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THE LOCATION OF STUTTERING IN THE SPONTANEOUS  
SPEECH OF YOUNG CHILD STUTTERERS: A SYNTACTIC  
AND ARTICULATORY ANALYSIS

by

MERYL JOHNSON WALL

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1977

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## CHAPTER I

### STATEMENT OF THE PROBLEM

This is a thesis which will attempt to describe where in the spontaneous speech of young children stuttering occurs, in reference to (1) the syntactic structure of a sentence, and (2) the voicing feature of articulation.

Stuttering has, to date, defied satisfactory definition. Van Riper states that "a stuttering behavior consists of a word improperly patterned in time and the speakers' reaction thereto" (Van Riper, 1971, p. 15), while Bloodstein defines stuttering as "whatever is perceived as stuttering by a reliable observer who has relatively good agreement with others". (Bloodstein, 1975, p. 9.)

Though stuttering is difficult to define, it has been well described and documented with regard to advanced stutterers (Van Riper, 1971). Stuttering in young children is more resistant to definition, and more resistant to description. This difficulty appears to be partly attributable to an indistinct relationship which may exist between early stuttering and the normal non-fluencies of early childhood speech. Johnson (1959) adhered to the viewpoint that young stutterers were normally nonfluent speakers, who became "stutterers" when diagnosed as such by an adult in the

immediate environment. Bloodstein, Alper and Zisk (1965) put the possible relationship between stuttering and normal non-fluencies into a different perspective. They proposed that there are non-fluencies, or disfluencies, in the speech of nearly all young children, which are early prototypes of stuttering behavior, and which will develop into stuttering in a few cases. "On the basis of present knowledge it would appear that among the most notable of primitive stutterings of normal children are syllable and word repetitions, and prolongations of sound. (Bloodstein et al., 1976, p. 52.)

Van Riper points out however, that many researchers accept stuttering as an entity in young children, as distinct from normal non-fluencies. He outlines diagnostic criteria for early stuttering which include an excessive amount of repetitive speech, primarily of repeated syllables, and prolongations of silent articulatory postures (blockages) or of voiced sounds. (Van Riper, 1971.) Given that stuttering may be defined in this way in young children, it may be illuminating to study it before developmental changes take place.

The lack of agreement of definitive aspects of stuttering complicates research and has provoked many attempts to specify characteristics of the condition. Some investigators interested in stuttering have focused on why the stutterer's

speech is likely to break down at particular points in his utterance. These investigators have measured the amount of stuttering on content words (nouns, verbs, adjectives, adverbs) versus function words such as prepositions, conjunctions, articles, pronouns (Brown, 1937; Hejna, 1955; Quarrington, Conway and Siegel, 1962; Taylor, 1966b; Soderberg, 1967); propositional speech versus non-propositional speech (Eisen-son and Horowitz, 1945; Conway and Quarrington, 1963); the initial sounds of stuttered words (Johnson and Brown, 1935; Fairbanks, 1937; Hahn, 1942; Quarrington et al., 1962; Taylor, 1966b; Hejna, 1955); and the position of stuttered words in sentences (Brown, 1938; Hejna, 1955; Conway and Quarrington, 1963; Taylor, 1966; Hannah and Gardner, 1968). This research has contributed much information on where fluency breaks down in the sentences of stutterers. It has, however, been carried out primarily on adult stutterers. Stuttering frequently changes as the stutterer matures (Van Riper, 1971; Bloodstein, 1975), and information on the location of stuttering in the young child is lacking.

This proposed research will explore the location of stuttering in the spontaneous speech of young children. Spontaneous speech is selected, not because young children have difficulty reading, but because our interest is in

where the child's fluency breaks down in self-generated sentences, rather than sentences that have been generated by someone else. In addition, the stuttering of young children is newly developed and may give information about the origin of the condition.

Most "loci" studies have examined the words or sounds that provoke stuttering. Syntactic structure and its possible relevance to stuttering have received somewhat less attention (Hannah and Gardner, 1968; Bloodstein, 1974; Wells, 1976; Tornick and Bloodstein, 1976). Psycholinguistic studies indicate that sentence perception and production are in large part dependent on the constituent structure of sentences. "Constituent structure" refers to words which are naturally grouped together in a sentence, the word groups representing grammatical relationships. Clauses and phrases are considered to be major constituents of sentences, and may be defined through a surface structure analysis. This type of analysis has been documented by Fromkin and Rodman (1974), Bach (1974), Fodor et al. (1974) and Akmajian and Heny (1975). The influence of constituent structure on the perception of sentences was demonstrated in a number of ways, for example, by Fodor and Bever (1965) in studies carried out within the "click" paradigm. The "click" refers to noise placed in recorded

sentences that were used in a sentence processing task. Bever, Garrett and Hurtig (1973) and Fodor, Bever and Garrett (1974) developed the click research further and specified the clause as the primary unit in sentence processing.

In the spontaneous speech production of normal speakers, hesitation phenomena have been related to constituent structure by Maclay and Osgood (1959), Martin (1971), Clarke (1971) and Boomer (1965). Boomer viewed the clause as the unit of sentence planning. He suggested that a speaker uses hesitations at or near the onset of a clause, because the speaker is involved in the cognitive process of planning at that point.

Johnson (1965) and Suci (1967) support the findings on the relationship of constituent structure to speech production in their experimental investigations. Johnson found a hierarchy (subject-predicate, verb-object breaks) of within-clause influence on speech production, when word errors were counted in a task of sentence recall.

Sentence complexity in sentence processing may be relevant to studies of the loci of stuttering. Bach, referring to one measure of sentence complexity, the amount of embedding in sentences, states that it "plays an obvious role in the

difficulties of comprehension as well as expression". (Bach, 1974, p. 53.) Tornick and Bloodstein (1976) examined stuttering at the onsets of short and long sentences that were read orally by adult stutterers. They found significantly more stuttering at the onsets of longer sentences, which were often complex sentences. The authors point out that stuttering on the longer sentences was equally distributed between the onset and the remainder of the sentence, but do not comment on whether the onset of the second clause in the sentence precipitated the remainder of the stuttering. They note that "We evidently need to learn more about the reaction of stuttering to clauses within compound sentences, as well as to other aspects of syntactic structure". (Tornick and Bloodstein, 1976, p. 653.)

Studies that have related sentence perception and production to the constituent structure of sentences seem applicable to attempts to define the location of stuttering in sentences. If the stutterer's fluency breaks down at points which are crucial to normal speech perception and production, a relationship between stuttering and sentence organization may be implied. Bloodstein (1974) has suggested that this is the case. The fact that complex sentences are more difficult to process and produce than simple sentences

suggests the possibility that stutterers may stutter more frequently on complex sentences. Wells (1976) has noted that stutterers stutter more on complex sentences which have two relative clauses or more, as opposed to those which have one relative clause. Wells' use of relative clauses raises the question of clause type and its possible influence on stuttering. The only other study pertinent to this is one by Hannah and Gardner (1968) who reported more stuttering at the onset of "post-verbal" clauses than on most other parameters they investigated. Stuttering and its occurrence at clause and phrase boundaries, in complex sentences, and according to clause type, has not been evaluated systematically in children or adults to date.

In studies of stuttering and articulation, investigators have studied the frequency of stuttering on words that begin with consonants and words that begin with vowels. Stuttering was found to occur more on consonants than vowels (Brown, 1938; Hahn, 1942; Quarrington et al., 1962; Taylor, 1966b). Adams and Reis (1971, 1974) suggest a further method of examining stuttering and articulation. They examined the off/on voicing adjustment of articulation and its relationship to stuttering during oral reading, and found more stuttering on sounds where a voicing adjustment was required than otherwise. The off/on voicing effect on stuttering was more

notable in the first study than in the second. Adams and Reis' subjects were adults, but the experimental procedure may be adapted for use with children. The findings appear to be particularly meaningful in view of the aberrations of vocal cord activity during stuttering found by Freeman (1975) in EMG studies of laryngeal function in adult stutterers. The glottographic studies of Chevie-Muller (1963) cited by Adams (1975) also revealed abnormal vocal cord activity during stuttering: arrhythmic vibrations of the vocal folds; partial or complete lack of voice during persistent, rapid vocal cord activity. Fine vocal cord adjustments are required for the off/on voicing adjustment of articulation; any muscle imbalance during the rapid activity required for off/on voicing could be reflected in moments of stuttering.

Starkweather, Hirschman and Tannenbaum (1976) compared latency of voice onset in stutterers and non-stutterers who were asked to say each of a series of syllables as quickly as possible, following presentation of a short flash of light on a screen. They found that stutterers were slower than non-stutterers to initiate vocalization on 14 of 16 initial sounds of syllables. Since the possibility of auditory dysfunction was eliminated by the nature of the experimental task, the authors suggest vocal dysfunction or central dysfunction (perhaps lack of cerebral dominance) as a possible

explanation for the delay in vocalization by the stutterers. Starkweather et al.'s study is an example of the increasing attention that is being paid to voicing in the speech of stutterers.

Although the development of voicing has been extensively studied (Preston and Port, 1968; Port and Preston, 1972), the possible relevance of this aspect of maturation to the development of stuttering has been neglected. In a review of acoustic studies of the speech of young children, Kent (1976) highlights some of the developmental characteristics of voice onset time (VOT). Kent defines VOT as: "the time interval between release of the stop (identified by a noise burst on a spectrogram) and the onset of voicing for a following vocalic element (identified by the appearance of fine vertical striations on a wide-band spectrogram)". (Kent, 1976, p. 436.) Voice onset time for stop cognates has been studied in adults and has been found to have a bimodal distribution for voiced and voiceless stops. That is, VOT for voiced stops precedes occlusion release by 35 to 195 msec (Lisker and Abramson, 1965), though there may be a slight lag for /d/ and /g/. For unaspirated voiceless stops, VOT is from 0 to 50 msec after occlusion release, and for aspirated voiceless stops, VOT ranges from 35 to 135 msec after the occlusion release. Summarizing the

research of others, Kent states that there are systematic changes in VOT in the first six years of life. A child's first words have a unimodal rather than a bimodal distribution of VOT, because the voicing contrast is not yet well developed. Voice onset time begins to show a bimodal distribution shortly before the age of three years. By six years of age, VOT distributions are usually bimodal, though the voiced and voiceless stops overlap more than they do in adults. With further maturation there is a distinctly bimodal distribution of VOT. Also with maturation, voicing lead (voicing that precedes articulatory release) becomes more frequent. VOT stability is achieved at about eight years of age.

Kent also notes that control of duration of a speech sound changes rapidly between three and six years of age, assuming adult proportions at about 11 years of age. The articulatory system therefore is in a state of maturational flux when stuttering usually begins in the preschool years. The feature of voicing is sensitive to the state of flux, and the possibility of the off/on voicing adjustment influencing the location of stuttering in young children has not been examined.

#### Need for the Study

Research on the location of stuttering in sentences within a syntactic framework has focused on grammatical

class of words rather than on word groups (constituents) which are basic to the structure of the sentence. Research on the articulatory characteristics of the location of stuttering has primarily concentrated on the consonant/vowel distinction. The need for further exploration of stuttering and its relation to syntax is suggested by the work of Taylor (1966a & b) and Adams and Reis (1971) who found stuttering at phrase boundaries as well as at sentence boundaries. This observation was made on adult stutterers in an oral reading task, and was incidental to the main purpose of the Adams and Reis study. Bloodstein (1974) saw a relationship between stuttering and constituent structure in an informal analysis of the spontaneous speech of young stutterers. This internal breakdown of the sentence and its possible influence on stuttering has not been examined systematically in adults or children.

Complex sentences are composed of more than one clause, and are considered more difficult to process and produce than simple sentences. They might therefore be expected to produce a higher rate of stuttering than simple sentences. As complexity can result from the addition of different types of dependent clauses (coordinates, subordinates, relatives, complements) to an independent clause, it seems appropriate to examine not only complexity, but the clause types that

contribute to the complexity.

The consonant/vowel differentiation and its impact on stuttering has been replaced by a more sensitive articulatory analysis, that of off/on voicing adjustments (Adams and Reis, 1971, 1974) and voice onset time (Starkweather et al., 1976). The current trend in focusing on voicing and stuttering show promise, but has not yet been developed with young stutterers.

There is generally a lack of information on the location of stuttering in the spontaneous speech of stutterers, while a limited amount exists on the spontaneous speech of children who stutter. As stuttering is generally a condition that begins in early childhood, a study which focuses on the spontaneous speech of young stutterers is considered desirable and necessary. In addition, there is a need for research that examines stuttering and its possible association with syntax and articulation within a contemporary framework.

The questions this study will try to answer are as follows:

(1) Does the clause, being the primary unit of sentence structure, incur more stuttering at its onset (boundary) than at other points in the utterance?

(2) Does clause type influence the frequency of stuttering?

(3) Is the internal structure of the clause the next most important influence on the occurrence of stuttering? As the subject-predicate, verb-object splits are considered to represent the hierarchical structure of the sentence, it may be that more stuttering within the clause occurs at these splits than at other points internal to the sentence.

(4) Do complex sentences incur more stuttering than simple sentences?

(5) Does the off/on voicing adjustment in a speech sound at the beginning of a word result in more stuttering than sounds which do not require the voicing adjustment?

#### Hypotheses

The null hypotheses are:

Stuttering occurs randomly with respect to:

- (1) Clause boundaries
- (2) Clause type
- (3) Subject-predicate, verb-object splits
- (4) Complex sentences
- (5) The off/on voicing adjustment of articulation.

CHAPTER II  
REVIEW OF THE LITERATURE

Review of the literature will cover: (1) reasons for studying a childhood population of stutterers; (2) analyses carried out on the location of stuttering in the speech of adults within (a) a syntactic framework and (b) an articulatory framework; (3) analyses carried out on the location of stuttering in the speech of children within (a) a syntactic framework and (b) an articulatory framework; (4) the structure of a sentence; and (5) sentence perception and production.

Reasons for Studying a Childhood Population of Stutterers

Stuttering is regarded as a condition which has its onset in early childhood (Van Riper, 1971; Bloodstein, 1975). As developmental changes are frequently reported to occur with maturation of the stutterer, a young childhood population of stutterers offers a group to be studied in the early stages of the condition, before possible developmental changes take place. It is assumed here, as it is assumed by Bloodstein (1974), that in studying children with relatively new symptoms, we are studying stuttering close to the source of the condition. Onset and development of stuttering is explored in more detail in the following sections.

Onset of Stuttering. The most thorough research which includes age of onset data appears to be that of Andrews and

Harris (1964). This research is unique in that it is based upon direct observation of a population, rather than on parental reports of the onset of stuttering. Andrews and Harris studied the development of one thousand children in Newcastle-on-Tyne, England. Forty-three cases of stuttering were found in the group.

The stutterers were divided into three categories: developmental, benign and persistent. The developmental stutterers (16) experienced transient episodes of stuttering between the ages of two and four years. These episodes lasted six months or less. The benign group consisted of 18 children and showed a wider range of onset time, from three to eleven years. Nine of the 18 benign stutterers had an onset prior to the age of six years. A characteristic of the stutterers in the benign group was that the children had a spontaneous remission of the condition, though in some instances the stuttering lasted for six years, and never less than six months. Nine persistent stutterers constituted the third group. Seven of the nine stuttered by age five. All persistent stutterers were still stuttering at age 16.

The Andrews and Harris data agree with those of past studies (Darley, 1955; Johnson and associates, 1959), in that 32 of the 43 children began to stutter prior to or at six years. The developmental group appears to contain a special

group of children with transient periods of stuttering. Excluding them from the data for this reason, 16 of the remaining 27 children began to stutter before the age of six. These figures, based upon direct observations of developing stuttering, approximate previously established findings based on parental reports. That is, the greatest frequency of onset is in the preschool or very early school years, with the new cases becoming progressively fewer over time.

The Development of Stuttering. Van Riper (1971) attempted to characterize the changes in stuttering which occur in individuals over the years. His work is presented to support the claim that stuttering in adolescents or adults is usually different from stuttering in young children.

Through detailed case notes, Van Riper traced the onset and development of stuttering in 44 stutterers from early childhood to adolescence or adulthood. He divided the subjects into four units or "tracks". The following is a broad outline of his findings.

Track 1. The subjects in Track 1 began to stutter at 2-1/2 to four years, with the stuttering gradual in onset. Characteristics of the stuttering were long periods of remission, syllabic repetitions, no tension or tremors, no concern about speech, good articulation and good speech rate. As Track 1

stutterers matured, the following changes were noted.

Repetitions became more frequent and less regular. Prolongations developed, with an increase in overt tension, tremors, struggle and facial contortions. There was an increase in frustration and concern about speech, and the development of avoidance behavior and word and sound fears. Tricks were used to cover the stuttering and the output of speech decreased.

Track II. The onset of stuttering in Track II was gradual and approximated the time of the first sentences. The characteristics were poor articulation, fast rate, no remissions of the stuttering, and no apparent awareness or frustration. As the stuttering developed, there was little change in its form, though syllabic repetitions increased. The stutterer showed little awareness of speech and little frustration. The output of speech increased with maturation.

Track III. Track III stutterers exhibited a sudden onset of stuttering at any age after connected speech began, and often after trauma. The stuttering was characterized by slow rate, unvoiced prolongations, laryngeal blockings, tension and tremors. The subjects were highly aware of speech and frustrated by the stuttering. Situational and word fears were present. As stuttering developed there was an increase in tension, tremors and struggle, with the

speech pattern growing more bizarre. Intense fears of words and sounds developed, with many avoidances of stuttering. These subjects ultimately ceased trying to talk.

Track IV. For Track IV subjects, the onset of stuttering was late (after four years) and sudden. There were no remissions of the stuttering; articulation and rate of speech were normal. The children were very aware of speech but exhibited no frustration and talked freely. Some unusual behavior was noted. Generally the number of stutterings increased as the stutterer matured, and he stuttered in more situations. There was little change in the nature of the stuttering, though the length of the block increased. The output of speech increased, and the stuttering pattern was consistent.

Track I and Track III stutterers (26 of the 44 subjects) exhibited major changes in the stuttering pattern. Track II stutterers showed some changes, though considerably fewer than those of Tracks I and III. That is, 37 subjects changed the form of their stuttering from the time of onset to adolescence or adulthood while, according to Van Riper, the stuttering of the five subjects in Track IV remained relatively unchanged.

Further evidence of developmental change has been offered by Bloodstein (1975) based on extensive research carried out

in the 1960's. Bloodstein surveyed 418 case histories of stuttering children, aged two to 16 years, and proposed four major phases of development. Early characteristics (Phase 1) include episodic stuttering, repetition of syllables and words, stuttering under communicative pressure, and little concern about speech by the stutterer. There are increasing though gradual changes through Phases 2 and 3, while Phase 4 represents the most severe form of stuttering. Its characteristics are fearful anticipation of stuttering; feared words, sounds and situations; frequent word substitution and circumlocution, and avoidance of speech situation. Phase 4 stuttering is seen in late adolescence and adulthood.

The evidence offered by Van Riper (1971) and Bloodstein (1975), while differing somewhat because of the different methodologies employed, indicates that stuttering usually changes in form from the time of onset to adolescence or adulthood. In addition to changes in the form of the stuttering, changes in reactions of the stutterer to speech are frequently apparent. The study of stuttering in young children therefore offers an opportunity to study the condition before additional elements may have changed it from its more pure form.

It is apparent in examining the studies on onset and development of stuttering that different types of stutterers

may exist. While present knowledge of "types" is not sufficiently advanced to permit differentiation of stuttering groups for study, it does seem essential to exclude from a study of this kind the group known as "developmental" (Andrews and Harris, 1964), as the stuttering in this group is conspicuous in its rapidly transient nature.

The Location of Stuttering in the Speech of Adults:  
A Syntactic Framework

Most research on the location of stuttering with reference to syntax has been done with adult subjects. Speech samples used have been oral reading and spontaneous speech, with the former predominating.

Oral Reading. Loci studies on read speech appear to have been initiated by Brown and his colleagues (Johnson and Brown, 1935; Brown, 1937, 1938; Brown and Moren, 1942). This work culminated in Brown's "four factor theory" which refers to the high frequency of stuttering that occurs on certain word types. Brown (1945) used data from an earlier study (Johnson and Brown, 1935), which consisted of recordings of 32 adult stutterers reading running text that totalled 10,000 words. The subjects stuttered on 9.7% of the words read. Parts of speech which resulted in higher than average stuttering were assigned a plus rating. Plus ratings were given to nouns, verbs, adjectives and adverbs (with the gradient of stuttering in that order); to the first, second and third words of

sentences, and to each word of five or more letters. That is, stuttering occurred primarily on words which were of a particular grammatical class, which were positioned within the first three words of a sentence, which were 5 letters long or longer. The finding from an earlier study (Johnson and Brown, 1935) that words beginning with consonants are stuttered more than words beginning with vowels, was incorporated into the "four factors" which influence the loci of stuttering in the read speech of adults. Hence, Brown's "four factors" which are said to influence the loci of stuttering are: grammatical class of word, word position, word length and beginning sound of word.

Attempts were made in the 1960's to isolate the interdependencies of Brown's four factors. In constructing 64 sentences to be read, Quarrington, Conway and Siegel (1962) controlled for word length, part of speech (noun, adjective, adverb, verb), initial sound and frequency of usage. One of the experimental words was placed at the beginning or the end of each sentence. Twenty-seven adult stutterers read each sentence from a card to an experimenter who observed the speech performance. Quarrington et al.'s findings supported the influence of a positional factor on the frequency of stuttering as reported by Brown (1945), in that an average of 45.3% of stuttering occurred on words

in the initial positions of sentences, while 24.1% occurred on words in the final positions of sentences. The authors established a gradient of stuttering on the parts of speech at variance with Brown's findings. Quarrington et al. found that adverbs, verbs, adjectives and nouns were stuttered in that order of frequency, and noted that adverbs were difficult to control for length.

Conway and Quarrington (1963) examined word position and stuttering again in reading material. Twenty-four experimental words were placed in three positions (initial, medial, final) in word groups which varied from random sequences of words to highly contextual sequences of words. The experimental words were controlled for initial phoneme, length and stress. All words were nouns and, with the four variables controlled, were selected randomly from the Thorndike and Lorge word lists. The usual procedure for this type of study was followed, with the subjects reading the word sequences and the location of stuttering recorded by the experimenter. The frequency of stuttering was found to be dependent upon the position of the stuttered word in the sequence of words, regardless of the contextual nature of the material. That is, the level of meaning in the word sequence did not influence the amount of stuttering on words with regard to position. However, the more contextual

the material, the higher the general level of stuttering.

Further attention was paid to stuttering and word position, as well as information value of words, by Quarrington in 1965. Quarrington had 24 adult stutterers read a passage of prose which was constructed with words from the Thorndike and Lorge word lists. Information value of the words was evaluated by Miller's (1951) procedure. The author found that both word predictability (high information words) and word position (word at the beginning of the sentence) were significantly correlated with a high stuttering rate. Word position was the more potent factor of the two, apparently operating independently of word information value.

The trend towards isolation of variables continued with the work of Soderberg (1967). Soderberg had 10 stutterers, aged 9 to 44, read a 141 word passage. The words in the passage were classified as lexical and function words. The information value of each word had been estimated by having a group of college students predict the words of the recorded passage. The information value of a word was the percent of students who correctly predicted the word. A linguist marked the passage for onsets of clauses as defined by Trager and Smith (1962). The definition is "a phonologically marked macrosegment which contains one and only one primary stress and ends in one of the terminal junctures

/1,11,111 (rising, loud, falling)"/". (Trager and Smith, 1962, p. 150.) The stutterers recorded the passage and moments of stuttering were judged by six students and the experimenter. The analysis of stuttering in association with word information value and part of speech was carried out on 276 clauses of 2 to 10 words in length. Soderberg found significantly more stuttering on words of high information value as opposed to words of low information value, when those words were situated at or near clause onsets. In addition, there was generally more stuttering on high information words than low information words. Significantly more stuttering occurred on lexical words as opposed to function words, but only in the medial position of clauses.

Taylor (1966b) had 12 advanced stutterers read a passage which was tape recorded. The transcripts were examined for stuttering as it occurred on words beginning with consonants or vowels, according to the position of the word in a sentence, and according to word length. Taylor's findings were that stuttering occurred with significantly higher frequency on words that began with consonants rather than vowels and on words positioned early in sentences and phrases. Word position had a significantly greater effect on stuttering than word length.

Taylor (1966a) gave a comprehensive review of the "loci" literature, and questioned previous findings that stuttering occurs, for the most part, at the beginning of sentences (Brown, 1938, 1945; Quarrington et al., 1962; Conway and Quarrington, 1963). She pointed out that stutterers in her study (1966b) showed no more stuttering on initial words of sentences than initial words of phrases.

The research reviewed above on the loci of stuttering in the oral reading of adult stutterers has a syntactic orientation in that Brown (1945), Quarrington et al. (1962), Soderberg (1967) examined parts of speech. The most relevant variable examined however, from the point of view of contemporary syntax analysis, was position of the stuttered word in the sentence. Early positioning of the word in the sentence (and phrase, according to Taylor) was the characteristic most consistently related to stuttering, regardless of other attributes the stuttered word possessed (information value, word length, etc.). The possible link between the point of breakdown in the stutterer's sentence (at the onset of sentence or phrase) and the constituent structure of the sentence is unmistakable. The relationship that Soderberg (1967) found between stuttering and lexical words in the medial position of clauses could have been due to the positioning of the words at an important constituent break, but

internal constituent boundaries were not examined.

While the oral reading task has been used with skill and imagination by researchers to ascertain the loci of stuttering, its shortcomings are clear. Studies which aim to associate the location of stuttering with variables of syntax ideally should be carried out using spontaneous speech, so that the stutterer's breakdowns in fluency can be studied in the context of sentences he has generated, rather than sentences generated by another person.

Spontaneous Speech. Hejna (1955) examined stuttering in the spontaneous speech of 18 high school stutterers. His study supported Brown's (1945) findings on the characteristics of stuttered words. Hejna found that stuttering occurred most frequently on words that began with consonants as opposed to vowels, words that belong to particular grammatical classes (nouns, verbs, adjectives, adverbs), longer words (more than six letters) rather than shorter words. With regard to word position, Hejna found that more stuttering occurred on the 2nd, 3rd, 4th, 6th and 7th word positions of sentences. In explanation of the lack of support for the usual finding of increased stuttering on the first word of sentences, he stated that in spontaneous speech, the stutterer frequently began sentences with "well," "and," and other starters, which were not stuttered. This point focuses attention on the need to

establish the actual onset of sentences in "loci" studies.

As part of a larger study of nonfluency in normal speakers, Lanyon (1968) investigated the speech of three adult stutterers. He hypothesized a relationship between stuttering and information value of words, regardless of the position of words in sentences. Each subject tape-recorded spontaneous speech segments of about 300 words on a given topic. After transcription, only those sentences with between 8 and 30 words were retained for analysis. For the examination of position in sentences, words were designated "initial" (words 1 to 6), "medial" (words 7 to 12), or "final" (words 13 to 30). Twenty-five stuttered words and twenty-five fluent words were matched for the sentence position category. Information value of words was estimated by having college students read a copy of the transcript, guessing the twenty-five words which had been left blank. The scores from the task provided the word information value. Stuttering was not predictable on the basis of the information value of words, however, Lanyon observed the previously established fact of more stuttering in the early part of the sentence.

Lanyon also inspected his data with regard to Brown's remaining three factors: initial sound of the word; word length; grammatical class (Brown, 1945). He found that words beginning with consonants were stuttered significantly less

frequently than those beginning with vowels, that stuttering occurred with greater than chance frequency on pronouns as opposed to verbs and nouns, and that there was no relationship between stuttering and word length. Lanyon's three results are contrary to those of Brown for the oral reading task.

The limited research available on stuttering in spontaneous speech makes comparison difficult, however, the diametrically opposed findings of Hejna (1955) and Lanyon (1969) are puzzling. Hejna's results support Brown's four factor theory while Lanyon's do not. Some of the problems of working with spontaneous speech are evident in Lanyon's study. For example, the sentence is not defined; the whereabouts of the stutterings which did not occur in the selected 105 sentences remain unknown; the breakdown of the sentence into initial, medial and final segments does give a broad location of stutters, however, an analysis which examined the position of stuttering in relation to clauses (and phrases) would inform us of any relationship between stuttering and sentence structure. The literature in the area of stuttering and spontaneous speech is clearly impoverished, and has not yet been approached with methods of contemporary syntax analysis.

The Location of Stuttering in the Speech of Adults:  
An Articulatory Framework

Johnson and Brown (1935) studied the loci of stuttering of 32 adults on words in oral reading. Previously described data of 10,000 words of oral reading were analyzed for the position of stuttering within words, and the sounds on which stuttering occurred. Ninety-two percent of the stuttering instances occurred on the initial sounds of words. Initial consonants were stuttered significantly more frequently than vowels in the same positions. Consonants /z/, /d/, /l/, /j/, /m/, and /p/ were generally associated with a high frequency of stuttering. Consonants /w/, /t/, /f/, /h/ were usually associated with a low frequency of stuttering. The difference between the high and low frequency groups was not significant. Apart from the vowel-consonant difference, the authors felt that any specific sound difficulty was a characteristic of the individual stutrer.

Soderberg (1962) composed three lists of 15 phrases made up of words from the Thorndike and Lorge Word Lists, controlling for length of phrase. The initial sounds of the words in one list were voiced consonants; the initial sounds of words in the second list were vowels; in a third list all initial sounds were voiceless consonants. The author attempted to control other variables including part of speech and word length. Fifteen stutrerers read the phrase lists

and their readings were tape-recorded. The transcripts of the tapes were analyzed for stuttering and length of stuttering blocks. No significant differences in the number of stutterings or mean duration of stutterings were found among words whose initial sounds were vowels, voiced consonants, or voiceless consonants.

More recently, Wingate (1969a) identified the stutterer's difficulty as one of "phonetic transition". That is, the stutterer's difficulty is in getting "off" sounds rather than in getting "on" sounds. The stutterer is unable to move from the sound that is being repeated or prolonged to the succeeding sound. Further, Wingate (1969b) points out that a change in the manner of vocalization is one of the changes a stutterer can make which invariably produces at least temporary fluency. Considerably earlier, Kenyon (1943) pointed out the abnormal actions of the chest and larynx during the stuttering block which, he thought, were accompanied by normal action for articulation.

Adams and Reis (1971) examined the loci of stuttering in relation to the initiation of voice in a speech segment. Fourteen young adult stutterers read two passages orally. In one paragraph all sounds were voiced, another contained a combination of voiced and voiceless sounds. The authors found significantly less stuttering in the all-voiced passage than

in the combined passage, and greater adaptation with the all-voiced readings. In the combined passage, more than one-third of the stuttering was at the start of a new phrase or sentence, or at the transition from voiceless to voiced sounds. The authors speculate that "spasmic glottal closures" may account for stuttering that occurs in such locations.

Replicating their study, Adams and Reis (1974) found that the all-voiced material did not produce significantly less stuttering than the combined reading, but it did produce significantly more adaptation. Adaptation in this context refers to the tendency for stuttering to decrease with successive readings of the same passage.

Finally, through electromyographic studies, Freeman (1975) has drawn attention to antagonistic abductor-adductor activity of the muscles of the glottis during stuttering in adults. This antagonism is at variance with the reciprocity and fine balance of laryngeal muscle activity in fluent speech.

The earlier studies on stuttering in relation to speech sounds focused on the consonant-vowel difference which was established by Johnson and Brown (1935) and later incorporated into Brown's "four factor theory" of the loci of stuttering (Brown, 1945). More recent research has focused on the problem cited by Kenyon many years ago (Kenyon, 1943), that of aberrant underlying laryngeal activity in stuttering. The

studies of Adams and Reis (1974, 1971) and Freeman (1975) suggest renewed interest in vocal cord activity as it relates to the stuttering block. Vocal cord adjustments for off/on voicing are reflected in the phonetic features of speech sounds. Further research into off/on voicing adjustments of articulation might clarify the unresolved question of a laryngeal component in stuttering. In addition, it should be noted that in the usual analyses of the location of stuttering according to articulatory factors, "transition" data, as discussed by Wingate (1969a), are usually omitted.

The Location of Stuttering in the Speech of Children:  
A Syntactic Framework

Research into stuttering in children within a syntactic framework is limited, though there seems to have been an increasing interest in this area in the last decade. The studies have dealt with the location of stuttering in repeated speech, oral reading, and spontaneous speech.

Repeated Speech and Oral Reading. Repeated speech and oral reading were used by Williams, Silverman and Kools (1969) in analyzing the location of stuttering in 76 children, aged 5 to 13 years. This was part of a larger study which also analyzed the disfluencies of young fluent speakers. The authors' aim was to see if Brown's "four factor theory" (Brown, 1945) applied to stuttering in children. As stated previously, Brown found that in the oral reading of adult

stutterers, stuttering was most likely to occur on words that begin with consonants rather than vowels, on nouns, verbs, adjectives and adverbs (in that order of frequency), longer words rather than shorter words, and on the first three words of the sentence.

Williams et al. asked the children in kindergarten and first grade to repeat 10 sentences. The older children (2nd to 6th graders), read an appropriate passage of approximately 100 words. The speech samples were tape-recorded and transcribed, and each word in the samples was evaluated according to the four attributes. The number of stutterings occurring on words that possessed the attributes was computed. For the combined data of younger and older children, Williams et al. found that a significantly large amount of stuttering occurred on 3 of Brown's 4 factors. The attributes that the children shared with adults were part of speech, sentence position, and word length, with a tendency for stuttering to occur on consonants rather than vowels. The younger children (kindergarten and first grade) were more disfluent than the older children at the beginnings of sentences. The difference between the two groups was not significant. The authors conclude that children who stutter share the same loci of stuttering as adults who stutter.

Spontaneous Speech. Bloodstein and Gantwerk (1967) examined

parts of speech and stuttering in the spontaneous speech of 13 children, aged 2.11 years to 6.6 years. Each child was involved in a play session lasting from 40 minutes to one hour, where he was encouraged to talk. The transcripts of the tapes were marked for location of stutterings and the distribution of parts of speech for the total number of words was determined. The parts of speech that were analyzed in the subject's transcripts were adjective, adverb, conjunction, interjection, noun, preposition, pronoun, and verb. Bloodstein and Gantwerk found that conjunctions and pronouns were stuttered on more, and nouns and interjections were stuttered on less than would be expected by chance. The authors noted that the children's stuttering on function words was at variance with previous findings in the adult population, when adults had been found to stutter on content words more than function words (Brown, 1945; Hejna, 1955; Quarrington et al., 1962). Bloodstein and Gantwerk thought that conjunctions and pronouns might be important in the location of stuttering in children because of the usual position of these parts of speech as the first words of sentences. The children, in seeing the sentence as a "single patterned entity" which is perceived as difficult, may stutter on the first word, which happens to be a conjunction or a pronoun.

In a later publication, Bloodstein (1974) related

stuttering to a surface structure analysis of samples of spontaneous speech of young stutterers. Bloodstein's analysis of the speech of the six children (ages three to six years) was a descriptive one, rather than a formal analysis. He found that the children tended to stutter at the onset of sentences, clauses and phrases. His observations led him to propose that the first word in a syntactic unit is more important than the other factors usually considered, such as the word-bound attributes of Brown's four factor theory (Brown, 1945).

The results of the Bloodstein and Gantwerk study contradict those of Williams et al. (1969), in that Bloodstein and Gantwerk found that stuttering occurred on function words in their young subjects, as opposed to content words. While there was some overlap in the ages of subjects in the two studies, the subjects of Bloodstein and Gantwerk were, for the most part, younger (2.11 years to 6.6 years) than those of Williams et al. (5 years to 13 years), suggesting that the loci of stuttering may change with maturation. Another possible source of the difference in findings may be the different speech tasks assigned to the children - repeated speech and oral reading in one instance, and spontaneous speech in the other. Further evidence of a possible developmental trend however, is cited by Williams et al., whose younger stutterers

were more prone to breakdown at the onset of sentences than the older stutterers.

The Location of Stuttering in the Speech of Children:  
An Articulatory Framework

Remarkably little attention has been paid to the articulatory aspects of childhood stuttering. Williams et al. (1969) examined the initial phoneme of words as a possible influence on the loci of stuttering (in conjunction with other factors previously cited), in repeated speech and oral reading. They found no significant relationship between specific phonemes and stuttered words. The trend was for words beginning with consonants to be stuttered more than vowels, but this difference was not significant.

Van Riper (1971, p. 25) cites the work of Stromsta (1965) who analyzed spectrographically the recordings of young stutterers made 10 years previously. Those who had continued to stutter shared one common characteristic. The characteristic was abrupt phonatory stoppages with cessation of air flow. Van Riper considers that this may be the distinguishing feature which separates normal nonfluency from stuttering.

Agnello (1975) examined VOT and VTT (Voice Termination Time) of 11 child stutterers, aged five to seven years, and found VOT measures delayed when compared with non-stutterers, in saying consonant-vowel combinations /pa, ba/. VTT was also

delayed for the stutterers for the consonant-vowel combination /ap/, though for /ab/ the stutterer's VTT preceded the non-stutterers. This part of Agnello's study was not presented in detail, but the author commented that "adult stutterers are sluggish in getting voice initiated. Children are even more sluggish as a group". (Agnello, 1975, p. 65.)

The Stromsta and Agnello works offer an interesting introduction to the direction that research might take in examining articulatory aspects of stuttering, while Bloodstein's informal observations of 1974 point toward the relationship of stuttering and constituent structure of sentences. The limited research available on the location of stuttering in the speech of young stutterers, whether in spontaneous speech, repeated speech or oral reading, makes comparison or conclusions difficult. Brown (1945) has clearly exerted considerable influence on research into the loci of stuttering, most of which has focused on word-bound factors, while the consonant/vowel dichotomy has monopolized investigations of the articulatory aspects of stuttering.

In sum, the research literature on stuttering and its location in an utterance is sparse. The focus of the research has been on adults rather than children, and oral reading rather than spontaneous speech. Studies which incorporate a "grammatical factor" mean, for the most part,

studies of parts of speech rather than grammatical relationships of word groups within the sentence. Studies which incorporate an "articulatory factor" usually focus on the consonant/vowel difference.

### The Structure of a Sentence

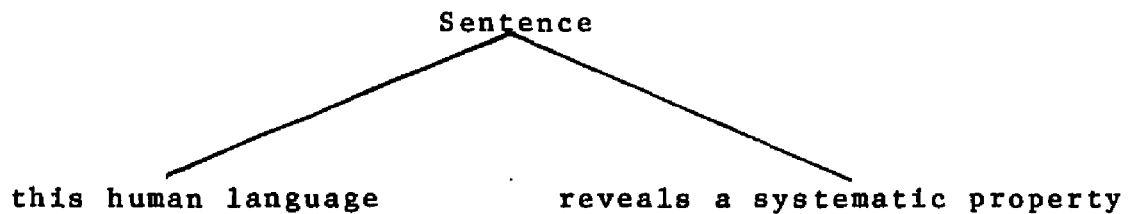
The following is a theoretical discussion of contemporary descriptions of the structure of a sentence rather than a review of research. It is inserted as a logical step to the discussion of sentence perception and production.

Jacobs and Rosenbaum define sentences as "structured strings of words". (Jacobs and Rosenbaum, 1968, p. 10.) The words in English sentences tend to be grouped together in clusters by speakers of the language. Jacobs and Rosenbaum offer the following example of clustering of words (p. 11). The sentence:

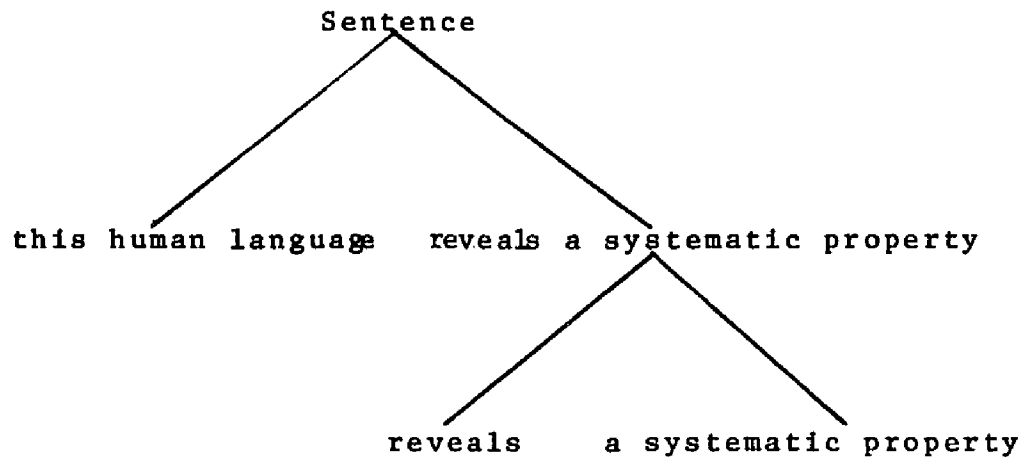
This human language reveals a systematic property.  
would be intuitively divided into:

This human language            reveals a systematic property.

Groups of words in sentences can be conveniently depicted by tree diagrams. For example:



Breaking the sentence into further groups results in:



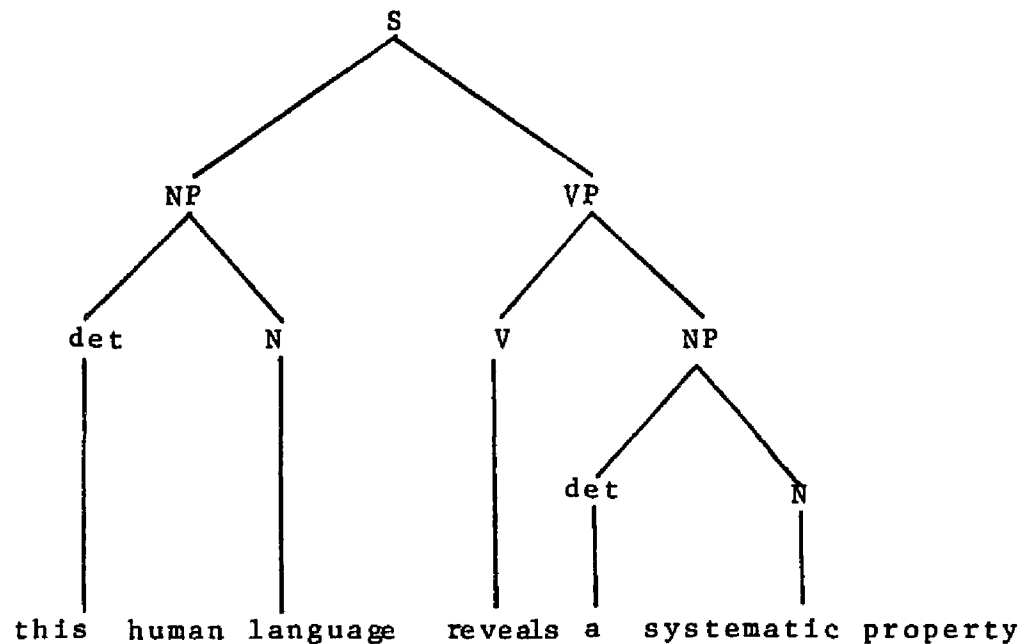
In addition to tree diagrams, words can be grouped by bracketing.

[[this human language] [reveals] [a systematic property]]

The groups of words into which sentences can be divided are called constituents. The constituents in the example given are considered major constituents. In this instance they correspond with the syntactic boundaries of the subject-predicate, verb-object. It is possible to continue to break the sentence down into smaller constituents (Jacobs and Rosenbaum, 1968, p. 14).

The tree diagram can be presented with labelling, in which case the diagram is a phrase marker, or P-marker. The P-marker is a linguistic reconstruction of traditional "parsing" and provides information about constituents and

types of constituents (Bach, 1974, pp. 38-40). For example:



where S = sentence

VP = verb phrase

NP = noun phrase

N = noun

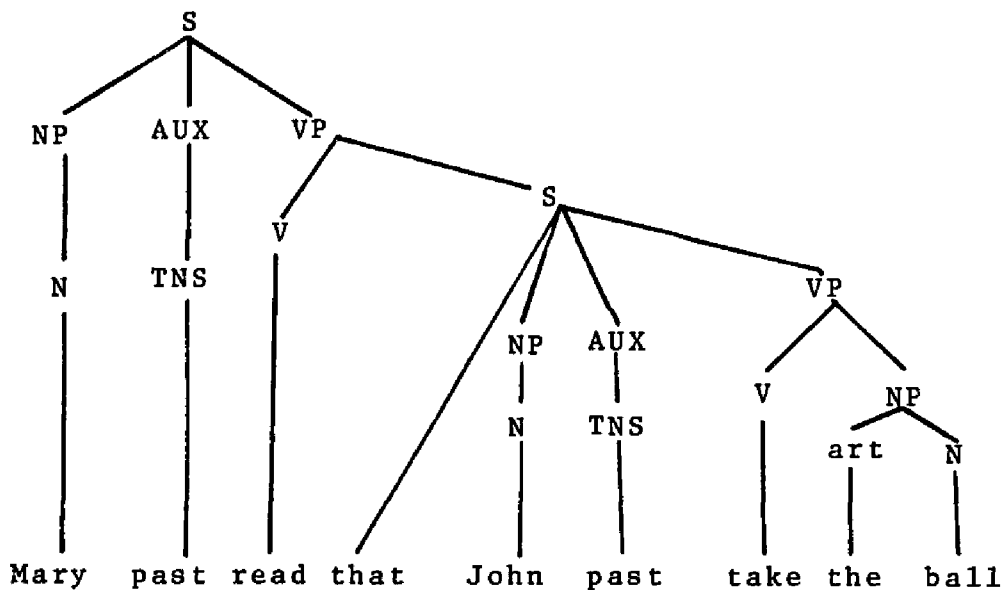
det = determiner

The sentence which has been divided into constituents in the above example, is a surface structure representation. All surface structures however, have underlying deep structure representations (Chomsky, 1957, 1965; Bach, 1973; Akmajian and Heny, 1975; Cairns and Cairns, 1976). The above sentence example is also a simple sentence (having one verb), while

complex sentences contain more than one verb. According to Cairns and Cairns:

"A complex sentence is a sentence that contains other sentences at the level of the deep structure. Complex sentences, then, are sentences that contain embedded sentences, usually referred to as clauses in traditional terms." (Cairns and Cairns, 1976, p. 58.)

An example of a complex sentence is one that contains a complement clause, such as a "that" complement. The following tree diagram shows the deep structure of a "that" complement sentence, from Cairns and Cairns (p. 62).



The two S nodes in the tree diagram refer to the two sentences which underlie the surface form of the sentence: Mary read that John took the ball.

Knowledge of constituent structure of sentences, and of the underlying representations of the surface structure of sentences, has led to research on sentence perception and production.

#### Sentence Perception and Production

Studies indicate that sentence perception and sentence production are considerably influenced by the boundaries of the major constituents of sentences. Fodor et al. (1974) argue extensively in favor of the psychological reality of P-markers. Several studies suggest that the underlying representations of sentences are reflected in sentence processing.

In a task of sentence perception, Fodor and Bever (1965) used 25 sentences that contained one single major boundary. The major boundary (or "zero point") divided the sentence into two constituents. The sentences were recorded 9 times on one track of a stereophonic recording tape. A 25 millisecond click of high intensity was recorded on the second track of the 9 taped copies of the sentence. One click coincided with the zero position for one copy. Other clicks were located at designated points for each of the other 8 copies, with the objective location of the clicks balanced on either side of the zero point. Nine groups of four subjects, wearing headphones, heard the sentences presented

in one ear, and the clicks in the other. They were instructed to write each sentence, and indicate where they heard the click. Significantly more of the correctly placed clicks were in the objective zero position than in any other of the nine positions. There was also a tendency for the subjects to displace clicks into the zero position. The data support the authors' hypothesis that the constituent structure of the sentence plays an important role in determining subjective location of noise during speech.

The strength of the clause as a perceptual unit was advanced by Bever, Garrett and Hurtig (1973). These authors studied the length of time taken to process sentence fragments which were either ambiguous or unambiguous. The subjects were 48 college students. Each subject was presented with cards on which were typed variations of sentence fragments. One sentence fragment was an ambiguous, incomplete clause; another was an ambiguous, complete clause; a third was an ambiguous complete clause with the addition of the first word of a second clause. Corresponding sentence fragments for unambiguous clauses were also presented. Subjects were required to read a sentence fragment silently, and as quickly as possible, read the fragment with the completion of the sentence aloud. The sessions were recorded, and the time interval between the presentation of the stimulus and the

onset of response was determined. Most relevant was the finding that comprehension time for structurally ambiguous clauses was greater when the clause was incomplete than when it was complete. That is, incompleteness of an ambiguous clause increases its processing time. The finding was predicted by the assumption of the authors of the importance of the clause as a unit of processing. In addition, the authors suggest that the increased processing time for the incomplete ambiguous clause is due to the fact that more than one choice of meaning is available to the subject, whereas for completion of a sentence after a perceptual unit (clause) has been completed, perceptual closure has taken place. That is, the unit has been identified as having one interpretation and is no longer ambiguous; sentence completion is therefore facilitated by the fact that perceptual closure has taken place.

Bever, Lackner and Kirk (1969) applied the click paradigm to different types of complement sentences heard by subjects in an experimental situation. They found that one type of complement sentence (noun phrase complement) attracted clicks most strongly at the point between the verb and noun phrase. The sentence was:

The corrupt police can't bear the criminals to confess.  
The click frequently was placed between bear and the criminals,

demarcating the clause break in the underlying structure of the sentence, which is

The corrupt police can't bear it the criminals confess. This sentence has surface boundaries which coincide with the boundaries of underlying sentences, and the underlying sentences apparently influenced the subjects' perception of the click in relation to the clause boundary. Regarding these findings, the authors state that: "It is our general view that a primary part of immediate speech processing is the isolation of underlying sentence units."

Fodor, Fodor, Garrett and Lackner (1974) further explored the perception of surface boundaries as they relate to underlying sentence structure. They did this using complex sentences which contained complement sentences, relative clauses, and reduced relative clauses, again within a click paradigm. Comparing sentences with relative clauses (This time of year, anyone who is rich enough takes a vacation in the Carribean) to those with relative clause reduction (This time of year, anyone rich enough takes a vacation in the Carribean) where a click was placed after anyone in each sentence, the effects of the click in the unreduced version were stronger. This study is also considered to support the concept that the surface structure representations of underlying representations are important for sentence processing.

Goldman-Eisler studied the location of hesitations in the sentence production of adults (Goldman-Eisler, 1958a,b). She first established the predictability of content words in a series of twelve, syntactically correct sentences from the subjects' spontaneous speech. Hesitations that occurred in the sentences were then related to the occurrence of words that were difficult to predict (words of "lexical uncertainty"). The author found that hesitations in spontaneous speech occur in places of high lexical uncertainty. This study appears to give support to word-bound factors having a strong influence on the breakdown of normal spontaneous speech. Goldman-Eisler's work has, however, been criticized by Boomer (1970) and Fodor et al. (1974). Boomer (1970) takes issue with Goldman-Eisler's research because of the small size of the sample, the fact that only well structured sentences were used, and other aspects of experimental design and analysis. Fodor et al. (1974) dispute her findings, in part because hesitations associated with juncture pauses and respiration were not considered.

Maclay and Osgood (1959) analyzed samples of 50,000 words of spontaneous speech of adults, for hesitations other than juncture pauses and pauses for effect. They found a small but significant increase in hesitations before content words as opposed to function words (59% hesitations

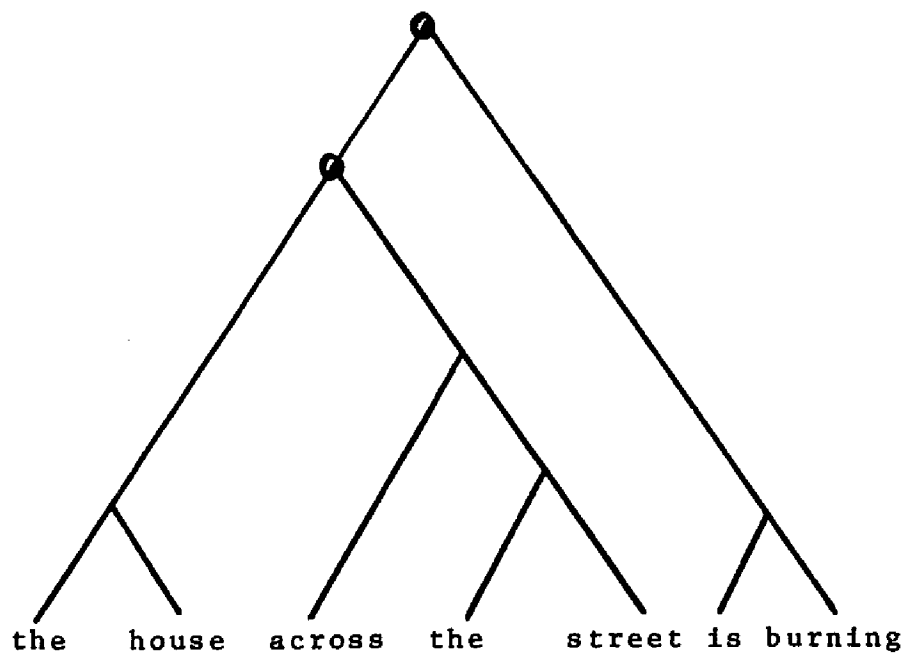
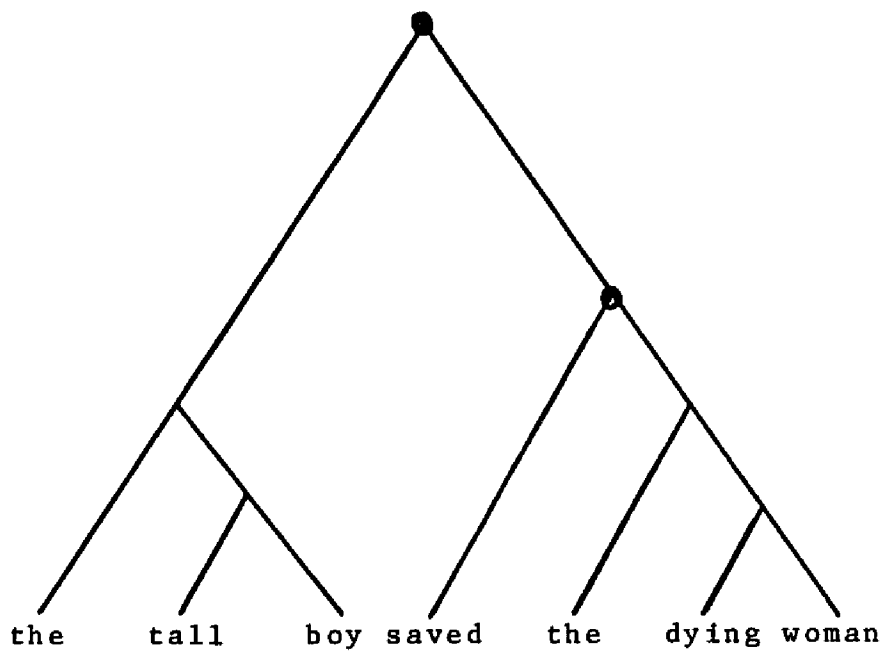
on content words and 41% on function words). While this finding tends to support Goldman-Eisler's thesis of word-by-word planning for sentence construction, Fodor et al. point out that there was not an equal opportunity for the hesitations to be evenly distributed because of the nature of the distribution of content and function words. In addition, Maclay and Osgood found that when a speaker changes his mind about a word, he usually repeats the whole phrase, suggesting that the unit of production for sentences is longer than the word.

Martin (1971) examined hesitations in spontaneous speech by having subjects describe pictures from the Thematic Apperception Test. The speakers used both lexical and constituent pauses. When another subject (the decoder) reproduced what the original speakers said, the decoder was more consistent in reproducing pauses at constituent boundaries. The variability of occurrence of hesitations is pointed out by Clarke (1971) in his discussion of Martin's work. He comments that in reading, pauses occur only at junctures, because the speaker knows what lexical items he wants to use.

Johnson (1965) was interested in the extent to which subjects used their knowledge of grammar to break a sentence into units as they attempted to learn it. The prediction was

that the subjects, in learning the sentence, would show a high probability of error at specific points of transition in the sentence. The Transitional Error Probability (TEP) is specified by the probability that the word is incorrectly recalled, given that the preceding word is correctly recalled. The subjects learned eight sentences, each by means of a paired association task. They were encouraged to give as much of each response as they could. Johnson found that subjects made errors in predictable places according to the constituent structure of the sentence and according to phrase structure level, or hierarchical structure. That is, the higher the node was on the tree, the more likely the constituent governed by that node was to be affected. Examples are shown on page 49.

The TEP showed a significant increase in errors for the first words in major constituents of a sentence, with little regularity noted in internal constituent errors. Johnson's findings suggest that the subjects learned the sentences in phrase groups, that when part of a phrase is learned the remainder tends to be learned as well, and that the level of transition affects learning; that is, the constituent break matching the highest node is more susceptible to error and so on, according to the hierarchy of level.



These findings were supported by Suci (1967) and Walker, Gough and Wall (1968). Suci (1967) presented a sentence to each subject and immediately followed it with the presentation of a probe word from the sentence. The subject was required to respond as quickly as possible with the next word from the sentence. The longest response occurred when the probe was the final word of a constituent. The fastest response occurred following the probe words which were at the beginning of major constituents. This study supports Johnson's concept that major constituents are learned as units.

Walker, Gough and Wall (1968) also examined the relationship between surface structure adjacency and underlying grammatical relations by measuring response latencies to probes. They found shorter latencies for pairs of words that were grammatically related than for unrelated pairs, even when the related pairs were further apart in the surface structure of the sentence than unrelated pairs. Therefore, responses to probe pairs that were grammatically related were significantly faster than responses to probes in which the subsequent word was unrelated. This finding reflects the strong effect of grammatical relatedness on response latency.

Boomer (1965) studied hesitations and their relationship

to the onsets of clauses in the spontaneous speech of adults. He analyzed the speech by segmenting it into "phonemic clauses" according to Trager and Smith (see p. 23). Fodor et al. (1974, p. 422) note that such clauses show an approximate correspondence with most surface structure clauses. Boomer found 11,593 phonemic clauses in the corpora, 713 of which contained one or more pauses. He noted "filled pauses" (um, er) and "unfilled pauses". The results were that pauses occurred more often than would be expected by chance near the onset of a phonemic clause, in the position after the first word of the clause. Fodor, Bever and Garrett (1974) point out that if a new clause is often being introduced by the second word of a clause, it would mean that Boomer's data support the syntactic clause as a unit of sentence planning. The phonemic versus syntactic clause as used by Boomer is not a clear concept. Boomer's data suggest however that a clause-like structure is the basis of the occurrence of hesitations in spontaneous speech.

The study of spoonerisms has offered a further opportunity to note the relationship between syntactic structure and a form of breakdown in speech production. Fromkin (1973) reported on 6,000 errors of spontaneous speech, examining their phonetic, morphemic, semantic and syntactic properties. She states that words are organized into groups of phrases

(sometimes whole sentences) and stored in a "buffer memory" for utterance. She demonstrates this with the examination of errors in the phrase: Nerve of a vergious breakdown instead of Verge of a nervous breakdown, where the "n" from "nervous" has been brought forward in exchange for the "v" from "verge". The transposition can only occur, according to Fromkin, if the phrase is stored in a buffer zone where the "n" from the fourth word in the phrase is available for use on the first word.

Boomer and Laver (1968) found that the stressed word in a sentence is the one most likely to be affected by spoonerism. Fodor et al. (1974) discuss this phenomenon. They postulate that the most heavily stressed item in a construction is usually at the head of the construction (that is, at a major constituent boundary). Further, they suggest that heads of constructions may be chosen the earliest with the remainder of the construction organized around them. As items chosen first are available the longest, such items should be the source of more intrusions.

There appears to be considerable evidence that speakers manipulate sentences in units that can be specified. That is, there is an underlying organization of language which is reflected in the perception and production of sentences. The

research presented above suggests that the external representations of the underlying organization of language are the clause and the phrase, with phrases organized in a hierarchical manner. The word-bound influence on hesitations in spontaneous speech that Goldman-Eisler found, which was in part supported by Maclay and Osgood, cannot be considered the sole influence on hesitations in view of the other evidence cited, and previous criticisms (Boomer, 1970; Fodor, et al., 1974). In addition to the clause/phrase role in sentence processing, Bever, et al. (1969) and Fodor, et al. (1974) drew attention to complex sentences and the influence of clause boundaries within such sentences on the perception of those sentences. While note has been made of the possible influences of clause and/or phrase boundaries on the occurrence of stuttering (Taylor, 1966; Soderberg, 1962; Adams and Reis, 1971; Bloodstein, 1974; Tornick and Bloodstein, 1976), the effects of clause boundaries and the hierarchical structure within clauses have not been explored. The influence of syntactic complexity has also been neglected, though Tornick and Bloodstein (1976) mention a possible influence of complexity on the frequency of stuttering.

In summary, the relationship between stuttering and clause and phrase boundaries, clause type and sentence complexity, has not been examined in previous research. The

articulatory feature of off/on voicing has received some, but insufficient attention. Research into the location of stuttering in the speech of young children, particularly with spontaneous speech, is extremely limited.

## CHAPTER III

## METHODOLOGY

Subjects

The subjects were nine young male stutterers, aged 4.0 years to 6.6 years. Six of the children were recruited through speech clinics in colleges, and three were from private practice. A total of twelve children were recorded, but three did not meet the criteria for stuttering (in the recorded session) and were eliminated from the study.

An experienced clinician had diagnosed each subject as a stutterer, and each was reported to have been stuttering for a minimum of six months (thus eliminating the possibility of including the "developmental" stutterers of Andrews and Harris, 1964). Seven of the nine subjects were receiving stuttering therapy, while two subjects (P.S. and S.W.) were scheduled to begin treatment. The subjects had suffered no known brain damage and had no known learning disabilities. Children referred to the clinics for remediation of language delay and/or articulation disorder in conjunction with stuttering, were excluded from the study when the language and/or articulation problem was the primary reason for the referral. Each child expressed himself with a flow of language and was intelligible to the examiner.

Information obtained on the subjects was: date of birth,

sex, order of birth in family, handedness, parental occupation, genetic history.

#### Materials

The subjects' speech was recorded on a Sony Cassette-Corder Model TC-110A, used with an external Sony microphone. Play materials used were the Childcraft Playhouse, Playdoh, Flannel Board Storykits, and bubble blowing kits.

#### Collection of the Data

The spontaneous speech of each subject was recorded in one play session. Each session lasted approximately 40 minutes, and the children were encouraged to express themselves freely. Conversation usually focused on play; when it did not, the focus was the child's school, family, and social relationships. Attempts were made to record each child in a clinic/office setting, for consistency of environment. The parents of subjects P.S. and S.W., however, preferred the recordings to be made at home. All parents signed release forms permitting use of the tapes.

#### Transcription of the Tapes

The tapes were transcribed without notation of stuttering in the first instance (Transcript 1). This transcript was used in the constituent analysis. At a second hearing of the tape, stuttering instances were judged by the examiner

and noted on a copy of the original transcript (Transcript 2). Percentage of stuttered words was computed. A reliability check of stuttering was made by the same examiner one month after the original assessment, using a third copy of the transcript. The correlation of the two evaluations of stuttering, as measured by the Spearman Rank-Order Correlation Coefficient, was .97. Where there was disagreement on a stuttering instance, the tape was replayed, and a decision reached on whether or not stuttering occurred, for the final count of stuttering.

All speech used by each child was transcribed, with the following exceptions. Word and phrase repetitions were omitted, as these sometimes were associated with stuttering and could act as "cues" of stuttering during the examiner's analysis of constituent structure. Play noises were transcribed when possible, and always if they functioned as parts of speech, as in "It went whoosh". Minor articulatory errors were not transcribed. Attention was paid to the possibility of a voiceless substitution for a voiced consonant, or vice versa, at the onset of words, as this would affect the off/on voicing analysis. No such substitutions occurred. Relatively few unintelligible items occurred, and these were noted in the transcripts.

### Word Count

The word count of each transcript incorporated words which were in partially intelligible utterances; fillers and exclamations such as "hey," "oops," "oh," "oh boy;" play noises, and the words of songs offered by the children. This was done to ensure that the off/on voicing analysis would cover all phonetic transitions in the corpora.

### Notation of Stuttering and Off/On Voicing

Characteristics of early stuttering as reported by Van Riper (1971), were used as criteria to guide the assessment of stuttering instances. These characteristics are: sound and syllable repetitions; prolonged sounds; prolonged articulatory postures with or without tension (as only auditory cues were available in this study, "silent block" with audible tension was substituted here); and broken words.

Characteristics of each stutter were noted on Transcript 2 above the stuttered word for all subjects. Examples are: sound repetition, mememan; sound prolongation, mman; silent block with tension, --man; broken word, m-an. The types of notations provided the examiner with a method of verifying that the stuttering instances were in accord with the previously specified criteria. Stuttering which occurred at the end of a word was excluded from the voicing count. Two such stutterings occurred.

The off/on voicing feature reflects any alteration required to switch from voice to no voice, or vice versa. The variety of off/on adjustments examined are listed below. These 12 characteristics appear on Transcript 2 via the appropriate numerical notation within the range of one through twelve, (see example below), according to the associated off/on category. Zero voice (prior to the onset of utterance) is represented by "0," a voiced speech sound is represented by "V," and a voiceless speech sound is represented by "VL". The center symbol of each group of three (for example, V-VL-V) represents the first sound of a word, while the symbol on either side represents silence (0), or the voicing environment (V or VL) of the initial sound of that word.

Voicing:	Onset of utterance	O-VL-V	1
		O-V	2
	Onset after other pause	O-VL-V	3
		O-V	4
	Without preceding pause	V-V-V	5
		VL-VL-VL	6
	V-VL-VL	7	
	V-V-VL	8	
	VL-VL-V	9	
	VL-V-V	10	
	V-VL-V	11	
	VL-V-VL	12	

A brief example of this analysis from the transcript of R.G. is as follows:

<sup>2</sup>Oh <sup>5</sup>boy <sup>8</sup>its <sup>9</sup>sort <sup>10</sup>of <sup>7</sup>stupid <sup>5</sup>there.  
<sup>2</sup>Well <sup>5</sup>because <sup>8</sup>it <sup>10</sup>don't <sup>9</sup>snow <sup>5</sup>and <sup>11</sup>today  
<sup>8</sup>its <sup>10</sup>gonna <sup>11</sup>snow <sup>5</sup>in <sup>5</sup>the <sup>5</sup>night. <sup>1</sup>So <sup>5</sup>we  
<sup>11</sup>can <sup>3</sup>have <sup>8</sup>a <sup>11</sup>snowball <sup>11</sup>fight <sup>10</sup>and <sup>5</sup>we <sup>11</sup>can  
<sup>5</sup>build <sup>8</sup>a <sup>11</sup>snowman.

### Analysis of Constituent Structure

This will be discussed according to (i) an utterance, (ii) definitions, (iii) marking the transcripts, and (iv) position of instances of stuttering.

(i) An Utterance. An utterance was considered complete at 1) terminal fall, or 2) no terminal fall but a pause followed by a statement about something else, or 3) a statement by the examiner, terminating the child's utterance. Utterances including fragments, incomplete and one-word utterances were scored. Song lyrics were not included in the constituent analysis, and partially intelligible utterances were omitted from the analysis.

(ii) Definitions. These will be divided into (a) Clause Categories, (b) Within-Clause Categories, and (c) Non-Clause Categories. A bracketed abbreviation which appears after a definition indicates that the item is used in the analysis of constituent structure. A summary of such items is on page 77.

(a) Clause Categories. Word Preceding Clause (WPC) refers

to a word which precedes the head construction (NP or equivalent) of a simple sentence or main clause. These words were frequently "fillers" such as "hey," "well," and so on. As conjunctions and adverbs were also used at times in this position, in a "filler" capacity, words occurring in this position which could act as fillers were classified as WPC, for conformity. The following examples are from the corpora.

[Like] I got the rest of this at home.

[Whoops] I forgot something.

[Now] where's the ball.

[Hey] I fly it and you fly it.

[OK] bear says "hi lady".

[Yeah] they'll burn up.

[Well] what one you gonna push through there with this?

[Oh] they try to find him.

The WPC category was also used for topic-comment constructions as in: [This] I'll take this out first. All bracketed words were classified as WPC. When two words were used in this position, as in:

[Well then] I'm going home.

[Oh shucks] I know how to make that.

[Oh yeah] I know this.

the two words were incorporated into one unit of WPC. In the word count, WPC1 designated the single WPC or the first of a

two-word WPC, while WPC2 was the second of a two-word WPC. Phrases which were considered an integral part of the sentence were not labelled WPC, as the first word of the phrase was considered to be the first word of the clause, as in:

This afternoon I'll go to school.

The WPC category was used in association with simple sentence and main clauses (see SSC and MC below) to form categories of SSC+WPC and MC+WPC.

A Surface Clause is a sequence of words consisting of subject and predicate.

A Simple Sentence Clause (SSC) is a clause which stands alone and conveys complete meaning. It is an independent clause which is not attached to a subordinate or coordinate clause. While most simple sentence clauses consisted of subject-predicate components, those with the subject omitted were also regarded as simple sentence clauses. Examples are imperatives: Go home! Say something! One word imperatives were not included in this category. Further examples of simple sentence clauses are simple declaratives and questions.

Main Clause (MC) is an independent clause which is part of a larger construction. It is attached to one or more subordinate clauses, as in: I went shopping because it was necessary.

And Clause may be a simple sentence clause beginning with

and (SAC), a main clause beginning with and (MAC), or a coordinate clause beginning with and (ACo).

Coordinate Clause (Co) is a clause which is connected to another by a conjunction, as in:

Jane was running so I ran too.

In some instances coordination occurs without a coordinate or subordinate word (Limber, 1973). Such clauses were included in the coordinate clause category. Example:

You do this I'll do that.

Subordinate Clause is a part of a larger sentence, and depends for its completed meaning on the independent clause. Subordinate clauses beginning with subordinate conjunctions such as because, if, until, after, were labelled as coordinates, though use of the subordinate word was noted. Example: I went shopping because it was necessary. Other subordinate clauses were labelled according to the type of clause, as in relative clause. Example:

The ball that I want is in the box.

Complement Clauses are of three types: that, for-to, and poss-ing.

Complement Clause "that" (that) examples:

That John drove the car bothers me.  
She hates it that John drives so fast.

Reduced versions of "that" complementation were found in the corpora and were labelled as "that" complements. Examples:

She knows I'm five.  
 I think she's the mommy.  
 I mean this one's just right.  
 And pretend this is the school.

Complement Clause "for-to" (f-t) examples:

For you to do that was clever.  
 I don't like for you to do that.  
 John wants to leave.

The last example is a reduced "for-to" complement.

The underlying structure is: John wants for John to leave.

Reduced "for-to" complements in the corpora were included in this category.

Complement Clause "poss-ing" examples:

John's driving the car bothers me.  
His leaving early was wise.

While the "poss-ing" complement is considered one of the common forms of complementation (Jacobs and Rosenbaum, 1968), none were found in the corpora of the subjects in this study. A form of complement clause cited by Limber (1973), the "ing" complement, was found. Examples are:

They like standing like this.  
 I was too busy playing.  
 There's the dog leaving it.

The "ing" complement was substituted for the "poss-ing" complement.

A Relative Clause (RC) is dependent on the main clause to which it is connected by a relative word, though in some instances the relative word is deleted (see "reduced relative

clause" below). Relative words used may be that or a WH-word, who, whom, how, what, where.

Modifying Relative Clause (MR) examples:

The house that Jack built fell down.  
 The one that got away was huge.  
 The person who said that made an error.

Relative WH Clause (RWH) examples:

I know what to do.  
 Come when you can.  
 I know where he went.

The last two examples are known as "headless" relatives, with when standing in place of at the time when, and where standing in place of the place where (Jacobs and Rosenbaum, 1968).

Reduced Relative Clause (RR) examples:

The house Jack built fell down.  
 The man I saw had aged.  
 The pets he had were well cared for.

The types of relatives were marked on the transcripts but were combined into a total score of relative clauses (RC) on the data sheet.

A Complex Sentence (CS) is one that contains one or more embedded or conjoined clauses. A complex sentence in this data may be composed of a main clause (MC), or a main clause plus word preceding clause (MC+WPC), or a main "and" clause (MAC) together with one or more of the following: coordinate clause (Co), "and" coordinate (ACo), complement clause (that,

f-t, ing), relative clause (MR, WH, RR). In doubtful cases, Limber's "rule of thumb" for complex sentences was used: "I will consider any sentence with more than one verb as complex; auxiliaries and possessives are perhaps arbitrarily excluded." (Limber, 1973, p. 170.)

(b) Within-Clause Categories. The Subject (S) of a sentence is the noun, pronoun or nominal structure that usually agrees in number with the verb and usually stands before the verb:

The old man walked home.  
He is going home.

The Predicate (P) consists of one or more verbs, plus objects, modifiers, and complements.

The old man walked home.

An Object is a noun, noun phrase or other nominal that can be replaced by a personal pronoun. The present data were analyzed for words occurring in the object position immediately following the verb. A variety of structures can occur in such positions, prepositional phrase, adverbial, complement clause. Any part of speech occurring in this position was classified as "X," with the juncture of the verb and X marked as V-X.

A Phrase is a word group without a subject-predicate sequence, and may be a noun phrase, verb phrase, prepositional phrase, adjectival, adverbial, coordinate phrase (I'll do

this then this), or "and" phrase (I want that and that).

A Phrase Boundary is the demarcation of the onset of the phrase. Phrase boundaries may overlap with clause boundaries, subject-predicate splits, and verb-X splits, as in:

$$\left[ \text{The little boy} \right] \overset{S-P}{/} \left[ \text{is climbing} \right] \overset{V-X}{/} \left[ \text{on} \right] \left[ \text{the roof} \right]$$

Lesser Phrase Boundary (LPB) is any phrase boundary other than one which is also a clause boundary, subject-predicate split or verb-X split. It denotes a phrase boundary of less importance than those of clause boundary, subject-predicate and verb-X splits. In the example above, there is one lesser phrase boundary at the onset of the phrase the roof.

Random (R) refers to words which do not come under clause or lesser phrase boundary categories, or subject-predicate, verb-X categories. Assignment of a word to this category indicates that the unit has no demonstrable positional value in the structure of a sentence.

Any word not included in the constituent structure analysis (for example, words in partially intelligible utterances, song lyrics) was assigned to an other category, so that all words in the corpora would be accounted for. Only one complete utterance was excluded from the syntactic analysis. While the utterance could be interpreted, it was impossible

to analyze within the stated framework of analysis. The sentence, from the corpus of D.S. is as follows:

"You like you know like to be just like a door when like when ya like see like uh like we close it."

(c) Non-Clause Categories. Fragment (F) is a syntactically incomplete utterance which is semantically appropriate, and complete in its expression of a thought. For example, the response of the whole thing to the question do you have the part or the whole thing, is considered to be a fragment.

And Fragment (AF) applies to a fragment which begins with and. Separate categories were created for and utterances because of the high frequency with which and appeared in the corpora.

Incomplete Utterance (IU) refers to an utterance which is begun but not completed. It is semantically inappropriate in its incompleteness. The incomplete utterance may undergo revisions: My daddy lives ..... he lives ..... daddy lives in Connecticut. This example has two incomplete utterances. An incomplete utterance may contain a syntactically complete clause. Such clauses were retained for analysis and the remainder of the utterance classified as incomplete. For example:

[I saw the dog] [when he...  
Main clause      incomplete clause

One-word Utterance (1/W) consists of individual items such as "yes," "no," "right," "hey," "oh boy," "oh no," uttered separately from clauses, fragments, etc.

A reliability check of the analysis of constituent structure was carried out by a doctoral student in speech and hearing sciences, experienced in such analyses. A sample of each corpus (the first half of pages 2 and 10) was used in the reliability check. Comparison of the two analyses was carried out with the Spearman Rank-Order Correlation Coefficient, with a resulting correlation of .92.

(iii) Marking the Transcripts. A clause boundary was marked by large brackets at the beginning and end of the clause. The type of clause was noted in the lower left corner.

[The big ball went in the box.]  
SSC

A phrase boundary was marked by small brackets at the beginning and end of each phrase.

[[The big ball] [went [in [the box.]]]]

Subject-predicate, verb-X splits were marked with slashes, and labelled S-P, V-X.

[ [The big ball] /<sup>S-P</sup> [went /<sup>V-X</sup> [in [the box.]] ] ]

When contractions occurred in the transcript, as in

He /<sup>S-P</sup>s going home.

the S-P split was considered to occur on the uncontracted part of the verb, going.

S-P, V-X splits in questions were treated as follows. If word order was preserved, as in

I can take it out?

conventional S-P, V-X splits were marked.

I /<sup>S-P</sup> can take /<sup>V-X</sup> it out?

When the customary subject-auxiliary inversion was used interrupting the relationship of verb parts, S-P splits were omitted. The V-X split was considered intact and was marked.

Can I take /<sup>V-X</sup> it out?

The following is a segment of the transcript of subject M.L., with the constituents marked, and the stutterings recorded according to the off/on voicing category, above the site



word between "clause onset" and "end clause" is "mid clause". "End clause" and "mid clause" tallies were combined in "non-onset" count. One word clauses (Know what I'm gonna do?) were considered clause onset.

Some clauses, notably clauses beginning with the "word preceding clause" category, had two possible onsets. The following breakdown further specifies clause onset in such clause types.

Simple Sentence Clause Plus Word Preceding Clause (SSC+WPC)

In the sentence Well I'm going home, clause onset may be regarded as well, or I'm, which appears to be the actual first word of the clause, with well acting as a filler. Stuttering may occur on either or both words. To accommodate these possibilities, the following analyses were made:

(a) A "broad" count, where the two words, well and I'm were considered clause onset. Stuttering on either was tallied as one stuttering at clause onset, stuttering on both words was tallied as two stutterings at clause onset.

(b) A second count was made according to whether the stuttering occurred on well (a WPC stutter), or I'm (a "first word" stutter). If stuttering occurred on both words, one tally was assigned to each category. When stuttering occurred on one or both of a two-word WPC (Well then I'm going home) the stuttering(s) was assigned to the WPC category. This

category could therefore involve stuttering which occurred in the first three words of a sentence (Well then I'm going home).

This analysis was also carried out for MC+WPC's, MAC's, SAC's and ACo's.

Coordination. In the "broad" count, the first word of a coordinate clause is regarded as the first word of the clause when no coordinating word is used. If a coordinating word is used, the coordinate plus the "first word" are regarded as clause onset. In the examples

You do this I'll do that.  
 You do this cause I'm doing that.

the underlined portions are clause onsets. A further count delineated stuttering which occurred on I'll, cause, and I'm.

For relative clauses and complements, the first word of the clause was clause onset.

Phrases. Phrase position is specified by the term "lesser phrase boundary" (see p. 67) which is onset of the phrase. Further differentiation of phrase positions was not attempted due to the limited number of words in many phrases. Subject-predicate, verb-X splits occur at phrase boundaries, but are labelled S-P, V-X to signify their importance in the structure of the sentence.

Clause positions therefore, are noted by clause onset, mid and end clause categories, with the last two combined for non-onset position. Non-onset positions are further

specified by subject-predicate and verb-X splits, lesser phrase boundaries, and the random (see p. 67) category.

Non-Clause Categories. (Fragments, "and" fragments, incomplete utterances, one-word utterances.) Position of stuttering was not evaluated in these categories. An overall count of stuttering was more appropriate because of the fragmented nature of the items.

#### Analysis of the Data

This will be discussed as follows:

(1) Stuttering and Syntactic Categories

- (i) stuttering at clause boundaries, at mid and end clause positions and non-onset (mid plus end) positions;
- (ii) stuttering and clause type;
- (iii) stuttering at within-clause positions: S-P, V-X splits, lesser phrase boundaries, random words;
- (iv) stuttering and non-clause categories;
- (v) stuttering on complex sentences;

(2) Stuttering and off/on voicing.

All stutterings in each category were tallied and analyzed with reference to the computed number of opportunities to stutter in that category. An assumption was made that it was possible to stutter once on each word in the corpora. A subject therefore who used 65 clause onsets and stuttered 20 times at clause onsets, had the opportunity to

stutter 65 times and an actual stuttering score of 20.

"Opportunities to stutter" are designated OTS, and "actual stutters," AS.

(1) Stuttering and Syntactic Categories

(i) Stuttering at Clause Boundaries. OTS and AS for clause boundaries for all subjects were entered on the data sheet. This was done according to clause type. In the same way, OTS and AS for mid and end clause positions were tallied, and then combined to give OTS and AS for non-onset positions.

Further delineation of stuttering at clause boundaries for the "word preceding clause" category was done, as previously described. These categories were SSC+WPC, MC+WPC, SAC, MAC, ACo. The category of coordination was refined to show AS at clause onset when no coordinating word was used, and AS when a conjunction or subordinating word was used.

(ii) Stuttering and Clause Type. There is some overlap between this category and clause boundary, as the positional effect of stuttering is examined according to clause type. Further examination of clause type was carried out by computing OTS and AS for the combined tallies of clause boundaries and non-onset positions, giving an overall sum of OTS and AS according to clause type.

(iii) Stuttering and Within-Clause Positions. OTS and

AS for subject-predicate, verb-X splits, lesser phrase boundaries and random words were tallied.

(iv) Stuttering and Non-Clause Categories. OTS and AS for fragments, "and" fragments, incomplete utterances, one-word utterances, were tallied.

(v) Stuttering on Complex Sentences. Previously computed scores for OTS and AS were used to examine stuttering on complex sentences as opposed to simple sentences in two ways:

(a) Stuttering at the onset of complex sentences (onsets of MC, MC+WPC, MAC) as compared with stuttering at the onsets of simple sentences (SSC, SSC+WPC, SAC).

(b) The total amount of stuttering on complex sentences (MC, MC+WPC, MAC, Co, ACo, RC, Comps) as compared with the total amount of stuttering on simple sentences.

(2) Stuttering and Off/On Voicing

OTS and AS for voicing categories 1 through 12 were tallied for the first sound of every word in the corpora.

Summary of Categories for Analysis

Constituent Structure

Clause Categories:	Simple Sentence Clause	
	plus word preceding clause	SSC+WPC
	Simple Sentence Clause	SSC
	Main Clause plus word	
	preceding clause	MC+WPC
	Main Clause	MC
	Simple "and" Clause	SAC
	Main "and" Clause	MAC
	"And" coordinate	ACo
	Coordinate Clause	Co
	Complement Clause	
	(that, f-t, ing)	Comp
	Relative Clause	
	(MR, WH, RR)	RC
Complex Sentence	CS	
Within-Clause Categories:	Subject-Predicate split	S-P
	Verb-X split	V-X
	Lesser Phrase Boundary	LPB
	Random	R
Non-Clause Categories:	Fragment	F
	"And" Fragment	AF
	Incomplete Utterance	IU
	One-word Utterance	1/W

Voicing

Onset of Utterance:	O-VL-V	1
	O-V	2
Onset after other pause:	O-VL-V	3
	O-V	4
Without preceding pause:	V-V-V	5
	VL-VL-VL	6
	V-VL-VL	7
	V-V-VL	8
	VL-VL-V	9
	VL-V-V	10
	V-VL-V	11
	VL-V-VL	12

## CHAPTER IV

## RESULTS

Table 1 shows the distribution of the total number of words in the corpora by category and by subject. Table 2 shows the percentage of stuttered words for each subject's corpus. There was considerable variation in the rate of stuttering for individual stutterers, ranging from 3% (mild to moderate stuttering, according to the "Scale for Rating Severity of Stuttering," Johnson, Darley and Spriestersbach, 1963) to 19% (severe stuttering), with an average of 8.3% stuttered words per subject.

Inspection of the stutterers' corpora revealed what appeared to be impoverished syntax. For example, the number and kind of complex sentences seemed to be below the standard expected for the ages of the subjects. In view of this, it was decided to add a small comparison of the syntactic categories of four of the stutterers and four matched non-stutterers. Results therefore will be discussed for: (1) stuttering and syntactic categories; (2) stuttering and off/on voicing; (3) comparison of syntactic categories of four stutterers and four non-stutterers.

Table 1. Distribution of Words in Corpora According to Category and Subject

Category	Subject:									Totals
	B.S.	P.S.	M.M.	R.G.	D.S.	S.W.	W.O.	F.M.	M.L.	
SSC	296	474	358	324	389	474	383	465	230	3393
SSC+WPC	108	174	33	128	135	174	104	112	60	1028
MC	54	101	150	102	126	84	109	57	105	888
MC+WPC	29	21	6	61	67	25	25	14	22	270
SAC	20	56	77	66	59	172	0	30	120	600
MAC	1	18	8	73	9	37	7	9	29	191
Co	20	43	36	70	64	52	53	34	40	412
ACo	15	21	45	160	61	95	9	22	80	508
RC	0	3	54	55	48	15	16	18	41	250
ing	0	0	2	3	0	5	5	3	1	19
f-t	82	88	115	105	113	74	66	59	65	767
that	4	38	7	27	42	4	38	16	32	208
F	42	76	111	113	76	180	110	129	45	882
AF	4	6	18	21	5	73	2	11	0	140
IU	14	42	17	65	44	60	21	13	29	305
l/W	66	96	157	48	75	114	66	65	61	748
WPC 1	50	75	45	140	86	107	42	42	76	663
WPC 2	4	14	1	49	8	33	11	3	8	131
Other	0	8	3	11	36	2	9	1	6	76
<b>Total Words</b>	<b>809</b>	<b>1354</b>	<b>1243</b>	<b>1621</b>	<b>1443</b>	<b>1780</b>	<b>1076</b>	<b>1103</b>	<b>1050</b>	<b>11,479</b>

Table 2. Distribution of Words and Stutterings Per Subject

Subject	C.A.	Total Words	Total Stuttering	% Stuttering
B.S.	4.0	809	63	8
P.S.	4.4	1354	40	3
M.M.	4.9	1243	200	16
R.G.	5.5	1621	128	8
D.S.	5.11	1443	58	4
S.W.	6.4	1780	71	4
W.O.	6.4	1076	50	5
F.M.	6.5	1103	149	14
M.L.	6.6	1050	199	19
Total		11,479	958	8.3

(1) STUTTERING AND SYNTACTIC CATEGORIES

(i) Stuttering and Clause Boundaries. Figure 1 compares the percentages of stuttering at clause boundaries with the percentages of stuttering within the clauses for all stutterers combined. Most stutterings occurred at clause boundaries, where 615 (27.6%) of the 2,230 clauses were stuttered. By comparison, of 6,304 words not at clause boundaries (mid clause plus end clause), only 242 (3.8%) were stuttered. At mid clause positions, 202 (4.8%) of 4,134 words were stuttered; at end clause positions, 40 (1.8%) of 2,170 words were stuttered. The null hypothesis that stuttering occurs randomly with regard to clause boundaries was rejected by inspection of the data.

The clause boundary effect was examined further to determine whether stuttering was more likely to occur on

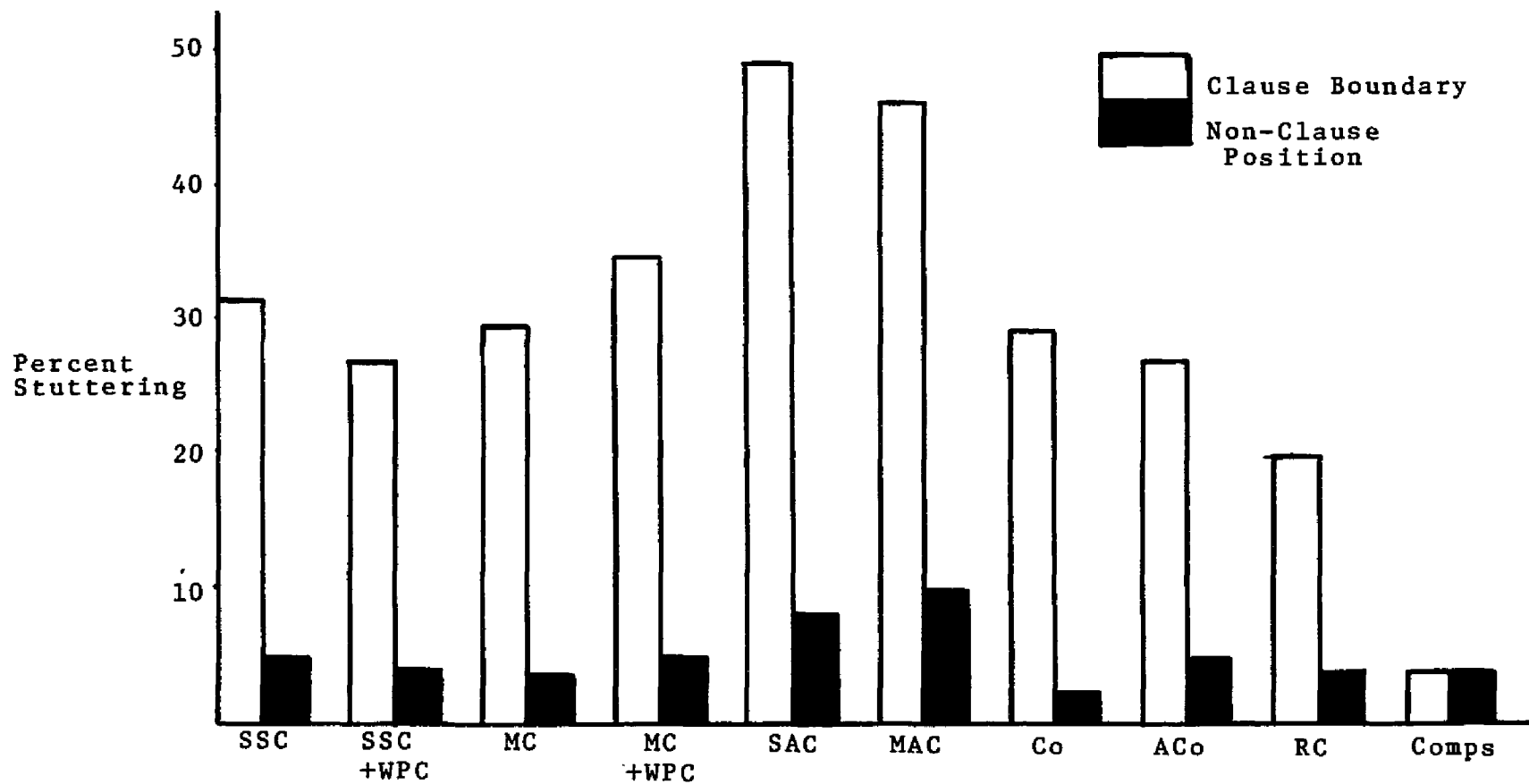


Figure 1. Stuttering at Clause Boundaries and Non-Clause Positions According to Clause Type for all Subjects.

the "word preceding clause" (WPC), the "and," or the "first word" of the clause. Percent stutterings on WPC's, "ands," and "first words" of the simple sentence clause plus WPC, main clause plus WPC, simple "and" clause and main "and" clause categories is shown in Figure 2. For this comparison, a Wilcoxon Matched-Pairs Signed-Ranks Test was computed between the AS/OTS proportion (see p. 75) of stuttering on the WPC and the same proportion on the "first word" (see Tables 3 and 4). For the SAC, MAC and SSC+WPC categories, the difference in the frequency of stuttering between the two types of words was significant at the .05 level of confidence in a two-tailed test (for SAC, N=7, T=0; MAC, N=6, T=0; SSC+WPC, N=7, T=1). That is, the "and" words in the SAC's and MAC's, and the "fillers" in the SSC+WPC's were stuttered significantly more than the "first words" of the clauses. There was however, no significant difference in the frequency of stuttering between the WPC onset and the "first word" onset for the MC+WPC category. This indicates a smaller difference between stuttering on the "first word" and on the starter word of the main clause of a complex sentence than on the other categories (SSC+WPC, MAC, SAC) tested for this distinction at clause boundaries. The scores of two subjects (F.M. and M.L.) appeared to exert a strong influence on this result (see Table 4).

Because many coordinate (Co) clauses were used without

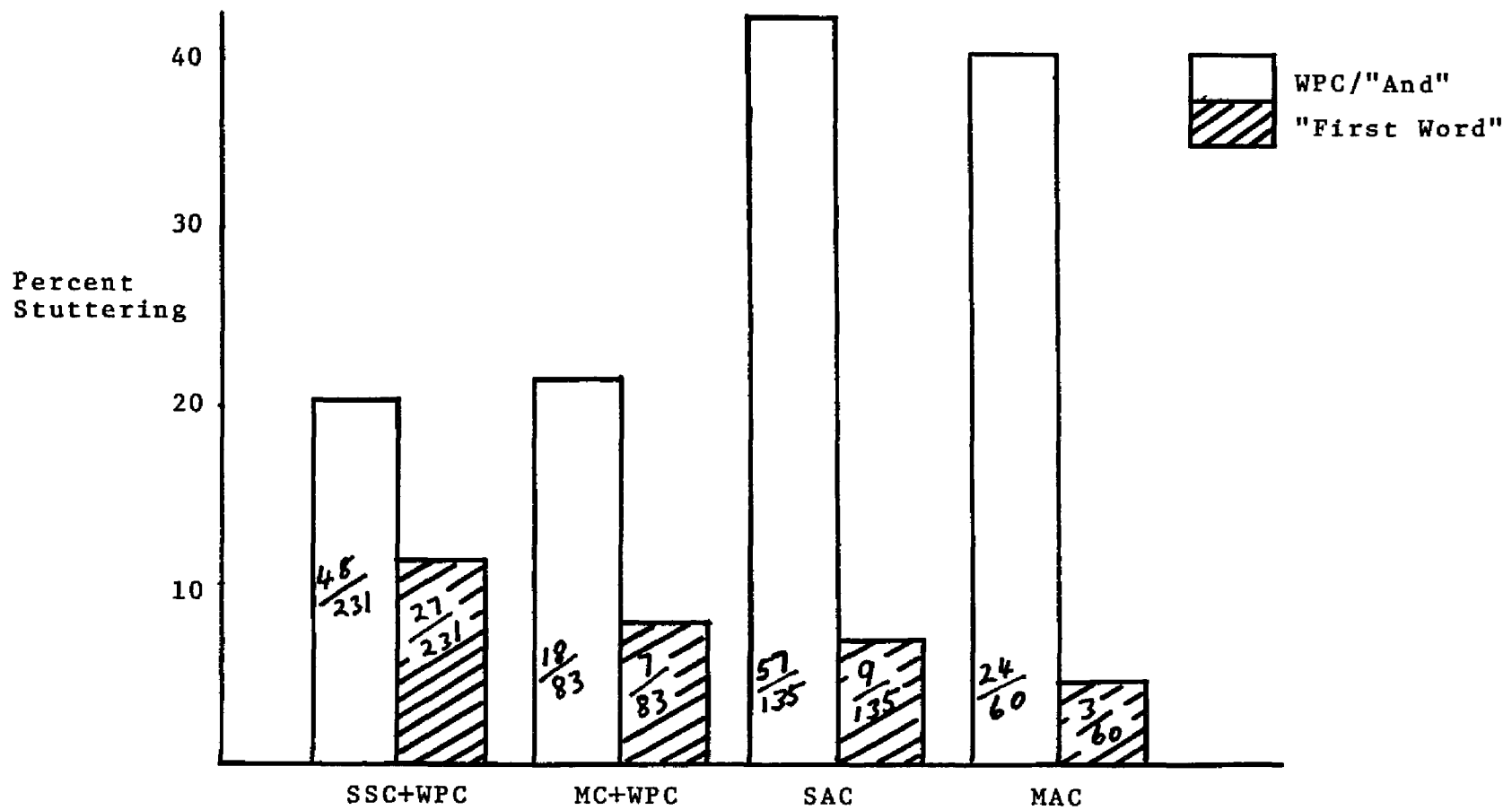


Figure 2. Stuttering on Word Preceding Clause (WPC), "And" and "First Word" at Clause Boundaries.

a connecting word of coordination or subordination, a comparison was made between stuttering at the onsets of Co clauses in the absence of a coordinate (or subordinate) word, and stuttering at the onsets of Co clauses with a coordinate (or subordinate) word. Table 5 shows the AS/OTS proportions for the two types of onsets.

Table 3. Percentage of Actual Stutters/Opportunities to Stutter (AS/OTS) on "And" and "First Word" in SAC's and MAC's

Subjects	<u>Simple and clause</u>		<u>Main and clause</u>	
	"and" AS/OTS %	"first word" AS/OTS %	"and" AS/OTS %	"first word" AS/OTS %
B.S.	17	17	0	0
P.S.	25	0	33	0
M.M.	78	0	100	0
R.G.	28	17	33	10
D.S.	21	0	0	0
S.W.	23	3	10	10
W.O.	0	0	100	0
F.M.	67	33	67	33
M.L.	73	8	70	0

Table 4. Percentage of Actual Stutters/Opportunities to Stutter (AS/OTS) on "WPC" and "First Word" in SSC+WPC and MC+WPC

Subjects	<u>Simple sentence clause+WPC</u>		<u>Main clause+WPC</u>	
	"WPC" AS/OTS %	"first word" AS/OTS %	"WPC" AS/OTS %	"first word" AS/OTS %
B.S.	27	15	44	11
P.S.	15	0	0	0
M.M.	56	0	67	0
R.G.	22	11	24	5
D.S.	13	13	17	0
S.W.	9	12	33	0
W.O.	12	0	0	0
F.M.	35	27	14	43
M.L.	38	38	25	50

Table 5. Percentage of Actual Stutters/Opportunities to Stutter (AS/OTS) On Coordinate Clauses Without Coordinating Word (No Co) and with Coordinating Word (With Co)

Subjects	No Co AS/OTS %	With Co AS/OTS %
B.S.	0	50
P.S.	0	0
M.M.	62	100
R.G.	50	33
D.S.	15	0
S.W.	0	0
W.O.	11	20
F.M.	0	100
M.L.	60	80

Of 67 examples of the Co category where no coordinating word was used, 16 (24%) were stuttered. Forty-seven Co's occurred in which a coordinating word was used, and 15 (32%) of these were stuttered. Eleven of the 15 stutterings occurred on the "first word" of the clause (e.g., I'll do it but I don't want to). A Wilcoxon Test was used to determine whether the type of onset of the Co clause influenced the frequency of stuttering. The difference between the amounts of stuttering on clauses used without coordinate words and those used with coordinate words was non-significant (N=7, T=5).

Although the Comp. category incurred little stuttering, onsets of the two most stuttered Comps, "for-to's" and "thats," were compared for frequency of stuttering. The

comparison was interesting because "that" complements usually have more structure and more length than "for-to" complements and might conceivably influence breakdown in stutterers. Although the paucity of stutterings on the categories did not permit a statistical treatment of the data, it was noted that 4 (1.7%) of 233 "for-to" onsets were stuttered, and 7 (12.5%) of 56 "that" onsets were stuttered.

Different types of relative clauses were compared for stuttering at the boundaries of WH relatives, reduced relatives and modifying relatives (see p. 65), although these clauses and stutterings occurred infrequently. Roughly the same amount of stuttering occurred at the onsets of WH relatives and reduced relatives. Of 37 WH relatives, 8 (22%) were stuttered, and of 20 reduced relatives 5 (25%) were stuttered. None of the 5 modifying relatives used by the subjects was stuttered.

(ii) Stuttering and Clause Type. Stuttering and clause type were examined with respect to (a) the relationship between stuttering and clause type at the boundary position, and (b) the relationship between stuttering and clause type at all positions.

(a) The Relationship between Stuttering and Clause Type at the Boundary Position. A two-way analysis of variance with one entry per cell (Roscoe, 1975, p. 323) was computed.

The dependent variable was the rate of stuttering within each clause type, computed by the formula  $X=AS/OTS$ , where X is the dependent variable. For example, in Table 7, subject B.S.'s rate of stuttering for the SSC clause was computed by  $AS/OTS$  or  $18/64$ , which is .28. The independent variables in the analysis of variance were (1) subjects and (2) clause type.

Results of this analysis are in Table 6.

Table 6. Summary of Analysis of Variance for Stuttering at Clause Onsets.

Source of Variance	df	SS	MS	F	p
Rows (subjects)	8	3.70	.4625	14.9676	$\leq .05$
Columns (categories)	9	1.4550	.1616	5.2297	$\leq .05$
Interaction	72	2.2310	.0309		

The analysis of variance shows that the differences in the rate of stuttering were significant among categories. The null hypothesis with regard to stuttering and clause type (at the boundary position) was therefore rejected. A further finding, though one incidental to the hypotheses of this study, was that there were significant differences in the rate of stuttering among individual subjects.

In order to locate more precisely the sources of variance among categories, the Scheffé test for all possible

Table 7. Opportunities to Stutter (OTS) and Actual Stuttering (AS) at Clause Onset According to Clause Type.

Subject B.S. (4.0 years)			P.S. (4.4 years)		
Clause Type	OTS	AS	OTS	AS	
SSC	64	18	111	16	
SSC+WPC	26	11	40	6	
MC	22	4	41	6	
MC+WPC	9	5	7	0	
SAC	6	2	16	4	
MAC	1	0	6	2	
Co	5	2	11	0	
ACo	4	1	5	0	
RC	0	0	1	0	
Comps	25	1	40	0	
Total	162	44	278	34	

Subject M.M. (5.5 years)			R.G. (5.5 years)		
SSC	99	53	67	22	
SSC+WPC	9	5	27	9	
MC	64	44	32	12	
MC+WPC	3	2	21	6	
SAC	18	14	18	8	
MAC	3	3	21	9	
Co	14	9	19	7	
ACo	14	9	41	14	
RC	14	8	14	0	
Comps	47	0	39	1	
Total	285	147	299	88	

Subject D.S. (5.11 years)			S.W. (6.4 years)		
SSC	87	13	92	12	
SSC+WPC	31	8	33	7	
MC	47	3	31	5	
MC+WPC	18	3	6	2	
SAC	14	3	31	8	
MAC	4	0	10	2	
Co	18	2	12	0	
ACo	19	3	22	1	
RC	13	0	4	0	
Comps	43	2	25	0	
Total	294	37	266	37	

Table 7. Opportunities to Stutter (OTS) and Actual Stuttering (AS) at Clause Onset According to Clause Type (continued).

Subject W.O. (6.4 years)			F.M. (6.5 years)	
Clause Type	OTS	AS	OTS	AS
SSC	98	19	108	30
SSC+WPC	26	3	26	16
MC	38	10	23	10
MC+WPC	8	0	7	4
SAC	0	0	6	6
MAC	2	2	3	3
Co	14	2	11	2
ACo	3	0	4	4
RC	4	0	4	2
Comps	33	0	23	5
Total	226	36	215	82

Subject M.L. (6.6 years)

SSC	59	29
SSC+WPC	13	10
MC	28	19
MC+WPC	4	3
SAC	26	21
MAC	10	7
Co	10	7
ACo	22	8
RC	8	4
Comps	25	2
Total	205	110

comparisons (Roscoe, 1975, pp. 313-315) was computed, using the critical difference method. A  $d$  of .36 was obtained, indicating that only the MAC versus complement clause and SAC versus complement clause comparisons were significantly different. That is, the rate of stuttering on MAC's and SAC's was significantly ( $p \leq .05$ ) more than on complement clauses. The means for all 9 categories are listed in Table 8.

Table 8. Mean Rate of Stuttering for Different Clause Types (Onset Position).

Category	Mean
MAC	.5166
SAC	.4500
SSC+WPC	.3766
MC+WPC	.3666
MC	.3277
ACo	.3088
Co	.2811
SSC	.2766
RC	.1744
Comps	.0433

Summarizing the findings for stuttering according to clause type at the boundary position: significant differences were found in the amount of stuttering among clause types; the SAC's and MAC's were stuttered significantly more than complement clauses.

(b) The Relationship between Stuttering and Clause Type in All Positions. Onset positions and non-onset (mid plus end)

positions of OTS and AS (see Tables 10 and 11) were combined for this overall category. A two-way analysis of variance with one entry per cell (see p. 87) was done to see if there was a relationship between the rate of stuttering and clause type when data from all positions in the clause type were considered. The dependent variable was the AS/OTS ratio (see p. 87), and the independent variables were again, subjects and clause type. Results are presented in Table 9.

Table 9. Summary of Analysis of Variance for Stuttering in All Positions of Clauses.

Source of Variance	df	SS	MS	F	p
Rows (subjects)	8	.7172	.0896	11.4871	$\leq .05$
Columns (categories)	9	.3236	.0359	4.6025	$\leq .05$
Interaction	72	.5689	.0078		

The analysis of variance shows that the differences in the rate of stuttering were significant among categories. The null hypothesis with regard to stuttering and clause type (in all positions) was rejected. Once again, there were significant differences in the rate of stuttering among individual subjects.

In order to locate more precisely the sources of variance among categories, the Scheffé test for all possible comparisons (Roscoe, 1975, pp. 313-315) was computed, using

Table 10. Opportunities to Stutter (OTS) and Actual Stuttering (AS) at Mid Clause Position According to Clause Type.

Subject B.S. (4.0 years)			P.S. (4.4 years)		
Clause Type	OTS	AS	OTS	AS	
SSC	168	4	252	2	
SSC+WPC	56	3	94	0	
MC	12	0	21	0	
MC+WPC	13	0	8	0	
SAC	8	2	24	0	
MAC	0	0	6	0	
Co	10	0	21	0	
ACo	7	0	11	0	
RC	0	0	1	0	
Comps	37	3	50	1	
Total	311	12	488	3	
Subject M.M. (5.5 years)			R.G. (5.5 years)		
SSC	160	15	190	1	
SSC+WPC	15	2	74	1	
MC	30	3	44	1	
MC+WPC	1	0	20	0	
SAC	41	6	30	0	
MAC	2	0	31	0	
Co	8	0	32	0	
ACo	19	1	78	6	
RC	26	2	28	1	
Comps	36	1	60	1	
Total	338	30	587	10	
Subject D.S. (5.11 years)			S.W. (6.4 years)		
SSC	215	4	290	11	
SSC+WPC	73	3	108	3	
MC	35	1	25	0	
MC+WPC	31	0	13	0	
SAC	31	0	110	3	
MAC	1	0	17	2	
Co	28	3	28	0	
ACo	23	0	51	0	
RC	22	0	7	1	
Comps	71	2	33	0	
Total	530	13	682	20	

Table 10. Opportunities to Stutter (OTS) and Actual Stuttering (AS) at Mid Clause Position According to Clause Type (continued).

Subject W.O. (6.4 years)			F.M. (6.5 years)		
Clause Type	OTS	AS	OTS	AS	
SSC	187	2	249	19	
SSC+WPC	52	0	60	8	
MC	34	1	12	2	
MC+WPC	9	0	1	1	
SAC	0	0	18	4	
MAC	3	0	3	3	
Co	25	1	12	1	
ACo	3	0	14	1	
RC	8	0	10	0	
Comps	47	0	33	7	
Total	368	4	412	46	

Subject M.L. (6.6 years)

SSC	112	11
SSC+WPC	34	9
MC	49	9
MC+WPC	14	3
SAC	68	16
MAC	11	2
Co	20	5
ACo	36	1
RC	25	3
Comps	49	5
Total	418	64

Table 11. Opportunities to Stutter (OTS) and Actual Stuttering (AS) at End Clause Position According to Clause Type.

Subject B.S. (4.0 years)			P.S. (4.4 years)	
Clause Type	OTS	AS	OTS	AS
SSC	64	0	111	0
SSC+WPC	26	1	40	0
MC	20	0	39	0
MC+WPC	7	0	6	0
SAC	6	0	16	0
MAC	0	0	6	0
Co	5	0	11	0
ACo	4	0	5	0
RC	0	0	1	0
Comps	24	0	36	0
Total	156	1	271	0

Subject M.M. (5.5 years)			R.G. (5.5 years)	
Clause Type	OTS	AS	OTS	AS
SSC	99	1	67	0
SSC+WPC	9	2	27	0
MC	56	2	26	3
MC+WPC	2	0	20	0
SAC	18	0	18	0
MAC	3	1	21	0
Co	14	0	19	0
ACo	12	0	41	2
RC	14	0	13	1
Comps	41	0	36	3
Total	268	6	288	9

Subject D.S. (5.11 years)			S.W. (6.4 years)	
Clause Type	OTS	AS	OTS	AS
SSC	87	0	92	0
SSC+WPC	31	0	33	0
MC	44	1	28	0
MC+WPC	18	0	6	0
SAC	14	0	31	0
MAC	4	0	10	0
Co	18	0	12	1
ACo	19	0	22	0
RC	13	0	4	0
Comps	41	0	25	0
Total	289	1	263	1

Table 11. Opportunities to Stutter (OTS) and Actual Stuttering (AS) at End Clause Position According to Clause Type (continued).

Subject W.O. (6.4 years)			F.M. (6.5 years)	
Clause Type	OTS	AS	OTS	AS
SSC	98	1	108	3
SSC+WPC	26	0	26	0
MC	37	1	22	1
MC+WPC	8	0	6	1
SAC	0	0	6	0
MAC	2	0	3	1
Co	14	0	11	0
ACo	3	0	4	2
RC	4	0	4	0
Comps	29	0	22	1
Total	221	2	212	9

Subject M.L. (6.6 years)

SSC	59	1
SSC+WPC	13	0
MC	28	3
MC+WPC	4	0
SAC	26	1
MAC	8	2
Co	10	3
ACo	22	0
RC	8	0
Comps	24	1
Total	202	11

the critical difference method. A  $d$  of .178 was obtained. This showed that the MAC versus relative clauses and MAC versus complement clauses were significantly different. That is, the rate of stuttering on MAC's was significantly ( $p \leq .05$ ) more than that for relative and complement clauses. The means for all 9 categories are listed in Table 12.

Table 12. Mean Rate of Stuttering for Different Clause Types (All Positions).

Category	Mean
MAC	.2569
MC+WPC	.1589
SAC	.1515
SSC+WPC	.1358
MC	.1336
Co	.1164
ACo	.1004
SSC	.0906
RC	.0637
Comp.	.0441

To summarize the findings for stuttering according to clause type for all positions: significant differences were found in the amount of stuttering among clause types; the MAC was stuttered significantly more than relative and complement clauses.

(iii) Stuttering at S-P, V-X splits, Lesser Phrase Boundaries and Random Words. With regard to the hierarchical structure of the sentence, Table 13 shows the distribution of OTS and AS for subject-predicate, verb-X splits, lesser

Table 13. Opportunities to Stutter (OTS) and Actual Stuttering (AS) on Non-Onset Categories of Subject-Predicate (S-P), Verb-X (V-X), Lesser Phrase Boundary (LPB) and Random Words (R).

Category	B.S.		P.S.	
	OTS	AS	OTS	AS
S-P	88	2	122	1
V-X	90	3	162	1
LPB	102	4	150	0
R	187	4	325	1
<b>Total</b>	<b>467</b>	<b>13</b>	<b>759</b>	<b>3</b>
	M.M.		R.G.	
S-P	166	11	184	7
V-X	155	10	162	4
LPB	61	6	144	4
R	224	9	385	4
<b>Total</b>	<b>606</b>	<b>36</b>	<b>875</b>	<b>19</b>
	D.S.		S.W.	
S-P	180	4	151	7
V-X	183	3	205	3
LPB	153	2	231	6
R	303	5	358	5
<b>Total</b>	<b>819</b>	<b>14</b>	<b>945</b>	<b>21</b>

Table 13. Opportunities to Stutter (OTS) and Actual Stuttering (AS) on Non-Onset Categories of Subject-Predicate (S-P), Verb-X (V-X), Lesser Phrase Boundary (LPB) and Random Words (R) (continued).

Category	W.O.		F.M.	
	OTS	AS	OTS	AS
S-P	121	2	150	11
V-X	127	1	124	8
LPB	82	0	84	7
R	259	3	266	29
<b>Total</b>	<b>589</b>	<b>6</b>	<b>624</b>	<b>55</b>
	M.L.			
S-P	123	12		
V-X	145	27		
LPB	97	21		
R	255	15		
<b>Total</b>	<b>620</b>	<b>75</b>		

phrase boundaries and random words. Of 1,285 S-P breaks, 57 (4.4%) were stuttered; of 1,353 V-X splits, 60 (4.4%) were stuttered; of 1,104 lesser phrase boundaries, 50 (4.5%) were stuttered; of 2,562 random words, 72 (2.9%) were stuttered. A two-way analysis of variance with one entry per cell (Roscoe, 1975, p. 323) was computed. The dependent variable was the rate of stuttering within each clause type (see p. 87). The independent variables were (1) subjects and (2) within-clause categories. Results of this analysis are in Table 14.

Table 14. Summary of Analysis of Variance for Stuttering on Subject-Predicate, Verb-X Splits, Lesser Phrase Boundaries and Random Words.

Source of Variance	df	SS	MS	F	p
Rows (subjects)	3	.0637	.0212	35.333	≤ .01
Columns (categories)	8	.0028	.0003	0.500	non-significant
Interaction	24	.0161	.0006		

The analysis of variance shows no significant difference in the rate of stuttering among categories. That is, no within-clause constituent break emerged as more frequently stuttered than any other. There were significant differences in the rate of stuttering among individual subjects.

(iv) Stuttering and Non-Clause Categories. A two-way analysis of variance with one entry per cell (Roscoe, 1975,

p. 323) was done on the non-clause categories of fragment (F), "and" fragment (AF), incomplete utterance (IU), and one-word utterance (1/W), to see if there was any relationship between the rate of stuttering and non-clause categories. The dependent variable in the analysis of variance was the AS/OTS ratio (see p. 87) and the independent variables were subjects and non-clause category. The raw data for this analysis are in Table 16, and the results are in Table 15.

Table 15. Summary of Analysis of Variance for Stuttering on Non-Clause Categories.

Source of variance	df	SS	MS	F	p
Rows (subjects)	8	.0369	.0046	.7666	non-significant
Columns (categories)	3	.0536	.0179	2.9830	non-significant
Interaction	24	.1440	.0060		

The analysis of variance shows that the differences in the rate of stuttering were not significant among categories. In addition, there were no significant differences in the rate of stuttering among individual subjects.

To summarize the findings of stuttering at constituent breaks within clauses: the rate of stuttering did not differ significantly among the categories of S-P, V-X splits, lesser phrase boundaries and random words.

(v) Stuttering on Complex Sentences. Complex and simple

Table 16. Opportunities to Stutter (OTS) and Actual Stuttering (AS) on Non-Clause Categories of Fragment (F), "And" Fragment (AF), Incomplete Utterance (IU) and One-Word Utterance (1/W).

Category	B.S.		P.S.	
	OTS	AS	OTS	AS
F	42	2	76	1
AF	4	0	6	0
IU	14	3	42	1
1/W	<u>66</u>	<u>1</u>	<u>96</u>	<u>1</u>
Total	126	6	220	3
	M.M.		R.G.	
F	111	8	113	7
AF	18	4	21	1
IU	17	1	65	9
1/W	<u>157</u>	<u>4</u>	<u>48</u>	<u>4</u>
Total	303	17	247	21
	D.S.		S.W.	
F	76	2	180	3
AF	5	0	73	5
IU	44	2	60	4
1/W	<u>75</u>	<u>3</u>	<u>114</u>	<u>1</u>
Total	188	7	427	13
	W.O.		F.M.	
F	110	5	129	6
AF	2	0	11	0
IU	21	2	13	5
1/W	<u>66</u>	<u>1</u>	<u>65</u>	<u>1</u>
Total	199	8	218	12
	M.L.			
F	45	10		
AF	0	0		
IU	29	3		
1/W	<u>61</u>	<u>1</u>		
Total	135	14		

sentences were compared by combining the frequency for rate of stuttering at the onsets of MC, MC+WPC and MAC categories to create a macrocategory (complex sentences) and by combining SSC, SSC+WPC and SAC categories to create another macrocategory (simple sentences). A Scheffé test for combined means (Roscoe, p. 313-315) was computed. There was no significant difference between the rate of stuttering at the onsets of complex and simple sentences.

Stuttering in all positions on complex and simple sentences was examined by combining the categories of MC, MC+WPC, MAC, Co, ACo, RC and Comp. for complex sentences and SSC, SSC+WPC and SAC for simple sentences. Again the Scheffé test for combined means was computed. There was no significant difference between the rate of stuttering on complex and simple sentences when all positions were considered.

In sum, results of this investigation with regard to the relationship between stuttering and syntax are:

1. Stuttering occurred primarily at clause boundaries.
2. In cases where a "word preceding clause" occurred, that word was more likely to be stuttered than the "first word" of the clause.
3. Stuttering was distributed unevenly among clause types at the boundary position; SAC's and MAC's incurred more stuttering at this point than Comp. clauses.

4. Stuttering was also distributed unevenly among clause types when boundary and non-boundary positions were combined; the rate of stuttering was higher on MAC's than on RC's and Comps.
5. Relatively little stuttering occurred in non-onset positions of clauses; a hierarchical effect was not found in this analysis.
6. In non-clause categories, the category did not significantly affect the rate of stuttering.
7. Stuttering did not occur at onsets of complex sentences more than at the onsets of simple sentences, and the overall rate of stuttering was not higher on complex than on simple sentences.

## (2) STUTTERING AND OFF/ON VOICING

Figure 3 shows the distribution of stuttering for the 12 off/on voicing categories for all subjects. Nineteen percent of categories 1 to 4 were stuttered; these were categories where voicing was initiated from silence either at the beginning of an utterance or after a pause of some kind (clause boundary within a complex sentence, phrase boundary or random word). The stuttering occurred fairly evenly among the four categories regardless of whether the first sound of the word was voiceless or voiced.

Of categories 5, 7, 8, 9, 10, 11 and 12, 4.1% were stuttered. Category 6, a voiceless sound in a voiceless environment, was the only category on which stuttering did not occur. Although 6 was the least used category, it did occur 31 times, giving ample opportunity for stuttering. The raw data for this analysis is contained in Table 19.

The null hypothesis that stuttering occurs randomly with respect to off/on voicing was rejected by inspection of the data. The sharp difference in rate of stuttering between categories 1 to 4 and 5 to 12 suggests that two variables (at least) are determining the stuttering. One variable operates at the onset of speech following silence while the other occurs in connected speech. For this reason, 2 two-way analyses of variance were computed (Roscoe, 1975, p. 323), one for categories 1 to 4 and one for categories 5 to 12, to test for possible differences in the amount of stuttering among voicing categories. The dependent variable was the rate of stuttering within each voicing category (AS/OTS, see p. 87). The independent variables were subjects and voicing categories 1 to 4. Data for the analysis of categories 1 to 4 are in Table 19; results are in Table 17.

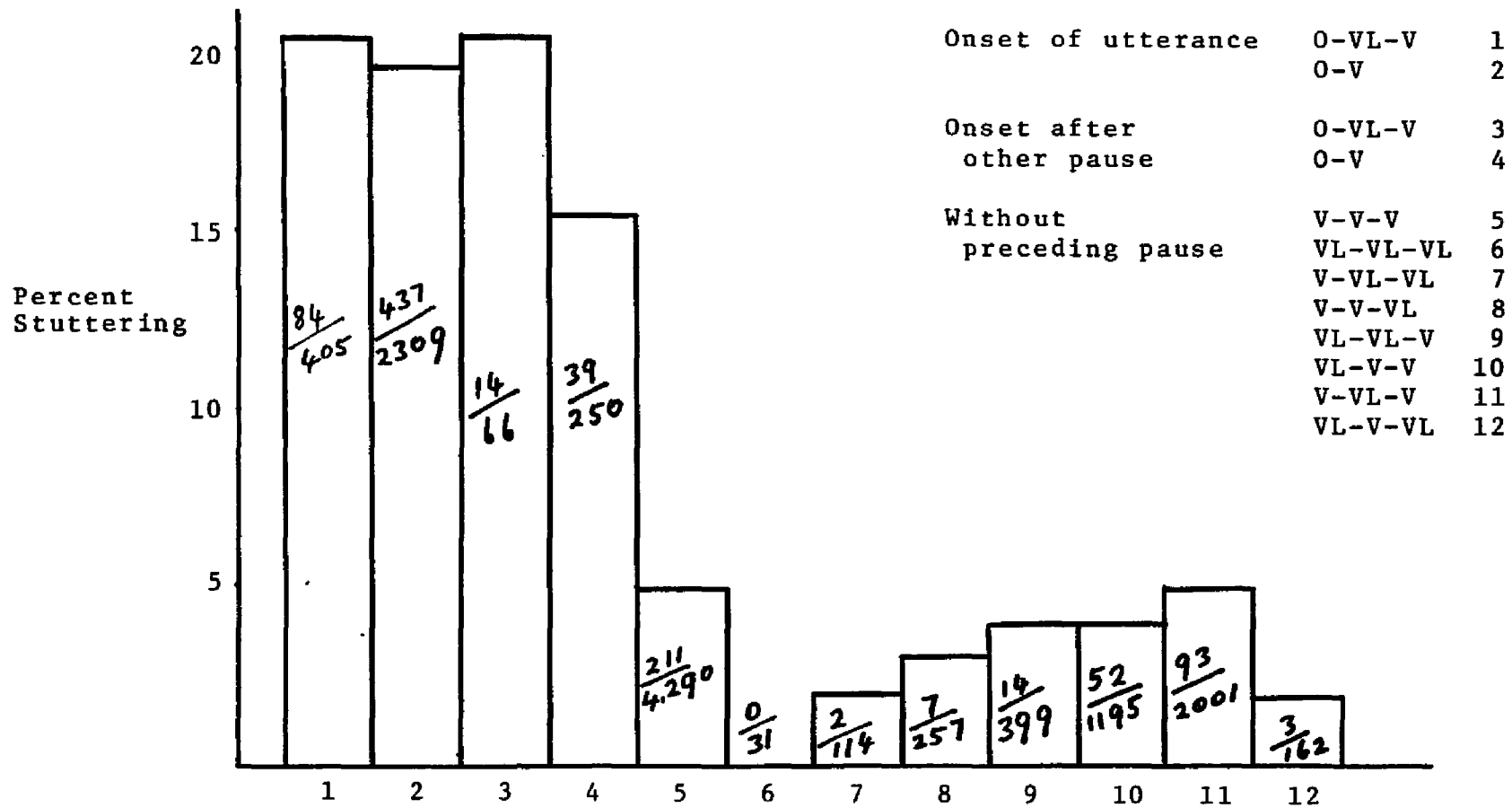


Figure 3. Stuttering on the Twelve Off/On Voicing Categories for all Subjects.

Table 17. Results of Analysis of Variance for Stuttering on Categories 1 to 4.

Source of variance	df	SS	MS	F	p
Rows (subjects)	8	.6460	.0807	4.7192	$\leq .05$
Columns (categories)	3	.0506	.0168	.9824	non-significant
Interaction	24	.4108	.0171		

These results show that the differences in the rate of stuttering were not significant among these voicing categories. In other words, given that 0 occurred first, the rate of stuttering was not determined by whether the first sound of the stuttered word was voiced or voiceless. There were significant differences in the rate of stuttering among individual subjects.

Data for the analysis of variance for categories 5 to 12 (connected speech) are in Table 17, and the results of this analysis are in Table 18.

Table 18. Summary of Analysis of Variance for Voicing Categories 5 to 12 (connected speech).

Source of variance	df	SS	MS	F	p
Rows (subjects)	8	.0566	.0070	11.6666	$\leq .05$
Columns (categories)	7	.0248	.0035	5.8333	$\leq .05$
Interaction	56	.0361	.0006		

The differences in the rate of stuttering among the 8

Table 19. Opportunities to Stutter (OTS) and Actual Stuttering (AS) for Off/On Voicing Categories.

Category			B.S. (4.0 years)		P.S. (4.4 years)	
			OTS	AS	OTS	AS
Onset of utterance	O-VL-V	1	43	9	70	10
	O-V	2	171	30	292	25
Onset after other pause	O-VL-V	3	0	0	6	0
	O-V	4	9	1	18	0
	V-V-V	5	336	17	496	2
	VL-VL-VL	6	1	0	1	0
	V-VL-VL	7	3	0	16	0
	V-V-VL	8	17	0	28	0
	VL-VL-V	9	29	0	43	1
	VL-V-V	10	74	1	157	2
	V-VL-V	11	124	5	215	0
	VL-V-VL	12	2	0	12	0
Total			809	63	1354	40

Category			M.M. (4.9 years)		R.G. (5.5 years)	
1			52	14	28	10
2			352	124	213	52
3			5	2	14	5
4			22	9	44	11
5			397	24	643	29
6			3	0	4	0
7			5	0	16	0
8			28	1	46	1
9			53	6	58	0
10			113	8	164	6
11			192	12	357	12
12			21	0	34	1
Total			1243	200	1621	128

Category			D.S. (5.11 years)		S.W. (6.4 years)	
1			42	7	48	8
2			270	18	348	32
3			14	1	14	2
4			31	3	63	2
5			538	16	679	16
6			12	0	3	0
7			12	0	16	0
8			22	0	40	0
9			55	2	47	0
10			163	5	199	5
11			270	6	298	5
12			14	0	25	0
Total			1443	58	1780	71

Table 19. Opportunities to Stutter (OTS) and Actual Stuttering (AS) for Off/On Voicing Categories (continued).

Category	W.O. (6.4 years)		F.M. (6.5 years)	
	OTS	AS	OTS	AS
1	46	7	55	13
2	228	29	239	49
3	4	1	7	1
4	13	2	15	2
5	363	4	432	46
6	3	0	2	0
7	13	0	13	0
8	28	1	23	3
9	46	1	33	2
10	130	0	81	7
11	182	5	184	25
12	20	0	19	1
Total	1076	50	1103	149

Category	M.L. (6.6 years)	
1	21	6
2	196	78
3	2	2
4	35	9
5	406	57
6	2	0
7	20	2
8	25	1
9	35	2
10	114	18
11	179	23
12	15	1
Total	1050	199

voicing categories in connected speech were significant.

That is, the rate of stuttering in this analysis was determined by the voicing feature. A further finding was that there were significant differences in the rate of stuttering among subjects.

The Scheffé test for all possible comparisons (Roscoe, 1975, pp. 313-315) was used to compare individual categories with each other. A critical  $d$  of .046 was obtained. Means for the categories are presented in Table 20.

Table 20. Mean Rate of Stuttering for Voicing Categories in Connected Speech.

Category	Mean
5	.0523
11	.0518
10	.0481
9	.0346
8	.0292
12	.0165
7	.0111
6	.0000

The results indicate that the differences between the following pairs of means were significant:

5 > 6  
 11 > 6  
 10 > 6  
 5 > 7  
 5 > 12  
 5 > 8  
 5 > 9

The findings of this Scheffé test suggest a further

comparison. Reference to Table 20 reveals that the voicing categories that were stuttered at a high rate (categories 5, 11 and 10) share a common characteristic - in each case the stuttered sound was followed by a voiced sound. Conversely, the categories that were stuttered less (categories 6, 7, 8, 12 and 9), with the exception of category 9, share the characteristic of having the stuttered sound followed by a voiceless sound. To test the hypothesis that the voicing feature of the subsequent sound determined the rate of stuttering, a Scheffé test for combined means (Roscoe, 1975, pp. 313-315) was computed. In this test a composite mean for categories 6, 7, 8 and 12 was compared with a composite mean for categories 5, 9, 10 and 11, thus testing directly to see if there was a significant difference in stuttering rate between sounds followed by voiced sounds and sounds followed by voiceless sounds. A significant difference was obtained indicating that stuttering rate is determined by the voicing feature of the second sound of the stuttered word.

To summarize the findings of stuttering on the 12 voicing categories:

1. Stuttering was distributed unevenly among the 12 voicing categories.
2. Stuttering occurred on all categories except the VL-VL-VL category where no voicing feature was present.

3. Stuttering occurred more in categories 1 to 4 when voice was initiated from silence (whether or not the voicing feature was present in the first sound of the word), than when voicing adjustments were made in connected speech.
4. The distribution of stuttering was not significantly different among the categories (1 to 4) where voice was initiated from silence.
5. Stuttering was distributed unevenly in the categories (5 to 12) which reflected voicing adjustments in connected speech.
6. In categories 5 to 12, stuttering occurred significantly more on the first sounds of words that were followed by a voiced sound (categories 5, 9, 10 and 11), regardless of whether the first sound was voiced or voiceless, than on the first sounds of words that were followed by voiceless sounds.

(3) COMPARISON OF SYNTACTIC CATEGORIES OF  
FOUR STUTTERERS AND NON-STUTTERERS

Four stutterers (R.G., D.S., F.M., M.L) were matched with four non-stutterers for age, sex, socio-economic level, and position in family. The same procedures and materials that were used to tape the stutterers were also used to tape the non-stutterers. The non-stutterers were recorded in their homes, with the exception of B.C., who was recorded

in an office. The non-stutterers were considered, by those in their environments, to have normal speech and language development. This opinion was shared by the examiner except in the case of B.C., who was considered to have slightly below average language and speech skills.

The recordings of the non-stutterers were transcribed, and a word count made so that an equivalent number of words could be analyzed for each matched stutterer and non-stutterer. The corpora were analyzed for the frequency of complex sentences, simple "and" clauses, main clauses, main "and" clauses, coordinates, "and" coordinates, relative clauses, complement clauses (that, for-to, ing). Statistical analysis was not attempted because of the limited number of subjects.

Table 21 shows the frequency distribution of clause types for stutterers and non-stutterers. The non-stutterers used more clauses than the stutterers for the same number of words (159 clauses as opposed to 130). The stutterers' corpora contained more non-clause items (fragments, etc.) than the non-stutterers, and this is considered to account for the depressed number of complete clauses in their transcripts. The non-stutterers used more complex sentences and more complement clauses (especially "that" complement) than the stutterers. They also used more coordinates than the stutterers, and began more of these clauses with connecting words of coordination or subordination (see Table 22).

Table 21 Comparison of Stutterers and Non-Stutterers on Number of Various Clause Types Used.

Clause	R.G.	K.H.	D.S.	B.C.	F.M.	D.R.	M.L.	S.A.	TOTAL		N-S	%
	(S)	(N-S)	(S)	(N-S)	(S)	(N-S)	(S)	(N-S)	S	%		
CS	74	86	69	64	33	45	42	50	218	27	245	28
MC	53	71	65	56	30	43	32	49	180	22	219	25
MAC	21	15	4	8	3	2	10	1	38	5	26	3
SAC	18	7	14	28	6	6	26	9	64	8	50	6
Co	19	30	18	13	11	21	10	15	58	7	79	9
ACo	41	33	19	17	4	6	22	3	86	11	59	7
RC	14	25	13	11	4	1	8	6	39	5	43	5
that	6	16	11	9	5	21	8	20	30	4	66	8
f-t	32	21	32	28	16	21	16	21	96	12	91	10
ing	1	0	0	0	2	0	1	2	4	0	2	0
Total												
Comps	39	37	43	37	23	42	25	43	130	16	159	18

Table 22. Comparison of Stutterers and Non-Stutterers on Number and Type of Coordinate Clauses.

Coordinate Clause	R.G.	K.H.	D.S.	B.C.	F.M.	D.R.	M.L.	S.A.	TOTAL		N-S	%
	(S)	(N-S)	(S)	(N-S)	(S)	(N-S)	(S)	(N-S)	S	%		
With Conjunction	12	18	4	2	2	6	4	4	22	38	30	38
With Subordinate	3	4	1	3	0	10	1	3	5	9	20	25
No Conjunction	4	8	13	8	9	5	5	8	<u>31</u>	53	<u>29</u>	37
Total									58		79	

The stutterers used more "ands" at the beginning of all the "and" categories; main "and" clause, simple "and" clause, "and" coordinate. Roughly equivalent numbers of "for-to" and "ing" comps, and relative clauses were used by both groups. Relative clauses were inspected for possible differences in the distribution of WH relatives, reduced relatives and modifying relatives. This was done because, according to Limber (1973), WH relatives precede modifying relatives in time of onset by several months, while the reduced form of the relative clause precedes the unreduced form (modifying relative) by a very brief period of time (a month or two).

It can be seen by the data in Table 23 that relative clauses did not show the same pattern as the coordinate clauses and complement clauses which were, on the whole, used by the stutterers in less sophisticated form than the non-stutterers. For relative clauses, the non-stutterers used the early-acquired "WH" relatives more frequently than the stutterers, and fewer modifying and reduced relatives.

When these data are examined for percentage of clause types for each group, the largest difference between the groups appears to be on the ACo's. Eleven percent of the stutterers' clauses and 7% of the non-stutterers' clauses

Table 23. Comparison of Relative Clauses in Four Stutterers (S) and Non-Stutterers (N-S)

Relative Clauses	K.G. (S)	K.H. (N-S)	D.S. (S)	B.C. (N-S)	F.M. (S)	D.R. (N-S)	M.L. (S)	S.A. (N-S)	S Totals	NS Totals
WH relatives	9	24	8	8	3	1	0	6	20	38
Reduced relatives	3	2	5	2	1	0	5	0	10	4
Modifying relatives	2	0	0	1	0	0	3	0	9	1
Totals	15	26	13	11	4	1	8	6	39	43

were ACo's. A further difference occurred on the "that" complement, where 4% of the stutterers' clauses were "that," and 8% of the non-stutterers clauses were "that."

CHAPTER V  
DISCUSSION

(1) STUTTERING AND SYNTACTIC CATEGORIES

A relationship between the occurrence of stuttering and clause boundaries is apparent in the spontaneous speech of young children examined for this study. The boundary effect on stuttering specifies the main sites of stuttering instances in simple and complex sentences (see Figure 1). The distribution of stuttering within the clauses shows no hierarchical effect of the importance of subject-predicate, verb-X splits. There is however, a pattern to the distribution of stuttering within clauses, in that stuttering tends to occur at constituent breaks (S-P, V-X, and lesser phrase boundary) rather than randomly.

Since clause boundaries are thought to be important for sentence planning (Boomer, 1963; Boomer and Laver, 1968; Fromkin, 1973), and clause boundaries exert considerable influence on the rate of stuttering, a possible relationship between sentence organization and stuttering in the early stages of the condition is suggested by these findings. That is, a weakness in sentence planning may be a contributory factor to the occurrence of stuttering in young stutterers.

The fact that stuttering occurs primarily at clause boundaries tends to support research which has found the clause to be the primary unit of sentence processing and production (Boomer, 1963; Fodor and Bever, 1965; Boomer and Laver, 1968; Bever, et al., 1973; Fromkin, 1973). These results also support Bloodstein's observations on stuttering and syntax which "suggest that there are certain regularities that govern the distribution of early stuttering in its typical form" (Bloodstein, 1975, p. 283). Further, the results specify the rate of stuttering to be expected at specific types of clause boundaries and lesser constituents within the clause. While no hierarchical effect of within-clause stuttering was found in this study, further research which uses subjects who have more severe stuttering and therefore more opportunities for non-onset breakdown might clarify the hierarchical issue.

The clause boundary effect needs to be viewed within the context of the definition of "clause boundary" used in this study, which incorporated one, sometimes two, and more rarely three words at the clause boundary. The frequencies in the "word preceding clause 1" and "word preceding clause 2" categories are in Table 1 (see p. 79). The broad definition of "boundary" was considered necessary as clause boundaries in spontaneous speech are frequently not well defined.

However, stuttering was likely to occur on the first word of the utterance, "filler" or not. This result is at variance with Hejna's finding that, in the spontaneous speech of adults who stutter, the first word of the sentence (often a filler) was frequently not stuttered, though the second word was frequently stuttered (Hejna, 1955). This suggests a developmental trend in the change of the loci of stuttering over the years.

As far as stuttering at the onsets of specific clause types is concerned, the contrast between the amount of stuttering on "for-to" and "that" complement boundaries is interesting in that "for-to's" develop first (Limber, 1973), and the more sophisticated form, "that," was more highly stuttered (12.5% as opposed to 1.7%). The numbers however, were too small for a statistical analysis, and no conclusions can be drawn.

A similar developmental trend was observed at coordinate boundaries, where less stuttering occurred on the more primitive form of coordination, (without a coordinating word, Limber, 1973) than on the more mature form (with a connecting word). The difference between the two groups failed to reach a level of statistical significance.

Complement clauses deserve attention as they attracted little stuttering at the boundary position. This low

stuttering rate may be associated with the fact that many complements are quite short and in some instances may not be considered true clauses. Relative clauses have more structure, but are somewhat like coordinate clauses in their dependence or "bound-ness" to the remainder of the sentence. They are perhaps related much more closely to, and are more integrated with, the main (independent) clause, while coordinate clauses maintain their sentence structures though attached to the main clause. Relative clauses and complement clauses were alike in one aspect of this analysis, in that they attracted the least stuttering when all positions of clauses were considered.

The onsets of complex sentences were not stuttered significantly more frequently than the onsets of simple sentences. It should be noted however, that the main clause which introduced complex sentences beginning with "and" (MAC) was distinctive. It incurred (with SAC) a high rate of stuttering at the boundary position, and in addition, was the most stuttered clause when all positions of the clause were considered. The lack of differentiation of initial words of complex sentences as opposed to simple sentences in this study failed to confirm the findings of Tornick and Bloodstein (1976) whose study (previously described) reports on adult stutterers using an oral reading

task. Tornick and Bloodstein infer that the motor planning of the longer utterances may precipitate more onset stuttering, but they also note that many of the longer sentences were syntactically complex.

The overall amount of stuttering on simple and complex sentences was comparable, contrary to anticipated findings. The low overall rate of stuttering on relative and complement clauses undoubtedly contributed to this finding.

The possible effect of motor planning on stuttering versus the effect of syntactic planning (Tornick and Bloodstein, 1976) raises some interesting questions, as motor planning and syntactic planning appear to be closely allied. If motor planning is important in precipitating stuttering, then one would perhaps expect the one-word utterance category to have incurred less stuttering than other categories, due to the limited motor planning involved. However, in the non-clause categories (which included the one-word utterance category) it was found that category did not significantly affect the rate of stuttering. While the one-word utterance may require less motor planning than a longer utterance, it also requires less syntactic planning. As a sentence increases in length (and presumably, in the amount of motor planning required), it also increases in the amount of structure, though the nature of the structure may vary (additional

phrases or clauses). Further research which examines stuttering in the oral reading of word groups of equivalent length, but manipulating the structure of the word groups according to non-structured sequences of words, complex sentences, and simple sentences, while controlling the phonetic composition of the word groups, may contribute further knowledge in this area.

Two "and" clauses, simple "and" clauses and main "and" clauses, were very highly stuttered at onset, while the "ands" of the "and" coordinates were stuttered in roughly equivalent proportions to the coordinate clauses. The powerful effect of "and" at the onset of the sentence may be due not only to the clause boundary effect, but perhaps also to physiological factors. Because "and" begins with a vowel, the responsibility for initiating utterance falls totally on the larynx. This would not apply to the "and" coordinate, where there is not necessarily a juncture pause, and therefore less responsibility on the larynx to begin voice for the vowel. The word "and" at the beginning of simple and complex sentences precipitated a high rate of stuttering, with no discernible attempts on the part of these young stutterers to avoid this highly stuttered category. The MAC, which was the most highly stuttered clause when all positions were considered, has two special characteristics: it begins with "and", and

it is the first part of a complex sentence.

"And" is cited by Limber (1973) and Hood, et al. (1976) as the first connecting word used by young children. Hence "and" may be regarded as a less mature way of connecting speech. This may explain in part the stutterers' frequent use of it as a connecting word. The few stutterers who were compared with the non-stutterers showed quite constricted use of coordinate and subordinate words in comparison with the non-stutterers. "And" however, was used profusely by the stutterers; not by the non-stutterers. This does suggest a possible immaturity of syntax in the young stutterer, where the early learned "and" may be used frequently because he has fewer choices available to him.

## (2) STUTTERING AND OFF/ON VOICING

The preponderance of stuttering that occurs with the initiation of voice, whether at the onset of an utterance or during the utterance but after a pause, suggests a difficulty in mobilizing the voice mechanism and could reflect covert difficulties in the aerodynamic events leading to voice production. Adams states that:

"the repetition and prolongation of various articulatory gestures may be reflective of underlying disturbances in the speaker's ability to properly generate, time the release of, and maintain voicing or air flow. In other words, repetitions and prolongation, the articulatory events identified as the universally

demonstrable characteristics of stuttering could signal the presence of less obvious deviations in respiration and phonation." (Adams, 1975.)

Whether the possible deviations in respiration and phonation that Adams speaks of are physiologically based difficulties or manifestations of emotional stress (Schwartz, 1972) or both, is purely conjecture at this time. The link between respiration and sentence structure is pointed out by Fodor, et al., (1974). They comment that: "in fluent speech, people tend to breathe at major constituent boundaries; in non-fluent speech, they tend to breathe at hesitation points" (Fodor, et al., 1974, p. 425). The points of respiration in fluent and non-fluent children's sentences should be determined through further research, as this work may illuminate possible interconnections among respiration, voicing and sentence planning in the speech of young stutterers.

With regard to connected speech, the fact that no stuttering occurred on a voiceless sound in a voiceless environment (the VL-VL-VL category) emphasizes the importance of voicing in stuttering. In their study of off/on voicing adjustments, Adams and Reis (1971) found that 35% of stuttering in oral reading of the "combined" passage (with voiced and voiceless sounds) occurred at the beginning of a sentence or phrase, or at the transition from a voiceless

to a voiced sound. The findings for the children in the present study were overwhelming in terms of a high rate of stuttering at the sentence onset and onset after pause. In connected speech, the sound following the stuttered sound was the most influential in the environment, regardless of the voiced/voiceless state of the stuttered sound. The reason for this is unclear. Consonant/vowel differences were not examined in this study; such examination may contribute information in this area. Further experimental procedures, similar to the Adams and Reis study, where stuttering is observed in relation to the following sound, may be instructive.

The current findings may partially clarify a finding of Conway and Quarrington (1963), who found that adult stutterers, in reading aloud, stutter the most at onset of sequences of words, whether the sequences have a great deal of meaning or whether they are random strings of words. The initiation of voice from silence is a powerful factor on the occurrence of stuttering.

### (3) COMPARISON OF SYNTACTIC CATEGORIES IN FOUR STUTTERERS AND FOUR NON-STUTTERERS

There have been reports in the literature which state that stutterers frequently develop speech and language skills at a slower rate than do non-stutterers (Berry, 1938, Morley,

1957). More recently, there has been a focus on the language use of "disfluent" children who have not been diagnosed as stutterers. Muma (1971) found that disfluent pre-schoolers used fewer "double-based" sentences than fluent pre-schoolers. In the terms of the present study, Muma's disfluent children used more simple sentences and fewer complex sentences than their more fluent counterparts. Westby (1975) found that kindergarten and first grade boys who stuttered or who were highly disfluent differed significantly from their fluent controls in the number of grammatical errors made, had poor Peabody Picture Vocabulary Test scores, and were more variable in all measures studied than the fluent group. As finer comparative methods develop, more data are gradually becoming available on the possible differences between the language skills of stutterers and non-stutterers, though much more remains to be done.

The present study suggests simpler, less mature language use in the stutterers than in the non-stutterers. In addition to the prominent use of the "and" conjunction at the expense of more diverse conjunctions and subordinate words, the stutterers used more coordinates that did not have a connecting word, in comparison with the non-stutterers. This type of coordination, according to Limber (1973), is the first to appear. The stutterers showed a less mature

developmental trend in their use of "that" complements. Limber states that the unreduced form of "that" complementation (I wish that I could go) is a more advanced form than the reduced version (I wish I could go). No stutterer used the unreduced form of "that," while the non-stutterers used seven. The stutterers however, showed somewhat more mature use of relative clauses than the non-stutterers.

### Conclusions

Two strong influences on the loci of stuttering emerge from this research: the syntactic structure of the sentence, and the influence of voicing (particularly when initiated from silence). The small comparison of stutterers and non-stutterers hints at differences between the two groups in the syntax used, though the numbers are too small to make a definitive statement. If, however, this is the case (that some stutterers, apparently developing well in physical and cognitive areas, have poorer than average skills in structuring their sentences) then the foundations of verbal communication are weakened, imposing strain on the already complicated linguistic task of sentence planning. Because of this linguistic overload, the young stuturer may break down at salient points of sentence planning, overburdening

a not fully developed articulatory/phonatory system (Kent, 1976). The combination of linguistic and physiological overload on the system is manifested at points of particular linguistic/physiological sensitivity - clause boundaries and/or points of initiation of voice.

While some stutterers are said to outgrow stuttering by the age of 11 or 12 years (Andrews and Harris, 1964), many stutterers persist beyond this point and become chronic stutterers. Spontaneous recovery rates vary from 36% (Cooper, 1972) to 80% (Andrews and Harris, 1964; Sheehan and Martin, 1970). The characteristic that persistent stutterers appear to have in common is severity of stuttering (Sheehan and Martin, 1970). That is, the less severe stutterer has a greater chance of spontaneous recovery. In persistent and severe stutterers, the stuttering may become well entrenched, as the central nervous system is considered to be fairly mature at approximately 12 years of age. This may explain the difficulties clinicians and stutterers frequently have in ameliorating the condition; it is by then established as part of the linguistic and physiological system. While further research may help to define the weighting of emphasis on syntactic and voicing factors, they are seen here as inter-related in the total process of verbal communication.

Further comparison of the syntax of stutterers and non-stutterers is indicated on the basis of this research. If the results of this study are confirmed when applied to a larger population, therapeutic attention to the language use of the young stutterer may be indicated.

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