic errors.

Automatic sequences (days of week, months of year, counting, alphabet) were good. Reciting was impaired, as were singing and rhythm.

APHASIA SEVERITY RATING SCALE

0. No usable speech or auditory comprehension.

1. All communication is through fragmentary expression; great need for inference, questioning and guessing by the listener. The range of information which can be exchanged is limited, and the listener carries the burden of communication.

2. Conversation about familiar subjects is possible with help from the listener. There are frequent failures to convey the idea, but patient shares the burden of communication with the examiner.

3. The patient can discuss almost all everyday problems with little or no assistance. However, reduction of speech and/or comprehension make conversation about certain material difficult or impossible.

4. Some obvious loss of fluency in speech or facility of comprehension, without significant limitation on ideas expressed or form of expression.

5. Minimal discernible speech handicaps; patient may have subjective difficulties which are not apparent to listener.

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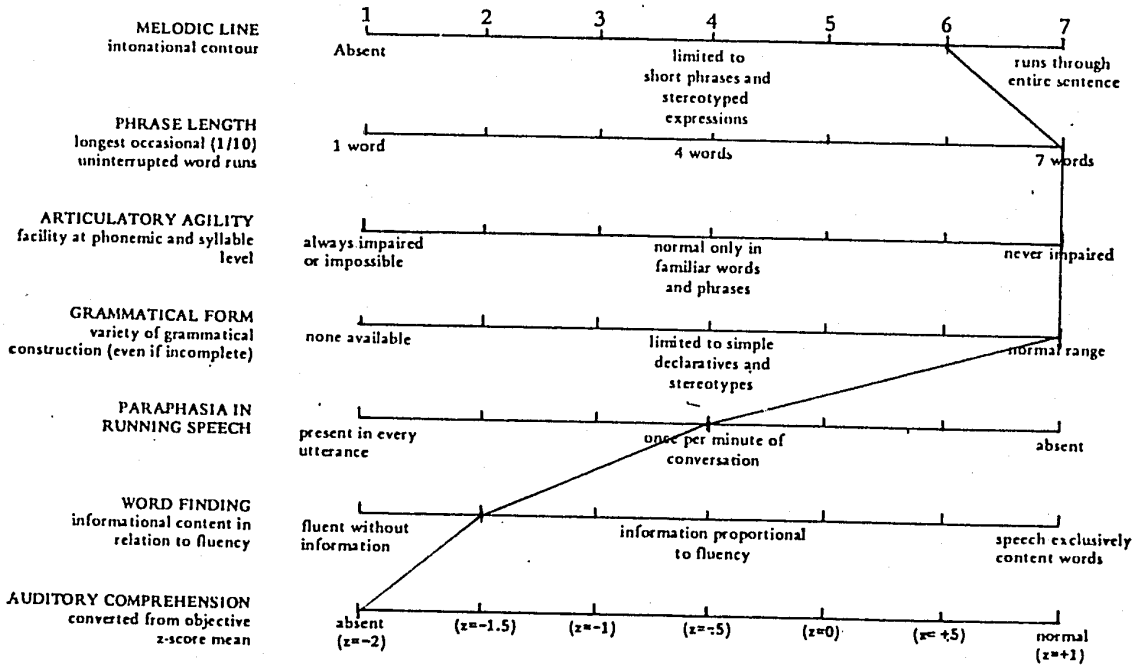
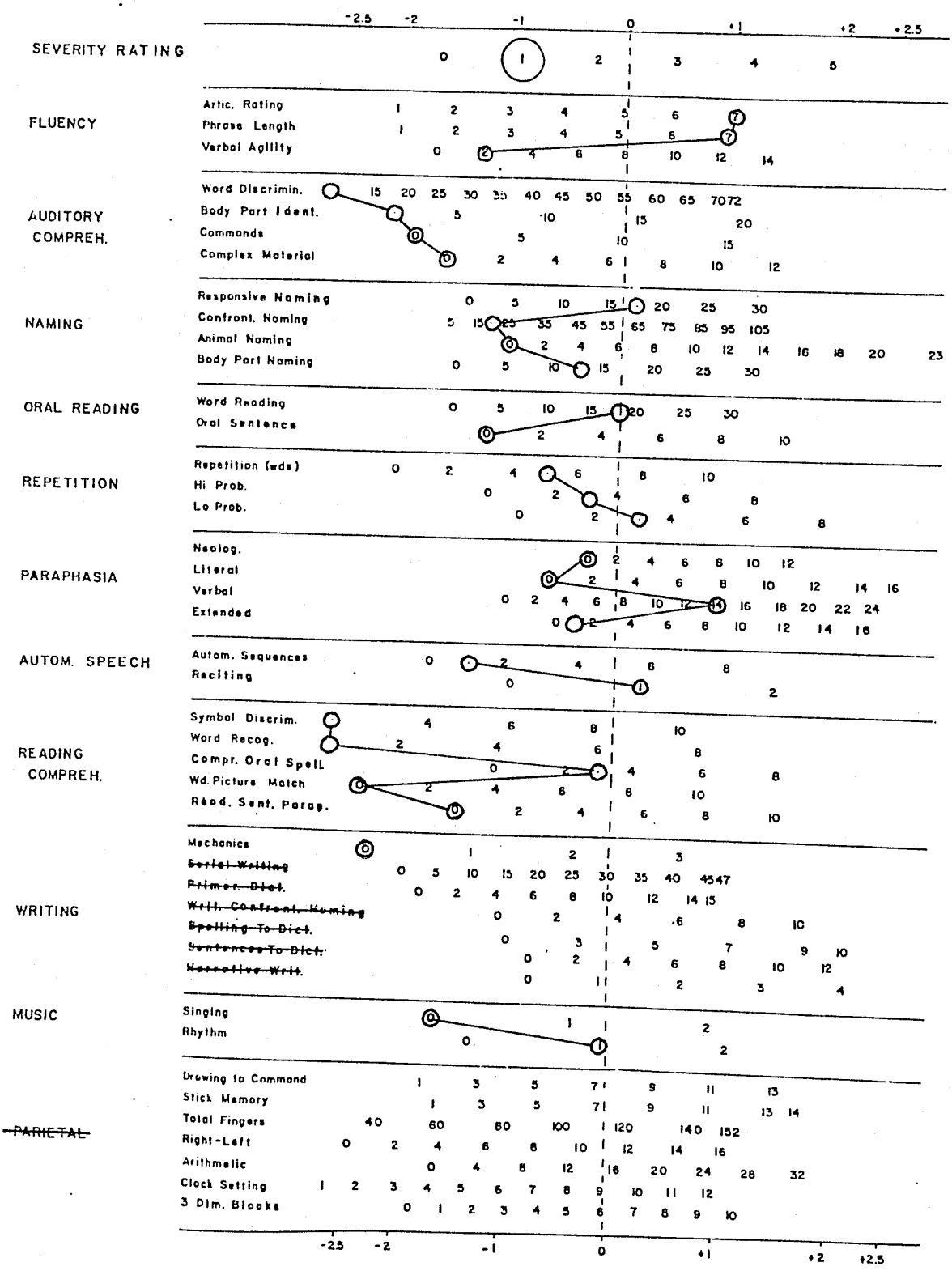


Z-SCORE PROFILE OF APHASIA SUBSCORES



#7M
Tests:
BDAE

WRAT-R

Results:
-Severity Level "1"
-Receptive dysphasia
-Grade 3.2

(#7M's) language functions are severly impaired. His free speech is fluent, though often irrelevant and repetitious. He can use long phrases and articulates well.

Auditory comprehension was very poor on four tests - pointing to pictures of words read to him, pointing to different body parts on himself, following commands, and following material read to him. However, he can repeat words and sentences. He could repeat some rhythms tapped out by the examiner.

He can read words but not sentences. He can understand words that are spelled orally for him. He could write one letter of his name and had great difficulty pointing to words on discrimination and word - picture matching tasks.

He could name objects that fit particular uses and name the purpose of some objects. He could name some pictures and body parts. He couldn't name different animals under a time limit, an indication of low ideational and word finding fluency.

He was impaired on imitating mouth movements in a time limit. This reflects a muscular incoordination. He was somewhat better repeating words, also within a time limit, although there was paraphasic word distortion on the more difficult words.

(#7M) could not point to words or pictures on the test cards in the four auditory comprehension tests. He couldn't write and

had difficulty imitating mouth movements. Taken together, these signs could indicate an apraxia.

Overall language functioning was depressed. He makes verbal paraphasic (substituting one word for another) and perseverative errors.

Naming and repetition skills are higher than one would expect in comparison with his severity level for a Wernicke's aphasia. Also, there is an abscence of literal and neologistic errors. Otherwise, the pattern of functioning is grossly similar - fluent, non-substantive speech with poor auditory comprehension.

APHASIA SEVERITY RATING SCALE

0. No usable speech or auditory comprehension.

1. All communication is through fragmentary expression; great need for inference, questioning and guessing by the listener. The range of information which can be exchanged is limited, and the listener carries the burden of communication.

2. Conversation about familiar subjects is possible with help from the listener. There are frequent failures to convey the idea, but patient shares the burden of communication with the examiner.

(3.) The patient can discuss almost all everyday problems with little or no assistance. However, reduction of speech and/or comprehension make conversation about certain material difficult or impossible.

4. Some obvious loss of fluency in speech or facility of comprehension, without significant limitation on ideas expressed or form of expression.

5. Minimal discernible speech handicaps; patient may have subjective difficulties which are not apparent to listener.

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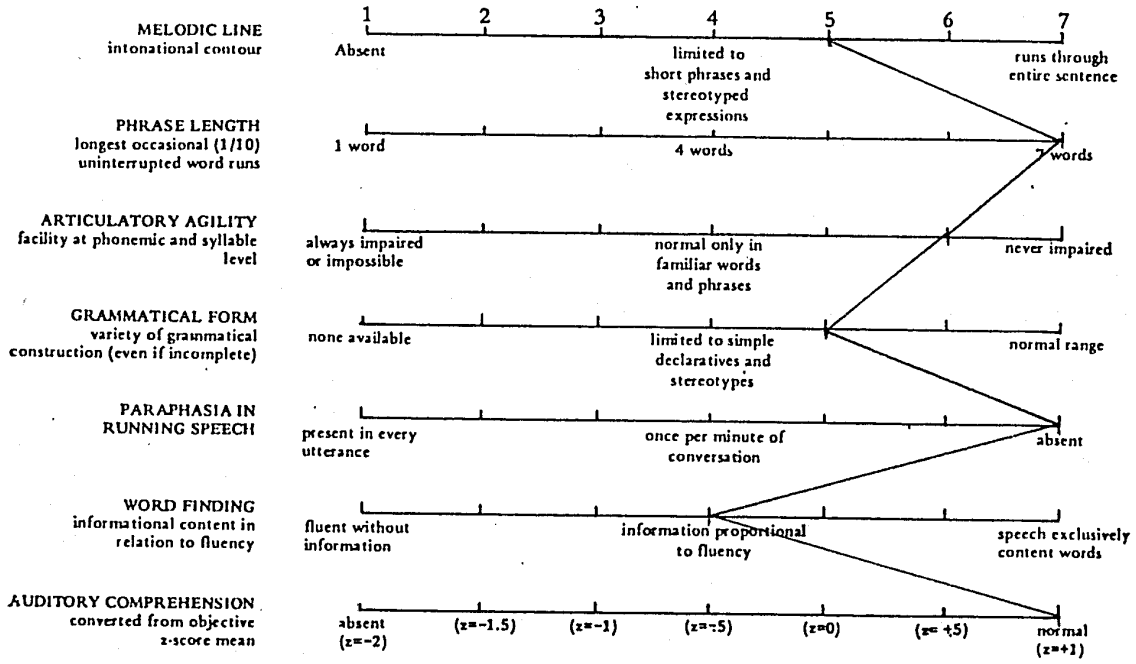
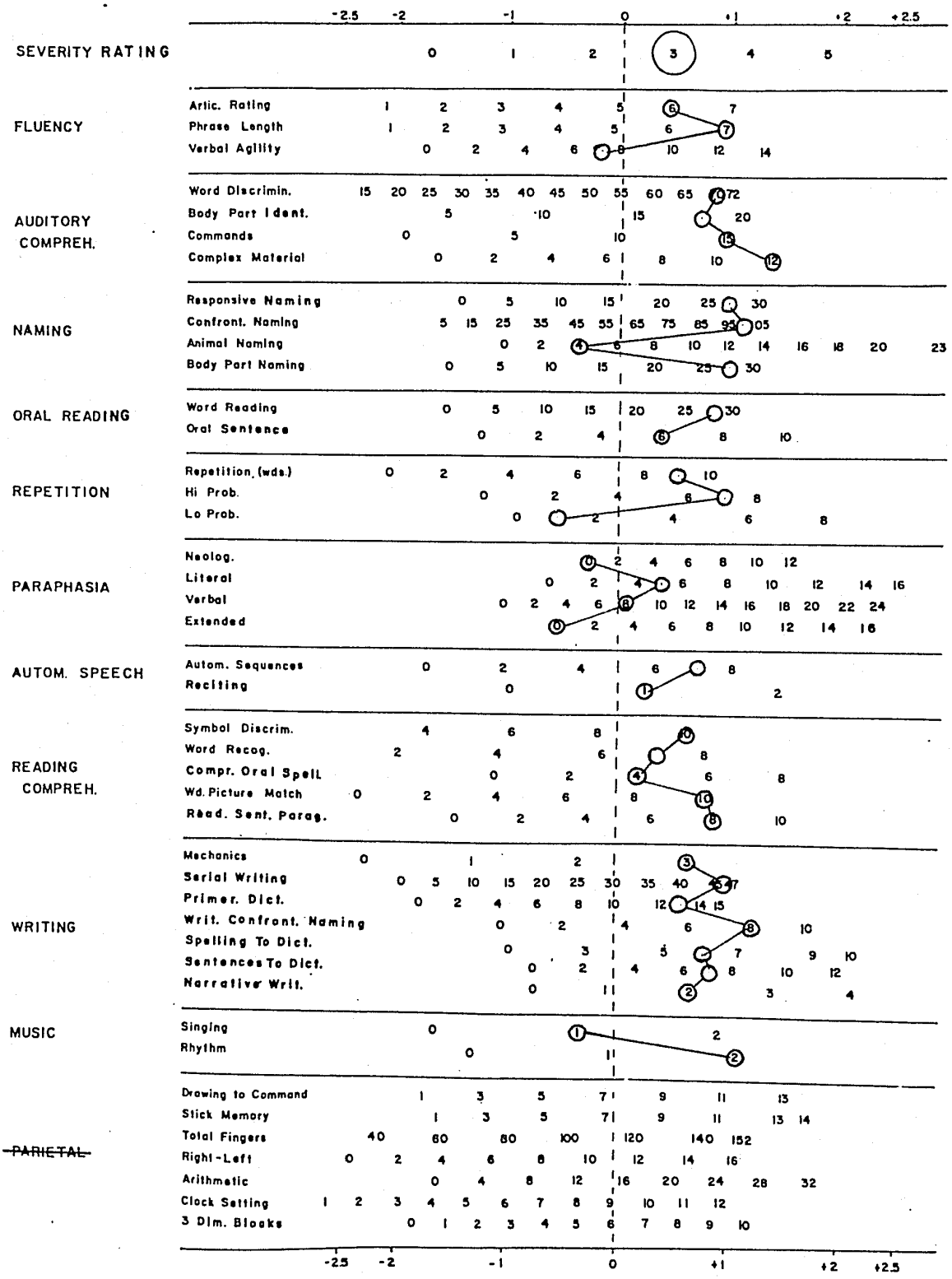


Z-SCORE PROFILE OF APHASIA SUBSCORES



#8M
Tests:
BDAE

WRAT-R

Results:
-Mixed dysphasia
-Severity Level "3"
-Grade 6.8

(#8M's) main communication difficulty revolves around finding the right words to express himself. He speaks slowly and carefully, with frequent pauses to choose a word or phrase. When he takes his time and is relaxed, he can convey his ideas successfully. His articulation is somewhat stiff and his verbal agility is low. He is capable of constructing long sentences with the occasional variation of grammatical form.

Auditory comprehension is practically normal. Naming skills are good, except for animal naming (which reflects a lack of fluency in associations within a limited range).

Reading and writing skills are generally good, with weaknesses in oral sentence reading, comprehension of oral spelling and word recognition. The lower score on the sentence reading was due to the occurrence of literal and verbal paraphasic errors on the "low probability" sentences. On the Wide Range Achievement Test, he is reading at the Grade 6.3 level.

A low score on the oral repetition of low probability sentences again occurred because of literal and verbal paraphasic errors. Repetition of words and of "high probability" sentences was good.

Automatic sequences were good except for a small difficulty with the alphabet. Reciting of rhymes and singing were also slightly impaired. There was no difficulty repeating rhythms.

APPENDIX IV

TABLE 14

ABLATION STUDIES - AREAS OF DAMAGE AND TASKS IMPAIRED

	NEOCORTEX		EXTRAPYRAMIDAL SYSTEM	LIMBIC SYSTEM	
Disability to inhibit.	Prefrontal	Frontal	Caudate Nucleus	Hippocampus	Septal
A.	N=8		N=14 M Rosvold & Delgado 1956		n=7 R Dalland 1970
Stimulus choice Discrimination Task	M Settlage et al 1956	M Ettlinger et al 1966	N=23 M Rosvold et al 1958		N=32 R Dalland 1974
		N=4	N=4* M Battig et al 1960		N=14 R Schwartz baum et al 1964
		M Battig et al 1960	N=8 R Mikulas & Isaacson 1965		
B. Conditioned Response				N=36 R Jarrard et al 1964	N=16 R Schwartz baum et al 1964
				N=19 R Kimble et al 1966	N=20 R La Vaque 1966
C. Spontaneous Response				n=6 R Dalland 1970	

*same S pool as previous study by same author (s)
R = Rats
M = Monkeys