WORD ASSOCIATION OF TIME-ALTERED AUDITORY AND VISUAL STIMULI IN APHASIA

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Statement of the Problem

The purpose of this study is to determine whether a relationship exists between the speed of presentation of stimulus variables through the auditory as well as the visual modalities and the number of paradigmatic and syntagmatic word association responses of aphasic and control subjects.

Specific Problems

1. To determine whether a relationship exists between the presentation of words of different abstraction levels at different speeds and the number of paradigmatic and syntagmatic word association responses of aphasic and control subjects.

2. To determine whether a relationship exists between the presentation of words of different parts of speech at different speeds and the number of paradigmatic and syntagmatic word association responses of aphasic and control subjects.

3. To determine whether a relationship exists

between the presentation of words of different lengths at different speeds and the number of paradigmatic and syntagmatic word association responses of aphasic and control subjects.

4. To determine whether a relationship exists between the presentation of words of different frequencies of occurrence in written English language usage at different speeds and the number of paradigmatic and syntagmatic word association responses of aphasic and control subjects.

5. To determine whether the word association responses of the aphasic subjects to word stimuli presented at different speeds represents a reversal of the types of word association responses observed in normal language development.

6. To evaluate the theoretical and therapeutic implications of the data obtained, and to recommend appropriate theoretic and therapeutic procedures based on them.

Definitions of Terms

Stimulus variables refers to conditions existing in the environment, which are hypothesized to produce responses in an individual.

Word association in this study refers to a single word or short phrase response to a single word stimulus.

Subjects were required to say the first word they thought of, following presentation of the stimulus word.

Paradigmatic refers to two words belonging to the same grammatical class, such as dog - cat (Ervin, 1961).

Syntagmatic refers to two words belonging to different grammatical classes, or to a grammatical continuation, such as dog - bark, or bake - cake.

Aphasia refers to impairments, due to cerebral lesion, in the ability to interpret and formulate language symbols. It is a multimodal loss or reduction of the ability to decode and encode conventional meaningful linguistic elements (morphemes and larger syntactic units), and is disproportionate to impairment of other intellectual functions (Darley, 1964, p. 30).

Abstraction level of words refers to the classification of words according to high, medium, and low abstraction. Words were assigned a low level of abstraction when they have a specific reference and high when they were more general in reference or tended to leave out details (Darley, Sherman, and Siegel, 1959).

Part of speech refers to the classification of words according to their form and characteristic position in sentences, as provided in standard dictionaries. Specifically, the parts of speech of the words used in this study are nouns, verbs, and adjectives, following the list developed by Darley, et al. (1959) and employed

by Halpern (1965a, b).

Word length refers to the classification of words as either "long" or "short". In this study (as in Darley, et al., 1959; Halpern, 1965a, b) "long" words were designated as containing two or more syllables and six or more letters. "Short" words were monosyllabic words of four or fewer letters.

Frequency of occurrence refers to the number of times a word appears in written English usage (Thorndike and Lorge, 1944). In this study (as in Halpern, 1965a, b) the 2000 most frequently occurring words in written English usage constituted the "frequent" level and the three through ten thousandth most frequently occurring words comprised the "infrequent" level.

Modality refers to the avenue of reception for sensory stimuli. In this study, the specific modalities to be employed are the auditory and the visual.

Controls refers to adults who have not suffered brain injury and, as gleaned from hospital records and clinical observation, were deemed to have normal speech and language.

Delimitations

1. The subjects used in this investigation included thirty-two aphasic patients and thirty-two controls who received stimulus presentation of words through the auditory modality, and twenty aphasic patients

and twenty controls who received stimulus presentation of words through the visual modality. Most of the aphasic and control subjects were patients at the New York Veterans Administration Hospital; the others were taken from hospitals and treatment centers in the New York City area.

2. The aphasic patients used in this study have had organic damage to the brain, according to hospital records.

3. Patients who were very severely impaired in language and those showing practically no language impairment were excluded from this study, on the basis of a Pre-Test.

4. Each subject chosen for this study used English as his native language.

5. The pre-morbid educational level of the subjects selected for this study was sixth grade or better.

6. Patients who had uncorrected peripheral visual and hearing handicaps were excluded from this study. Hospital records provided this information.

7. The word stimuli used in this investigation were taken from the Darley, Sherman, and Siegel (1959) scaled list of abstraction level of single words, and the Halpern (1965a, b) word list balanced for abstraction level, frequency of occurrence in English language usage,

part of speech, and word length.

Basic Assumptions

1. The subjects used in this study had been previously diagnosed as having no uncorrectable peripheral hearing loss and no uncorrectable visual loss.

2. The background data gleaned from hospital records of patients used in this study were correct and reliable.

3. The word list used in this study had been properly scaled according to various levels of abstraction (high, medium, low).

4. The words used in this study had been properly classified according to their length, part of speech, and frequency of occurrence in written English usage.

5. The investigator's own tests provided the suitable stimulus variables for this experiment.

Basic Hypotheses

1. Aphasic subjects supply a greater number of paradigmatic than syntagmatic word association responses to word stimuli presented at slower, rather than faster speeds.

2. Control subjects are not affected, in their production of paradigmatic and syntagmatic word association responses, when word stimuli are presented at

different speeds.

3. Words of low abstraction level presented to aphasic subjects elicit more paradigmatic word association responses than do words of medium or high abstraction level.

4. Words that are classified as adjectives when presented to aphasic subjects elicit the most paradigmatic word association responses, followed by nouns and verbs.

5. Words that are short (one syllable and four or fewer letters) when presented to aphasic subjects elicit more paradigmatic word association responses than words that are long (two or more syllables and six or more letters).

6. Words occurring frequently in written English usage when presented to aphasic subjects elicit more paradigmatic word association responses than infrequently occurring words.

7. Word association responses of aphasic subjects do not represent a reversal of the type of word association responses observed in normal language development.

Significance of the Problem

The purpose of the present study was to identify and describe some aspects of the language disorder which occurs in aphasia using a word association test as a tool. In a model of semantic processing Collins and

Loftus (1975) proposed a model of lexical retrieval which incorporates word association. The process of word association consists, in general, of three stages:

1. Retrieving the stimulus word from the mental dictionary.

2. Searching through the lexicon for a suitable associate.

3. Producing the response.

In aphasia each of these stages may represent areas of potential breakdown.

Models of Aphasia: Reduction of Efficiency vs. Loss

Models of aphasia have historically viewed the disorder as either a loss of language ability or a reduction of efficiency of the ability to interpret and formulate language symbols. Proponents of the "loss" hypothesis presented evidence suggesting cerebral localization for language functions. Strict localizationists (sometimes called "diagram makers") held the position that specific correlations existed between relatively small areas of the brain and related functions. A lesion in a specific language area of the brain would result in a specific language loss. Early localizationists included Bastian (1887), Broca (1861) and Wernicke (1874). Among the strict localizationists of the twentieth century, Henschen (1926) and Nielsen (1941) are foremost. A comprehensive treatise on the

contribution of Wernicke and the Breslau School to aphasia has been published by Geschwind (1966).

Early opponents of strict localization included Freud (1891), Head (1926), and, in particular, Jackson (1886). According to Jackson, aphasia resulted in the loss of voluntary actions with conservation of the more automatic. Nowhere in the nervous system was there a sharp line of demarcation between the two. In aphasia language was not lost, but the ability to use it in certain ways was. Particularly affected was the voluntary use of language as a means of expressing the relationships between stimuli previously organized by the nervous system and those currently being registered from the environment. Freud (1891), while acknowledging a debt to Jackson as the inspiration of his views, drew an analogy between anatomy and poetry. According to Freud, the fiber tracts which reach the cerebral cortex contain the body periphery in the same was as a poem contains the alphabet. He viewed the speech area as a continuous cortical region of a complexity beyond comprehension.

The "reduction of efficiency" model. The modern "reduction of efficiency" model has received support in the writings of Schuell and her colleagues (Schuell, 1950; Schuell and Jenkins, 1961; Schuell, Jenkins, and Jimenez-Pabon, 1964; Sies, 1974). In this extensive body of work aphasia is defined as a reduction (as opposed to a loss)

of language ability, resulting from brain injury, which cuts across various language modalities. Loss of language only occurs in the most severe impairment. There is a reduction of available vocabulary (reading, writing, and naming vocabulary), impaired verbal retention span, and impaired perception and production of messages.

If aphasia implies reduced efficiency, then there might be circumstances under which efficiency can increase. Comprehension by aphasic adults has been shown to improve as a result of expanding (i. e., making longer) the duration of stimulus presentation (Goldfarb, Jager, Rocco, and Silny, 1976; Lasky, Weidner, and Johnson, 1974; Parkhurst, 1971; Rolnick and Hoops, 1969; Schuell, 1953; Sheehan, Aseltine, and Edwards, 1973). It seems reasonable to suggest that the aphasic adult benefits from continuously processing the stimulus for a longer period of time. It may also be suggested that, under certain conditions, the efficiency of the aphasic adult's linguistic performance may be improved.

The "loss" model. Among modern aphasiologists, the notion of a loss of language ability is represented in two descriptions of aphasia by the noted linguist, Roman Jakobson (1961, 1966). His first theory of language loss describes aphasia as either a selection or combination disorder, and his second is the phonemic regression hypothesis.

Similarity (synonymy) and contiguity are roughly equivalent to selection and combination, which Jakobson (1966) proposed as a description of the linguistic impairment in aphasia. Selection and combination disorders in aphasia refer to the loss of a particular language strategy. Selection involves the conscious or unconscious choice of, for example, one of the possible terms--father, papa, dad, daddy--to describe one's male parent. Combination involves differentiating between such terms as "wife's brother" and "brother's wife". The aphasic adult with a combination disorder, according to Jakobson, might consider both terms to refer to the same person. Appropriate selection and combination, applied to word association, would be compatible with production of paradigmatic (sit - stand) and syntagmatic (sit - chair) responses, respectively.

Similarity is not the only kind of association possible among words. In fact, for many applications it may not even be the most important kind of association. This suggests that a second type of word association should be considered, i. e., association which is primarily due to close real-world relationships among the objects or actions which the words designate. Examples are: table - top, hammer - nail, food - eat, bank - money. This is called contiguity association, since the objects or properties denoted by the words

are presumed to be contiguous in some sense in the real world. A combination disorder in aphasia would, in part, result in the inability to formulate or comprehend contiguity associations.

Jakobson's other theory of language loss in aphasia is embodied in his phonemic regression hypothesis. Essentially Jakobson (1961) considered phonemic regression to be the opposite of the child's development of speech sounds, showing the child's acquisition in reverse. The phonemic regression theory, however, has not been confirmed empirically (Fry, 1959; Halpern, Darley, and Keith, 1976; Shankweiler and Harris, 1966; Stoudt, 1964). Furthermore, through "laws of implication" Jakobson expanded his theory to include the child's acquisition of language, the development of which is reversed in aphasic regression.

> Thus we observe that in the child's language the acquisition of a certain phenomenon B implies the acquisition of a phenomenon A, we discover that the loss of A in aphasia implies the loss of B (Jakobson, 1961, p. 421).

An expansion of the phonemic regression theory (which supports the "loss" model of aphasia) may be tested by analyzing the word association responses of aphasic adults. Normal young children and normal adults produce predictable, but different, word association response classes. Considering phenomenon A in Jakobson's model to be syntagmatic (throw - ball) associations, since they are produced earlier (Woodrow and Lowell,

1916) by children, and phenomenon B to be paradigmatic (throw - catch) responses, since they appear later developmentally (Kent and Rosanoff, 1910; Palermo and Jenkins, 1964; Russell and Jenkins, 1954), then the following types of word associations by aphasic subjects might be expected to occur:

Only syntagmatic responses.
More syntagmatic than paradigmatic responses.

The following types of word associations by aphasic subjects should not occur:

Only paradigmatic responses.
More paradigmatic than syntagmatic responses.

Responses of the latter type would falsify the expansion of the phonemic regression hypothesis, and would offer evidence against the "loss" model of language impairment in aphasia.

Word Association in Aphasia

The production of a word association response has been described (Collins and Loftus, 1975) as a process involving decoding through word retrieval, lexical search, and encoding. Researchers have suggested which part or parts of this process may be impaired due to aphasia.

The difficulty may lie in the aphasic adult's auditory or visual processing of the stimulus word. The sound complex may be sufficiently precise to stimulate a realm of ideas to which the idea belongs, without being sufficiently precise to stimulate the individual idea

which belongs especially to the presented word (Goldstein, 1948). The aphasic patient may not be able to perceive the word so well that he is able to understand it or repeat it, but sufficiently well so that the sphere of meaning to which it belongs is elicited, and the patient may summon up another word belonging to this sphere. In other words, there is a problem with the word retrieval mechanism.

Goldstein has made a very strong claim in suggesting that aphasic patients can supply associations to a given word without recognizing the word. That is, word association may occur instead of, or in the absence of, lexical retrieval. However it may be that word association can only occur following retrieval of the stimulus word, as implied by Collins and Loftus (1975).

According to Schuell, et al. (1964), the word retriever is a device which transfers information from the permanent memory unit and makes it accessible for further processing. In aphasia one of three adverse conditions occurs. In the most severe the retriever doesn't work and there is no response. In the second the retriever operates with reduced efficiency, and activates part of the appropriate pattern in the network. This fragment may or may not contain the precise information required. The word may or may not be the one the aphasic adult was searching for, but it will probably be a closely associated one. Under the third condition the

retriever works a little better, and the aphasic adult may be able to continue the search, correct a wrong response, produce synonyms, related responses, or longer responses. The second adverse condition described by Schuell, et al. supports Goldstein's claim that word association may occur in the absence of lexical retrieval. However the description of the third adverse condition implies (as do Collins and Loftus) retrieval of the stimulus word before word association occurs.

In the preliminary stages of his investigation of word association in aphasia, the author attempted to recall the language behavior of the many aphasic clients he had seen clinically over the past seven years. Aside from clients with severe, or global aphasia, every aphasic adult produced word associations in spontaneous speech. This behavior was described by Freud (1891) as "a speech disorder in which the appropriate word is replaced by a less appropriate one, which, however, still retains a certain relationship to the correct word" and was termed paraphasia.

Schuell (1950) reviewed a number of theories of aphasia which she considered relevant to a model of paraphasia and paralexia. She defined paraphasia as "any response in which words related in sound or meaning to the appropriate symbol are substituted for it." In paralexia a word or words may be substituted for the given

symbol in reading. The relationship between paraphasia (and paralexia) and word association was carefully addressed by Schuell. She found that paraphasic and paralexic responses resembled word associations of normals. In fact, in a study more than two decades later (Rinnert and Whitaker, 1973), properties shared by semantic confusion (paraphasia) data and word association data were described. Firstly, semantic confusions were found to be more like than unlike word associations. Secondly, word associations were found to be less specific than semantic confusions. Finally, Rinnert and Whitaker (1973, p. 66) suggested the following:

> If X-Y is a semantic confusion pair, then it is highly likely that the word association X-Y will take place in some context such as a testing situation; the converse, however, does not necessarily seem to be the case.

In other words, word association responses may be effectively predicted on the basis of observed paraphasic responses, but not the other way around. This suggests that the class of word association responses is different from, and cannot be completely explained by, the response class called paraphasia. The studies of Schuell (1950) and Rinnert and Whitaker (1973) noted the differences between the responses on word association tasks and word association in paraphasias. Somewhat different conclusions were reported by Howes (1964). Although paraphasia was not specifically addressed,

Howes (1964, p. 72) noted that his word association experiments "in all essential details . . . confirm the picture presented by the results of ad libitum language." The "essential details" referred to speed and accuracy of word selection, as well as latency of association where associative frequency was controlled.

The research on paraphasia and word association in aphasia reviewed above supports the model of reduction of efficiency in aphasia. None of the authors has implied or stated that aphasic adults might be unable to produce word associations. However the notion that word association responses of aphasic subjects might be more generalized or require a longer latency than those of normal adults accomodates the philosophy of reduced efficiency in the aphasic population. A different prediction of the language behavior of aphasic adults would follow from the writing of Head (1926). He stated that organic brain damage disturbs the "march of events" necessary for the effective accomplishment of an acquired act. Such a disturbance might, as predicted by the "loss" model, prevent the performance of a particular behavior.

The way one considers the aphasic impairment (i. e., either as a loss or as a reduction of efficiency of language comprehension and production) is crucial to a program of clinical intervention for language rehabilitation. The clinician who supports the "loss" model might attempt to train alternative means of communication to

compensate for that which is lost. For example, a language board might be constructed for a client with limited oral expressive abilities. The "reduction of efficiency" model would encourage the clinician to explore those conditions under which the aphasic client might perform more efficiently. A clinical example of this philosophy would be expansion of speed of presentation of stimulus materials.

The present study was a further attempt to demonstrate variability of aphasic word association responses as a result of time-altered auditory and visual stimuli. It was undertaken to address theoretical issues and suggest clinical implications. It was hoped that the results of this study might provide a basis for increased sensitivity to some of the needs of aphasic adults in therapeusis, as well as to isolate some specific linguistic manifestations of aphasia.

Chapter 2

RELATED LITERATURE

Word Association

Since the early part of this cintury, researchers have employed word association tests to generate psychoanalytic data. For example, although schizophrenics do not differ from normal subjects with their associations to neutral words, they give significantly more associations to affective (pleasant and unpleasant) words than do normals (Buss, 1966). The following section will consider the use of word association tests for linguistic analyses.

Lists of stimulus words were compiled (Kent and Rosanoff, 1910; revised by Russell and Jenkins, 1954; also Palermo and Jenkins, 1964) and presented to normal adults with the results that specific response classes could be predicted. Furthermore, when word association tests were undertaken by children, a class of responses also emerged, although it was different from that obtained from the adults (Woodrow and Lowell, 1916). Studying this discrepancy more closely, Ervin (1961) and Brown and Berko (1960) found that responses to word association tests correlated with age and linguistic development.

Classification of word association responses is based upon theories of the development and organization of the mental dictionary. These theories account for the shift from the predominantly syntagmatic (tall - boy) responses of young children to the predominantly paradigmatic (tall - short) responses of older children and adults. The shift from syntagmatic to paradigmatic occurs between six and eight years of age (McNeill, 1970). At this time children are also able to distinguish anomolous from fully grammatical sentences.

According to Vygotsky (1934):

> The meanings of words are not constant. They change as the child develops; they change also in accordance with the different ways in which thought functions. Word meaning is a dynamic, not a static function (p. 514).

Indeed, the word associations of children often involve similarity of word sound, a type of association that is reduced in frequency later in life (Posner, Lewis, and Conrad, 1972). Aphasic adults, as well as young children, demonstrate phonetic similarity in their associations. This type of word association strategy was not examined in the present study.

Word association techniques used by investigators of child language (Brown and Berko, 1960; Ervin, 1961; McNeill, 1970) have presented evidence bearing on two basic hypotheses: horizontal development and vertical development. These two hypotheses are not mutually exclusive, and may both be true regarding the enlarge-

ment of dictionaries (sometimes called the lexicon). They differ in when, earlier or later, a semantic feature spreads through the dictionary. A semantic feature is a distinction that separates one class of words from another. For example, four-leggedness separates animals that stand upright from those that do not.

The work of Ervin (1961) and of Brown and Berko (1960) reflect the effects of horizontal development of dictionary entries. Considering the S→R in word association to be forming a grammatical unit, then responses of children are often anomolous with their stimuli (e. g., soft - wall, fast - shout). Depending upon the grammatical relation of R to S, two general categories of word association prove descriptive. Ervin's syntagmatic class, which is the same as Brown's and Berko's heterogeneous class, applies to two words belonging to different grammatical classes. Ervin's paradigmatic class, which is the same as Brown's and Berko's homogeneous class, applies to two words belonging to the same grammatical class. The investigators found that young children respond most often with syntagmatic word associations, while older children and adults respond mostly with paradigmatic word associations.

In his horizontal development hypothesis, McNeill (1970) considered the shift from syntagmatic to paradigmatic in terms of horizontal completion of dictionary

entries. He considered syntagmatic responses to be actually paradigmatic responses that, because of the size of the semantic categories available to young children, fall outside the grammatical class of the stimulus. That is, the greater breadth of the semantic categories available to young children can accomodate an association of "fast - shout" in a single grammatical class. For an older child or adult, the words "fast - shout" belong to different semantic categories and different grammatical classes. According to McNeill (1970), a paradigmatic R matches its S semantically, and a syntagmatic R is a grammatical continuation.

Word Association in Aphasia Research

Word association responses of aphasic adults have been examined in studies measuring word retrieval (Marshall, 1976), word fluency (Howes, 1964), and grammatical classes (Sefer and Henrickson, 1966).

In an analysis of 740 instances of word retrieval demonstrated by 18 aphasic subjects in conversation with the author, Marshall (1976) classified all recorded responses into one of the following five categories: delay, semantic association, phonetic association, description, and generalization. Word retrieval behavior was operationally defined (Marshall, 1976, p. 445) as: "a situation whereby the aphasic, unprompted by the clinician, illustrates that he is unable to retrieve a word and

initiates some effort to do so without assistance from the clinician." Data were gathered from nondirective clinician-client discussions. Of the five categories, only in generalization was it possible to separate associational processes from the phenomenon of word retrieval. This behavior frequently represented a manipulative effort on the part of the aphasic subject to get the clinician to supply the needed word. In generalization, the aphasic subject produced a general or empty word (such as "thing") in place of the desired word. Generalization was also found to be the lease effective method of retrieval. In other words, in all four of the effective word finding strategies, associational clusters preceded successful retrieval.

An example of word retrieval assisted by semantic association might help to demonstrate the relationship between Marshall's research and a model of reduction of efficiency in aphasia. The present author has observed an aphasic client demonstrate the following in his attempts to retrieve the word "pen": crayon - no - write - no - ink - no - pencil - pen - PEN! The correct word was finally retrieved, albeit much less efficiently than if the client were not aphasic, through the use of semantic associations.

In a study examining word fluency in aphasia, Howes and Geschwind (reported by Howes, 1964) administered

a word association test to 60 aphasic subjects. Type A subjects (corresponding to those with Broca's aphasia) produced word associations similar to those given by normal subjects, but the experimental group required a much higher latency than normal. That is, the Type A subjects suffered a loss of speed in their responses. With severely impaired Type B subjects (corresponding to those with Wernicke's aphasia), the experiment could not be conducted, because of the severe comprehension disorder of these subjects. Type B subjects who were able to follow the instructions frequently chose associations that were bizarre, but demonstrated normal latencies. That is, Type B subjects suffered a loss of accuracy in their responses. There were no other differences between aphasic responses and those of normal adults. The investigation offers support for a "reduction of efficiency" model of aphasia. Although similarities existed between the word association responses of aphasic subjects and normal adults, the reduced efficiency of the aphasic group was evident in three areas (reduced speed of word selection, reduced accuracy of word selection, and reduced use of words of low frequency of occurrence).

Sefer and Henrickson (1966) examined the relationship between word association and grammatical classes in aphasia. An oral word association test consisting of five each of nouns, verbs, adjectives, adverbs, and prepositions

was administered to 50 aphasic and 50 nonaphasic patients at the Minneapolis Veterans Administration Hospital. The study compared word association responses of aphasic and nonaphasic patients, investigated the relationship between part of speech and the number of homogeneous (paradigmatic) responses for aphasics and nonaphasics, and attempted to separate the aphasics into two groups based on selection and combination functions. Their results indicated that aphasic subjects produced fewer homogeneous (paradigmatic) responses than normal controls.

The number of homogeneous responses elicited by a stimulus word depended on its part of speech and decreased with the severity of aphasia. Aphasics' word association responses varied by part of speech in the same way nonaphasics' responses varied. For both the aphasic and control groups, the order of greatest to least number of homogeneous responses resulted from presentation of adjectives, followed by nouns and verbs. Finally it was not possible to divide aphasic subjects into grammatical and agrammatic types on the basis of word association responses.

The relationship of the Sefer and Henrickson (1966) study to the model of reduction of efficiency in aphasia derives from the evidence that, the greater the aphasic impairment, the fewer the number of homogeneous responses. Since the bulk of normal adult word associations are homogeneous, the description by Schuell (1950, 1961, 1964) of

reduction of language abilities in aphasia (except for very severe aphasic impairment, where there is a loss of language) is supported. The importance of the Sefer and Henrickson article to a view of aphasia as a reduction of efficiency lies in the similarity in patterns between the aphasic and control groups.

The expansion of Jakobson's (1961) phonemic regression theory, which predicted a reversal of the normal paradigmatic (homogeneous) shift, does not seem to be supported by the data of Sefer and Henrickson. The proportion of homogeneous associations produced as a function of part of speech followed the same pattern for aphasic subjects as for normal controls. However aphasic subjects did produce significantly fewer homogeneous responses than normal subjects, a finding which is predicted by the regression theory. Thus Sefer and Henrickson's study confirms both theories, not permitting a choice between them.

Classification of Word Association Responses

Regarding word association responses as either homogeneous - heterogeneous (Brown and Berko, 1960) or paradigmatic - syntagmatic (Ervin, 1961) reflects the syntactic classifications traditionally used. Syntactic classifications have, however, been rejected by Petrey (1977), who defined changes with age in response to verbal stimuli by the distinctions between the episodic and semantic storage - retrieval systems. Based on a model of memory

proposed by Tulving (1972), in episodic information the word is the focal element, or one of the focal elements, in a particular situation. For example, the word "tree" might be stored as part of a situation involving picking fruit from the backyard peach tree or building a tree house. On the other hand, semantic information about a word is independent of its autobiographical component. For example, the word "pencil" may be stored in memory with no autobiographical context. The shift in word association responses with age is from episodic to semantic. Petrey accounts for this shift by suggesting that younger children are retrieving from an episodic store and older children from a semantic store.

While consideration of word associations in terms of the development of lexical memory is interesting, it is somewhat more ambiguous than syntactic classifications. Petrey (1977) used "salt - pepper" to describe an association deriving from episodic memories. However the percentage of "salt - pepper" responses of adults (32%), who are supposed to supply semantic associations, was roughly the same as the percentage of "salt - pepper" responses of kindergarten children (37%), who are presumed to use episodic associations. Data such as these suggest at least two possible conclusions. Although the percentage of "salt - pepper" associations remained the same for both children and adults, they may still represent, as

Petrey has claimed, a shift from episodic to semantic. On the other hand, the same results might be described by syntactic classifications or by no shift at all. It may be that syntactic classifications are not entirely satisfactory as descriptors of word association. However Petrey's data do not seem to be persuasive enough to substitute episodic and semantic classifications for syntactic. The value of Petrey's study lies not in attempts to substitute classification systems, but in the effort to explain them.

Syntactic (paradigmatic - syntagmatic) classifications of word association responses may provide information about such stimulus variables as part of speech, abstraction level of words, frequency of occurrence in English usage, and word length, which may be controlled in the presentation of word stimuli.

Part of Speech

Part of speech seems to have an effect on the error performance by aphasic subjects. Schuell, Jenkins, and Jimenez-Pabon (1964) tested the hypothesis that aphasic adults with anomia have more difficulty recalling nouns than other parts of speech. Their findings, which were later substantiated by Eisenson (1973), suggested that a defect in evoking nouns appears more frequent only because the bulk of most vocabularies consists of nouns. The anomic disturbance, then, should apply equally regardless

of part of speech. Wepman and Jones (1966, pp. 146-147) presented a classification of five aphasic language disturbances. Their classification of semantic aphasia indicated the following defects:

> (a) except for very high-frequency generalized terms, the semantic aphasic has great difficulty in evoking once well-known proper names and substantive words; and (b) circumlocutions and gestures may be substituted for words which cannot be recalled.

The Wepman-Jones classification of semantic aphasia accomodates the traditional concept of anomia, but adds the notion of difficulty in evoking substantive words to the previously discussed problem of noun retrieval.

There is remarkable disagreement concerning the parts of speech with which aphasic adults experience the most difficulty. For example, in a task involving reading single words, Siegel (1959) found that aphasic subjects made more errors on adjectives than on either nouns or verbs. Halpern (1965a, b) tested aphasic verbal perseverations and verbal errors when stimuli were presented auditorily, visually, and a combination of auditory-visual. Aphasic subjects either repeated or read aloud a 72-word list balanced for frequency of occurrence, abstraction level, part of speech, and word length. Regardless of modality, aphasic subjects did not demonstrate significant differences among nouns, verbs, and adjectives in their verbal perseverations. However verbs and adjectives produced significantly more verbal errors

than nouns, regardless of modality of stimulus presentation. In a study examining word association and grammatical classes in aphasia, Sefer and Henrickson (1966) observed that, for both aphasic and control groups, adjectives, nouns, and verbs, in that order, elicited the greatest through least number of paradigmatic (homogeneous) associations, but did not suggest an explanation for this finding.

Abstraction Level of Words

Among the issues addressed by some of the early scholars in aphasia research, the relationship of problems on confrontation naming tasks to the level of abstraction of the items to be named was considered. Head (1926), citing his own work and that of Hughlings Jackson, concluded that concrete names were more easily produced than abstract ones. The impairment of the abstract attitude (Goldstein, 1948) was linked to the total personality change observed in aphasic adults.

Siegel (1959) presented a list of words to 31 aphasic adults. The error scores (words incorrectly read) for both high-abstraction-level and low-abstraction-level words were significantly greater than for medium-abstraction-level words. The difference between high and low levels of abstraction was not significant. These results are questionable, however, since frequency of occurrence of the stimulus words was not controlled. Halpern (1965a, b) analyzed the oral responses of 33 dysphasic subjects and

found that the fewest errors occurred on words that were designated as a low level of abstraction.

Except for Siegel's somewhat questionable data, the research on abstraction level of words clearly supports a model of reduction of efficiency in aphasia. Aphasic adults are not unable to respond appropriately in a confrontation naming task, but succeed only when the target words have a specific reference or tend to include details.

Frequency of Occurrence

The effect of frequency of occurrence of words on aphasic linguistic performance has received considerable attention in the literature. Siegel's (1959) 31 aphasic subjects produced more reading errors on words occurring infrequently in written English language usage than on frequently used words. Schuell, Jenkins, and Landis (1961) administered a vocabulary test to 48 aphasic subjects. Word frequency was found to be an important factor in the ability of aphasic subjects to comprehend spoken words. Howes (1964) reported a reduction in the use of infrequent words in the responses of 60 aphasic subjects to a word association test. Halpern (1965b) found more verbal errors following presentation of infrequent than frequent words, regardless of modality of stimulus presentation. However Halpern (1965a) found no significant differences in the number of aphasic verbal perseverations due to frequency of occurrence of the word stimuli.

From the research cited it seems that aphasic adults, needing all the help they can get in language tasks, would be expected to prefer frequent to infrequent words. That this appears to be so is further support for a model of reduction of efficiency in the comprehension and production of language symbols in aphasia.

Word Length

Among the early investigations, Goldstein's (1948) claim that motor aphasia affects the oral expression of long words more than short words is a typical finding. More recently, Siegel (1959) found that aphasic subjects made more errors, in reading single words, on long words than on short words. Halpern (1965a, b) discovered that aphasic subjects made more verbal perseverations and verbal errors on long words than on short words. This occurred whether word stimuli were presented through the auditory modality, the visual modality, or a combination of auditory-visual.

Again, the aphasic population appears to be operating with reduced efficiency. While they are able to process (auditorily and/or visually) and articulate short words, their comprehension and production of long word stimuli is less efficient.

Modality of Stimulus Presentation

Word association studies using aphasic subjects

have examined responses in the auditory modality; that is, responses to the spoken or tape recorded word. It may seem reasonable to propose that similar projects be undertaken utilizing the visual modality, that is, the printed word, or even a combination of auditory-visual. The basic problem with such endeavors is that responses to word stimuli presented through the auditory and visual modalities cannot be compared, since the stimuli themselves are not comparable. When a word is presented visually it appears immediately in its entirety; a word presented auditorily represents a process which takes place over a period of time (depending upon how long the word is). There is even a more elementary difference between the two presentations which Cairns and Cairns (1976, p. 189) speak to in their discussion of the innateness hypothesis.

The ability to speak and understand spoken language is, according to the innateness hypothesis, a natural human activity. This is not the case with reading. No one is expected to learn to read without special instruction (Cairns and Cairns, 1976). Thus there are two different types of learning which must have taken place before a word association test through the auditory and visual modalities can be undertaken. The inability to learn to understand spoken language is a sign of pathology; pathology may or may not be the cause of failure to respond to the test through the visual modality.

Differences between modalities become apparent

when considering language learning in the presence of a sensory deficit. Deaf children require special instruction in order to learn to speak and understand spoken language; blind children do not.

Temporal Manipulation

Although responses to auditory and visual presentations of word association stimuli must be considered separately, temporal manipulation is possible under both conditions. The optimal rate of speaking is 165 words per minute (Fairbanks, 1960). The "Amplifier Passage" used by Fairbanks (1960, p. 114) to train optimal rate of speech contains 300 words. Transcribed into phonetic form, the same passage contains 1167 phonemes. Conversion of optimal rate from words per minute to phonemes per second results in an optimal speaking rate of about ten (10.7) phonemes per second.

Competence at various reading grade levels is determined by accuracy of recognition of written materials presented at different speeds tachistoscopically. Educational Developmental Laboratories (EDL), a subsidiary of the McGraw-Hill Book Company, has published a reading program of increasing complexity with levels corresponding to school grades. A description of the target population indicates the following:

> It cannot be emphasized too strongly that Learning 100 is an adult program - not a

> "warmed over" school curriculum. It is a new program, created especially to answer the needs and capture the interest of mature people who, because of unfortunate circumstances beyond their control have not yet learned to read (EDL, 1968, p. 4).

One of the performance objectives at the fifth grade reading level is labelled "Perceptual Accuracy and Visual Efficiency" (EDL, 1972, p. 63). Five numerals or letters are presented tachistoscopically for 10 msec for recognition by the student. Students indicate recognition of the letters or numerals by writing them on a score sheet. Only those students who have previously demonstrated the ability to write letters and numerals are included in this procedure. Competence at the fifth grade level requires correct recognition of all five letters and all five numerals. In the present study, words at the fifth grade level were presented to aphasic and normal adults. Words at or below the fifth grade level of difficulty have been presented in lists to aphasic subjects by Siegel (1959) and Halpern (1965a, b).

Aphasic Comprehension of Time-Altered Auditory Stimuli

Recent studies have presented research which viewed aphasic comprehension in terms of responses to time-altered stimuli. Rate of speech is an extremely important factor in aphasic comprehension. Aphasic adults have reported the feeling that people speak too fast, use sentences that are too long, and anticipate the aphasics' responses rather than allow them sufficient time to

formulate a reply (Rolnick and Hoops, 1969). Schuell supported the contention that rate of speech is crucial to aphasic comprehension (1953). Her patients indicated greater understanding of words or phrases spoken more slowly than in ordinary conversational speech.

Sheehan, Aseltine, and Edwards (1973) mechanically introduced silences into normally enunciated speech in order to determine whether or not aphasic comprehension would be improved. They compared aphasic comprehension under three conditions: 1) normal enunciation, 2) interpolated silences of 150 msec around each phoneme, and 3) accumulated time which inserted the same amount of silence as in condition 2, but after each word rather than between phonemes. They found that their group of younger aphasics, who ranged in age from 37 to 50, responded best to interpolated silences (condition 2).

Parkhurst (1971) also tentatively concluded that slowed speech might be beneficial to aphasic comprehension. Using the Token Test (De Renzi and Vignolo, 1962) as a measure of comprehension, she presented the directions to aphasic adults under compressed, expanded, and normal speech conditions. Poorest performance was noted under the compressed speech condition while no difference was noted between slowed and normal speech conditions. However she observed that slowing the signal aided the comprehension of instructions by the aphasic subjects, although her data

were not statistically significant.

Lasky, Weidner, and Johnson (1974) provided further evidence indicating that aphasic comprehension is improved by slowing the overall rate of speech. In addition, they found that imposing one second pauses between major syntactic boundaries improved aphasic comprehension. The task required the subject to point to the appropriate picture specified by the stimulus sentence. The greatest increase in comprehension performance was demonstrated under the condition which combined slower rate of presentation with pauses between major syntactic boundaries.

Goldfarb, et al. (1976) presented a reading comprehension task to three aphasic adults representing mild, moderate, and severe stages of language impairment. Two independent variables, rate of speech and modality of presentation (auditory and visual) were examined. Regardless of severity of aphasia, either reduction of rate of speech or the institution of shadowing resulted in increased comprehension. Comprehension was assessed by a multiple-choice comprehension test.

Research which does not demonstrate improved comprehension as a result of slowed speech was presented by Klor and Canter (1975). The question investigated was whether or not slowing the rate of utterance, lengthening pauses, or a combination of both would facilitate the comprehension of yes/no questions in aphasic patients.

The scores (i. e., the number of correct answers) of the ten subjects responding to sixty yes/no questions were not significantly affected by the temporal changes which had been introduced into the speech stimuli.

Most of the studies of temporal manipulation suggest improved comprehension by aphasic subjects as a result of expansion of the duration of stimulus presentation. Apparently, aphasic subjects become more efficient in language comprehension given more processing time. If word association tests require comprehension of the stimulus word (although Goldstein, in 1948, suggested that this may not be the case), it seems reasonable to suspect that performance by aphasic subjects would improve (i. e., more paradigmatic responses would be produced) as a result of expanding the duration of presentation of the stimulus word.

Comprehension of Visual Stimuli

As previously discussed, time-altered stimuli have been presented, in a variety of ways, to aphasic subjects, but only through the auditory modality. In addition, normative data regarding rate of speech have been presented. The following section deals with the ability of normal adults to comprehend information through the visual modality.

One of the major difficulties in assessing comprehension of visual stimuli lies in developing means to measure what has been seen in one brief exposure.

Sperling (1969) indicated the inadequacies of instructing an observer of a brief presentation to repeat what he has seen:

> When complex stimuli consisting of a number of letters are tachistoscopically presented, observers enigmatically insist that they have seen more than they can remember afterwards, that is, report afterwards (p. 61).

Certainly there is a limit on the memory report. This information has been known for some time and has been widely disseminated by George Miller (1956) using such terms as span of attention, apprehension, or immediate-memory. Sperling's contribution is his deduction that more information is available during, and possibly for a short time after the presentation of the stimulus than can be reported. After indicating all the letters (or numbers) they had seen, Sperling's subjects indicated that they knew more information was presented, but were unable to remember it. This new description of memory expands the traditional conception of short-term and long-term memory. First, according to Sperling, is the memory of events occurring at the present time, which is complete. Second is an immediate or short-term memory containing the limited information extracted from the rapidly decaying sensory image. Third is the small part of the image which may be stored in permanent, long-term memory. One requirement not mentioned by Sperling for what may be termed just-occurring memory to take place is that the

visual stimulus have sufficient size, clarity, and duration to impress upon the viewer a sensory image.

Gough (1972) discussed what occurs in one second of reading:

> The Reader's eyes focus on a point slightly indented from the beginning of the line, and they remain in that fixation for some 250 msec. Then they will sweep 1 - 4 degrees of visual angle (say 10 - 12 letter spaces) to the right, in a saccadic movement consuming 10 - 23 msec, and a new fixation will begin.
>
> The Reader's initial fixation yields an icon containing materials corresponding to the first 15 to 20 letters and spaces of the sentence.

The icon may be defined as a relatively direct representation of a visual stimulus that persists for a brief period after the stimulus vanishes.

The speeds of presentation of auditory and visual stimuli employed in the previously reported studies included the following:

For auditory stimuli - Normal Speed (10 phonemes per second)
Half Speed (5 phonemes per second)

For visual stimuli - Fixation Speed (250 msec)
Sweep Speed (10 msec)

That is, studies investigating responses to time-altered presentation of stimulus variables, through the auditory and visual modalities, have used speeds similar or identical to those noted above.

The comprehension performance of aphasic adults generally improved as a result of expansion of the rate of

auditory stimulus presentation. There have been no studies of aphasic comprehension of time-altered visual stimuli similar to those performed on normals by Sperling (1969), Gough (1972) or EDL (1968, 1972). However the studies of visual processing of linguistic events by normals suggested two speeds which may be sufficient to process ten or more letter spaces.

In most instances, aphasic adults seemed to respond more efficiently following slower rate of auditory stimulus presentation. This pattern may extend to visual stimuli as well. Related to Gough's research, aphasic adults may be expected to experience a longer fixation as well as a slower sweep in reading. In addition, aphasic subjects may require longer for transfer of information to short-term memory, which is expressed in Sperling's second phase.

Finally, all the above findings and predictions support a model of reduction of efficiency in aphasia. A view of aphasia as a reduction of efficiency implies similarity of the pattern of responses between aphasic and nonaphasic groups. By slowing the speed of presentation of auditory and visual stimuli, the pattern of word association responses of aphasic and control groups might be more similar than they would be at faster speeds.

Hypotheses

The preceding discussion has attempted to relate a body of literature to one of two broad models of aphasia:

loss of language or reduction of efficiency. If the entire class of loss hypothesis (or part of it, such as the regression hypothesis) is falsified, then any variable which facilitates performance may increase "optimal" responding of a word association test, defined *a priori* as paradigmatic responses.

On the basis of the research findings that aphasic comprehension improves given increased processing time (Goldfarb, *et al.*, 1976; Lasky, *et al.*, 1974; Parkhurst, 1971; Rolnick and Hoops, 1969; Schuell, 1953; Sheehan, *et al.*, 1973), which supports a reduction of efficiency model of aphasia, the following effect of the speed of stimulus presentation variable is predicted:

1. Aphasic subjects supply a greater number of paradigmatic than syntagmatic word association responses to word stimuli presented at slower, rather than faster speeds.

Because the above studies did not include a control population, there are no comparable research findings for nonaphasic subjects. Therefore, the following effect of the speed of stimulus presentation variable is predicted for the control group in this study:

2. Control subjects are not affected, in their production of paradigmatic and syntagmatic word association responses, when word stimuli are presented at different speeds.

On the basis of research findings that confrontation naming ability varies inversely with abstraction level

(Goldstein, 1948; Head, 1926), the following effect of the abstraction level variable is predicted:

3. Words of low abstraction level presented to aphasic subjects elicit more paradigmatic word association responses than do words of medium or high abstraction level.

There is considerable disagreement in the literature concerning the parts of speech with which aphasic adults experience the most difficulty. However Sefer and Henrickson (1966) found that, for aphasic and control subjects, adjectives, nouns, and verbs, in that order elicited the most through fewest paradigmatic associations. The following effect of the part of speech variable is predicted:

4. Words that are classified as adjectives when presented to aphasic subjects elicit the most paradigmatic word association responses, followed by nouns and verbs.

On the basis of research findings that long words, more than short words, elicit, in aphasic subjects, errors of oral expression (Goldstein, 1948), reading errors (Siegel, 1959), verbal perseverations (Halpern, 1965a) and verbal errors (Halpern, 1965b), the following effect of the word length variable is predicted:

5. Words that are short, when presented to aphasic subjects elicit more paradigmatic word association responses than words that are long.

On the basis of research findings that infrequent words, more than frequent words, elicit, in aphasic subjects,

reading errors (Siegel, 1959), comprehension errors (Schuell, et al., 1961), and verbal errors (Halpern, 1965b), the following effect of the frequency of occurrence variable is predicted:

6. Words occurring frequently in written English usage when presented to aphasic subjects elicit more paradigmatic word association responses than infrequently occurring words.

On the basis of research findings which fail to confirm Jakobson's (1961) phonemic regression hypothesis (Fry, 1959; Halpern, et al., 1976; Shankweiler and Harris, 1966; Stoudt, 1964), the following prediction is made:

7. Word association responses of aphasic subjects do not represent a reversal of the type of word association responses observed in normal language development.

Chapter 3

SUBJECTS, MATERIALS, AND PROCEDURES

Subjects

Auditory Presentation

Twenty-seven men and five women, diagnosed as aphasic, responded to a word association test presented through the auditory modality. Aphasia resulted from left hemisphere CVA in thirty subjects, right hemisphere CVA in one subject who was left-handed, and left cortical trauma in one subject. History of brain injury was determined by examination of hospital and treatment center records.

The diagnosis of aphasia was based upon administration of standardized tests for aphasia by a speech and language pathologist, psychologist, or physician. These tests included the Minnesota Test for Differential Diagnosis of Aphasia (Schuell, 1965), the Porch Index of Communicative Ability (Porch, 1967), and the Boston Diagnostic Aphasia Examination (Goodglass and Kaplan, 1972). The severity of aphasic impairment in the experimental population ranged from mild to moderate. The amount of time elapsed since the onset of aphasia ranged from 1 month to 9 years, 5 months, with a mean of 2 years, 2 months.

The subjects chosen all spoke English as their native language and had a sixth grade education or higher. Education level ranged from sixth grade to post-graduate work in college, with a mean of 12.1 years spent in school. Word stimuli were drawn from graded word lists (Gates, 1935; Buckingham and Dolch, 1936) and were rated no higher than fifth grade by at least one of the sources. Consequently, control of the native language and the pre-morbid educational level of each subject was necessary. This information was ascertained from the hospital or treatment center records. Their age ranged from 26 years, 1 month to 83 years, 9 months with a mean of 58 years, 6 months.

Twenty-seven men and five women who were not aphasic served as controls, and were matched to the aphasic population for age, sex, and educational level.

Visual Presentation

Seventeen men and three women, diagnosed as aphasic, responded to a word association test presented through the visual modality. Aphasia resulted from left hemisphere CVA in all twenty subjects. All subjects spoke English as their native language. Educational level ranged from seven to nineteen years with a mean of 11.8 years. Time elapsed since onset of aphasia ranged from 1 month to 10 years, 1 month with a mean of 2 years, 7 months.

Seventeen men and three women, who were not aphasic, served as controls, and were matched to the aphasic popula-

tion for age, sex, and education (see Table I).

None of the subjects had uncorrected peripheral visual and/or peripheral hearing defects, and none of the subjects had a present history of psychotic disorders. Since the experiment involved reception of and responses to visual and auditory stimuli, the above delimitations prevented contamination of subjects' reception and responses. This information was provided by the speech pathologist assigned to the subjects, as well as hospital and treatment center records.

Not all of the aphasics and controls served as subjects for both the auditory and visual tests. Some patients were discharged from the hospital or treatment center after testing in only one modality was accomplished; others were able to pass the Pre-Test, which excluded severely and very mildly impaired aphasic adults from the study, in only one modality.

Materials

The stimulus materials used in this experiment were the Darley, Sherman, Siegel (1959) list of single words which are scaled according to their abstraction levels. In this list, the median scale values of level of abstraction were obtained for each of 572 words from the responses of thirty-five judges who rated the words on a five-point equal-appearing interval scale. Statistical analysis provided evidence that the abstraction level of single

TABLE I

Data base for aphasic and control subjects.

Auditory Presentation

	N	Sex		Age		Education	
		M	F	Range (yr,mo)	$\bar{X}$	Range (yr)	$\bar{X}$
Aphasics	32	27	5	26,1 - 83,9	58,6	6 - 19	12.1
Controls	32	27	5	19,10-82,11	57,11	7 - 20	12.1

Visual Presentation

	N	Sex		Age		Education	
		M	F	Range (yr,mo)	$\bar{X}$	Range (yr)	$\bar{X}$
Aphasics	20	17	3	37,10- 84,8	58,2	7 - 19	11.8
Controls	20	17	3	26,10-82,11	55,3	7 - 17	11.9

words according to low, medium, and high can be reliable when scaled in this manner.

The list of 572 words is also classified according to the parts of speech (noun, verb, adjective) of the words, which were defined by a standard dictionary. The length of each word in the list was established by a criterion involving the number of letters and number of syllables. "Long" words contain two or more syllables and six or more letters. "Short" words contain one syllable of four or fewer letters. All words were at the fifth grade level or below.

Halpern (1965a, b) further delimited the word list to achieve an equal counterbalancing of frequency of occurrence in written English language usage with the other parameters (abstraction level, part of speech, and word length) described above. The 72 words in the Halpern list were composed of the following: twenty-four words at each of the three levels of abstraction (low, meduim, high); twenty-four nouns, twenty-four verbs, twenty-four adjectives; thirty-six short and thirty-six long words; thirty-six frequent and thirty-six infrequent words. For the designation, classification and value of each of these words see Appendix C (Tables XX - XXIII). Halpern's list of 72 words actually represents two equivalent lists of 36 balanced words.

The list developed by Halpern (1965a, b) was further modified to control for possible ambiguity of words

presented through the auditory modality. For example, the word "be" in the Halpern list, a verb, might well elicit the associate "sting" (for "bee", a noun) when presented auditorily. The following substitutions were made without jeapordizing the integrity of Halpern's balancing (see Appendix C, Tables XX - XXIII): joy/soul, zone/ware, tub/ant, fail/ail, let/know, try/be, bake/sew, and mid/mum. The substituted words were equivalent to the original words in Halpern's list in terms of frequency of occurrence in written English language usage, abstraction level, part of speech, and word length.

Ten words, selected from the Darley, Sherman, Siegel (1959) list were used in a Pre-Test. They included 4 nouns, 3 verbs, 3 adjectives; 5 long, 5 short; 5 high abstraction, 5 low abstraction; 5 frequent, 5 infrequent (see Appendix C, Tables XVI - XIX). The Pre-Test was developed in order to exclude severely and very mildly impaired aphasic adults from the study.

Temporal Manipulation of Stimulus Materials

Stimulus words were recorded on TDK SD C60 Cassette tape using a Panasonic RQ 228 S LL Cassette Recorder. The reader of the word list was a male speech and language pathologist who was experienced in these recording procedures (Goldfarb, et al., 1976; Goldfarb, 1976). Each word was read at a speed of approximately ten phonemes per second. They were recorded a second time, using the same equipment. The first tape was expanded to

.5 normal speed (or five phonemes per second) using a Lexicon Varispeech 1, a device which can manipulate playback speed while maintaining normal pitch through a computerized pitch correction. By connecting the Preamp Output of the Varispeech 1 to the Auxiliary In of the Panasonic recorder the stimulus words were simultaneously expanded to .5 on the Varispeech 1 and recorded on the Panasonic recorder. The result was two tapes of the same stimulus words, one at normal speed, or ten phonemes per second, and one at half speed, or five phonemes per second.

For the visual presentation the list of stimulus words was professionally printed and a tachistoscopic film strip (Answer Print #54174) was prepared by Berkey Manhattan Laboratories. On the EDL tachistoscope sold by McGraw-Hill, position A focuses the image for 10 msec, and position C focuses the image for 250 msec. The clear image is immediately preceded and followed by a blurred one.

Prior to recording or printing, the two lists of 36 words each were exposed to a pseudo-random ordering, according to a Table of Random Numbers (Anderson, 1971, p. 170). With this type of ordering randomization was manipulated to prevent three consecutive occurrences of any one variable. For example, no three consecutive low abstraction words or no three consecutive nouns occurred; nor were there three consecutive frequent words or three consecutive short words in the recorded or printed lists (see Appendix B, Table XV).

Procedures

Collecting the Data

The majority of the aphasic and control subjects were tested in a therapy room in the Speech Pathology Service of the New York Veterans Administration Hospital. The remaining subjects were tested in similar rooms in university and hospital treatment centers in the metropolitan New York area. For the auditory stimuli the subject and examiner sat across from each other with a Panasonic cassette tape recorder placed on a table between them. For the visual stimuli the subject sat on the examiner's left with the tachistoscope placed on a table between, and directly behind them. Words were flashed on a white screen approximately six feet in front of the subject.

The directions given to all subjects were similar to the ones in the Sefer and Henrickson (1966) study:

> I am going to say a word and I want you to say the first word you think of. For example, if I say "sky" you may say "blue"; if I say "up" you may say "down". Just say the first word you think of, whatever it is. There aren't any wrong answers.

There was no limit on the number of times these instructions could be given. However there was a twenty second maximum response latency before a rating of No Response was scored. That is, following the presentation of the stimulus word in testing, the subject was required to respond within twenty seconds.

Presentation of the word lists was counterbalanced

(see Table II) to control for effect of order of presentation.

Pre-Test

Aphasic subjects included in the study were required to complete the Pre-Test, consisting of ten balanced words (see Appendix C, Tables XVI - XIX). The Pre-Test was designed to exclude subjects from the study who represented the extreme upper and lower limits of aphasic impairment. As a word association test requires considerable linguistic competence for a response, some aphasic adults are too severely impaired to function in such a test. On the other hand, responses of very minimally impaired aphasic adults are often comparable to those of normal (nonaphasic) adults.

Aphasic candidates for the auditory test supplied associates for words presented via tape recorder; for the visual test, associations followed words presented tachistoscopically. Only vocal responses were accepted, and were recorded in written form by the examiner. Prospective subjects passed the Pre-Test by supplying normal associations for at least one, but no more than nine, of the ten stimulus words. That is, at least one, but no more than nine, of the associations to the ten stimulus words was required to be anomolous. Control subjects were not given the Pre-Test.

TABLE II

Counterbalancing to control for effect of order of presentation. Numbers indicate number of subjects.

WORD LIST PRESENTED FIRST

Auditory Presentation

	Normal Speed		Half Speed	
	Aphasics	Controls	Aphasics	Controls
List A	8	8	8	8
List B	8	8	8	8

Visual Presentation

	Normal Speed		Half Speed	
	Aphasics	Controls	Aphasics	Controls
List A	5	5	5	5
List B	5	5	5	5

Scoring

Oral responses of subjects were recorded in written form by the examiner. The five categories for scoring were modified from the Palermo and Jenkins (1964) classification system employed in the Sefer and Henrickson (1966) study (see Appendix A, Table XIII). The modified scoring system expanded the traditional definitions of paradigmatic and syntagmatic to reflect the needs discussed by Jakobson (1961) and McNeill (1970). According to Ervin (1961) paradigmatic refers to two words belonging to the same grammatical class (e. g., up - down); syntagmatic refers to two words belonging to different grammatical classes (e. g., up - stairs). In this study a broader definition was applied for syntagmatic to account for contiguous real-world relationships of words of the same grammatical class. An association of "paper" for the word "news" was scored as syntagmatic, even though both words are nouns.

When distortions, neologisms, phonemic reversals, or phonemic paraphasias, all of which involve less than completely accurate articulation, occurred, the procedure described by Halpern, Darley, and Keith (1976) was employed. Instances of the above responses were placed into the categories of recognizable distortions or unrecognizable distortions. A recognizable distortion (e. g., "aminal" in response to "cat") was transcribed by the examiner in the correct form of the presumed target word. An unrecognizable distortion was scored as a jargon response.

When reapproaches (repeated attempts to produce the target word) were employed, the final attempt was recorded. Responses which did not include the vocal production of a word, including gesture, pantomime, and spelling, either aloud or "writing" in the air with one's finger, were not scored, but were encouraged if they resulted in a spoken word.

Each response was assigned to one of the following categories: paradigmatic, syntagmatic, repetition, anomolous, or unclassifiable. For example, if the stimulus word were "light" a paradigmatic response expected might be "lamp" or "dark". A syntagmatic response would be "bulb" or "switch". A response would be scored as a repetition if the stimulus word, or the stimulus word $\pm$ a prefix or suffix were repeated (e. g., "lighter"). Examples of anomolous responses would be "push" or "fast". Unclassifiable responses included jargon, a long phrase, or no response.

In the examples above, it is evident that a stimulus word may be interpreted as a noun by one subject and an adjective by another. One need only consult a standard dictionary to see how often words can shift in classification. Scoring an association of "light - lamp" as paradigmatic, since both may be nouns, or syntagmatic, since "light the lamp" is a contiguity relationship, was left to the discretion of the judges. "Light", however, was not one of the word stimuli used in the present study.

Three judges (certified speech pathologists) evaluated the words and indicated whether the response was paradigmatic, syntagmatic, repetition, anomolous, or unclassifiable. When the decision of the judges was not unanimous, the score assigned by two of the three judges was accepted. Lack of unanimity accounted for approximately 17% of the responses by the aphasic group. Almost invariably, the discrepancy resulted from a choice between paradigmatic and anomolous, or syntagmatic and anomolous, where two judges chose one classification (e. g., paradigmatic) and the third chose another (e. g., anomolous). There were no instances of all three judges assigning different scores.

Chapter 4

RESULTS

The Problem

The present study tested the hypothesis that aphasic subjects supply a greater number of paradigmatic word association responses to word stimuli presented at slower, rather than faster speeds, and that control subjects are not affected in their number of paradigmatic word association responses as a function of speed of stimulus presentation.

To determine whether a significant relationship existed between the speed of presentation of stimulus variables through the auditory and visual modalities and the number of paradigmatic and syntagmatic word association responses of aphasic and control subjects, two statistical analyses were performed. To determine whether a significant difference existed between the speed preferences of the aphasic and control populations, a chi square analysis (Ferguson, 1966, p. 192) was performed. To determine whether a significant difference existed between the number of paradigmatic and syntagmatic responses produced as a result of slower vs. faster presentation of stimuli, a test of proportions (Ferguson, 1966, p. 177) was performed.

The total number and percentages of the word association responses of aphasic and control subjects to stimuli presented at different speeds through the auditory and visual modalities are shown in Table III. According to a chi square analysis, the aphasic and control subjects appear to respond differently to temporal manipulation of stimuli presented through the auditory ($\chi^2 = 4.03$, df = 1, $p < .05$) or visual ($\chi^2 = 6.38$, df = 1, $p < .02$) modalities.

A test of proportions (Table IV) was performed in an attempt to localize the above differences in either the aphasic or control population. Ratio differences were significant for the aphasic population for stimuli presented at different speeds through the auditory ($p < .05$) and visual ($p < .05$) modalities. There were no significant speed differences observed for the control group, regardless of modality.

The results indicate that, regardless of modality of stimulus presentation, the aphasic and control groups have different speed preferences. The aphasic adults produced significantly more paradigmatic word association responses when stimuli were presented at a slower speed, regardless of modality. The number of paradigmatic word association responses produced by normal adults was not affected by temporal manipulation of stimuli, regardless of modality.

For the individual stimulus variables (abstraction

TABLE III

Totals of the number (top) and percentage (bottom) of word association responses by aphasics and controls to time-altered auditory (normal, half speed) and visual stimuli (10 msec, 250 msec). P = paradigmatic, S = syntagmatic, R = repetition, A = anomolous, U = unclassifiable.

NUMBER OF RESPONSES

	APHASICS				CONTROLS			
	Auditory		Visual		Auditory		Visual	
	N	½	10	250	N	½	10	250
P	241	283	99	146	666	635	410	417
S	264	246	152	165	330	322	223	246
R	51	39	26	15	5	0	2	1
A	404	412	320	296	137	160	71	50
U	192	172	123	98	14	35	14	6

PERCENTAGE OF RESPONSES

P	21	25	14	20	58	55	57	58
S	23	21	21	23	29	28	31	34
R	4	3	4	2	0	0	0	0
A	35	36	44	41	12	14	10	7
U	17	15	17	14	1	3	2	1

TABLE IV

Test of proportions for significance of differences for speed of stimulus presentation (N = 10 phonemes per second, $\frac{1}{2}$ = 5 phonemes per second, 10 = 10 msec, 250 = 250 msec).

	z	p (one tailed)
APHASICS		
Auditory (N, $\frac{1}{2}$)	1.81	0.035
Visual (10, 250)	1.83	0.034
CONTROLS		
Auditory (N, $\frac{1}{2}$)	0.24	0.405
Visual (10, 250)	0.73	0.267

level, part of speech, word length, and frequency of occurrence in written English language usage), the existence of statistically significant relationships were tested only for paradigmatic word association responses, since these responses represent the type considered most appropriate for adults to produce.

Sub-problem 1

The first sub-problem was concerned with the hypothesis that words of a low abstraction level presented to aphasic subjects elicit more paradigmatic word association responses than do words of a medium or high level of abstraction.

To determine whether a statistically significant relationship existed between the presentation of words of different abstraction levels (high, medium, low) presented through the auditory and visual modalities, and the number of paradigmatic word association responses of aphasic and control subjects, the Treatments x Treatments x Subjects (Lindquist, 1953, pp. 237-238) analysis of variance was used. For each individual analysis in Sub-problems 1-4, the T x T x S design permitted a test of the interaction of each variable as well as tests of the main effects. Scores representing the number of paradigmatic responses for each subject were punched on computer cards using the Data Text (Armor and Couch, 1972) computer language, and were fed into a 370-168 IBM computer.

The percentages of the associates obtained from time-altered auditory and visual presentations of words, for levels of abstraction (high, medium, low) appear in Table V. For paradigmatic responses, the aphasic group behaved more consistently than the control group did. That is, for the aphasic subjects, the percentage of paradigmatic word association responses varied inversely with abstraction level. This pattern was not affected by speed of modality of stimulus presentation. For the control group, no clear pattern emerged. The order of abstraction level which corresponded to the order of greatest to least number of paradigmatic associates was low, high, and medium for words presented at 10 msec and 250 msec visually; medium, high, low for words presented auditorily at normal speed; medium, low, high for words presented auditorily at half speed. The main effect of abstraction, found in Table VI, is significant for words presented auditorily ($F = 4.592$, $df = 2$, $p < .02$) and visually ($F = 4.449$, $df = 2$, $p < .02$). In addition, the main effect of group type (aphasic, control) was highly significant for words presented auditorily ($F = 141.504$, $df = 1$, $p < .001$) and visually ($F = 91.100$, $df = 1$, $p < .001$) for this analysis and all subsequent analyses of variance.

Sub-problem 2

The second sub-problem was concerned with the

TABLE V

Total and mean percentage scores of paradigmatic word association responses by aphasic and control subjects to time-altered auditory and visual stimuli for levels of abstraction (high, medium, low).

APHASICS

	Auditory			Visual		
	N	½	$\bar{X}$	10	250	$\bar{X}$
L	23.7	27.3	25.5	18.3	24.6	21.45
M	20.1	25.5	22.8	12.1	21.3	26.7
H	19.0	20.8	19.9	10.8	15.0	12.9
$\bar{X}$	20.93	24.53		13.73	20.3	

CONTROLS

	Auditory			Visual		
	N	½	$\bar{X}$	10	250	$\bar{X}$
L	56.3	55.5	55.9	59.6	59.2	59.4
M	59.9	59.6	59.75	55.0	55.8	55.4
H	57.3	50.3	53.8	57.5	58.8	58.15
$\bar{X}$	57.83	55.13		57.37	57.93	

TABLE VI

Summary of analysis of variance of paradigmatic responses to words of low, medium and high abstraction.

ABSTRACTION LEVEL

Visual

Source	ss	df	ms	F	p
Groups	1411.348	1	1411.348	91.100	0.001
Subjects	588.710	38	15.492		
Speed	12.150	1	12.150	0.868	0.358
Grp x Spd	6.667	1	6.667	0.476	0.495
Spd x Ss	532.182	38	14.005		
Abstraction	18.033	2	9.017	4.449	0.015
Grp x Abstr	7.600	2	3.800	1.875	0.161
Abstr x Ss	154.032	76	2.027		
Spd x Abstr	0.700	2	0.350	0.204	0.500
Grp x Spd x Abstr	1.733	2	0.867	0.504	0.500
Spd x Abstr x Ss	130.566	76	1.718		

Auditory

Source	ss	df	ms	F	p
Groups	1587.077	1	1587.077	141.504	0.001
Subjects	684.160	61	11.216		
Speed	0.173	1	0.173	0.024	0.500
Grp x Spd	12.639	1	12.639	1.725	0.195
Spd x Ss	447.063	61	7.329		
Abstraction	20.746	2	10.373	4.592	0.012
Grp x Abstr	11.984	2	5.992	2.653	0.075
Abstr x Ss	275.580	122	2.259		
Spd x Abstr	8.385	2	4.192	1.605	0.206
Grp x Spd x Abstr	0.554	2	0.277	0.106	0.500
Spd x Abstr x Ss	318.661	122	2.612		

hypothesis that words which are classified as nouns when presented to aphasic subjects elicit the most paradigmatic word association responses, followed by verbs and adjectives.

In Table VII, the percentages of paradigmatic responses for parts of speech are displayed. The largest percentage of paradigmatic responses was produced for adjectives, followed closely by nouns, with responses to verbs clearly impoverished. Without exception, this pattern occurred for aphasic and control subjects, at normal speed and half speed auditorily, and at 10 msec and 250 msec visually. The main effect of part of speech, shown in Table VIII, is highly significant for words presented auditorily ($F = 8.523$, $df = 2$, $p < .001$) as well as visually ($F = 21.715$, $df = 2$, $p < .001$).

These findings replicate the results of an earlier investigation (Sefer and Henrickson, 1966) of word association responses of aphasic and control subjects. The largest number of homogeneous (paradigmatic) responses were produced for adjectives, followed by nouns, and, finally, verbs. This pattern was the same for both the aphasic and control groups in the Sefer and Henrickson study. That is, the pattern, according to part of speech, for aphasic and control subjects in both the Sefer and Henrickson study and the present study was exactly the same.

TABLE VII

Total and mean percentage scores of paradigmatic word association responses by aphasic and control subjects to time-altered auditory and visual stimuli for levels of part of speech (noun, verb, adjective).

APHASICS

	Auditory			Visual		
	N	½	$\bar{X}$	10	250	$\bar{X}$
N	22.1	27.3	24.7	16.7	18.8	17.75
V	13.8	16.7	15.25	7.5	16.3	11.9
A	26.8	29.7	28.25	17.7	25.8	21.75
$\bar{X}$	20.9	24.57		13.97	20.3	

CONTROLS

	Auditory			Visual		
	N	½	$\bar{X}$	10	250	$\bar{X}$
N	57.0	54.9	55.95	58.3	58.3	58.3
V	50.3	49.5	49.9	49.2	47.5	48.35
A	66.1	60.9	63.5	64.6	67.9	66.25
$\bar{X}$	57.8	55.1		57.37	57.9	

TABLE VIII

Summary of analysis of variance of paradigmatic responses to nouns, verbs, and adjectives.

PART OF SPEECH

Visual

Source	ss	df	ms	F	p
Groups	1411.348	1	1411.348	91.100	0.001
Subjects	588.710	38	15.492		
Speed	12.150	1	12.150	0.868	0.358
Grp x Spd	6.667	1	6.667	0.476	0.495
Spd x Ss	532.182	38	14.005		
Part of Speech	109.308	2	54.654	21.715	0.001
Grp x P of S	10.075	2	5.038	2.001	0.143
P of S x Ss	191.282	76	2.517		
Spd x P of S	2.775	2	1.387	0.561	0.500
Grp x Spd x P of S	3.308	2	1.654	0.669	0.500
Spd x P of S x Ss	187.916	76	2.473		

Auditory

Source	ss	df	ms	F	p
Groups	2067.398	1	2067.398	41.002	0.001
Subjects	3126.135	62	50.422		
Speed	43.336	1	43.336	0.995	0.323
Grp x Spd	5.273	1	5.273	0.121	0.500
Spd x Ss	2700.549	62	43.557		
Part of Speech	123.396	2	61.698	8.523	0.001
Grp x P of S	4.938	2	2.469	0.341	0.500
P of S x Ss	897.659	124	7.239		
Spd x P of S	22.563	2	11.281	1.417	0.247
Grp x Spd x P of S	15.250	2	7.625	0.957	0.387
Spd x P of S x Ss	987.514	124	7.964		

Sub-problem 3

The third sub-problem was concerned with the hypothesis that words which are short (one syllable and four or fewer letters) when presented to aphasic subjects elicit more paradigmatic word association responses than words which are long (two or more syllables and six or more letters).

Table IX indicates percentages of paradigmatic responses for words of different lengths. A greater percentage of paradigmatic responses generally followed presentation of long words than they did short words. The one exception occurred in the aphasic group, for words presented visually at 10 msec, where the per cent of paradigmatic associations to short words exceeded those of the long words. The main effect of word length, as shown in Table X, was highly significant for words presented through the auditory modality ($F = 45.548$, $df = 1$, $p < .001$) but not for words presented through the visual modality ($F = 1.917$, $df = 1$, $p = .175$).

A significant interaction ($F = 14.617$, $df = 1$, $p < .001$) of Group x Length indicates greater differences for length in the control group, when stimuli are presented through the auditory modality. For stimuli presented visually, the Group x Length interaction is not significant. A significant interaction ($F = 4.059$, $df = 1$, $p < .05$) of Speed x Length, for stimuli presented auditorily, indicates a greater percentage of paradigmatic responses produced

TABLE IX

Total and mean percentage scores of paradigmatic word association responses by aphasic and control subjects to time-altered auditory and visual stimuli for words of different lengths (long, short).

APHASICS

	Auditory			Visual		
	N	½	$\bar{X}$	10	250	$\bar{X}$
L	21.5	27.8	24.65	13.1	20.8	16.95
S	20.3	21.4	20.85	14.4	19.7	17.05
$\bar{X}$	20.9	24.6		13.75	20.25	

CONTROLS

	Auditory			Visual		
	N	½	$\bar{X}$	10	250	$\bar{X}$
L	63.7	63.0	63.35	58.6	60.3	59.45
S	51.9	47.2	49.55	55.3	55.6	55.45
$\bar{X}$	57.8	55.1		56.95	57.95	

TABLE X

Summary of analysis of variance of paradigmatic responses to words of different lengths (long, short).

WORD LENGTH

Visual

Source	ss	df	ms	F	p
Groups	2102.495	1	2102.495	91.898	0.001
Subjects	869.389	38	22.879		
Speed	19.600	1	19.600	0.935	0.340
Grp x Spd	9.025	1	9.025	0.430	0.500
Spd x Ss	796.875	38	20.970		
Length	5.625	1	5.625	1.917	0.175
Grp x Lth	6.400	1	6.400	2.182	0.148
Lth x Ss	111.475	38	2.934		
Spd x Lth	0.900	1	0.900	0.355	0.500
Grp x Spd x Lth	0.225	1	0.225	0.089	0.500
Spd x Lth x Ss	96.375	38	2.536		

Auditory

Source	ss	df	ms	F	p
Groups	2358.316	1	2358.316	139.229	0.001
Subjects	1050.180	62	16.938		
Speed	0.473	1	0.473	0.044	0.500
Grp x Spd	20.816	1	20.816	1.919	0.171
Spd x Ss	672.461	62	10.846		
Length	160.973	1	160.973	45.548	0.001
Grp x Lth	51.660	1	51.660	14.617	0.001
Lth x Ss	219.117	62	3.534		
Spd x Lth	10.973	1	10.973	4.059	0.049
Grp x Spd x Lth	0.191	1	0.191	0.071	0.500
Spd x Lth x Ss	167.586	62	2.703		

for long words when speed of stimulus presentation is expanded to half speed (5 phonemes per second). For stimuli presented visually, the Speed x Length interaction is not significant.

Sub-problem 4

The fourth sub-problem was concerned with the hypothesis that words occurring frequently in written English language usage, when presented to the aphasic subjects elicit more paradigmatic word association responses than infrequently occurring words.

The percentage of the paradigmatic word association responses of aphasic and control subjects to stimuli presented at different speeds through the auditory and visual modalities, for levels of frequency of occurrence, are shown in Table XI. The results suggest that frequent words result in a greater percentage of paradigmatic associates than do infrequent words. Aphasic and control subjects all reacted to the frequency of occurrence variable with the same pattern; that is, frequent words elicited more paradigmatic responses than infrequent. Furthermore, the results do not appear to be affected by speed of stimulus presentation, modality of presentation, or presence or absence of aphasia. The main effect for frequency of occurrence observed in analysis of variance is highly significant for words presented through the auditory ($F = 48.087$, $df = 1$, $p < .001$) as well as the

TABLE XI

Total and mean percentage scores of paradigmatic word association responses by aphasic and control subjects to time-altered auditory and visual stimuli for levels of frequency of occurrence in written English language usage (frequent, infrequent).

APHASICS

	Auditory			Visual		
	N	½	$\bar{X}$	10	250	$\bar{X}$
F	22.9	26.4	24.65	15.8	23.6	19.7
I	19.4	22.7	21.05	11.7	16.9	14.3
$\bar{X}$	21.15	24.55		13.75	20.25	

CONTROLS

	Auditory			Visual		
	N	½	$\bar{X}$	10	250	$\bar{X}$
F	63.0	61.1	62.05	60.0	60.8	60.4
I	52.6	49.1	50.85	53.9	55.0	54.45
$\bar{X}$	57.8	55.1		56.95	57.9	

visual ($F = 14.601$, $df = 1$, $p < .001$) modalities (Table XII).

A significant interaction ($F = 14.278$, $df = 1$, $p < .001$) of Group x Frequency indicates greater differences for frequency of occurrence in written English language usage in the control group, when stimuli are presented through the auditory modality. For stimuli presented visually the Group x Frequency interaction is not significant.

Sub-problem 5

The fifth sub-problem was concerned with the hypothesis that word association responses of aphasic subjects to word stimuli presented at faster speeds represent a reversal of the word association responses observed in normal language development, while word association responses of aphasic subjects to word stimuli presented at slower speeds do not. In normal language development young children supply predominantly syntagmatic (tall - boy) responses, while older children and adults respond predominantly with paradigmatic (tall - short) associations. A reversal (regression) hypothesis would predict responses of aphasic adults to be predominantly syntagmatic.

When visual processing time was increased from 10 msec to 250 msec, the number of paradigmatic vs. syntagmatic associates changed. At 10 msec, for every 100 syntagmatic associates, there were 67 which were

TABLE XII

Summary of analysis of variance of paradigmatic responses to words of different frequencies of occurrence in written English language usage (frequent, infrequent).

FREQUENCY OF OCCURRENCE

Visual

Source	ss	df	ms	F	p
Groups	2117.021	1	2117.021	91.097	0.001
Subjects	883.086	38	23.239		
Speed	18.225	1	18.225	0.868	0.358
Grp x Spd	10.000	1	10.000	0.476	0.495
Spd x Ss	798.275	38	21.007		
Frequency	42.025	1	42.025	14.601	0.001
Grp x Freq	0.100	1	0.100	0.035	0.500
Freq x Ss	109.375	38	2.878		
Spd x Freq	0.400	1	0.400	0.301	0.500
Grp x Spd x Freq	0.625	1	0.625	0.471	0.497
Spd x Freq x Ss	50.475	38	1.328		

Auditory

Source	ss	df	ms	F	p
Groups	2358.316	1	2358.316	139.229	0.001
Subjects	1050.180	62	16.938		
Speed	0.473	1	0.473	0.044	0.500
Grp x Spd	20.816	1	20.816	1.919	0.171
Spd x Ss	672.461	62	10.846		
Frequency	108.941	1	108.941	48.087	0.001
Grp x Freq	32.348	1	32.348	14.278	0.001
Freq x Ss	140.461	62	2.265		
Spd x Freq	0.660	1	0.660	0.227	0.500
Grp x Spd x Freq	0.098	1	0.098	0.034	0.500
Spd x Freq x Ss	179.992	62	2.903		

paradigmatic. At 250 msec, for every 100 syntagmatic associates, there were 87 which were paradigmatic. When auditory processing time was increased from normal to half speed, the number of paradigmatic vs. syntagmatic associates increased from 91 paradigmatic for every 100 syntagmatic to 119 for every 100.

Chapter 5

DISCUSSION, SUMMARY, CONCLUSIONS, RECOMMENDATIONS

Discussion

The present study addressed a concept of aphasia that is represented by two models: loss of language and reduction of efficiency of language comprehension and production. Within the framework of syntactic classification of word association responses, the loss hypothesis predicts that aphasic subjects provide fewer paradigmatic word association responses than do control subjects. In addition temporal manipulation of word stimuli should not affect the number of paradigmatic responses by aphasic subjects. According to the reduction of efficiency hypothesis, any variable which facilitates performance may increase "optimal" responding, defined as paradigmatic responses.

Had the present study considered responses to fast stimulus presentation (normal speed auditorily and 10 msec visually) only, the expansion of the regression theory (which is part of a loss hypothesis) would have apparently been supported since more syntagmatic than paradigmatic associates were produced (see Table III). Expanded stimulus presentation, however, offered other evidence. When visual processing time was increased from 10 msec to

250 msec, the relationship between paradigmatic and syntagmatic associates changed.

The results of expanded visual presentation suggest that processing time, rather than regression to an earlier form of memory organization, might account for the observed differences. Evidence to support the processing time theory is found in the results of associates to words presented through the auditory modality. When auditory processing time was increased from normal to half speed, the incidence of paradigmatic vs. syntagmatic associates increased substantially. At half speed auditorily, there were more paradigmatic than syntagmatic associates, which does not support the regression theory. However these results are compatible with a theory of reduction of efficiency in aphasia.

Under the conditions where aphasic subjects responded most efficiently (250 msec visually and half speed auditorily), they still produced significantly fewer paradigmatic associates than controls. These data may erroneously be interpreted as supporting the loss hypothesis. This interpretation is in error, since, under the conditions of expanded stimulus presentation, the patterns of responses of the aphasic group nearly matched those of the control group, albeit at a much lower level. That is, all scorable responses were lower for aphasic subjects, but the proportion of paradigmatic/syntagmatic was almost the same as for normals. The only defensible

conclusion that can be drawn is that the aphasic group is indeed aphasic; that is, they suffered an impairment in the ability to interpret and formulate language symbols.

A breakdown of responses by aphasic and control subjects according to a syntactic classification system appears in Table III. While the focus in the present study has been on paradigmatic and syntagmatic responses, the number of anomolous responses is too large to ignore. If paradigmatic and syntagmatic are collapsed into a single category of "scorable" responses, then the difference between the aphasic and control groups may be seen to lie in the relationship between anomolous and scorable responses. That is, the major difference in the comparison of the two groups may lie not in whether paradigmatic vs. syntagmatic associations are produced, but in whether or not anomolous responses are given. Viewed this way, however, there does not appear to be an effect of the speed of stimulus presentation variable. Nevertheless, a description of anomolous responses might motivate recommendations for future research.

Anomolous Responses

The fourth category in the classification system for word association responses used in the present study, anomolous responses, was not examined for statistical significance. The anomolous responses of the aphasic subjects, however, may be among the more interesting

descriptors of the quality of aphasic responses. The following breakdown of types of anomolous responses employs, as examples, actual responses of aphasic subjects. The word "appropriate" in the following discussion is intended to represent either paradigmatic or syntagmatic.

Phonetic ambiguity: The association is an appropriate response to a word which is phonetically similar to the stimulus word. An example is "woolen - to work", where the response presumably relates to a stimulus word of "willing".

Phonetic similarity: The association matches the sound structure of the stimulus word, either rhyming with it, as in "keep - sheep", rearranging the order of the sounds, as in "adorable - April", or repeating the initial portion of the word, as in "explore - explain".

Verbal perseveration: The association produced as an appropriate response to a previous word is repeated, or a previous stimulus word is repeated, as in "bald - hair" followed by "silent - hair", or "forget - lose" followed by "arrive - forget".

Idiosyncratic: The scorer has the impression that the response might be considered appropriate if the subject would be permitted to explain it, as in "hum - glass". In this example, the response would be appropriate if an intermediate association were supplied, as in "hum - sing - break glass".

Self-centered: The response is presumed to be related to some aspect of the subject's life, as in "central - gunner".

Unscorable: The response seems totally inexplicable, as in "ill - rings".

The findings for the variables tested in this investigation--abstraction level of words, parts of speech, word length, and frequency of occurrence in written English language usage--might provide a rationale for clinical treatment of the aphasic client.

Abstraction Level

In the present investigation the number of paradigmatic word association responses varied inversely with abstraction level. This finding appears to be an exclusively aphasic response, since no clear pattern of abstraction level preference was evident in the responses of the control group. The present study used some of the words in a list developed by Darley, et al. (1959).

Darley et al. instructed a group of people to scale a list of words, describing as an operational definition of abstraction, words with no clear referent and words which leave out details. Operational definitions of abstraction could also include references to the difficulty in understanding, emptiness, even theoretical nature of some abstract words. That these concepts are not easily accomodated in an operational definition is evident.

However the list of Darley, et al., in oversimplifying the concept of abstraction, might not be scaled with complete accuracy.

Parts of Speech

The parts of speech which correlated significantly with greatest to least number of paradigmatic associates were adjectives, nouns, and verbs, for aphasic as well as control subjects, regardless of speed or modality of presentation of stimuli. Since there are many more nouns than adjectives in the English language (Thorndike and Lorge, 1944), and more, presumably, stored in the mental dictionary, frequency of occurrence in the lexicon cannot be cited as an explanation for the observed pattern.

The author is at a loss to propose a rationale for the occurrence of the pattern for part of speech observed in the present study. In an earlier study examining word association and grammatical class in aphasia, the authors (Sefer and Henrickson, 1966) also observed that, for both aphasic and control groups, adjectives, nouns, and verbs, in that order, elicited the most through fewest paradigmatic (homogeneous) associations, but did not suggest an explanation for this finding.

Word Length

Both aphasic subjects and normal controls, in the present study, supplied more paradigmatic associates to long as opposed to short words. Although differences

were not significant for words presented visually, they were highly significant when words were presented through the auditory modality. The present findings are unexpected in view of previous studies dealing with word length.

A possible explanation for the greater number of paradigmatic responses to longer words lies in the additional cues found in words with more than one syllable. In many instances, one-syllable words contain a degree of phonetic ambiguity that poly-syllabic words do not. For example, one of the long words in the stimulus list, "celebrate", has a first syllable phonetically identical to the word "sell". Presented through the auditory modality with no contextual cues, the word "sell" might be processed as "tell", "shell", or "sill", to name a few possibilities. The additional syllables, or cues, in the longer word "celebrate" would serve to make it less ambiguous, since the listener, hearing such combinations as "tellebrate" or "shellebrate", would realize they were nonsense words, and re-process them. The extra parts of the word, then, help the listener determine what the word really is. The exception occurred in the responses of some subjects to the word "cabbage". The occasional association of "sanitation" would suggest that the word processed was "garbage", which is phonetically similar to the stimulus word. However such apparent phonetic ambiguity was not evident in almost all the other long

words used in this study.

Frequency of Occurrence

In the present study, frequent words resulted in a greater number of paradigmatic associates than did infrequent words for both aphasic and control subjects, regardless of speed or modality of stimulus presentation. It may be that frequent words are closer to the automatic level of speech, which includes counting aloud, reciting the letters of the alphabet, or using profanities. Infrequent words might require more activity in the language centers of the brain, and would more likely be affected in aphasia.

In summary, the present study examined four aspects of word stimuli in a 72-word list. For three of the stimulus variables discussed (part of speech, word length, frequency of occurrence) the pattern of responses between aphasic and control subjects was similar. For the fourth variable (abstraction level), where the pattern of responses differed, there was some doubt concerning proper scaling of the levels of the variable. The similarity (rather than the dissimilarity) of the language behavior of aphasic and normal adults has been an important element of discussion of aphasia from Freud (1891) to Schuell (Schuell, et al., 1964; Sies, 1974). The additional support for this notion from the results of the present study strengthens the reduction of efficiency model of aphasia. Aphasic subjects

may be seen to respond with the same general pattern as control subjects, but at a lower level, or with reduced efficiency. In addition, aphasic subjects supplied more paradigmatic word association responses to concrete rather than abstract words, and to frequent rather than infrequent words, suggesting more effective responding when less efficiency is required in comprehension.

Clinical Implications

Extracting clinical techniques for the treatment of aphasia in adults, based on the results of this study, should be done with great care, since only a small part of the complex phenomenon of aphasia was addressed. The author hastens to add that, in his own clinical practice, single word stimuli are seldom employed in therapeusis for the aphasic adult. Single word stimuli are occasionally used in the treatment of aphasia, and somewhat more frequently in the assessment of aphasia. The following discussion suggests the types of words to be used, and conditions under which these words might be presented.

Based on the present, as well as previous findings on abstraction level of words, clinical treatment for aphasic adults might be programmed to present concrete word stimuli before words of medium and high abstraction levels are used. The difficulty of such a recommendation is the possibility, previously discussed, that the list of stimulus words might not have included all the nuances

of abstraction.

The order of preference (i. e., more paradigmatic responses) for part of speech among aphasic subjects and normal controls, was adjective, noun, verb. In normal language usage, adjectives do not exist without the presence of an implied or stated noun. Indeed, it is impossible to construct a picture stimulus of an adjective in isolation. However presenting two or more pictures differing only in a single attribute (e. g., a red circle and blue circle of the same size) can effectively isolate the adjective. The problems which relate to presentation of adjectives may be extended to the ineffectuality of making language judgments based on the single word. Therefore the clinical implications of any of the stimulus variables of the single word (abstraction level, part of speech, word length, and frequency of occurrence) must be made with reservations. In the case of part of speech, where experimental findings have not been conclusive, the present author does not find clinical implications to be motivated by research.

The clinical value of the research on the effect of word length on aphasic linguistic performance seems unclear. Where highly controlled responses are required, such as in visual discrimination, short words should facilitate a successful performance. However where more spontaneous or freer responses are involved, as in word associations or supplying definitions of words, poly-

syllabic words might prove more effective in eliciting an appropriate response than one-syllable words.

Clinical treatment, based on the findings for the variable of frequency of occurrence, might focus initially on the more frequent words. Frequency of occurrence of words used by an individual aphasic adult will vary from client to client, based on his premorbid occupation and interests, as well as on his current lifestyle.

In both the auditory and visual modalities, the optimal duration of stimulus presentation for maximum aphasic comprehension has not been determined. Further research in this area is warranted and encouraged.

Summary

In the present investigation the following question was addressed: Should the language impairment in aphasia be accounted for by a loss or by a reduction of efficiency model of aphasia? Specifically, the purpose of this study was to determine whether a relationship existed between the speed of presentation of stimulus variables through the auditory and visual modalities and the number of paradigmatic and syntagmatic word association responses of aphasic and control subjects. The basic hypotheses under investigation were: (1) that aphasic subjects supply a greater number of paradigmatic word association responses to word stimuli presented at slower, rather than faster speeds; (2) that control subjects are not affected, in

their production of paradigmatic and syntagmatic word association responses, when word stimuli are presented at different speeds; (3) that a low abstraction level of words presented to the aphasic subjects elicits more paradigmatic word association responses than does a medium or high abstraction level of words; (4) that words which are classified as adjectives when presented to aphasic subjects elicit the most paradigmatic word association responses, followed by nouns and verbs; (5) that words which are short (one syllable and four or fewer letters) when presented to aphasic subjects elicit more paradigmatic word association responses than words which are long (two or more syllables and six or more letters); (6) that words occurring frequently in written English language usage elicit more paradigmatic word association responses than infrequently occurring words; (7) that word association responses of aphasic subjects to word stimuli presented at faster speeds represent a reversal of word association responses observed in normal language development, and word association responses of aphasic subjects to word stimuli presented at slower speeds do not.

A word association test was administered to a group of aphasic adults and to a control group of normal adults equivalent in age, sex, education, and socio-economic level to the aphasic subjects. Each of the two stimulus lists used consisted of 36 words balanced according

to frequency of occurrence in written English language usage (frequent, infrequent), word length (short, long), abstraction level (low, medium, high), and parts of speech (noun, verb, adjective). Thirty-two aphasic subjects and the same number of controls responded to words presented auditorily at normal speed (equivalent to 10 phonemes per second) and at half speed (equivalent to 5 phonemes per second) speech. Twenty aphasic subjects and twenty controls supplied association responses to words presented visually at fixation speed (equivalent to 250 msec) and at sweep speed (equivalent to 10 msec).

Word association responses of all subjects were recorded in written form by the examiner. They were scored as (1) paradigmatic: words belonging to the same grammatical class (tall - short); (2) syntagmatic: words belonging to different grammatical classes or a grammatical continuation (tall - boy); (3) repetition: repeating the stimulus word, or the stimulus word ± a prefix or suffix (tall - taller); (4) anomolous: a candidate for a paradigmatic or syntagmatic response, but one which seems inappropriate or bizarre; (5) unclassifiable: a long phrase, jargon, or no response. The judges who scored the responses were three certified speech and language pathologists. As paradigmatic responses were the type most likely to be produced by normal adults in a word association test, statistical analysis considered the number of paradigmatic associations produced by aphasic and control

subjects in the experimental conditions.

For both auditory and visual presentation of stimuli, the aphasic and control groups demonstrated different speed preferences. Regardless of modality, when stimuli were presented at a slower speed, the aphasic adults produced significantly more paradigmatic responses. There were no differences in the number of paradigmatic responses produced by the control group resulting from temporal manipulation of auditory or visual stimuli.

The variable of speed of stimulus presentation, which revealed significant differences for the aphasic subjects supported the reduction of efficiency model of aphasia. Aphasic subjects were more efficient in their production of paradigmatic responses when given more processing time.

The number of paradigmatic responses to the word association test produced in relation to levels of abstraction, frequency of occurrence, word length, and part of speech were also analyzed. Presentation of frequent words resulted in more paradigmatic associates than presentation of infrequent words, regardless of speed or modality of stimulus presentation, or existence of aphasic impairment. Regarding word length, long words resulted in more paradigmatic responses than short words, when they were presented auditorily. Word length did not result in a significant difference, in terms of the number of paradigmatic

responses produced, when words were presented visually. For the aphasic group, the number of paradigmatic associates varied inversely with abstraction level. That is, regardless of speed or modality of stimulus presentation, more paradigmatic word association responses followed presentation of concrete rather than the more abstract words. No clear pattern emerged from the control group regarding abstraction level. Finally the order of greatest to least number of paradigmatic associates for part of speech was adjectives, nouns, and verbs. This pattern was observed in both aphasic and control populations, at normal speed and half speed auditorily, and at 10 msec and 250 msec visually.

Results of the single word variables (abstraction level, part of speech, word length, frequency of occurrence) also supported the reduction of efficiency model of aphasia. Except for the abstraction level variable, the pattern of responses of the aphasic group was similar to that of the control group, but at a lower, or less efficient, level. Increased production of paradigmatic responses, by the aphasic group, to word stimuli which were concrete and frequent suggested improved performance when less efficiency in comprehension was required.

Conclusions

In determining whether a significant relationship existed between the presentation of words at different

speeds through the auditory and visual modalities and the number of paradigmatic and syntagmatic word association responses of aphasic and control subjects, the data supported the first basic hypothesis (that aphasic subjects supply a greater number of paradigmatic word association responses to word stimuli presented at slower, rather than faster speeds) and led to the conclusions that:

1. Word stimuli, when presented to the aphasic subject auditorily at half speed (5 phonemes per second), elicited significantly more paradigmatic word association responses than equivalent word stimuli presented to the aphasic subject auditorily at normal speed (10 phonemes per second).

2. Word stimuli, when presented to the aphasic subject visually at fixation speed (250 msec), elicited significantly more paradigmatic word association responses than equivalent word stimuli presented to the aphasic subject visually at sweep speed (10 msec).

The data supported the second basic hypothesis (that control subjects are not affected, in their production of paradigmatic word association responses, when word stimuli are presented at different speeds), and led to the conclusions that:

1. Word stimuli, when presented to the nonaphasic subject auditorily at normal speed, did not elicit significantly more paradigmatic word association responses

than equivalent word stimuli presented to the nonaphasic subject auditorily at half speed.

2. Word stimuli, when presented to the nonaphasic subject visually at fixation speed, did not elicit significantly more paradigmatic word association responses than equivalent word stimuli presented to the nonaphasic subject visually at sweep speed.

In determining whether a significant relationship existed between the presentation of words of different abstraction levels at different speeds and the number of paradigmatic word association responses of aphasic and control subjects, the data supported the third basic hypothesis (that a low level of abstraction of words presented to aphasic subjects elicits more paradigmatic word association responses than does a medium or high level of abstraction of words), and led to the conclusions that:

1. The number of paradigmatic word association responses of aphasic subjects varied inversely, in a significant manner, with the abstraction level of stimulus words. Words of low level of abstraction elicited significantly more paradigmatic word association responses than words of medium or high abstraction level. This pattern was not affected by speed or modality of stimulus presentation.

2. The number of paradigmatic word association responses of nonaphasic subjects was not related to the

abstraction level of stimulus words.

In determining whether a significant relationship existed between the presentation of words of different parts of speech at different speeds and the number of paradigmatic word association responses of aphasic and control subjects, the data supported the fourth basic hypothesis (that words which are classified as adjectives when presented to aphasic subjects elicit the most paradigmatic word association responses, followed by nouns and verbs), and led to the conclusions that:

1. Adjectives, nouns, and verbs, in that order, when presented to aphasic subjects elicited a significant pattern of most to least paradigmatic word association responses. This pattern was not affected by speed or modality of stimulus presentation.

2. The same pattern observed in the group of aphasic subjects was also significant for nonaphasic subjects.

In determining whether a significant relationship existed between the presentation of words of different lengths at different speeds and the number of paradigmatic word association responses of aphasic and control subjects, the data did not support the fifth basic hypothesis (that words which are short when presented to aphasic subjects elicit more paradigmatic word association responses than words which are long), and led to the conclusions that:

1. The number of paradigmatic word association

responses of aphasic subjects was not related to the length of stimulus words introduced through the visual modality, regardless of speed of stimulus presentation.

2. The number of paradigmatic word association responses of nonaphasic subjects was not related to the length of stimulus words introduced through the visual modality, regardless of speed of stimulus presentation.

3. Significantly more paradigmatic word associations were produced by aphasic and nonaphasic subjects, in response to auditory presentation of long words, than in response to short words. This preference for long words occurred significantly more frequently with nonaphasic than aphasic subjects, and when word stimuli were presented at half speed, rather than at normal speed.

In determining whether a significant relationship existed between the presentation of words of different frequencies of occurrence in written English language usage at different speeds and the number of paradigmatic word association responses of aphasic and control subjects, the data supported the sixth basic hypothesis (that words occurring frequently in written English language usage when presented to aphasic subjects elicit more paradigmatic word association responses than infrequently occurring words), and led to the conclusions that:

1. Frequent words elicited in both experimental groups (aphasic and nonaphasic) more paradigmatic word associations

than did infrequent words, when stimuli were introduced through the auditory modality at normal and half speeds. A significantly greater difference resulted from presentation of stimuli to the nonaphasic, as opposed to the aphasic group of subjects.

2. Both experimental groups produced more paradigmatic word association responses following presentation of frequent words than infrequent words, when stimuli were introduced through the visual modality at fixation and sweep speeds.

In determining whether the word association responses of the aphasic subjects to word stimuli presented at different speeds represents a reversal of the type of word association responses observed in normal language development the data supported the seventh basic hypothesis (that word association responses of aphasic subjects to word stimuli presented at faster speeds represent a reversal of word association responses observed in normal language development, and responses to word stimuli presented at slower speeds do not), and led to the conclusion that the word association responses of aphasic adults do not represent a reversal, or regression, to the the types of word association responses observed in young children, when word stimuli are presented at slower speeds. In fact, not only the regression theory, but the entire loss hypothesis as it applies to word association

is falsified by the results of the present study. Under conditions of expanded speeds of stimulus presentation the pattern of responses of aphasic subjects nearly paralleled, at a reduced level, that of the control group. There was similarity, with reduced efficiency, for three of the four variables associated with the word stimuli (part of speech, word length, frequency of occurrence). That is, for almost all the variables tested in the present study, the aphasic subjects behaved as language-impaired adults, and not at all as normal young children.

Recommendations

In statistical analysis, significant interactions involving speed should have been observed in the present study. The absence of significant interactions in many of the analyses of variance may be the result of the wide variation of responses by the aphasic group, which ranged in severity of impairment from mild to moderate. In replication of this study, either limiting the severity of impairment in the experimental population or testing many more mildly to moderately impaired aphasic adults might compensate for the variation of responses observed in the present study.

Future research employing the word list used in the present study is recommended contingent upon independent verification of the reportedly proper scaling of the abstraction level variable. Such research might

include the following:

1. A representative body of normative data, analyzing responses of large numbers of nonaphasic subjects to words in the stimulus lists used in this investigation, might serve as a norm or standard against which to base the word association responses of aphasic adults and others.

2. Since the shift from syntagmatic to paradigmatic word association responses occurs between the ages of six and eight years, it is recommended that the present study by replicated with a population of five-year-old children.

3. Analyses not performed in the present investigation, including a comparison of phonetic similarity between word association responses and their stimuli, as well as an evaluation of anomolous responses, are recommended.

Recommendations for research, where the word list is not employed, might include the following:

4. The duration of stimulus presentation, through the auditory and visual modalities, sufficient to elicit optimal performance by aphasic adults on a variety of language tasks, should be determined.

5. Because of some of the weaknesses observed in the current syntactic classification system for word association responses, there should be further investigation in how to categorize and analyze the associative responses of aphasic adults.

APPENDIX A

TABLE XIII

Instructions for scoring the word association responses of aphasic and control subjects

Assign #1 for

PARADIGMATIC response: words belonging to the same grammatical class (e. g., light - dark).

Assign #2 for

SYNTAGMATIC response: words belonging to different grammatical classes, or a grammatical continuation (e. g., light - bulb, up - stairs).

Assign #3 for

REPETITION response: stimulus word ± prefix or suffix (e. g., happiest - happy); negative + stimulus word (loud - not loud); degree + stimulus word (deaf - very deaf, wonderful - pretty wonderful); or repetition of the stimulus word.

Assign #4 for

ANOMOLOUS response: a candidate for a paradigmatic or syntagmatic response, but one which seems inappropriate or bizarre.

Assign #5 for

UNCLASSIFIABLE response: a long phrase, jargon, or no response.

APPENDIX B

TABLE XIV

Pseudo-random ordering of the stimulus words in the Pre-Test

PRE-TEST

1. flat
2. am
3. healthy
4. grab
5. balloon
6. fun
7. greasy
8. dad
9. admire
10. nothing

TABLE XV

Pseudo-random ordering of the stimulus words in the word association test

	LIST A		LIST B
1.	glee	1.	goal
2.	let	2.	try
3.	woolen	3.	chilly
4.	prepare	4.	arrange
5.	bake	5.	hum
6.	mid	6.	slim
7.	forget	7.	understand
8.	keep	8.	join
9.	brownie	9.	helper
10.	happiest	10.	wonderful
11.	sick	11.	ill
12.	tore	12.	gape
13.	adorable	13.	dreadful
14.	arrive	14.	tremble
15.	jump	15.	pour
16.	gap	16.	zone
17.	explore	17.	celebrate
18.	dollar	18.	children
19.	art	19.	joy
20.	behave	20.	disappoint
21.	bald	21.	deaf
22.	silent	22.	southern
23.	country	23.	family
24.	tub	24.	oat
25.	fail	25.	heal
26.	central	26.	several
27.	tall	27.	loud
28.	heaven	28.	problem
29.	cute	29.	pert
30.	news	30.	game
31.	goblin	31.	scholar
32.	saluted	32.	awaken
33.	mile	33.	cat
34.	banana	34.	cabbage
35.	rotten	35.	selfish
36.	mere	36.	nice

APPENDIX C

TABLE XVI

The ten words used in the Pre-Test in this study classified according to their word length.

flat	S
am	S
healthy	L
grab	S
balloon	L
fun	S
greasy	L
dad	S
admire	L
nothing	L

L - "Long" words were designated as containing two or more syllables and six or more letters.

S - "Short" words were designated as containing one syllable and four or fewer letters.

TABLE XVII

The ten words used in the Pre-Test in this study with their median scale values as obtained from the Darley, Sherman, Siegel (1959) word list which were scaled according to their abstraction level.

flat	2.04
am	4.12
healthy	3.18
grab	1.63
balloon	0.79
fun	3.82
greasy	1.62
dad	1.34
admire	3.32
nothing	3.18

Following the procedure employed by Halpern (1965a, b):

Words falling between the median scale values of 2.89 and 4.50 were designated as the high abstraction level.

Words falling between the median scale values of 2.16 and 2.67 were designated as the medium abstraction level.

Words falling between the median scale values of 0.50 and 2.10 were designated as the low abstraction level.

TABLE XVIII

The ten words used in the Pre-Test in this study classified according to their part of speech (nouns, verbs, adjectives).

Nouns	Verbs	Adjectives
balloon	am	flat
fun	grab	healthy
dad	admire	greasy
nothing		

TABLE XIX

The ten words used in the Pre-Test in this study classified according to their frequency of occurrence in written English language usage as ascertained from the Thorndike and Lorge (1944) word list.

flat	A
am	AA
healthy	27
grab	18
balloon	17
fun	A
greasy	4
dad	41
admire	A
nothing	AA

"Frequent" level:
AA - 1st thousand for frequency (100 occurrences or over per million words)
A - 2nd thousand for frequency (50 occurrences or over per million words)

"Infrequent" level:
30-49 3rd thousand for frequency
(30-49 occurrences per million words)
19-29 4th thousand for frequency
(19-29 occurrences per million words)
14-18 5th thousand for frequency
(14-18 occurrences per million words)
10-13 6th thousand for frequency
(10-13 occurrences per million words)
8- 9 7th thousand for frequency
(8- 9 occurrences per million words)
1- 7 8th thousand or over for frequency
(1- 7 occurrences per million words)

TABLE XX

The seventy-two words used in this study classified according to their word length. Criteria for scoring are indicated in Table XVI (p. 100).

goblin	L	behave	L	adorable	L
scholar	L	disappoint	L	dreadful	L
heaven	L	forget	L	happiest	L
problem	L	understand	L	wonderful	L
glee	S	fail	S	cute	S
goal	S	heal	S	pert	S
art	S	let	S	mere	S
joy	S	try	S	nice	S
brownie	L	explore	L	rotten	L
helper	L	celebrate	L	selfish	L
country	L	prepare	L	central	L
family	L	arrange	L	several	L
gap	S	tore	S	mid	S
zone	S	gape	S	slim	S
news	S	keep	S	tall	S
game	S	join	S	loud	S
banana	L	saluted	L	woolen	L
cabbage	L	awaken	L	chilly	L
dollar	L	arrive	L	silent	L
children	L	tremble	L	southern	L
tub	S	bake	S	bald	S
oat	S	hum	S	deaf	S
mile	S	jump	S	sick	S
cat	S	pour	S	ill	S

TABLE XXI

The seventy-two words used in this study classified according to abstraction level. Criteria for scoring are indicated in Table XVII (p. 101).

		High			
goblin	3.28	behave	3.62	adorable	3.70
scholar	3.10	disappoint	3.21	dreadful	3.70
heaven	4.12	forget	3.20	happiest	4.08
problem	3.39	understand	4.02	wonderful	4.07
glee	3.20	fail	3.23	cute	3.62
goal	3.50	heal	2.89	pert	3.50
art	4.17	let	2.96	mere	3.94
joy	3.47	try	3.10	nice	3.82
		Medium			
brownie	2.39	explore	2.50	rotten	2.50
helper	2.16	celebrate	2.67	selfish	2.46
country	2.57	prepare	2.63	central	2.42
family	2.47	arrange	2.62	several	2.61
gap	2.46	tore	2.32	mid	2.54
zone	2.67	gape	2.57	slim	2.50
news	2.61	keep	2.41	tall	2.53
game	2.44	join	2.14	loud	2.65
		Low			
banana	0.58	saluted	1.41	woolen	1.35
cabbage	0.56	awaken	1.55	chilly	1.36
dollar	0.97	arrive	2.04	silent	2.10
children	1.41	tremble	1.96	southern	2.04
tub	0.97	bake	1.59	bald	1.37
oat	0.87	hum	1.38	deaf	1.47
mile	0.72	jump	1.21	sick	1.52
cat	0.60	pour	1.41	ill	1.68

TABLE XXII

The seventy-two words used in this study classified according to their part of speech (noun, verb, adjective).

Nouns	Verbs	Adjectives
goblin	behave	adorable
scholar	disappoint	dreadful
heaven	forget	happiest
problem	understand	wonderful
glee	fail	cute
goal	heal	pert
art	let	mere
joy	try	nice
brownie	explore	rotten
helper	celebrate	selfish
country	prepare	central
family	arrange	several
gap	tore	mid
zone	gape	slim
news	keep	tall
game	join	loud
banana	saluted	woolen
cabbage	awaken	chilly
dollar	arrive	silent
children	tremble	southern
tub	bake	bald
oat	hum	deaf
mile	jump	sick
cat	pour	ill

TABLE XXIII

The seventy-two words used in this study classified according to their frequency of occurrence in written English language usage. Criteria for scoring are indicated in Table XIX (p. 108).

goblin	14	behave	22	adorable	3
scholar	20	disappoint	28	dreadful	43
heaven	AA	forget	AA	happiest	AA
problem	AA	understand	AA	wonderful	AA
glee	9	fail	23	cute	5
goal	21	heal	27	pert	2
art	AA	let	AA	mere	A
joy	AA	try	AA	nice	AA
brownie	6	explore	19	rotten	14
helper	12	celebrate	22	selfish	20
country	AA	prepare	AA	central	A
family	AA	arrange	A	several	AA
gap	17	tore	24	mid	11
zone	26	gape	7	slim	14
news	AA	keep	AA	tall	AA
game	AA	join	AA	loud	A
banana	13	saluted	22	woolen	11
cabbage	16	awaken	28	chilly	6
dollar	AA	arrive	AA	silent	A
children	AA	tremble	A	southern	A
tub	16	bake	38	bald	9
oat	23	hum	20	deaf	19
mile	AA	jump	A	sick	AA
cat	A	pour	A	ill	AA

APPENDIX D

TABLE XXIV

Typical score sheet used for recording responses of aphasic and control subjects. The control group did not respond to the Pre-Test, nor were the data for etiology or time post onset considered for this group.

Name _____ Age ___ Sex __
Educational Level _____ Etiology _____
Time Post Onset ____ Modality (Aud., Vis.) _____

Pre-Test	List A (Speed)	List B (Speed)
1. flat	1. glee	1. goal
2. am	2. let	2. try
3. healthy	3. woolen	3. chilly
4. grab	4. prepare	4. arrange
5. balloon	5. bake	5. hum
6. fun	6. mid	6. slim
7. greasy	7. forget	7. understand
8. dad	8. keep	8. join
9. admire	9. brownie	9. helper
10. nothing	10. happiest	10. wonderful
	11. sick	11. ill
	12. tore	12. gape
	13. adorable	13. dreadful
	14. arrive	14. tremble
	15. jump	15. pour
	16. gap	16. zone
	17. explore	17. celebrate
	18. dollar	18. children
	19. art	19. joy
	20. behave	20. disappoint
	21. bald	21. deaf
	22. silent	22. southern
	23. country	23. family
	24. tub	24. oat
	25. fail	25. heal
	26. central	26. several
	27. tall	27. loud
	28. heaven	28. problem
	29. cute	29. pert
	30. news	30. game
	31. goblin	31. scholar
	32. saluted	32. awaken
	33. mile	33. cat
	34. banana	34. cabbage
	35. rotten	35. selfish
	36. mere	36. nice

APPENDIX E

TABLE XXV

Examples of indisputable and debatable responses in each category of classification for aphasic and control subjects. The stimulus word appears first in each word pair.

APHASIC SUBJECTS

	Indisputable	Debatable
Paradigmatic	cute-ugly	heaven-out of town
Syntagmatic	tremble-cold	cute-playboy
Repetition	awaken-wake	joy-nonjoy
Anomolous	scholar-sky	tub-often
Unclassifiable	No response, a long phrase, or jargon	No examples

CONTROL SUBJECTS

	Indisputable	Debatable
Paradigmatic	country-U.S.A.	helper-assister
Syntagmatic	woolen-clothing	rotten-Denmark
Repetition	happiest-happy	brownie-brownish
Anomolous	let-yes	happiest-joyest
Unclassifiable	No response, or a long phrase	No examples

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