PARAPHASIAS AND HESITATIONS IN THE FREE SPEECH OF APHASICS

by

EVELYN ANN GOSSE

B.A., University of Victoria, 1969

A THESIS SUBMITTED IN PARTIAL FULFILLMENT

OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF ARTS

in the department

of

Psychology

Accepted for the
Faculty of Graduate Studies
[redacted]
Dean pro tem
13 April 1971

We accept this thesis as conforming
to the required standard

[redacted]

UNIVERSITY OF VICTORIA

Supervisor: Otfried Spreen

ABSTRACT

Specific types of speech disturbances were defined and frequencies of occurrence for 20 aphasic subjects and 20 normal control subjects were compared. The scores of the aphasic subjects were examined to test Howes' theory of a division of aphasic patients on the basis of rate of speech; Wepman's model of language with three levels of integration; and Schuell's hypothesis of a general hierarchy of language deficit.

The results supported the hypothesis that the speech disturbances studied are affected by aphasic deficit. The results did not fully support any of the three hypotheses with respect to division of aphasic subjects into separate types. The data agreed with data reported by Howes and by Benson with respect to the relationship of speech hesitations to rate of speech in aphasic subjects, but no relationship was found between rate of speech and paraphasic substitution or editing material. The Wepman model was not supported by a comparison of subjects with primarily semantic, syntactic or pragmatic deficit. Speech errors were not found to be scaleable across aphasic subjects (the Schuell model) but severity of deficit did appear to be an important factor in the distribution of errors among groups based on the Howes and Wepman models.

Possible patterns of relationship among types of speech errors were discussed. Aphasic subjects were found to have distinctive

patterns of speech errors. It was suggested that a more detailed study with a larger number of subjects and more variables would be necessary to examine these patterns of deficit.

[redacted]

ACKNOWLEDGMENT

The author wishes to express her appreciation to Dr. O. Spreen for his direction and supervision of this research project. Appreciation is also expressed to the other members of the thesis committee, Drs. W.H. Gaddes and G.N. O'Grady for their advice and suggestions.

The author is indebted to Dr. R.S. Wachal for his guidance and assistance in the development of the linguistic aspects of this study.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

I Introduction

The term aphasia has been applied to the impairment of language abilities when the deficit is due to disease or injury of the cerebral hemispheres. Nielsen (1948), in tracing the history of the study of aphasia has pointed out that diverse definitions of aphasia have been formulated, which often overlap the definitions of apraxia and of some of the agnosias.

Much of the study of aphasia has been concerned with identifying different types of aphasic disorder and the specific language deficits which will occur with each type. Motor (expressive) and sensory (receptive) aphasia have usually been identified as the two major types of aphasic disturbance, with amnestic aphasia (anomia or anmesic aphasia, the inability to recall words) identified as a third type. Some authors have questioned the usefulness of the motor-sensory dichotomy because intermediate or mixed forms are far more common than purely motor or sensory ones. Weisenburg and McBride (1935) identified "predominantly expressive" and "predominantly receptive" types each of which displayed characteristic expressive and receptive disorders. Other authors (Head, 1926; Jakobson, 1964; Luria, 1965; Wepman & Jones, 1964) have suggested classifications on the basis of the type of expressive disorders displayed, differentiating among expressive disorders involving word formation, syntactic structure or comprehension of meaning.

Many terms have been suggested to identify general types of aphasic disturbance and specific language errors. Here also has been much overlap in the characteristics which different authors subsume under any one term. The term paraphasia has been used by some authors to designate a wide range of substitution errors (Nielsen, 1948; Benson, 1967) while other authors have distinguished between different types of paraphasic substitution (Weisenburg & McBride, 1935) or have limited the term paraphasia to a specific type of substitution (Grewel, 1950). There have also been differences in the terms applied to types of paraphasic errors and to other speech errors. Weisenburg and McBride (1935) identify agrammatism as the loss of function words and telegraph style with verbal omissions. They identify the total loss of syntactic rules as an extreme form of paragrammatism. Howes and Geschwind (1964) define telegraphic speech as a reduction of function words and agrammatism as a total loss of syntactic rules.

Systematic linguistic analysis of the free speech of aphasic patients has provided a basis for comparison of specific types of language deficit which, although often analogous to the terms applied in clinical diagnosis, are usually more rigidly defined (Goodglass and Berko, 1960; Goodglass, Fodor & Schulhoff, 1967; Goodglass, Hyde & Gleason, 1964; Goodglass, Quadfasel & Timberlake, 1964). However, Spreen (1968), in a review of psycholinguistic studies of aphasia, suggests that problems may arise in identifying speech errors for linguistic analysis as a result of the confounding effect of the presence of phonetic distortions, confusions and syntactic errors.

The present study examines specific types of speech errors and hesitations that have been reported in previous research on aphasia.

A system of classification of speech errors and hesitations is developed, and aphasic and normal speakers are compared for the frequency of occurrence of such characteristics. Aphasic subjects are also compared to test for the occurrence of speech errors and hesitations in different subjects as predicted by previous research on aphasic types.

II Review of the Literature

1) Paraphasia, paragrammatism and agrammatism in aphasic speech

Any comparison of the presence of paraphasias in different types of aphasic disturbance is complicated by the fact that there is no generally accepted operational definition of what constitutes a paraphasic error. The problem of identifying paraphasic disorders becomes even greater when the related disorders of paragrammatism and agrammatism are considered.

Howes and Geschwind point out that "...One of the great problems in the field of aphasia is that of finding adequate objective measures of linguistic impairment that are not purely empirical but that have a useful theoretical background as well...." (Howes & Geschwind, 1964, p. 229). With the initial problem of isolating relevant objective measures for quantitative studies, additional problems arise in relating such findings to the results of studies based on clinical observations and of identifying reasons for possible discrepancies between the two types of study.

Comparison of the studies by Howes (1965a; 1965b) and by Benson (1967) involves such problems when the frequency of occurrence of paraphasias reported in the two studies are considered. The major emphasis of Howes' study was on objective analysis of variables related to word frequency. The results with respect to paraphasias, word fragments, pause fillers and repetitions were reported briefly and not discussed in detail. The Benson study was based on clinical judgments of the speech characteristics of patients and the standards for these judgements were discussed in detail.

On the basis of quantitative analyses of several properties of the language of aphasic patients, Howes (1965a; 1965b) has identified two distinct patterns of aphasic disorder which are characterized respectively by an abnormally low and an abnormally high rate of speech. Using data based on the number of words produced during the total interview time (including the time occupied by the interviewer's questions) he found a range of 12 to 220 words per minute in aphasic subjects compared to a range of 100 to 175 words per minute for normal control subjects. The study compared two groups of aphasics; those that fell below the normal range (less than 100 words or more per minute) and those that fell within or above the normal range (100 words or more per minute). Aside from rate of speech, the properties of free speech measured were: 1) the distributions of word frequencies; 2) the distribution of word lengths; and 3) the proportion of paraphasias, word fragments, pause fillers, and repetitions of immediately preceding words.

Howes based his comparion of word frequency distributions on the relationship of word frequency distributions discovered by Zipf. Zipf showed that if the rank of words in order of their frequency of occurrence is entered logarithmically on the abscissa and the logarithmic frequency of occurrence on the ordinate, the resulting regression line would be a straight line. Howes found that, although the word frequency distribution for aphasic subjects had the same mathematical form as those for normal subjects, there was a decrease in the number of different words used resulting in a lowered Type Token Ratio (TTR, the number of word types over the total number of word tokens) or a raised Mean Frequency of Occurrence.

Howes reported the following differences in the characteristics of free speech for the two groups of subjects.

Group A (decreased speech rate) exhibited a marked shift of the word-frequency distribution, increased repetition of words, a decrease of interstitial words, a reduced proportion of personal pronouns, increased proportion of pause fillers, greatly increased word fragments and increased frequency of paraphasias.

Group B (normal or accelerated speech rate) exhibited a pattern of measurements that clearly contrasted with the pattern of Group A subjects, but did not present a simple picture of proportionate change as did the first group. There was only a slight shift in the word-frequency distribution, repetition of words was normal and there was a slight increase in filled pauses and in word fragments, and an increased frequency of paraphasias.

Benson also found differences in aphasic subjects with respect to rate of speech. He divided his subjects into three groups: 1) those with a rate of 50 words per minute or less (comparable to the lower extreme of Howes' Group A); 2) those with a rate of 150 words per minute or more (comparable to the higher extreme of Howes' Group B); and 3) those subjects whose rate of speech fell between these two extremes. Benson's lowest and highest rate of speech groups showed patterns of speech characteristics comparable to those outlined by Howes. The major difference between Benson and Howes studies was that Benson found that paraphasic substitution was rare for Group A and frequent for Group B, while Howes found above normal occurrence of paraphasias for both groups with no difference between the groups.

In the Howes study, all speech samples were transcribed according to a carefully specified set of rules and coded for computer analysis. In the Benson study, patients were evaluated on a three point scale for each of the variables used, on the basis of examination protocols and judgements of tape recordings of spontaneous speech. It is apparent, that for a certain type of verbal substitution, information that is available during clinical evaluation may be lost in a linguistic analysis of speech. For example, if a patient reports in a taped speech sample that he dropped a book, when in fact he dropped a pen, this error will not be detected. If this type of error were a discriminating variable between groups A and B, the differences in method of collecting data could account for some of the differences in results. A further problem is apparent when Benson's description of his standards for identifying the presence of paraphasic errors is examined. His standards seem designed to place more emphasis on the absence of dysarthria than on the presence of paraphasia. That is, a paraphasic error is any substitution error which is not accompanied by dysarthria.

> "...we may consider paraphasia as a process of substitution and outline three types signifying the type of substitution. Literal paraphasia is considered the substitution of a single phoneme ("the grass is greel"), verbal paraphasia, the substitution of an entire word ("the grass is blue") and neologism, i.e., substitution of an unintelligible or meaningless group of sounds for a word ("the grass is grumpfs")....

> Both literal paraphasia and neologistic speech must be differentiated from dysarthria and while this is usually possible it is not always done with ease. The ease of production of speech is a helpful guide as most paraphasic speech is easily and rapidly produced in contrast to the effort which often accompanies dysarthria...." (Benson, 1967, p. 379)

This method of discriminating types of speech errors is not unprecedented. Head (1926) also distinguished between defective word formation which is accompanied by a slow rate of speech, and verbal jargon or disintegration of the internal structure of words which is not accompanied by dysarthria. However, not all authors agree that the distinction between mispronunciation and literal paraphasia is a valid one. Weisenburg and McBride (1935) distinguish between the two types of error in theory, but argue that literal paraphasic errors are similar to the errors in word form resulting from mispronunciation and that the two types of errors cannot be reliably distinguished although mispronunciations are more likely to be distorted by faulty enunciation.

Other authors (Brain, 1965; Grewel, 1950) have not considered literal paraphasia and verbal paraphasia together, but emphasize the concept of language disturbances as disruptions of speech-schemas at different levels of language function. Grewel has identified five systems of signs: 1) phonemic; 2) phonetic-semantic; 3) word-formation; 4) sentence formation; and 5) accents. He defines only those errors that occur at the level of "word-formation" i.e. errors that consist of "...the composition of words from their syllables or of compound words out of their component parts...." (p. 104), as paraphasias.

The traditional classifications of motor aphasia, receptive aphasia and amnestic aphasia have considered paragrammatism as a type of paraphasia associated with receptive aphasia and have linked telegraph style with motor aphasia. Agrammatism has been classed both as a severe form of paragrammatism and as a separate class of error associated with motor aphasia. However, some authors (Jakobson, 1964; Luria, 1965; Wepman & Jones, 1964) have distinguished between disorders which involve breakdown in the relationship of words to meaning (similarity disorders) and those which involve a breakdown in the syntactic relationship of words (contiguity disorders). They have linked paraphasias which involve semantic substitution with similarity disorders, and paraphasias which involve substitution of a word into the wrong grammatical slot with contiguity disorders.

2) Models of language function

Several models of language function have been suggested to explain observed speech disturbance syndromes. Three of these will be discussed in relation to the occurrence of paraphasic and paragrammatic disorders.

In the study described above, Howes identified two distinct patterns of aphasic disorder which are characterized mainly by a difference in rate of speech. Howes has suggested that Type A corresponds to Broca's aphasia, while anomic aphasia and Wernicke's aphasia represent two different degrees of severity of the type of aphasia represented in Type B. He has suggested that these two types represent breakdown in two different systems of language production (Howes, 1965b).

Howes hypothesises that Type A aphasia results from disturbance of the α system which functions as a word selection mechanism. Disruption of the α system would result in decreased efficiency of word selection;

latencies of word selection would be increased and rare words would become more difficult to produce in comparison to high frequency words. Selection of the components of words will also be disrupted, resulting in pronunciation errors, word fragmentation and disturbed speech rhythm.

Type B aphasia results from disturbance of the β system. The system is responsible for the integration, coordination and codification of the potential information that can be expressed verbally. Severe injury to the β system will result in the production of words that are unrelated to the stimulus situation. The flow of words will be undisturbed because of an intact α system. Because of impairment of the pre-selection function of the β system, there is a tendency toward continued discourse on a limited subject, irrelevant speech, and jargon. Small lesions to the β system would have a less noticeable effect, particularly in ordinary conversation where the output of the system is not uniquely related to the input. It is mostly in tasks such as naming objects or giving specific answers to questions that the effects of small lesions to the β system would be evident.

An alternative to Howes' division of subjects is a division on the basis of similarity and contiguity disorders. Wepman and his associates (Wepman & Jones, 1964; Wepman, Jones, Bock & Van Pelt, 1960) have suggested a model of language with three levels of integration: 1) the semantic process of word selection; 2) the syntactic process; and 3) the arousal of a meaningful state. They suggest that language disturbance will be of at least three types which they have labeled, after Morris (1938), semantic, syntactic and pragmatic.

Wepman has defined semantic aphasia as a deficit in the semantic act of symbol formation. Wepman and Jones (1964) found "...in some patients a severe constriction in vocabulary where word usage tends to be limited to the more frequent words of the language....the classical term 'anomia' did not rigidly apply because within the verbal product was found an adequate use of all the parts of speech represented by the most frequent words of the language, with marked underuse of the less frequent words...." (p.193). Fillenbaum, Jones and Wepman (1961) suggested the Type-Token Ratio as a measure of diversity in vocabulary but were unable to interpret the results of this measure adequately because of the sensitivity of the measure to differences in sample size. They found that measures involving Yule's K, the distributions of words according to grammatical function and sequential dependencies in form class usage reflected difficulties in the word-selection and sequencing processes.

The syntactic aphasic retains the ability to nominate specific symbols, but "...displays a loss of the grammatical functions of language and shows a paucity of use of interstitial connectives between the signs...." (Wepman & Jones, 1964, p.192).

Pragmatic patients"...speak with a well-retained intonational pattern....Normally informative words appear with adequate syntax, yet the over-all context is inappropriate, often disordered and chaotic...." (Wepman & Jones, 1964, p.194).

In contrast to the above classifications based on differences in types of language dysfunction, Schuell (Schuell & Jenkins, 1959; Schuell, Jenkins & Jiminez-Palon, 1964) has hypothesized that all aphasias are part of a general hierarchy of language deficit. Differences that are found in the language ability of aphasic patients represent differences in the severity of the disorder, not differences in type of defect. To test the hypothesis of a unitary dimension of language, Schuell and Jenkins performed a Guttman Scale analysis on tests from the Minnesota Test of Differential Diagnosis of Aphasia. They found that tests presented visually, auditorily, or by "general directions" and requiring responses through gross motor areas, fine motor areas or "High level" speech functions were scalable in order of difficulty on a single dimension. Schuell, Jenkins and Carroll (1962) factor analyzed scores of aphasics on the Minnesota battery and identified a general language factor, and also factors of visual discrimination, visuospatial behavior, gross movements of the speech musculature, and recognition of a stimulus equivalence. The authors interpreted these results as supporting the existence of a single dimension of "pure" language deficit which may coexist with specific sensory or motor deficits.

Although Schuell has not tested her hypothesis on free speech samples, she has suggested a tentative model for a language system based on observations of aphasic disorders. Both the learned elements and the learned rules of language are stored in long-term memory units. It is at the stage of retrieval of these coded elements that the breakdown of verbal processes occurs in aphasia. The extent of language deficit is related to the extent of the disruption of the retrieval system.

If Schuell's hypothesis is correct, subjects will not be discriminated by the type of errors which they make. Instead, the number of errors of a specific type which occur in the speech of a subject will be a function of the relative frequency of that type of error and of the extent of the deficit in that subject.

3) <u>The occurrence of hesitation phenomena in aphasic and normal speech</u>

It has been remarked (Head, 1926; Lenneberg, 1967) that all types of speech error made by aphasics are found at some time in normal speech; the extent and quantity of errors distinguish aphasic speech from the speech of normal persons. This is particularly true of hesitation phenomena. Pauses, repetitions, corrections, restructuring of sentences and incomplete utterances all occur in normal speech.

Mahl (Kasl & Mahl, 1965; Mahl, 1956, 1959) related such hesitation phenomena to the "jumbled", "confused" or "flustered" speech observable during periods of anxiety. From a careful analysis of instances of extreme speech confusion, he established eight categories of speech disturbance: 1) Pause filler ("ah"); 2) Sentence change; 3) Repetition; 4) Stutter; 5) Omission; 6) Sentence incompletion; 7) Tongue slips; and 8) Intruding incoherent sound.

Mahl has found that there are "...striking individual differences in the frequency of speech disturbances and in the relative predilections for the individual categories of disturbance...." (Mahl, 1959, p.114). Other authors (Feldstein, Brenner & Jaffe, 1963; Lay & Paivio, 1969; Levin, Silverman & Ford, 1967; Maclay & Osgood, 1959; Martin & Strange, 1968a, 1968b) have found similar speech disturbances (hesitation phenomena) to be reliable measures for comparison of individuals.

Descriptions of the characteristic expressive disorders in different classes of aphasia include the means by which a patient compensates for disturbances in his ability to produce language. Some of these compensatory mechanisms are similar to the speech disturbances described in the literature on hesitation phenomena.

Head (1926) included clinical observations of such features in his descriptions of four classes of language dysfunction; verbal defects, syntactic defects, nominal defects and semantic defects.

1. Verbal defects are characterized by the inability to form words at the conceptual and articulatory levels. Accompanying compensatory mechanisms are:
   - (a) substitution of near synonyms for the target word; e.g. "...'but I never found we were much in pocket by her...her...thrift...or her...I want another word....' ...the word he was seeking was 'economy'...."
   - (b) word finding difficulties which may lead to reconstruction of sentences on a different plan;
   - (c) repeated attempts to correct defective articulation.
2. Syntactic defects are characterized by loss of grammatical structure with very little recognition of errors or self-correction.
3. Nominal defects involve an inability to find appropriate names or categorical terms in which to express ideas. Accompanying compensatory mechanisms are:
   - (a) retracing to convey meaning by changing the form of a phrase;

(b) use of gestures, ready made phrases or slang to complete sentences.

e.g. "...'putting heavy guns on to it,'....to imply that much effort had been used..."I made a priceless blob,' (a mistake in tact)...." (Head, 1926, p.241).

4. Semantic defects involve lack of recognition of the full significance of words and phrases. Sentence are often left unfinished and trail away aimlessly.

Weisenburg and McBride (1934) also found differences between aphasic types in the kind and amount of false start and incomplete material that was produced.

1. The predominantly expressive class showed awareness of errors in:

   (a) repeated attempts at words;

   (b) frequent and prolonged hesitations for words.

2. The predominantly receptive group showed very little hesitation for words or recognition and correction of errors.

3. Amnestic aphasics showed:

   (a) long hesitations for words;

   (b) use of colloquial expressions that are not precise in their significance for the particular situation.

   (c) use of automatic or well-learned series to arrive at the target word (e.g. counting to the desired number).

The speech disturbances from Mahl's classification which are representative of the compensatory mechanisms described by Head and by Weisenburg and McBride are "Sentence change" and "Sentence incompletion". These categories are roughly equivalent to the speech hesitations labeled by Maclay and Osgood "false Start Retraced" and

"False Start Non-retraced". Levin, Silverman and Ford (1967) have further differentiated among False Starts Retraced to identify the following sub types:

> "...2) Grammatical correction: 'The balloons go-went up.' 3) Word order correction: "The red is water-The water is red." 4) Lexical correction: 'The circles-the discs are the same.'...6) Phonological correction: "That's the idear-the idea.'..." (Levin et al, 1967, p.561)

For the purposes of aphasic research, a more useful classification might combine grammatical correction and word order correction under a single category, as both involve errors in syntactic processes. It would also be useful to include categories for situations where there is no apparent error in the false start and where an error is left uncorrected in the retrace.

Classifications of speech disturbances have not included distinctions between types of non-retraced false starts. The distinctions made by Head among types of compensatory mechanisms indicate that sub-classifications of non-retraced false starts may be useful in comparing aphasic patients (i.e. Semantic defects are accompanied by unfinished sentences with no evident recognition of the incompleteness. Both verbal and nominal defects are accompanied by stated recognition of the incompleteness, such as "I don't remember the name", and by sentences which are restructured to complete the meaning). These differences in incomplete material could be identified by the following subtypes of non-retraced false start material:

1. Total incompletion - sentences that trail off or for which the meaning and syntax are left incomplete.

2. Semantic incompletion - sentences for which the syntax is completed with a semantically empty word, phrase or clause.
3. Syntax incompletion - sentences for which the syntax is never completed, but for which the meaning is carried through to the following sentence (or sentences).

Head and Weisenburg and McBride found differences in the extent to which aphasics of different types recognized errors in their own speech and in the manner in which they attempted to correct errors or to compensate for language deficit.

It might be expected that if aphasic subjects can be differentiated on the basis of free speech characteristics, such subject groups would also differ in the type and amount of editing material (False Starts Retraced and False Starts Non-retraced) produced. Specifically, if aphasic patients can be differentiated on the basis of speech rate as Howes and Benson suggest, or on the basis of the type of speech deficit as Wepman suggests, it would be expected that there would be differences in the occurrence of editing material in such groups.

III Purpose and Hypotheses

The purpose of the present research was to test the validity of the theories of language proposed by Howes, Wepman, and Schuell by comparing the characteristics of the free speech of aphasic patients divided into groups as suggested by the above theories. A secondary purpose was to examine the relationship between different aphasic types and the editing material produced.

The following hypotheses were tested:

1. Errors, hesitations and editing material will show different

frequencies of occurrence in aphasic subjects than in normal subjects. This will be reflected in a difference in the distributions of scores for normal subjects and for aphasic subjects on each type of speech error and editing. This is a general hypothesis investigating the differentation of a normal and an aphasic population by the types of errors under study.

2. (a) The occurrence of word fragments, pauses, pause fillers and repetitions of words will be greater for subjects with a slow rate of speech than for those with an accelerated speech rate. This hypothesis is based on the theory of language change developed by Howes.

   (b) The occurrence of all types of word substitution and word order errors will be greater for subjects with an accelerated speech rate than for those with a slow speech rate. This hypothesis is based on the results of Benson's study with respect to paraphasias, which, although they were in agreement with Howes' theory of language change, did not agree with the results of Howes' study.

   (c) There will be differences in the types of editing produced by subjects with different rates of speech.

3. Groups identified on the basis of Wepman's classifications of Semantic, Syntactic and Pragmatic aphasia will produce editing material which is related to the type of aphasic deficit exhibited (e.g. Semantic aphasics will have the greatest number of semantically and syntactically incomplete sentences while pragmatic aphasics will have the greatest number of totally incomplete sentences).

Hypotheses 2 and 3 are not conflicting in that both explanatory concepts could be accepted by the results of this study.

4. Speech errors (mispronunciations, jargon, neologisms, and paraphasic and paragrammatic errors) will be found to be scalable with respect to frequency of occurrence for all aphasic subjects. This hypothesis will test Schuell's theory of a single dimension of language deficit. This is an alternative hypothesis to hypotheses 2 and/or 3 since it rejects the notion that distinct types of aphasia can be found.

IV Method

1) Subjects

Manuscripts and tape recordings of speech samples from a larger study (Spreen & Wachal, 1970) were used for the analyses.

The experimental subjects were 20 aphasic speakers between the ages of 13 and 77. The mean age was 45; the median age, 50.5. All experimental subjects had cerebral lesions sustained between 2 years and 1 month prior to the interview. Full information on medical findings including a neurological workup, EEG, x-rays, angiography, echoencephalography, and observation during surgery (if patient underwent surgery) are available for all patients. In order to be accepted into the aphasic group the diagnosis of aphasia had to be made by the attending neurologist or neurosurgeon during his examination. All subjects were free of confusion and anosognosia and, with few exceptions, were hospital inpatients. Except for the diagnostic requirements, all patients were unselected consecutive admissions to the Royal Jubilee Hospital, Victoria, B.C.

The control group consisted of 20 hospitalized patients matched for sex, age and educational background with the aphasic group. Subjects under 25 years of age were matched within one year for age; 25 to 40 year olds were matched within 2 years and subjects over 40 were matched within 5 years of age. When an aphasic subject had received his education in a school system that differed from the standard North American system, or when the subject had not completed secondary school, the control subject was matched for an approximate equivalent in number of years of education. Occupational level was also taken into consideration. All control subjects were hospitalized for reasons other than central nervous system or psychiatric disorder.

2) Procedure

Speech samples were recorded on tape and transcribed in standard English spelling (Webster's, 1965). The total word count (number of utterance tokens) for each subject consisted of:

1. A main word count (number of word-tokens) which included recognizable English words, vocal gestures (uhhuh, uhnuhn, etc.) and neologisms.
2. A supplementary verbal count which included pause fillers, unrecognizable sounds (utterances which, because of faulty speech or technical problems, could not be phonetically or semantically identified), and word fragments.

Transcripts were standardized in length so that they ended at the first sentence completed following the thousandth word token. Punctuation and utterances other than standard English words were entered according to a specific set of rules (Spreen & Wachal, 1970).

Each speech disturbance was identified on the basis of the following definitions. Items marked with * were selected from the variables used by Spreen and Wachal. All other items were coded for the present research.

A. Speech errors

*1. Mispronunciation

Theoretically a distinction can be made between an inability to form phonemes (mispronunciation) and errors in phoneme choice or in ordering of phonemes (literal paraphasia). It is, however, difficult to make this distinction in actual speech. In the present study, all errors in word production that result from dysarthria, phoneme substitution and addition or omission of phonemes were classed as mispronunciations. Another distinction that is often difficult to make is that between errors at the phonemic level and errors at the level of word choice. Decisions of this type were made on the basis of the extent of the phonetic and semantic relationship of the chosen word to the correct word (e.g. "Dust berry" for "just very" and "ride" for "write" are mispronounced, while "said" for "set" and "hockey" for "hobby" are incorrect word choices).

2. Jargon

These include neomorphs which consist of combinations of phonemes which do not form recognizable English morphemes, but which from context or intonation can be identified as serving the grammatical function of a word, even though the specific function may be indeterminate (e.g. He is gline).

3. Neologisms

These are word substitutes which consist of a combination of a neomorph and a regular English morpheme or of a combination of

English morphemes which does not occur in the English lexicon (e.g. drufferly, gooding).

4. Telegraph style

This includes all omissions of function words. (e.g. I going home today; I gave the book Mary.)

5. Paraphasias

The following terms and definitions were selected as a means of supplying a framework for comparison of types of speech errors that possibly could be included under the classification "paraphasias". Consistency with historical definitions was considered secondary to linguistic consistency. Grammatical errors refer to errors that involve the whole language mechanism and cannot be defined as specifically semantic or syntactic.

a) syntactic selection errors - substitution of a syntactically incorrect form of a word into a sentence. (e.g. I arm hurt; Can you helping me?)

b) syntactic ordering errors - errors in word order. A group of related word order errors was scored as one error. (e.g. We are sure getting done something today; We went up to a ride for a river.)

c) paralogisms - substitution of a semantically incorrect word in the correct grammatical slot (e.g. Then I have to go to the spoons).

d) paragrammatic unit - substitution of a semantically and syntactically incorrect word into a sentence. This may be by direct substitution or by the addition of an extra word (e.g. I just love to week the old shop. I had several tests at then).

e) semantic deficit - loss of meaning while syntax is retained. Each utterance which could be considered independent by syntactic structure and/or intonation was scored as one error (e.g. As soon as it catches me it's got me swallowed; We are my work).

f) agrammatism - loss of meaning and syntax. Each utterance which could be considered as independent by intonation was scored as one error (e.g. And here get the working worders considering of the then are red the red machine there with the damness).

B. Speech hesitations

1. Word fragments

*a) dependent units - utterances which bear a phonological or semantic relationship to the surrounding material.

*b) independent units - one or more phonemes that cannot be recognized as being related to the surrounding material.

2. *Pauses

hesitations of ¼ second or more occurring within the subject's speech.

3. *Pause fillers

hesitation noises or non-words used to fill a pause.

4. *Repetitions

These are exact repetitions of a preceding word, part word or group of words. They are usually immediate but there may be an intervening short, punctuating utterance, almost on the level of "automatic" speech, which does not add any unique information to the entire sentence. Each word or part word that was contained in a repetition was scored as one hesitation.

C Editing

1. False Starts Retraced

(In each of the following types, any word or group of words which, by intonation, could be identified as an independent false start was given a score of one.)

a) for phonological correction (e.g. one of the first--ens--explorers)

b) for grammatical correction (e.g. I would--like talk--like to talk)

c) for lexical correction (e.g.--They don't remem--They don't forget)

d) with an error left uncorrected (e.g. He--pattarnded--patternded it after)

e) for a change where no identifiable error occurs in the false start or the retrace. (e.g. I am staying--at--with my folks;--I used to--at one time I used to)

2. False Starts Non-retraced

(Each independent group of words was scored as one false start.)

a) syntactic incompletion - sentences for which the syntax is never completed, but for which the meaning is carried through to the following sentence (or sentences). This involves a complete restructuring of the material. (e.g. And then by the time we arrived at the Jubilee Hospital...I had to wait for Dr. Scott-Wallace--was--happened to be in the hospital. And he examined me for reflexes and so on. But by this time I wasn't able to speak to him.)

b) semantic incompletion - sentences for which the syntax is completed with a semantically empty word, phrase or clause or in which a colloquial expression which is not precise in its significance for the situation is used in place of a more direct word. (e.g. She is...I'll think about it later; I saw Tom, Bill and...What was his name?)

c) total incompletion - sentences that trail off or for which the meaning and syntax are left incomplete. (e.g. We thought that would be...And then in September we came here.)

3. Semantic editing

Word searching interruptions (e.g. Well we call him uh, oh now wait a minute, forget about it sometimes, Buddy.) or changes in semantic content without a syntactical interruption. These involve an expressed awareness of the change in semantic content which is not present in False Starts Retraced (e.g. I just had a head, not a head, an ear operation; That was in May, no, just the beginning of June). One score was given for each position where such an interruption or correction occurred.

A visual record of the sequences of sound and silence for each speech sample was obtained using a Grason-Stadler Model E7300A-1 Voice Operated Relay, a Mark II Brush Recorder and an Ampex Tape Recorder Model 602 with two speaker-amplifiers Model 622.

The length of each pause of one unit (1.25mm or ¼ second) or more was measured on the ink tape produced by the brush recorder. The length of coughs, sighs and laughter of the subject were measured and subtracted from the total of the surrounding pauses. The number of units of pause time were indicated on the manuscript above the word which preceded the pause. Examiner interruptions (the time elapsed from the last word of subject speech to the last word of the following examiner speech) were indicated on the manuscript in units of pause time.

A total-time measure for each subject was obtained by measuring the time elapsed from the utterance of the first subject word entered on the transcript to the utterance of the last subject word entered. Both Howes and Benson used a total-time measure in calculating a words per minute score for subjects. For the present study, it was considered that the time taken for examiner interruptions would be as much a function of examiner differences as of subject differences; inclusion of examiner interruptions in the time measure could result in a spuriously low rate of speech for some subjects. Therefore, a net speaking time (after subtraction of examiner interruption time) was used to calculate rate of speech.

Another artifact that could have contributed to differences in rate of speech was the structure of the interview. Examiners were instructed to encourage subjects to talk as much as possible and to interject remarks or questions only when it was obvious that the subject would not continue on his own initiative. This could result in longer pauses than would be found in ordinary diaglogue (Goldman-Eisler, 1968, found that pauses in ordinary dialogue were never longer than three seconds.). These long hesitations could be related to a reluctance to talk or to difficulty in choosing a topic as well as to specific speech characteristics. It was decided however, that exceptionally long pauses in aphasic speech would often be a function of difficulty in producing words and so should be included in the time used to calculate rate of speech.

3) Grouping of Subjects for Analyses

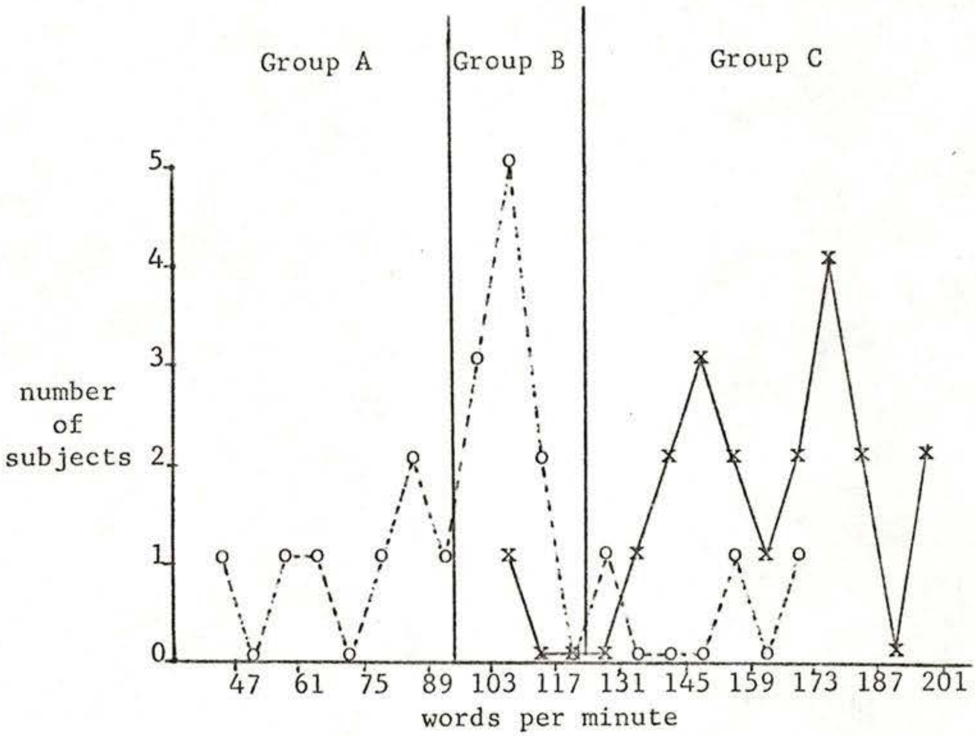
To test hypotheses 2a and 2c, it was decided to use a three group division on the basis of rate of speech, similar to that used by Benson. Howes' theory of language change predicts a difference between aphasic speakers with a rate of speech which is below normal and those with a normal or accelerated rate of speech. Any dichotomous division of aphasic subjects will necessarily be arbitrary and related to a specific normal sample. A three way division makes it possible to identify those subjects that are definitely below the normal range and those which are definitely within or above the normal range. The third group includes all subjects whose scores fall within the marginal area.

Comparison of the distributions of rate of speech scores for aphasic and normal subjects in the present study indicated that all aphasic subjects fell within or below the distribution of normal subjects (see figure 1). There were no subjects who showed abnormally high rates of speech as reported by Howes. Aphasic subjects were assigned to groups on the basis of the relation of their scores to the distribution of normal scores. Group A had scores which were more than three standard deviations below the normal mean. Group B had scores two to three standard deviations below the mean, and Group C had scores within two standard deviations of the mean.

To test hypothesis 3, subjects were divided into three groups, semantic (Group D), syntactic (Group E) and pragmatic (Group F), each

FIGURE 1

Distributions of Rate of Speech Scores for Aphasic Ss o----o and for Normal Ss x——x, and Boundaries for Aphasic Groups Based on the Distribution of Normal Scores



Aphasic $\bar{X}$ = 100.55 SD = 30.03
Normal $\bar{X}$ = 162.20 SD = 22.50

t = 7.35*

* $p < .01$

representing speech deficit in one of the areas of integration defined in Wepman's model of language. The mean frequency of occurrence of word types (the reciprocal of the Type Token Ratio) was used as the criterion for identifying semantic deficit. The mean was considered to be more appropriate for the present analyses because the direction of greater deficit is the same as for the frequency of errors and so can be more readily compared to types of errors for the purpose of classification of subjects. Fillenbaum et al (1961) had difficulty in interpreting data obtained on the TTR because of the sensitivity of the measure to sample size. This did not present a problem in the present study because the speech samples were standardized for length. Syntactic errors included syntactic selection errors, telegraph style and syntactic ordering errors. Pragmatic errors included semantic deficit and agrammatism.

T scores were computed for the mean frequency of word types and for each error type. The T scores for the mean, for syntactic errors and for pragmatic errors were compared for each subject and the subject was assigned to the group for which his T score was highest.

To test hypothesis 4 a Guttman Scale Analysis (Guttman, 1950) was performed on the ten speech error scores (mispronunciation, jargon, neologism, telegraph style and the six types of paraphasia) for all aphasic subjects.

V Analysis and Results

Each speech disturbance was coded for computer analysis as specified under procedure. A computer program (Wachal & Spreen, 1970) was used to compute the frequency of each variable for each subject and to translate the raw frequency scores into relative frequencies based on the total number of words and oddments produced. The relative frequency scores were used in comparing the experimental groups on each of the relevant variables.

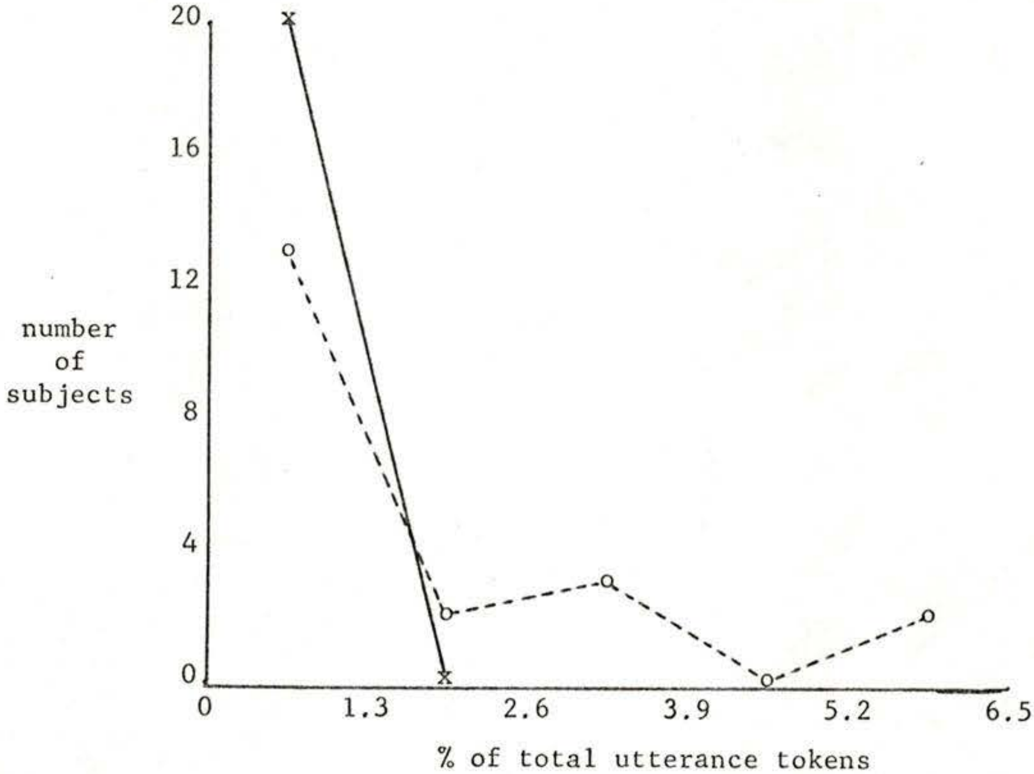
The shapes of the distributions for normal subjects and for aphasic subjects were compared for each of the dependent variables (speech errors, speech hesitations and editing as described in the procedure section; see figures 2 through 13). The results of two-tailed t-tests showed that the mean scores for aphasic subjects were significantly higher ($p < .05$) than the mean scores for normal subjects on all variables except jargon (see figure 4) and telegraph style (see figure 6). For all variables, the range of scores for aphasic subjects was greater than the range of scores for normal subjects, with a relatively low frequency of occurrence of each speech disturbance type in normal subjects. For each of the variables, there were some aphasic subjects whose performance was similar to that of normals and others for whom the rate of occurrence of the given speech disturbance was considerably more frequent.

These differences in the distributions of scores for normal and aphasic subjects offer evidence to support hypothesis 1: "Speech errors, speech hesitations and editing are sensitive to the effects of aphasic disturbance." The greater variation in the performance of aphasic subjects in comparison to the performance of normal subjects would suggest that the effect of aphasic deficit is not uniform across subjects but varies among aphasic subjects.

The results of analyses of variance of the scores of Groups A

FIGURE 2

Distributions of Mispronunciation Scores for Aphasic Ss o----o and for Normal Ss x——x



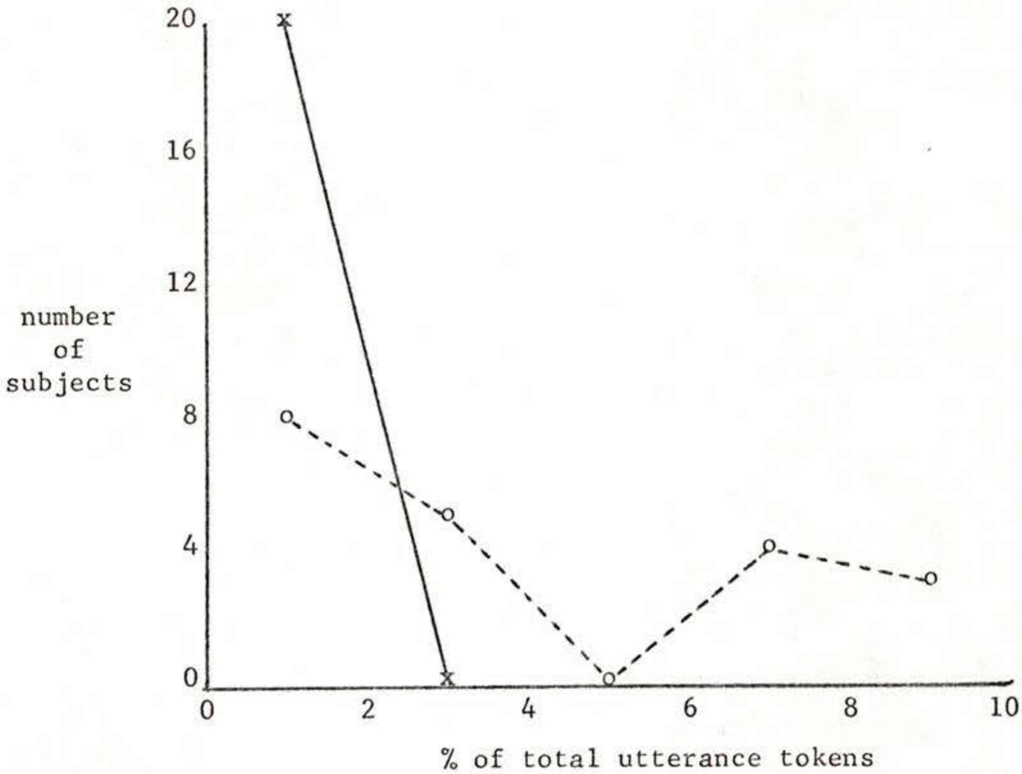
Aphasic $\bar{X} = 1.4$ SD = 1.94
Normal $\bar{X} = 0.1$ SD = 0.10

t = 2.99*

* $p < .05$

FIGURE 3

Distributions of Word Fragment Scores for Aphasic Ss o----o and for Normal Ss x——x

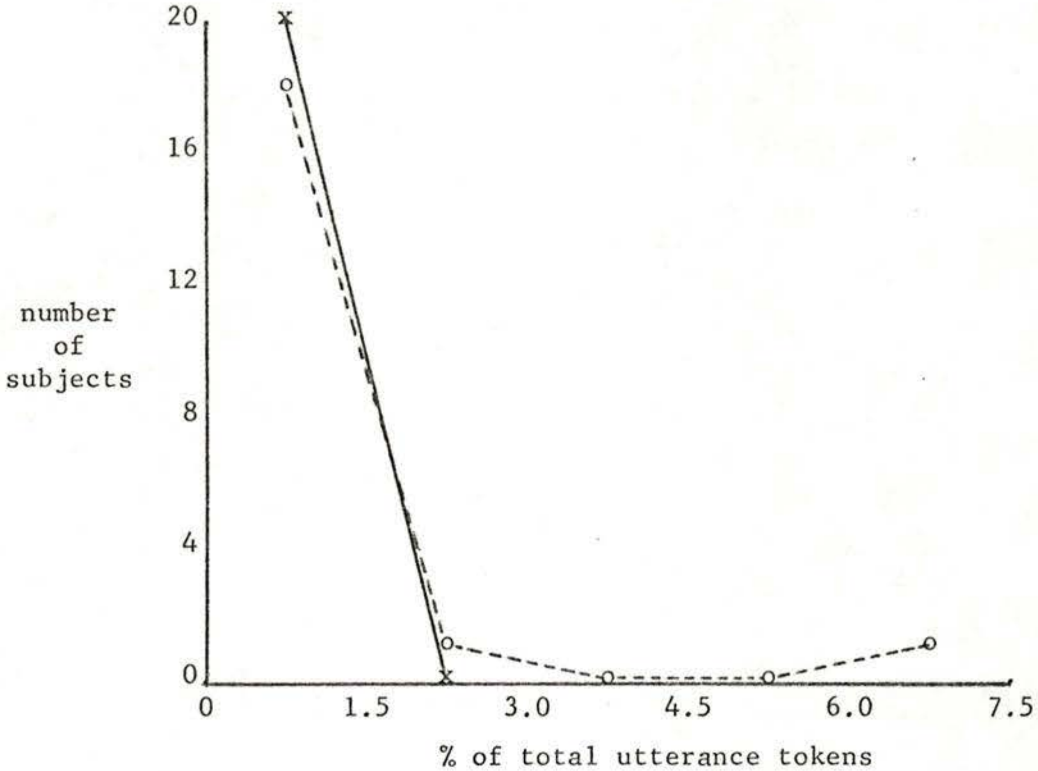


Aphasic	$\bar{X} = 3.8$	SD = 3.13	t = 4.33*
Normal	$\bar{X} = 0.8$	SD = 0.52	

*$p < .05$

FIGURE 4

Distributions of Jargon Scores for Aphasic Ss o----o and for Normal Ss x——x

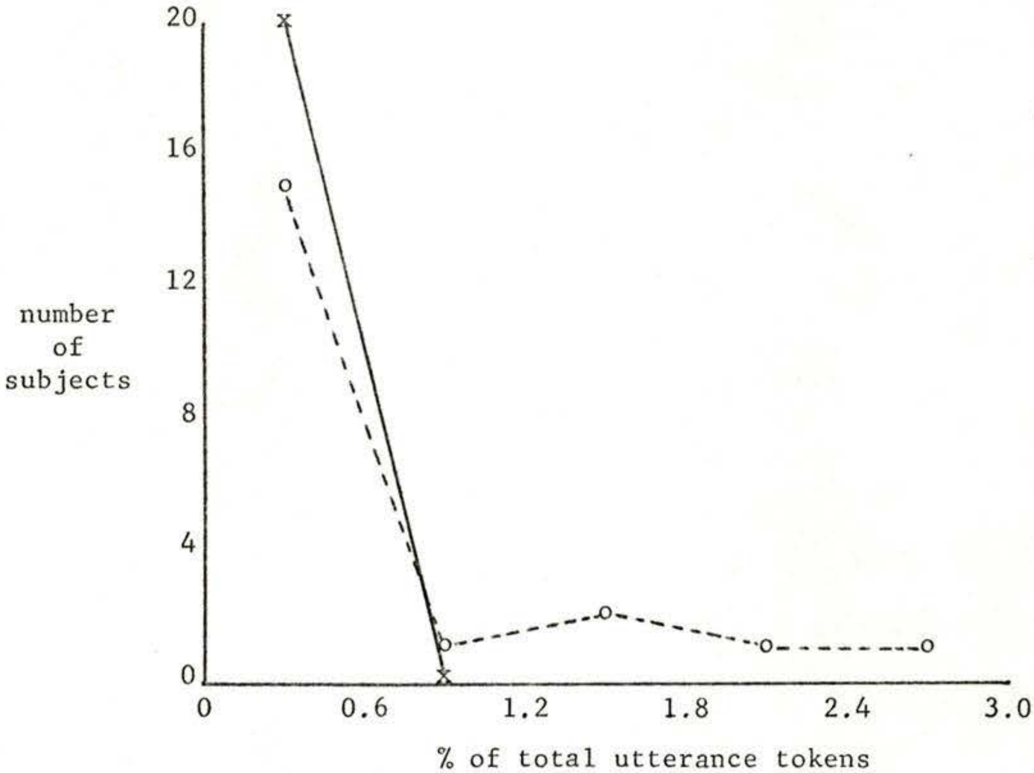


Aphasics	$\overline{X} = 0.7$	SD = 1.64	t = 1.80
Normals	$\overline{X} = 0.0$	SD = 0.00	

FIGURE 5

Distributions of Neologism Scores for Aphasic

Ss o----o and for Normal Ss x——x

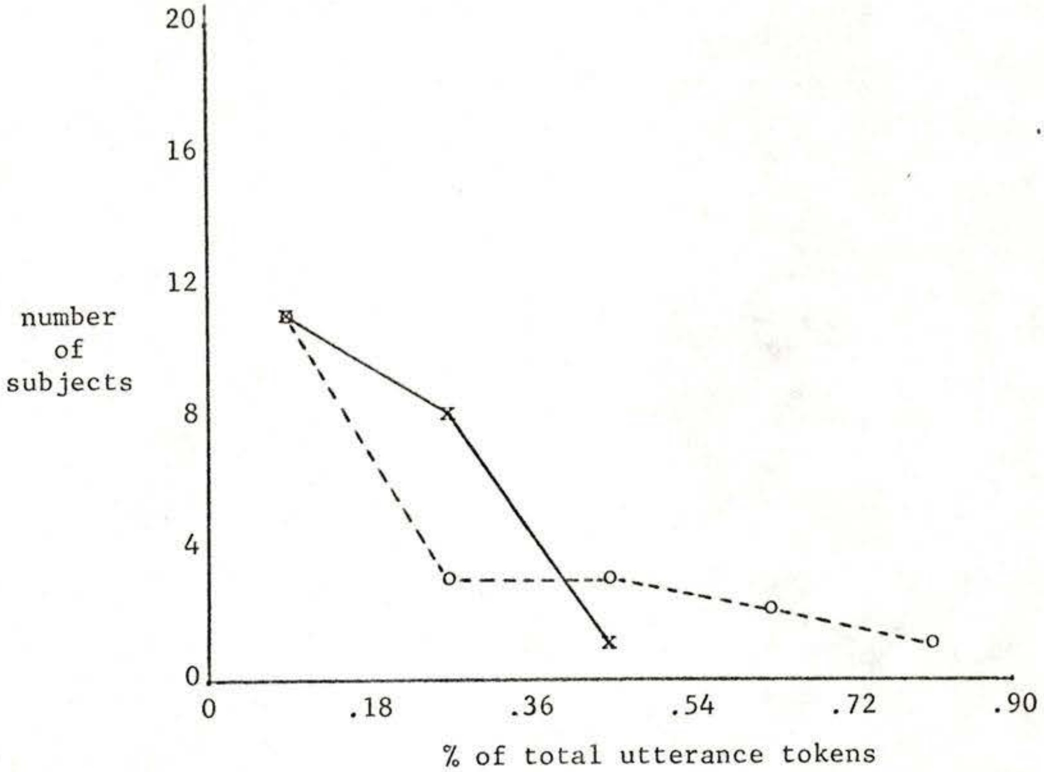


Aphasic	$\overline{X}$ = 0.5	SD = 0.78	t = 2.54*
Normal	$\overline{X}$ = 0.0	SD = 0.00	

*$p < .05$

FIGURE 6

Distributions of Telegraph Style Scores for Aphasic Ss o----o and for Normal Ss x——x

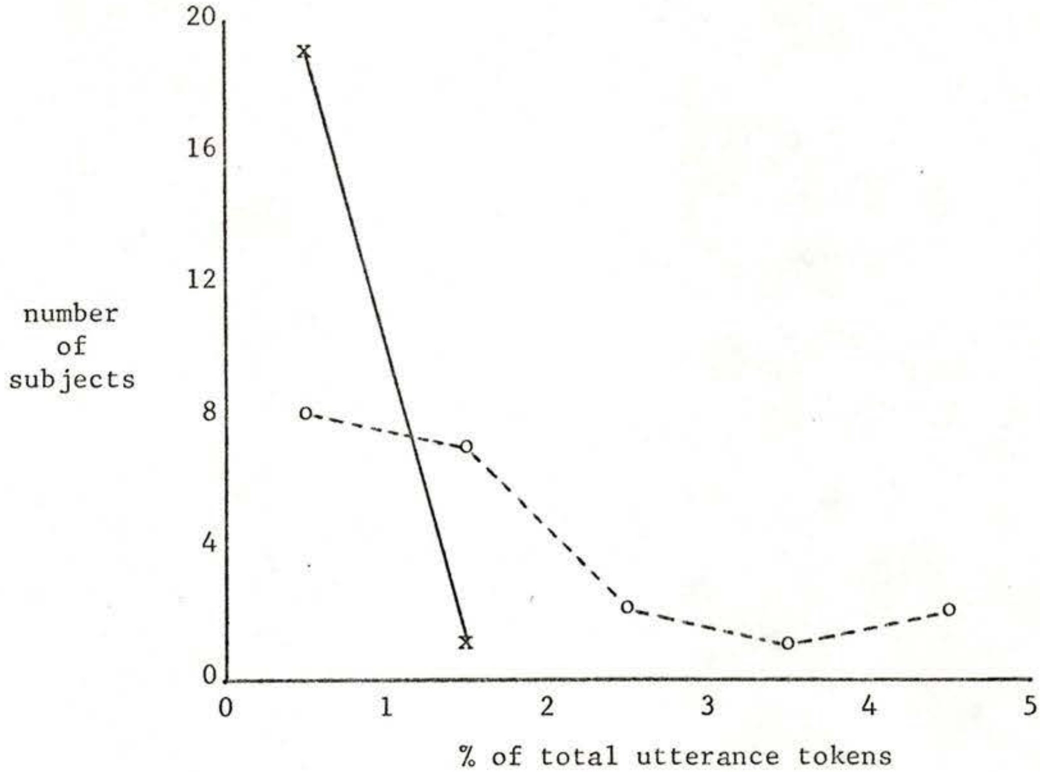


Aphasic	$\overline{X} = 0.3$	SD = 0.24	t = 1.97
Normal	$\overline{X} = 0.1$	SD = 0.13	

FIGURE 7

Distributions of Paraphasia scores for Aphasic

Ss o----o and for Normal Ss x——x

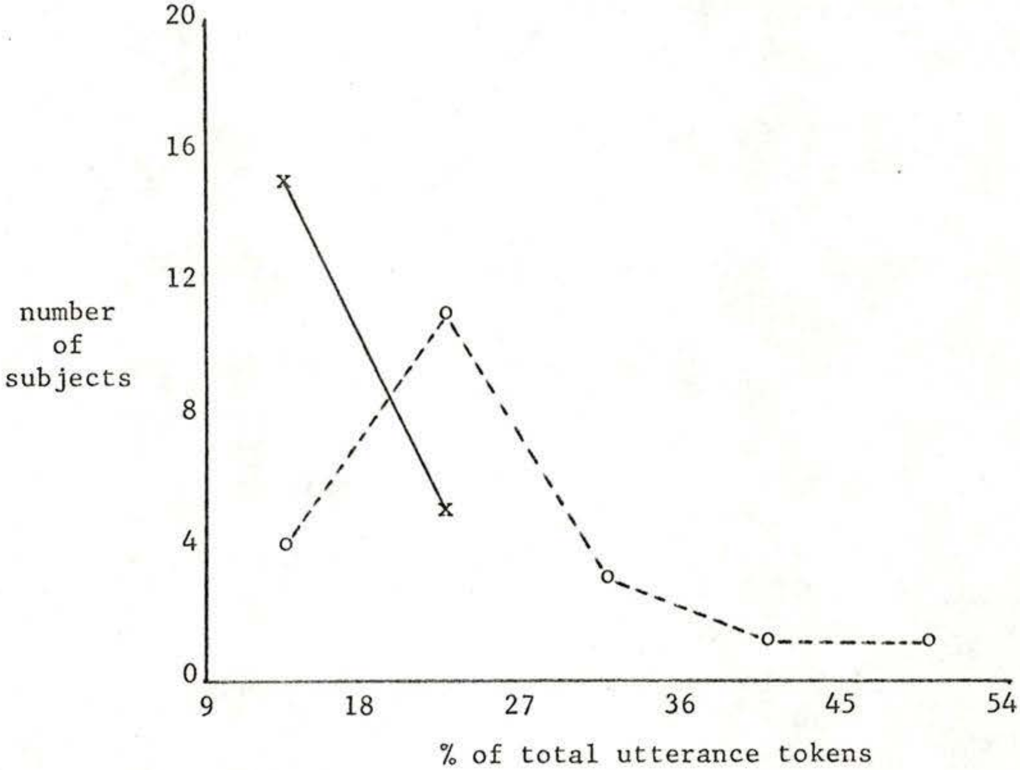


Aphasic	$\overline{X} = 1.7$	SD = 1.21	$t = 5.03^*$
Normal	$\overline{X} = 0.3$	SD = 0.29	

* $p < .05$

FIGURE 8

Distributions of Pause Frequency Scores for Aphasic Ss o----o and for Normal Ss x——x



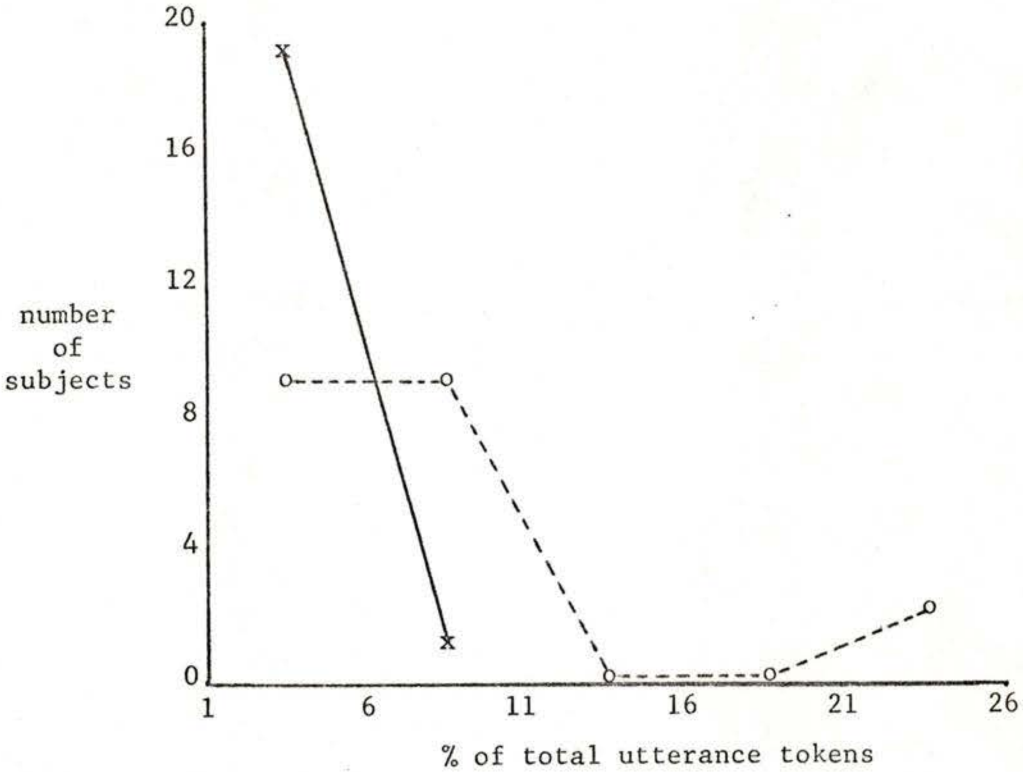
Aphasic	$\overline{X}$ = 25.3	SD = 9.35	t = 4.64*
Normal	$\overline{X}$ = 15.0	SD = 3.32	

* $p < .05$

FIGURE 9

Distributions of Pause Filler Scores for Aphasic

Ss o----o and for Normal Ss x——x

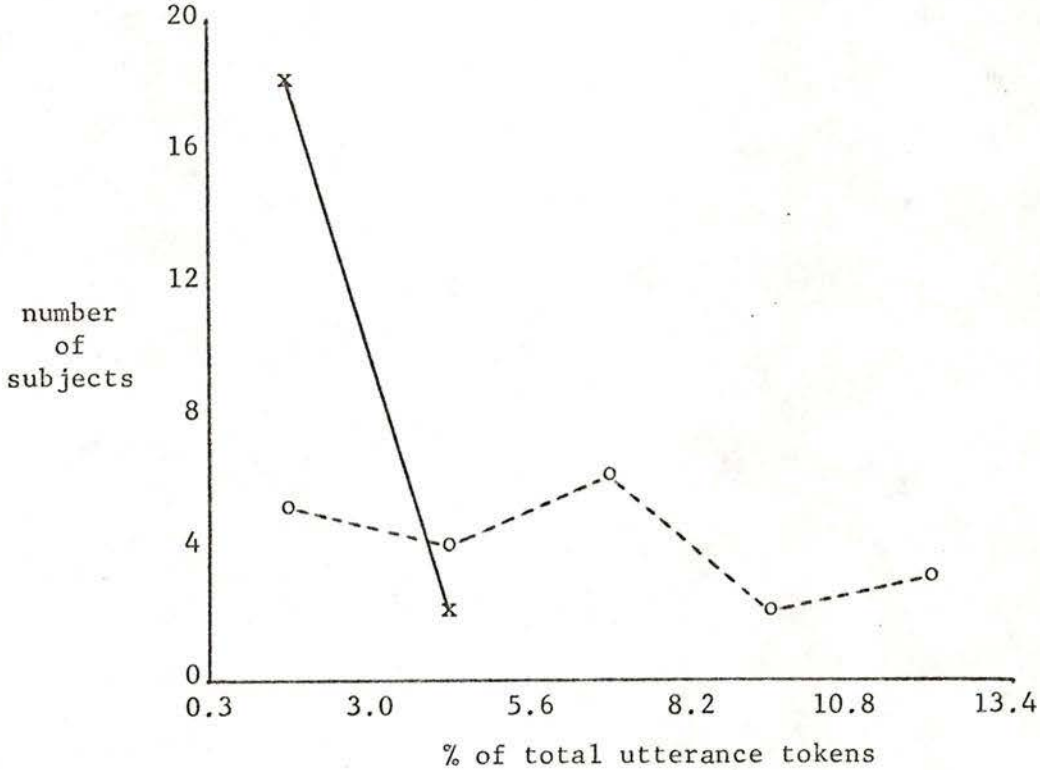


Aphasic	$\overline{X} = 7.4$	SD = 6.22	t = 3.17*
Normal	$\overline{X} = 2.8$	SD = 1.57	

* $p < .05$

FIGURE 10

Distributions of Repetition Scores for Aphasic Ss o----o and for Normal Ss x——x

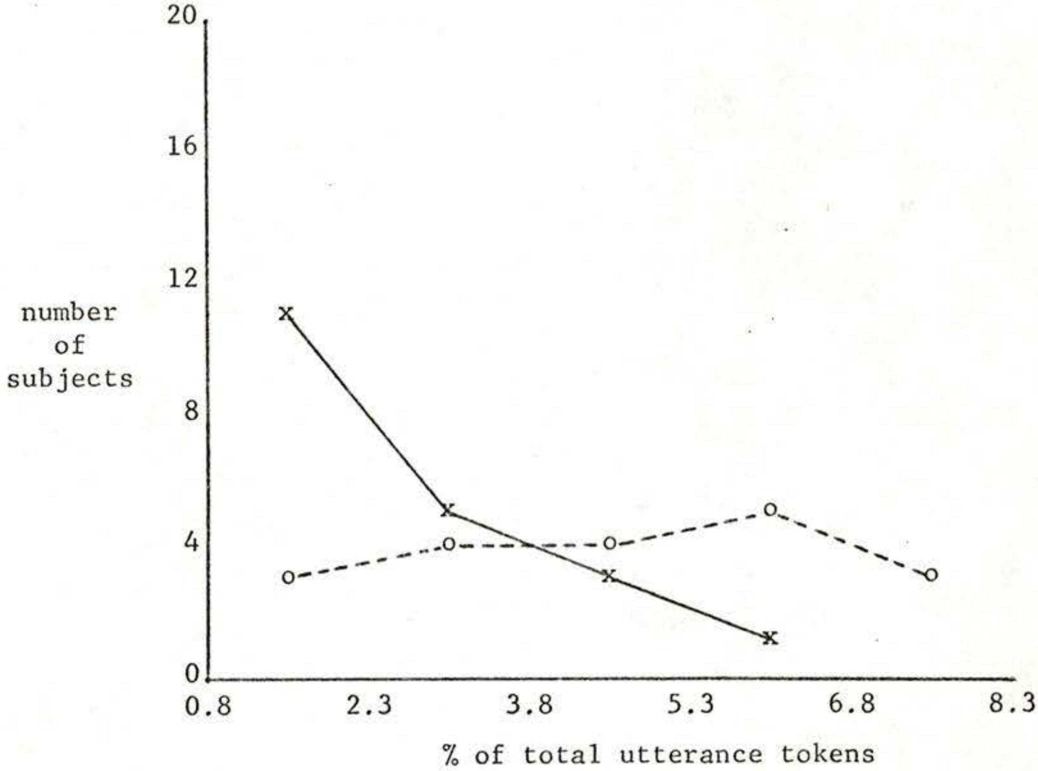


Aphasic	$\overline{X}$ = 6.2	SD = 3.85	t = 5.47*
Normal	$\overline{X}$ = 1.4	SD = 0.90	

* $p < .05$

FIGURE 11

Distributions of Retraced False Start Scores for Aphasic Ss o----o and for Normal Ss x——x

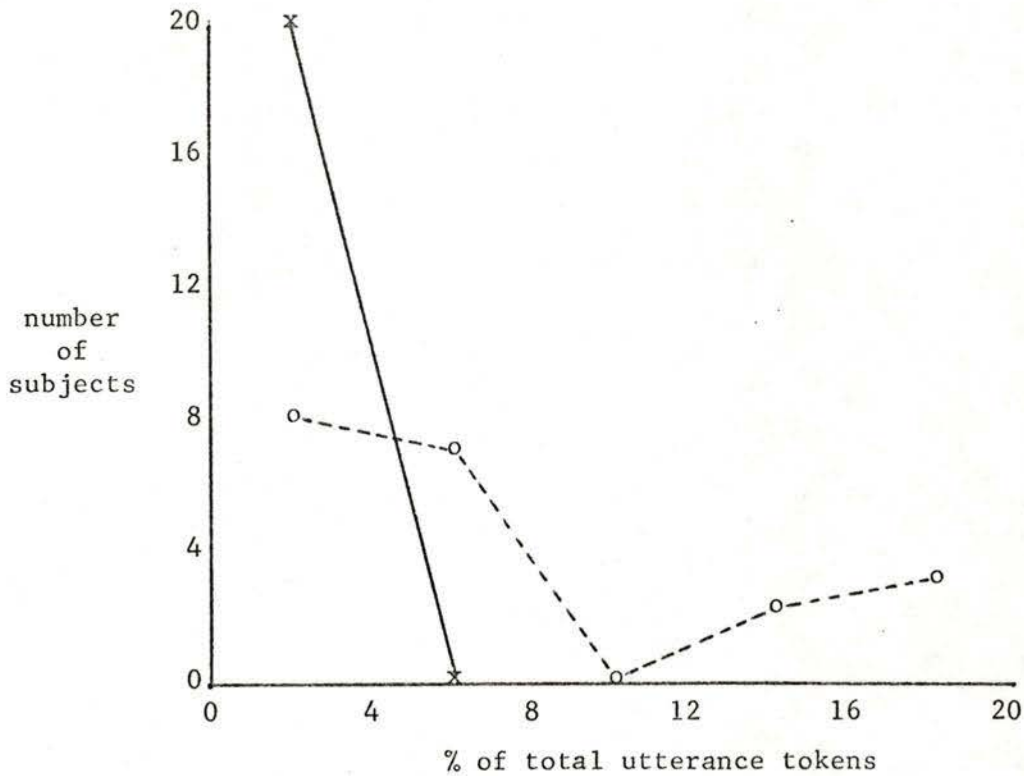


Aphasic	$\overline{X} = 4.9$	SD = 2.14	$t = 3.95^{*}$
Normal	$\overline{X} = 2.6$	SD = 1.50	

* $p < .05$

FIGURE 12

Distributions of Non-retraced False Start Scores for Aphasic Ss o----o and for Normal Ss x——x



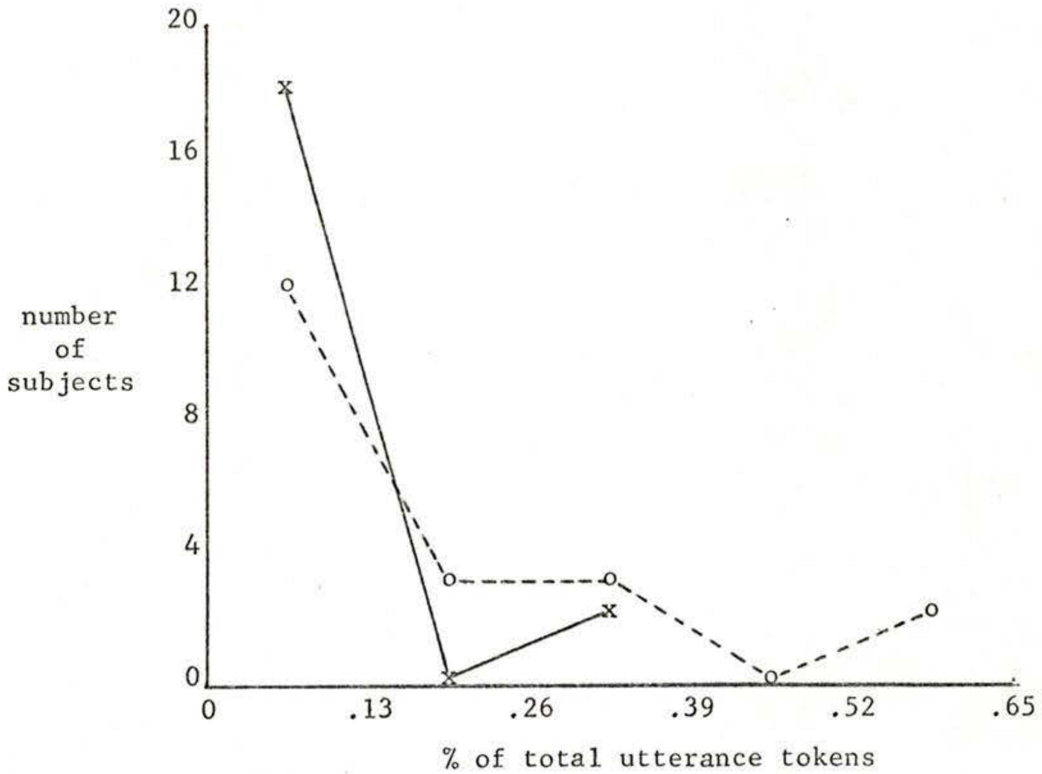
Aphasic $\overline{X} = 6.8$ SD = 6.68
Normal $\overline{X} = 1.6$ SD = 1.09

t = 3.44*

* $p < .05$

FIGURE 13

Distributions of Semantic Editing Scores for Aphasic Ss o----o and for Normal Ss x——x



Aphasic	$\overline{X} = 0.16$	SD = 0.19	t = 2.19*
Normal	$\overline{X} = 0.01$	SD = 0.10	

* $p < .05$

(slow speech rate), B and C (high speech rate) for word fragments, pauses and repetitions supported hypothesis 2a: "The occurrence of word fragments, pauses, pause fillers and repetitions of words will be greater for subjects with a slow rate of speech than for those with a high speech rate" (see table I). The comparison of the number of pause fillers yielded differences that were in the predicted direction, but the F ratio was non-significant (see table I).

The analysis of variance of the number of paraphasic errors of Groups A, B and C yielded an F ratio that was significant at the .05 level, but the differences were in the opposite direction to that predicted by hypothesis 2b, that is, subjects with a low speech rate had the highest incidence of these errors (see tableII).

The analyses of variance of the editing data failed to support hypothesis 2c, which predicted a relationship between rate of speech and the type of editing material most frequently produced. F ratios for all types of editing material were non-significant. Inspection of the means revealed that differences on most variables were in the direction of a higher frequency of occurrence for Group A. However, the F ratios for combined false starts non-retraced were also non-significant (see table III).

Analyses of variance of the occurrence of editing material for Groups D (semantic), E (syntactic) and F (pragmatic) generally failed to support hypothesis 3 which predicted a relationship between the type of aphasic deficit and the type of editing material most frequently produced. There was only one significant F ratio ($p<.05$): Group F showed a higher frequency of False Starts Retraced with an error left uncorrected (Table IV). The pragmatic group also showed

TABLE I

Comparison of Group A (low speech rate), Group B and Group C (high speech rate) on Speech Hesitations

	$\bar{X}A$	$\bar{X}B$	$\bar{X}C$	F
word fragments	6.51	2.76	1.24	6.66 **
pauses	32.55	23.42	14.56	6.99 **
repetitions	9.43	4.75	3.79	5.56 *
pause fillers	11.43	5.94	2.57	3.32

* $p < .05$

** $p < .01$

TABLE II

Comparison of Group A (low speech rate), Group B and Group C (high speech rate) on Paraphasic Errors

	$\bar{X}A$	$\bar{X}B$	$\bar{X}C$	F
combined paraphasic errors	2.61	1.19	1.18	4.23 *
word substitution	.79	.69	.74	.08
syntactic errors	.97	.32	.42	4.18 *
pragmatic errors	.86	.19	.03	5.66 *

* $p < .05$

TABLE III

Comparison of Group A (low speech rate), Group B and Group C (high speech rate) on Editing Material

	$\bar{X}A$	$\bar{X}B$	$\bar{X}C$	F
phonological retrace	.84	.42	.16	2.92
lexical retrace	.68	.42	.35	2.24
uncorrected retrace	1.01	.38	.13	2.04
retrace with no error	1.15	1.51	.83	1.03
combined retraces	3.85	2.73	1.46	3.41
syntactic incompletion	.16	.13	.10	.12
semantic incompletion	.42	.36	.19	.29
total incompletion	1.88	.73	.26	3.16
combined incompletions	2.46	1.23	.55	2.82
semantic editing	.10	.20	.13	.58

Variable 1b (grammatical retrace) was dropped from the analyses because 14 of the 20 Ss had 0 scores and the scores of the other 6 Ss were minimal.

TABLE IV

Comparison of Group D (semantic), Group E (syntactic) and Group F (pragmatic) on Editing Material

	$\bar{X}D$	$\bar{X}E$	$\bar{X}F$	F
phonological retrace	.32	.64	.71	1.21
lexical retrace	.58	.34	.60	1.63
uncorrected retrace	.40	.19	1.34	4.46 *
retrace with no error	1.49	.99	1.36	.79
syntactic incompletion	.21	.10	.08	.92
semantic incompletion	.56	.10	.38	2.97
total incompletion	.96	.45	2.10	3.41
semantic editing	.18	.18	.07	.55

* $p < .05$

Variable 1b (grammatical retrace) was dropped from the analyses because 14 of the 20 Ss had 0 scores and the scores of the other 6 Ss were minimal.

a greater frequency of occurrence of total incompletion, while the semantic group showed a high frequency of occurrence of semantic incompletion. The F ratios for these variables were non-significant. The F ratios for the remaining five editing variables were well above the .05 level of significance (Table IV)

A Guttman scale analysis of the ten speech error variables (mispronunciation, jargon, neologism, syntactic selection error, telegraph style, syntactic ordering error, paralogism, paragrammatic unit, semantic deficit and agrammatism) failed to support hypothesis 4. The analysis yielded a Coefficient of Reproducibility of .23 (Table V) indicating that these speech errors are not scaleable with respect to frequency of occurrence across aphasic subjects.

VI Discussion

1) The comparison between normal and aphasic subjects

Hypothesis 1, "Speech errors and editing are sensitive to the effects of aphasic deficit", was supported by the data from the present research. There were differences in the distributions for aphasic subjects and normal subjects on each of the speech disturbance variables. For each of the variables, the range of scores for the aphasic subjects completely overlapped the range of scores produced by normal subjects and extended beyond the normal range only in the direction of greater frequency of occurrence. This difference in the distribution of normal and aphasic subjects could reflect a difference in the overall severity of deficit if the rank distribution of subjects were similar for all variables or a difference in type of deficit if the distributions fluctuated across variables. Comparison of the performance of aphasic subjects

TABLE V

Guttman Scale Scores for 20 Aphasic Subjects
Based on Ten Speech Error Variables

Guttman scale score	subject	scaled error scores V9	V1	V3	V5	V4	V2	V10	V8	V6	V7
1	15	6	6	7	6	6	7	6	7	7	5
2	17	2	3	1	2	1	3	3	5	7	1
3	7	6	5	7	7	2	7	2	7	6	5
4	2	6	1	7	6	2	1	2	7	2	5
5	13	6	7	1	6	2	7	5	5	6	7
6	12	2	2	7	1	6	3	7	5	6	7
7	9	2	1	7	6	2	1	7	1	6	5
8	1	7	4	7	6	2	2	6	5	6	5
9	14	2	4	7	2	7	7	6	1	6	5
10	20	6	4	7	2	2	7	5	5	6	5
11	10	2	2	7	6	6	1	3	5	6	5
11	16	1	1	7	6	6	1	5	1	6	5
12	18	1	1	7	1	6	1	4	1	6	5
13	8	1	1	1	6	6	1	2	1	6	5
13	11	1	1	7	2	2	1	3	1	6	5
14	3	2	1	7	2	6	1	2	1	2	5
14	5	1	1	7	2	1	1	2	1	7	5
14	19	2	1	7	6	2	2	3	1	2	1
14	4	1	1	1	6	2	1	2	1	1	7
15	6	2	1	1	2	2	1	1	1	2	5

Coefficient of Reproducibility = 0.225

V1 = mispronunciation
V2 = jargon
V3 = neologism
V4 = telegraph style
V5 = syntactic selection
V6 = syntactic ordering
V7 = paralogism
V8 = paragrammatic
V9 = semantic deficit
V10 = agrammatism

on these variables would be expected to yield evidence about the groupings of aphasic subjects and about the relationship of different types of speech disturbance as explored in the second to fourth hypotheses.

2) The Howes - Benson model

The results of the present study supported hypothesis 2a "The occurrence of word fragments, pauses, pause fillers and repetitions of words will be greater for subjects with a slow rate of speech than for those with an accelerated speech rate." This hypothesis was based on the theory of language change developed by Howes which postulates that aphasics with a slow rate of speech suffer from a defective word selection mechanism while those with a normal or high rate of speech have a defective integration mechanism while maintaining an intact word-selection mechanism.

The data on paraphasias failed to support hypothesis 2b "The occurrence of all types of word substitution and word order errors will be greater for subjects with an accelerated speech rate than for those with a slow speech rate". This part of hypothesis 2 was based on Benson's report that paraphasic substitution was found in subjects with a high rate of speech but rarely seen in subjects with a low rate of speech.

Howes' own data on the occurrence of paraphasias neither supported nor rejected this theory, as he found an increased use of paraphasic substitution in subjects with a low rate of speech as well as in subjects with a high rate of speech. There are three possible reasons for the failure of the present study to support either of the

previous findings: a) the small number of subjects in the present study; b) differences in the criteria for identifying paraphasic substitution; and c) differences in method of obtaining a rate of speech measure.

a) None of the subjects in the present study showed the accelerated speech rate reported by Howes. Only one subject had a score which was above the mean for the normal group, and only three subjects fell into the high rate of speech group as defined by the present study. It might be expected that a larger sample would yield a greater number of subjects with a high rate of speech and that the larger sample might reflect a different distribution of paraphasias with respect to rate of speech.

b) Examination of the different types of paraphasic and paragrammatic errors was carried out to attempt to discover whether the inclusion of extraneous variables could have overshadowed the effects of specific word substitution errors (see table II).

Syntactic selection errors and syntactic ordering errors involve errors in syntax more than errors in word substitution. Semantic deficit and agrammatism involve a more complete breakdown in language production than is associated with a simple word substitution. It may be considered that paralogisms and paragrammatic units most clearly reflect paraphasic substitution without other confounding effects. Comparison of the total scores for word substitutions (paralogisms and paragrammatic units) for Groups A, B and C showed no significant differences among groups which is in agreement with Howes' findings. Comparison of the total scores for syntactic errors (syntactic selection and syntactic ordering errors) yielded a significant F ratio, with Group A showing the highest number of errors. Similarly, Group A showed significantly more errors of the pragmatic type (semantic deficit and agrammatism). These results suggest that substitutions which consist primarily of syntactical change, substitutions which are concurrent with a general breakdown in language production, and substitutions of a semantically incorrect word in an otherwise coherent sentence should each be considered separately.

c) To investigate the question of the effect of difference in method of obtaining a words per minute score on subject groupings, a correlation analysis was performed on the six possible sets of scores discussed in the procedure section (i.e. words and neologisms or words, neologisms and oddments over total time, total time less examiner interruptions or total time less examiner interruptions and pauses of greater than 3 seconds). All variables correlated above .91 (see table VI). The experimental rate of speech measure (words and neologisms/net time) showed correlations of .95 or greater with each of the other variables, indicating that each of these measures is a good estimate of a subject's rate of speech with respect to the total distribution of scores.

A further comparison was made to examine the relationship of the different measures to group boundaries. Inspection of the ranks of subjects for each of the six rate of speech variables with respect to the groups formed from the experimental rate of speech showed that four subjects exhibited changes in rank order that crossed group boundaries (see table VII). As these changes occurred in the total time measures which were equivalent to the measures used by Howes, it was decided that it would be appropriate to examine

TABLE VI

Correlation Matrix for Different Rate of Speech Measures

	WO/TT	W/TT	WO/NT	W/NT	WO/NT3
W/TT	.99				
WO/NT	.95	.94			
W/NT	.95	.97	.98		
WO/NT3	.94	.93	.97	.96	
W/NT3	.93	.96	.95	.98	.97

TT = total time

NT = net time (total time minus examiner interruptions)

NT3 = net time (total time minus examiner interruptions and pauses of over 3 seconds)

WO = words, neologisms and oddments

W = words and neologisms

TABLE VII

Rank Order of Ss on Six Rate of Speech Variables with Respect to the Groups Formed from the Experimental Variable

Rank	Subjects WO/TT	W/TT	WO/NT	W/NT	WO/NT3	W/NT3	
1	01	12	12	12	12	12	
2	12	01	01	01	01	01	
3	02	20	20	20	15	20	
4	20	02	07	15	07	15	Group A
5	15	15	15	(07)	20	09	
6	(10)	09	02	(09)	02	02	
7	(13)	(13)	09	02	09	07	
	- - -	- - -	- - -	- - -	- - -	- - -	3 SD from normal X
8	(07)	14	16	16	11	11	
9	(09)	(07)	10	17	10	17	
10	03	10	11	11	17	13	
11	14	17	17	(13)	13	14	
12	17	03	06	14	06	18	
13	06	16	18	18	04	10	Group B
14	16	18	13	(10)	18	06	
15	18	06	04	06	03	03	
16	11	11	03	03	14	04	
17	04	04	14	04	16	16	
	- - -	- - -	- - -	- - -	- - -	- - -	2 SD from normal X
18	19	19	19	19	19	19	
19	08	08	08	08	08	08	Group C
20	05	05	05	05	05	05	

Subject numbers are entered in each column in rank order. Circled subjects are those who have a change in rank order from one rate of speech measure to another that results in a change in group membership.

TT = total time
NT = net time (total time minus examiner interruptions)
NT3 = net time (total time minus examiner interruptions and pauses of over 3 seconds)
WO = words, neologisms and oddments
W = words and neologisms

the groupings which would be formed from a total time measure. Subjects were assigned to groups according to the relation of their "words and neologisms/total time" scores to the distribution for normal subjects by the same method as described above for the "words and neologisms/net time" scores.

Examination of table VIII reveals that six subjects showed changes in rank order which crossed group boundaries. While the two total time measures show corresponding patterns, there are divergencies in each of the other groups.

Because the major differences in subject groupings occurred between the two total time measures and the four net time measures, it was decided to compare 2 groups divided on the basis of total time scores by Howes' definition. That is, Group A' had rate of speech scores below the normal group and Group B' had scores within the normal range. Figure 14 shows the distributions of scores for aphasic and normal subjects. The scores for normal subjects are all greater than 100 words per minute. This is in agreement with Howes who divided his groups at 100 words per minute. There were 16 aphasic subjects from the present study with scores of less than 100 words per minute and 4 subjects with scores of greater than 100 words per minute. Because of the small n in group B', t-tests were not suitable for comparing these groups. Mann-Whitney U tests were performed on each of the relevant variables (see table IX).

Examination of the results for paraphasias shows that only pragmatic errors had a significant U with Group A' (slow rate of speech) having the greatest number of these errors. There were no

TABLE VIII

Rank Order of Ss on Six Rate of Speech Variables with Respect to the Groups Formed from the Words and Neologisms/Total Time Variable

Rank	WO/TT	W/TT	WO/NT	W/NT	WO/NT3	W/NT3	
1	01	12	12	12	12	12	
2	12	01	01	01	01	01	
3	02	20	20	20	15	20	Group A_2
4	20	(02)	(07)	15	(07)	15	
5	15	15	15	(07)	20	(09)	
	- - -	- - -	- - -	- - -	- - -	- - -	3 SD from normal X
6	10	(09)	(02)	09	(02)	(02)	
7	13	13	09	(02)	09	07	
8	07	(14)	16	16	11	11	
9	09	(07)	10	17	10	17	
10	03	10	11	11	17	13	
11	14	17	17	13	13	14	Group B_2
12	17	03	06	14	06	18	
13	06	(16)	18	18	(04)	10	
14	16	18	13	10	18	06	
15	18	06	(04)	06	03	03	
16	11	11	03	03	14	(04)	
	- - -	- - -	- - -	- - -	- - -	- - -	2SD from normal X
17	04	(04)	(14)	04	(16)	(16)	
18	19	19	19	19	19	19	
19	08	08	08	08	08	08	Group C_2
20	05	05	05	05	05	05	

Subject numbers are entered in each column in rank order. Circled subjects are those who have a change in rank order from one rate of speech measure to another that results in a change in group membership.

TT = total time
NT = net time (total time minus examiner interruptions)
NT3 = net time (total time minus examiner interruptions and pauses of over 3 seconds)
WO = words, neologisms and oddments
W = words and neologisms

TABLE IX

Mann-Whitney U Tests for Group A' and B' Defined on Total Time Rate of Speech Scores

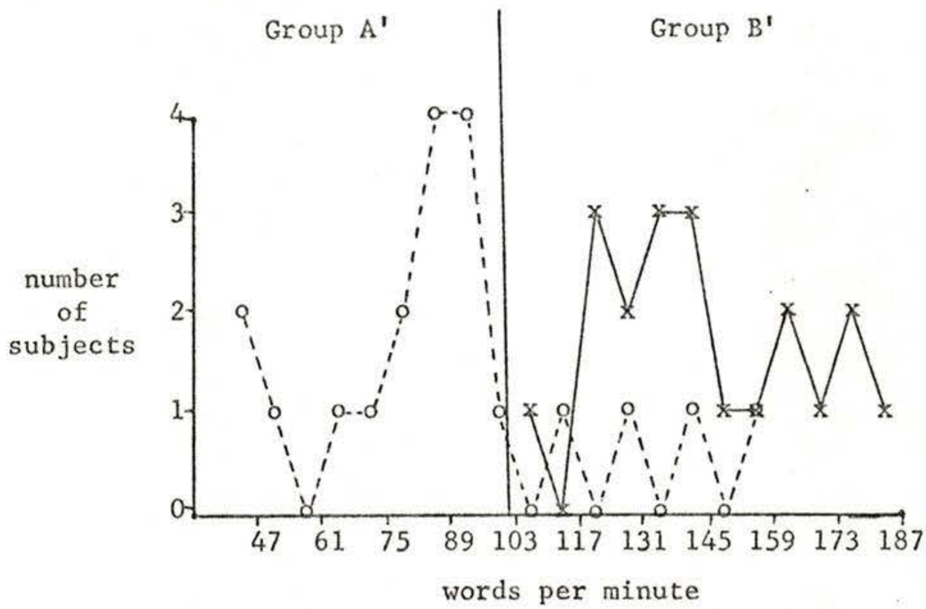
n A' = 16 n B' = 4

Variable	U	group with highest rank
Hesitations		
word fragments	7.0 *	A'
pauses	3.0 *	A'
repetitions	12.0 *	A'
pause fillers	10.0 *	A'
Paraphasias		
combined errors	30.5	
word substitution	30.0	
syntactic errors	22.0	
pragmatic errors	9.5 *	A'
Editing		
phonological retrace	19.5	
lexical retrace	19.0	
uncorrected retrace	23.0	
retrace - no error	18.0	
combined retraces	11.0 *	A'
syntactic incompletion	22.0	
semantic incompletion	19.0	
total incompletion	5.5 *	A'
combined incompletion	5.5 *	A'
semantic editing	21.5	

* $p < .05$

FIGURE 14

Distributions of Rate of Speech Scores Using a Total Time Measure for Aphasic Ss o----o and for Normal Ss x——x, and Boundaries for Aphasic Groups Based on the Distribution of Normal Scores



significant differences between Groups A' and B' on the other paraphasic errors.

Comparison of Group A' and B' yielded significant U's for all four hesitation variables. The difference in pause fillers, which had been in the predicted direction but non-significant in the three group comparison, was found to be significant when Group A' and B' were compared.

Comparisons of subjects on the occurrence of editing material yielded significant U's for combined retraced false starts, total incompletion and combined non-retraced false starts with Group A' having the highest frequency of each type of editing material. Each of these variables had approached the .05 level of significance in the original three group analysis.

Although the results of the present study replicated those of Howes and of Benson with respect to the occurrence of speech hesitations, the data on paraphasias and on editing material failed to support Howes' theory of two different types of aphasic deficit characterized mainly by a difference in rate of speech representing, respectively, a breakdown in a word selection mechanism and a breakdown in an integration mechanism. All significant group differences were in the direction of greater occurrence of speech disturbances in subjects with a low rate of speech. None of the speech disturbance variables in the present study showed a greater frequency of occurrence in Group C than in Group A (or in Group B' over Group A'). These results do not support a hypothesis of two different types of speech deficit, for they could equally well occur if the designated groups represented differences in severity of the same type of deficit.

3) The Wepman Model

A division of subjects based on Wepman's model of language failed to support the model (hypothesis 3) when tested on the occurrence of hesitations for different groups. If the subject groups reflect real differences in type of deficit, those speech errors not used in designating types should distribute differentially across the groups. Analyses of the other speech error types yielded only one significant F ratio (see table X). There was a greater frequency of occurrence of neologisms for Group F (pragmatic) than for the other groups. Inspection of the means for the other error types reveals that, with the exception of paralogisms, the differences are in the direction of greater frequency of occurrence in Group F. Inspection of the means for the analyses on editing material for which the F ratios approached the .05 level of significance reveals that, with the exception of semantic incompletion, there was a higher frequency of occurrence of editing material for Group F. The results of these analyses of data for Groups D, E and F could be interpreted as supporting a theory of a single dimension of language deficit, with the pragmatic group representing the most severe disturbance. To test the relationship between these results and those of the analyses of the rate of speech data, Groups D, E and F were compared on rate of speech. The F ratio was not significant, but the differences between means were in the expected direction, with Group F having the slowest rate of speech.

4) The Schuell model

The Guttman scale analysis of speech errors failed to support a theory of a single dimension of language deficit. Subjects with a

TABLE X

Comparison of Group D (semantic), Group E (syntactic) and Group F (pragmatic) on Speech Errors and Speech Rate

	$\bar{X}D$	$\bar{X}E$	$\bar{X}F$	F
mispronunciation	1.26	1.32	1.69	.07
jargon	.34	.23	1.76	1.63
neologisms	.21	.14	1.27	5.23 *
paralogisms	.65	.41	.49	.59
paragrammatic unit	.15	.18	.36	2.88
speech rate	113.98	101.75	77.38	2.71

* $p < .05$

high score for one type of speech error did not have a high score for all other types of speech error.

In the rate of speech analyses, all significant differences were found to be in the same direction, with subjects with a low rate of speech having the greatest number of speech errors. It was suggested that rate of speech might be related to severity of deficit rather than to type of deficit.

In the Wepman analyses, the pragmatic group had the highest frequencies for most types of speech errors and editing. It was suggested that here also the results might reflect a difference in severity of deficit, rather than type of deficit.

Because of the failure of the Guttman analysis to support a theory of a single dimension of deficit in language, it seems likely that the results of the rate of speech analyses and of the Wepman analyses do not reflect aphasic deficit as a unitary type of disorder, but rather reflect a relationship among those variables that showed significant or near significant results.

5) Implications for further research

A correlation analysis was performed on the mean number of tokens, the rate of speech and the frequency scores for the ten error types for all aphasic subjects. Because of the small n it would be unwise to draw any conclusion from these correlations, but the relationships demonstrated do suggest possible groupings that might be useful for future studies (Table XI).

Rate of speech showed significant negative correlations with mispronunciations and with agrammatism. The correlations of rate of

TABLE XI

Correlation Matrix for Ten Speech Error Types, Mean Number of Tokens and Rate of Speech

	1	2	3	4	5	6	7	8	9	10	11
2	.05										
3	.01	.81*									
4	.22	-.05	-.08								
5	.27	-.03	-.10	.08							
6	.03	.10	.27	-.27	.17						
7	.07	.24	.23	-.20	.06	.09					
8	.10	.39	.38	-.18	-.15	.12	.03				
9	-.07	.38	.52*	-.22	.17	.71*	.31	.11			
10	.09	.46*	.49*	-.26	.56*	.63*	.15	.14	.77*		
11	-.28	-.02	.07	-.45*	-.01	.30	.47*	-.23	.46*	.18	
12	-.57*	-.11	-.29	-.10	-.29	-.19	-.01	-.09	-.36	-.45*	.26

1 = mispronunciation
2 = jargon
3 = neologism
4 = telegraph style
5 = syntactic selection
6 = syntactic ordering
7 = paralogism
8 = paragrammatic unit
9 = semantic deficit
10 = agrammatism
11 = mean number of tokens
12 = rate of speech

* $p < .05$

speech with all other speech errors were negative though non-significant. This would suggest that, for subjects with a normal or reduced rate of speech, speech rate is related to severity of deficit.

There are inter-relationships among jargon, neologisms, syntactic ordering, semantic deficit and agrammatism. These variables do not all correlate significantly with each of the others, and some correlate significantly with other variables, but the relationships do suggest the possibility of the presence of an ordering deficit.

The differences in the extent to which these variables correlate with each other offer evidence in support of a relationship between certain error types. To examine the extent to which subjects could be assigned to categories on the basis of the presence or absence of specific types of speech error, the distributions of T scores for all subjects on the ten error types and the mean were examined.

Table XII shows the T scores that had a value of 50 or greater. It can be seen that, although there are no clear relationships among the distributions of subjects across variables, each subject did show a distinctive pattern of speech errors. This is in agreement with the subjective evaluation commonly made by anyone listening to different aphasic speakers: That a given subject will repeatedly make the same type of error. These patterns of error types could be related to an as yet unidentified pattern of deficit in specific language abilities, to the premorbid style of the subjects, or to a complex relationship of error types with severity of deficit. It is apparent that the examination of the relative merits of these possible explanations would require a much more detailed study with a larger number of subjects.

TABLE XII

T Scores of 50 or Greater for Each Aphasic Subject
for Ten Speech Error Types
and for the Mean Number of Tokens

S	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11
01	59.7	51.1			88.9	58.7	51.3		56.9	78.6	
02					5014	51.6			68.8	59.0	58.3
03				54.2	54.3						52.9
04						54.4		70.5			
05					55.1		65.4	60.5			66.2
06											56.2
07		52.2	64.7			85.9	55.2	59.3	77.4	71.0	62.1
08				51.3							53.4
09	76.1					58.7					51.9
10				51.3		52.6	60.3				
11											
12	75.6			55.9			51.8	69.4			
13		91.0	79.4				54.0	68.2	57.7	63.9	
14	56.9		53.7	76.7	56.8						
15	57.3	60.3	61.8	55.9	56.4	59.6	64.2		66.3	52.5	64.4
16	50.6			65.9							
17							77.5		54.0		68.6
18				68.4							
19					50.9	50.3					
20			68.9					53.5		51.0	

V1 = mispronunciation
V2 = jargon
V3 = neologism
V4 = syntactic selection
V5 = syntactic selection
V6 = syntactic ordering
V7 = paralogism
V8 = paragrammatic unit
V9 = semantic deficit
V10 = agrammatism
V11 = mean number of tokens

REFERENCES

Benson, F.D. Fluency in aphasia: correlation with radioactive scan localization. Cortex, 1967, 3, 373-394.

Brain, R. Speech Disorders: Aphasia, Apraxia and Agnosia. London, Butterworths, 1965.

Feldstein, S., Brenner, Marcia S., & Jaffe, J. The effect of subject set, verbal interaction and topical focus on speech disruption. Language and Speech, 1963, 6, 229-239.

Fillenbaum, S., Jones, L.V., & Wepman, J.M. Some linguistic features of speech from aphasic patients. Language and Speech, 1961, 4(2), 91-108.

Goldman-Eisler, Frieda. Hesitation, information and levels of speech production. In A.V.S. DeReuk & M. O'Connor (eds.) Disorders of Language. London, Churchill, 1964.

Goldman-Eisler, Frieda. Psycholinguistic Experiments in Spontaneous Speech. London and New York, Academic Press, 1968.

Goodglass, H. & Berko, Jean. Agrammatism and inflectional morphology in English. Journal of Speech and Hearing Research, 1960, 3, 257-267.

Goodglass, H., Fodor, Iris G., & Schulhoff, Celia. Prosodocic factors in grammar - evidence from aphasia. Journal of Speech and Hearing Research, 1967, 10(1), 6-20.

Goodglass, H., Hyde, Mary R., & Gleason, Jean B. The grammatical content of free conversation of aphasics. In "New Measures of Aphasic Symptom Variables." Progress Report on NIMH Grant 04187, Boston mimeo, 1964.

Goodglass, H., Quadfasel, F.A., & Timberlake, W.H. Phrase length and the type and severity of aphasia. Cortex, 1964, 1, 133-153.

Grewel, F. Aphasia and Linguistics. 8th Conference of the International Association for Logopedics and Phoniatrics, Amsterdam, 1950.

Guttman, L. The basis for scalogram analysis. In Stouffer, S.A., Guttman, L., Suchman, E.A., Lazersfield, P.F., Star, S.A., and Clausen, J.A., Studies in Social Psychology In World War II, Vol. IV. Princeton, Princeton University Press, 1950, 60-90.

Head, H. Aphasia and Kindred Disorders of Speech. New York, Hafner Pub. Co., 1926.

Howes, D. Some experimental investigations of language in aphasia. Presented to the Conference of Verbal Behavior, N.Y., 1965a.

Howes, D. Hypotheses concerning the functions of the language mechanism. Presented to the Conference on Verbal Behavior, N.Y., 1965b.

Howes, D. & Geschwind, N. Quantitative studies of aphasic language. In Rioch & Weinstein (eds.), Disorders of Communication, 1964, 229-244.

Jakobson, R. Towards a linguistic typology of aphasic impairments. In A.V.S. DeReuk & M. O'Connor (eds.), Disorders of Language. London, J.&.A. Churchill Ltd., 1964.

Kasl, S.V., & Mahl, G.F. The relationship of disturbances and hesitations in spontaneous speech to anxiety. Journal of Personnel and Social Psychology, 1965, 1, 425-433.

Lay, C.H. & Paivio, A. The effects of task difficulty and anxiety on hesitations in speech. Canadian Journal of Behavioral Science, 1969, 1, 25-37.

Lenneberg, E.H. Biological Foundations of Language. Wiley & Sons, 1967.

Levin, H., Silverman, I., & Ford, B.L. Hesitations in children's speech during explanation and description. Journal of Verbal Learning and Verbal Behavior, 1967, 6, 560-564.

Luria, A.R. Aspects of Aphasia. Journal of Neurological Science, 1965, 2, 278-287.

Maclay, H. & Osgood, C.E. Hesitation phenomena in spontaneous English speech. Word, 1959, 15, 19-44.

Mahl, G.F. Disturbances and silences in the patient's speech in psychotherapy. Journal of Abnormal and Social Psychology, 1956, 53, 1-15.

Mahl, G.F. Exploring emotional states by content analysis. In I. Pool, (ed.), Trends in Content Analysis. Urbana, 1959.

Martin, J.G. & Strange, Winifred. Determinants of hesitations in spontaneous speech. Journal of Experimental Psychology, 1968, 76, 474-479.

Martin, J.G. & Strange, Winifred. The perception of hesitation in spontaneous speech. Perception & Psychophysics, 1968, 3, 427-438.

Morris, C.W. Foundations of the theory of signs. International Encyclopedia of Unified Science, 1(2). Chicago, University of Chicago Press, 1938.

Nielsen, J.M. Agnosia, Apraxia, Aphasia. Hafner Pub. Co., New York, 1948.

Schuell, Hildred, and Jenkins, J.J. The nature of language deficit in aphasia. Psychological Review, 1959, 66, 45-67.

Schuell, Hildred, Jenkins, J.J., & Carroll, J.B. A factor analysis of the Minnesota test for differential diagnosis of aphasia. Journal of Speech and Hearing Research, 1962, 5, 349-369.

Schuell, Hildred, Jenkins, J.J., & Jimenez-Pabon, E. Aphasia in Adults. New York, Harper & Row, 1964.

Spreen, O. Psycholinguistic aspects of aphasia. Journal of Speech and Hearing Research, 1968, 11, 467-480.

Spreen, O. & Wachal, R.S. Linguistic Evaluation of Free Speech Samples Obtained from Aphasic Speakers: Manual of instructions for transcription and coding., Research Monograph No. 15, University of Victoria, 1970.

Spreen, O. & Wachal, R.S. Psycholinguistic Analysis of Aphasic Language: Theoretical Formulations and Procedures. Research Monograph No. 18, University of Victoria, 1970.

Wachal, R.S. & Spreen, O. A Computer Aided Investigation of Linguistic Performance. Mimeo: University of Victoria, 1970.

Webster's Seventh New Collegiate Dictionary. Ontario, Thomas Allen & Sons Ltd., 1965.

Weisenburg, T. & McBridge, Katherine E. Aphasia: A Clinical and Psychological Study. New York, Hafner Pub. Co., 1935.

Wepman, J.M. & Jones, L.V. Five aphasias: a commentary on aphasia as a regressive linguistic phenomenon. In Rioch & Weinstein, (eds.), Disorders of Communication, 1964.

Wepman, J.M., Jones, L.V., Bock, D.R., & Van Pelt, Doris. Studies in aphasia: background and theoretical formulations. Journal of Speech and Hearing Disturbances, 1960, 25, 323-332.

Vita

Surname GOSSE Given Names EVELYN ANN

Place of Birth VICTORIA, BRITISH COLUMBIA

Date of Birth NOVEMBER 12, 1933

Educational Institutions Attended
with Dates of Entering and Leaving

UNIVERSITY OF VICTORIA, VICTORIA, BRITISH COLUMBIA 1962 to 1971

Degrees, Diplomas, Etc., Awarded
with Dates and Names of Institutions

B. A.	1969	University of Victoria

THE UNIVERSITY OF VICTORIA LIBRARY

MANUSCRIPT THESIS

AUTHORITY TO DISTRIBUTE

AUTHOR: This thesis may be lent or microfile copies made available:

(a) Without restriction ✓

(b) With the restriction that, for a period of five years (until_____) the written approval of the following is required:

(1) The Chairman, School of Graduate Studies _______________

(2) The Author _______________

(3) both the Chairman, School of Graduate Studies and the Author _______________

BORROWERS: The borrower undertakes, by signing below, to give proper credit for any use made of the dissertation, and to obtain the consent of the author if it is proposed to make extensive quotations, or to reproduce the dissertation in whole or part.

Signature of Borrower	Address	Date