1980

Language Behavior of Preschool-Age Stutterers: a Longitudinal Study.

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The Louisiana State University and Agricultural and Mechanical Col. PH.D. 1980

LANGUAGE BEHAVIOR OF PRESCHOOL-AGE STUTTERERS: A LONGITUDINAL STUDY

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in

The Department of Speech

by
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B.A., University of Alabama, 1973
M.A., University of Alabama, 1975
May, 1980

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ABSTRACT

The relationship between language and speech fluency was explored longitudinally in four preschool age stutterers. Language and fluency measures were performed on the four subjects over five sampling sessions for each subject, for a maximum period of 19 months. Language measures completed at each sampling session included the Peabody Picture Vocabulary Test (PPVT) (Dunn, 1965); the Northwestern Syntax Screening Test (NSST) (Lee, 1969); the Test of Auditory Comprehension of Language (TACL) (Carrow, 1971); the Carrow Elicited Language Inventory (CELI) (Carrow, 1973); and the Developmental Sentence Scoring Technique (DSS) (Lee, 1974). Mean length of utterance (MLU) (Brown, 1973) were also computed for each subject at each sampling session. Fluency was assessed in terms of frequency of type (16 variables) and classified in terms of parts of speech.

The accumulated data were assessed through analyses of variance of the language and fluency variables across time for each subject and through regression and Chi-square analyses. Spontaneous language corpora for each subject were assessed with the Syntactic Language Computer Analysis

Program (SLCA-III) (Cummings and Renshaw, 1979).

Results indicated significant correlations between MLU and total words over time and between phrase repetitions and DSS scores. Regression analyses indicated significant increases across time in NSST scores, TACL scores, and PPVT scores. Significant decreases by time were displayed in a repetitions category (interjections and sound, word, and phrase repetitions) and in the ratio of total disfluencies to total words. Results of Chi-square analyses indicated similar subject profiles on language scores for three sampling sessions and similar fluency profiles for two sampling sessions.

Results of analyses of disfluencies across time classified as to parts of speech indicated a significant relationship among the subjects only for adjectives. Means of the frequency of disfluent parts of speech for the subjects across time indicated that the number of disfluencies were divided between content words (nouns, verbs, adjectives, and adverbs) and function words (articles, prepositions, pronouns, and conjunctions). Regression analyses indicated that significant decreases across time were displayed by two subjects in the number of disfluencies on content and function words. This was judged to reflect a decrease in total disfluencies.

Results of SLCA-III analyses indicated a significant relationship across time among the four subject's scores on six of the SLCA-III variables measuring perceptual

cognitive activity. Regression analyses for each of the subject's performance on each of 36 SLCA-III variables indicated significant increases and decreases of usage across time of isolated variables with no group trends apparent. Subjects One and Two both demonstrated significant changes in negative relation measures and measures of time; Subjects Three and Four both demonstrated significant changes across time in measures of asymmetric relation.

CHAPTER I

THE PROBLEM

Introduction

In the attempt to form a definitive statement of stuttering as a behavioral phenomenon, researchers have attempted to isolate and have investigated the influences of many factors on the disorder as well as the influence of stuttering on various other aspects of human behavior. Among the factors investigated have been the relationships of language development and specific linguistic variables to stuttering. The limited studies available in the literature on language variables relative to disfluency have been designed in part to assess, in stutterers, speed of general speech development as compared to non-stutterers (Berry, 1938; Andrews and Harris, 1964) or have been designed to look more at isolated language elements rather than at the stuttering child's overall level of language functioning at any given point in time (Silverman and Williams, 1967; Peters, 1968). Other researchers have reported on the relationships between normal disfluencies and language variables (Muma, 1971, Haynes and Hood, 1977; 1978).

More specifically, studies concerned with the speed of language development in stutterers have been essentially static comparisons of the language milestones of stutterers with those of non-stutterers (Darley, 1955). These studies were designed to record information such as the use of the first word, phrase usages, sentence usages, and speech intelligibility, obtained primarily from parental recollections (Johnson and Associates, 1959). In contrast, studies on specific linguistic skills were conducted through sampling procedures designed to measure such variables as mean length of response, structural complexity of speech, number of different words used, type-token ratio, latency of object naming and receptive vocabulary. Studies designed to specify the loci of disfluencies in connected speech have led to investigations of factors which might also be considered within the gestalt of language-based influences: the initial sound of the stuttered word, its grammatical function, the position of the stuttered word in the sentence, the length of the stuttered word, the frequency of the disfluent word in language usage, and its predictability in context (Brown, 1937, 1945; Wingate, 1967; Soderberg, 1967).

The results of these studies have been at times contradictory with one another and of debatable significance, (Haynes and Hood, 1978). Data from some studies have indicated that stutterers are slow in acquiring language skills (Milisen and Johnson, 1936; Andrews and Harris, 1964)

while others have indicated that essentially no temporally related language differences exist between stutterers and non-stutterers (Johnson, et al., 1942; Darley, 1955; Johnson and Associates, 1959). This same disparity of results has been reported with the studies designed to examine specific linguistic skills or language-related phenomenan (i.e., loci studies) in stutterers as compared with non-stutterers. Yet, even in light of this inconclusive data, some writers still contend that stutterers are often delayed in language skills acquisition and that the delay is influential in the disfluent behavior (Van Riper, 1973; Lee, 1974). Bloodstein (1975) noted that various workers concerned with the problem of stuttering have long held the belief that stutterers often tend to be slow in acquiring language skills. He also noted that data indicating qualified support for this belief has become "so strong as to amount substantially to verification" (Bloodstein, 1975).

In a critical review of the data relating language behavior and stuttering, several methodological points stand out as perhaps significant to the limited specificity of the reported results. The subject groups for the majority of these studies have been comprised primarily of elementary school age children. Language comparisons have been made consistently at this age level although language-based studies have shown the preschool years as valid indicators of language competencies and the greatest

period of linguistic instability and change (Brown, 1973). In addition, with only a few exceptions (Wyatt, 1969), researchers have measured the language variables in their stuttering and non-stuttering populations at one point in time with little regard being given to the cyclic, situational, and age variables reported as being significant (Bloodstein, 1960; Sheehan, 1969; Silverman, 1971) in language and stuttering development.

Language development has been measured and documented in studies of a longitudinal design (Brown, 1973) as has stuttering (Andrews and Harris, 1964). However, in a review of the literature on language and stuttering, no studies were found which utilized a longitudinal design in order to account for fluctuations across time of disfluency and language variables relative to one another. On the basis of the indicated significance of this relationship (Muma, 1972; Lee, 1974; Bloodstein, 1975; Haynes and Hood, 1978) and the paucity of reported data on the influences exerted by language and fluency variables on one another, further research in this area would appear warranted.

Statement of the Problem

The general purpose of this study was to examine language and language development variables concurrently with fluency and disfluency variables. Specific linguistic competency levels in stutterers and the stability of

those competency levels at various points across time were determined. Similarly, the nature and degree of disfluency for each subject were tracted across time, the speech sampling periods coinciding with the language sampling periods. Additionally, a secondary purpose of this study was to indicate the need for the direction of future research aimed at examining language variables in stuttering. The study was specifically designed to answer the following questions:

1. What are the levels of language competencies coexisting with stuttering across time as measured in four preschool stutterers?
2. How does the language behavior of preschool stutterers fluctuate across time?
3. How does the nature and degree of disfluency in preschool stutterers fluctuate across time?

Importance of the Study

The results of this study could: (1) provide insight into the course of language behavior and development of stuttering children; (2) indicate possible trends in the language behavior of preschool stutterers; (3) indicate possible trends in the fluency patterns of preschool stutterers; and (4) specify specific areas for future research into the language behavior of stutterers.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

A review of the literature on stuttering and language suggested that the following areas have been indicated by researchers to be elemental in the conjugate consideration of stuttering and language development: (1) loci of disfluencies; (2) cyclic, situational, and age variables in early disfluency; (3) language development relative to the development of stuttering; (4) linguistic differences relative to early disfluency; (5) methodology in the study of linguistic variables in stuttering; and (6) language development and measurement.

The review of loci disfluency studies provides information about the current understanding of grammatically-based factors suggested as being relevant in the occurrence of stuttering. This information will be considered in the interpretation of the current study through discussion of the grammatical features and consistency of disfluencies across time, constituting a longitudinal replication of the predating loci studies. This review will be limited, where possible, to studies dealing with preschool

subjects due to the apposition of this age group to the current study and due to the abundance of studies in this particular area. In like manner, the results of the present study will be considered with a foreknowledge of the reported cyclic, situational and age variables in early disfluency. An understanding of these data could possibly either preclude or enhance the formulation of hypotheses relating language variables to stuttering or simply account for any fluctuations noted in the data across time. Studies designed to investigate language development and linguistic variables relative to stuttering will also be reviewed, both as an examination of the nature of the studies completed to date in this area and as an introductory statement in way of a rationale for the present study. The methodologies employed in selected studies designed to examine language-disfluency interrelationships will also be critically reviewed as a prerequisite to stating the rationale for the current study. Lastly, source references for language development criteria and methodological technique used in the measurement of language which are to be employed in the current study will be reviewed.

Loci of Disfluencies

The loci of disfluencies in the speech of stutterers was initially demonstrated by Brown (1937) as being influenced by four factors: the initial sounds of words (phonetic factor), the position of words in sentences,

the part of speech (grammatical factor), and the length of words. Subsequent research has indicated the influence of two additional factors on the occurrence of disfluencies: word frequency and the predictability of words in context (information load).

Word Position, Phonetic Factor, and Word Length

Brown (1937, 1945) initially demonstrated that disfluencies tended (no probability figure indicated) to occur more on words having an initial consonant (primarily /t/, /h/, /w/, and /θ/) than on words beginning with vowels, tended to occur on words that were five letters or more in length, and on words that are at or near the beginning of sentences. Subsequent research has tended largely to support Brown's findings.

Supportive Data. Bloodstein (1960) examined the case records of 418 stutterers, aged two through sixteen years. In reference to the preschool subjects involved, he noted that there was a tendency for disfluencies to occur at the beginning of sentences.

Findings by Williams, Silverman, and Kools (1969) were also consonant with the results of Brown (1937, 1945). They compared the loci of disfluencies of 76 stutterers and 76 non-stutterers, aged five through thirteen years. Results indicated that the stutterers were significantly (0.05) disfluent on the variables of grammatical function, word length, and sentence position. Non-stuttering subjects

were found to be significantly (0.05) disfluent only on the variables of grammatical function and word length.

Non-supportive data. Silverman and Williams (1967) re-examined the results of Brown's (1945) study. They analyzed speech samples collected through oral reading from 24 adult non-stutterers for the loci of disfluencies. Although results indicated that the disfluencies of their subjects were similar in nature to those of Brown, they did not find a significantly greater occurrence of disfluency on the first three words of sentences.

Chaney (1969) replicated the Silverman and Williams study and supported their findings. His results also indicated that the loci of disfluencies of non-stutterers were similar to those of stutterers with the exception of position within the sentence. No level of statistical significance was reported.

Silverman (1971, 1972, 1974) reanalyzed data from a 1970 study designed to assess the disfluency patterns of preschool non-stutterers. Subjects included ten four-year-old boys from whom speech samples had been elicited. Her findings indicated that the children were significantly (0.05) more disfluent on monosyllabic words and the first words of utterances than could be expected by chance.

Although Brown's (1937, 1945) findings that disfluencies occur most often on initial consonants, longer words, and the initial words of utterances tend to be largely supported in replication or in studies of different

design, findings occasionally point to different results. Chief among these contrary findings has been the indication that disfluencies show no greater tendency to occur on the initial words of utterances (Silverman and Williams, 1967; Chaney, 1969). The findings of Silverman (1971, 1972, 1974) that disfluencies tend to occur most frequently on monosyllabic words can be construed as being in opposition to Brown's (1937, 1945) findings that disfluencies tend to occur on words of five letters or more in length.

Grammatical Factors

The results of Brown's (1937, 1945) studies indicated that disfluencies for stutterers tend to occur more on the content words of speech (nouns, verbs, adjectives, and adverbs) rather than on the function words (articles, pronouns, prepositions, and conjunctions). While some more recent reports have supported Brown's findings (for example, Taylor, 1966) for the grammatical factor at work with stutterers, as well as for non-stutterers (for example, Blankenship, 1964), others have reported conflicting results.

Supportive data. Taylor (1966), in trying to account for Brown's grammatical factor, suggested that less disfluency might occur on function words because these words tend to begin with vowels rather than consonants. He also suggested that initial consonants are harder to predict than vowels, involve greater articulatory complexity, and thus create more disfluency.

Williams, Silverman, and Kools (1969) reported that elementary school stutterers and non-stutterers have grammatical factor disfluency patterns similar to adult stutterers and non-stutterers. These findings were in contrast to the earlier findings of Bloodstein (1960).

Non-supportive data. Bloodstein (1960), after an extensive review of the case records of stutterers reported that there appeared to be a tendency for early disfluencies to occur on pronouns, conjunctions and prepositions.

Soderberg (1967) analyzed the recorded speech samples of ten stutterers, ranging in age from nine to 44 years. His results did not concur with earlier findings that more disfluency occurred on lexical words than on function words. The results were interpreted as support for the contention that stuttering is related to the encoding processes of speech and that grammatical and lexical uncertainty play roles in determining the instance and type of disfluency.

Bloodstein and Gantwerk (1967) studied the speech of thirteen stutterers, ranging in age from two years, eleven months to six years, six months. Spontaneous speech samples were collected and analyzed for grammatical function. They did not find evidence of the grammatical factor as it had been reported to exist for adult stutterers. Their results indicated that disfluencies occurred on conjunctions and pronouns significantly (0.05) more often than could be expected by chance alone and that disfluencies occurred

on nouns and interjections significantly (0.05) less than could be attributed to chance. They concluded that the grammatical factor does not exist in the initial phase of stuttering and probably develops as the difficulty of words increases.

Helmreich and Bloodstein (1973) studied the relationship between grammatical function and disfluency in fifteen non-stutterers aged three years, eleven months to four years, ten months. Their results indicated that pronouns and conjunctions appeared in significantly (0.05) greater proportion among the subjects' disfluent words than among their total words. Their findings also indicated that nouns, verbs, and prepositions had a significantly (0.05) low frequency of disfluency in their subjects' speech.

Silverman (1974), in a study designed to measure word position and grammatical function in relation to preschoolers' speech disfluencies, analyzed spontaneous speech samples of ten four-year-old non-stutterers. Her findings indicated statistically significant (0.05) tendencies for disfluencies to occur on pronouns and conjunctions.

The grammatical factor was originally found by Brown (1937, 1945) to exist in the speech of stutterers. Succinctly stated, this finding indicated that disfluencies tended to occur more on the content words of speech than on the function words. Subsequent studies designed to investigate the role of the grammatical factor in speech disfluency have produced conflicting results. Some

researchers (Taylor, 1966; Williams, Silverman, and Kools, 1969) have reported rationales and evidence in support of the grammatical factor as stated by Brown (1937, 1945) while others have not found evidence of its existance (Bloodstein, 1960; Bloodstein and Gantwerk, 1967; Soderberg, 1967; Helmreich and Bloodstein, 1973). Soderberg, (1967) concluded from his negative findings on the grammatical factor that stuttering is related to the encoding processes of speech and that the instance and type of disfluency are determined by grammatical and lexical uncertainty.

Word Frequency

Word frequency studies would appear to be the logical transition from the aforementioned studies in an attempt to more narrowly specify the loci of disfluencies. Word frequency in relation to the loci of disfluencies has most commonly been interpreted to mean word familiarity.

Egland (1955) investigated the nature and frequency of disfluency, and the situations in which speed reactions occurred in the speech of 29 stuttering and non-stuttering preschool children. Speech samples were elicited in five different speaking situations through the use of puppets. Analysis of the samples revealed that for the non-stuttering subjects, the percentage of repetitions occurring in repetition of polysyllabic words was significantly (no probability figure indicated) greater than for any of the other situations. For the non-stutterers, repetitions

were reported as having accounted for two percent of the total words spoken and repetitions associated with polysyllabic words as having accounted for eighteen percent of total polysyllabic words spoken. Egland reported that unfamiliar polysyllabic words were associated with a relatively high frequency of repetitions but did not report any statistical significance.

Hejna (1963) compared stuttering frequency to frequency of word usage. Using the Thorndike-Lorge (1944) and Bell Telephone Laboratory word lists, he matched twenty-five commonly used nouns and twenty-five uncommonly used nouns for length and initial syllable. Results indicated that the adult stutterers experienced significantly (no probability figure reported) less disfluencies on the more commonly used nouns.

Wingate (1967) also used the Thorndike-Lorge word list in matching two word lists for frequency of disfluency occurrence in a study of word length. His results indicated that significantly (0.01) more disfluencies occurred on uncommon rather than on common monosyllablic words. As he did not find this same relationship for two syllable words, he concluded that word length was a primary variable in disfluency.

The results of the studies designed to investigate the variable of word frequency in relation to loci of disfluency, have been in relative agreement. These findings (Egland, 1955; Hejna, 1963; Wingate, 1967) indicate

that disfluencies tend to occur more frequently on unfamiliar words than on familiar, or more frequently used, words.

Information Load

The ideas implicit in the predictability of words in context, or information load, stem from the literature on communication theory. The relative redundancy and/or entropy of words in context permit the assignment of levels of statistical uncertainty or transitional probabilities to words which are used in conversational speech and oral reading. This concept has led subsequently to the investigation of possible links between the transitional probabilities of words and the occurrences of disfluencies on particular words (Schlesinger, Forte, Fried, and Melkman, 1965; Lanyon, 1969; Soderberg, 1967, 1971).

Supportive data. Schlesinger, et al. (1965) analyzed the recorded speech of ten stutterers aged ten to 24 years in order to determine if disfluencies tended to occur at points of highest information load. The subjects were required to read a 184-word passage from a Hebrew third-grade primer. Results indicated that the loci of disfluencies could be predicted by the transition probability of words as estimated by forward word-to-word guessing and by response as measured by their frequency of occurrence in the language. Disfluencies were reported to have occurred on words of high transition probability half as often as on words of low transition probability and low frequency.

Soderberg (1967) assessed the influence of information value in disfluency with ten stutterers, ranging in age from nine to 44 years. The subjects were required to read a 141 word passage composed of the first 1000 most frequently used words according to Thorndike and Lorge (1944). Analysis of the recorded speech samples indicated that cycles of disfluencies occur on the first, third, and seventh words of sentences. Soderberg reported that words in these positions tend to carry more information value.

Soderberg (1971) reanalyzed his original data (1967) in order to test Lanyon's conclusions. Words of five letters or more in length were eliminated before analysis. Soderberg concluded that information value has an independent effect on the disfluencies of stutterers when word length is held constant.

Non-supportive data. Spontaneous speech samples and oral reading were used by Lanyon (1969) to assess the relationship between disfluency and information load. His results indicated a direct relationship (0.01) between disfluency and word length for his stuttering subjects. He concluded however, that information load was not a primary variable in the disfluencies of stutterers. The non-stutterers demonstrated the same relationship in their oral reading, but not in spontaneous speech.

The findings of the studies reported on information load in determination of disfluency tend largely to support the idea of a positive correlation between the two factors

(Schlesinger, et al., 1967; Lanyon, 1969; Soderberg, 1971). Occasionally, contrary results have been found, indicating no consistent relationship between information load and disfluency (Soderberg, 1967).

Cyclic, Situational, and Age Variables in Early Disfluency

It would appear that in any study designed to measure stuttering on a longitudinal basis, cognizance of the variations to which disfluency has been reported as being subject (Davis, 1939; Quarrington, 1965; Sheehan, 1969; Silverman, 1971; Martin, Kuhl and Haroldson, 1972 a, b; Yairi and Clifton, 1972) would be requisite. In the present consideration of these factors, three categories of fluency variables will be reviewed: cyclic or temporal variables, situational variables, and chronological age variables.

Cyclic Variables

Cyclic variations in disfluency have been indicated by researchers to be a significant aspect of early stuttering behavior (for example, Sheehan, 1969). The limited data that have been reported in this area have occasionally been non-supportive of cyclic variations in stuttering.

Supportive data. Quarrington (1965) studied 39 preschool stutterers with a mean age of four years, four months. The subjects' mothers supplied daily ratings of the frequency of stuttering over a one year period. The

data were submitted to Fisher's harmonic analysis, which indicated the presence of significant periodicities. Fifty-nine percent of the persistent stutterers showed statistically significant periodic components in the cycle length range of two to six months. Evidence of shorter periodicities or weekly patterning of stuttering frequency was not found.

Non-supportive data. Taylor and Taylor (1967) re-analyzed data from an earlier study (Taylor, 1966) in which nine stutterers had been required to read a 500 word passage three times in succession. Results were reported as being non-supportive of the existence of cyclic variation in stuttering. The authors reported that no tendencies for disfluency periodicity or clustering were found.

Periodic or cyclic components have been reported to exist in the speech of stutterers (Quarrington, 1965). This would indicate that stuttering varies on a temporally organized basis. Other findings have indicated that no periodic components in stuttering can be identified (Taylor and Taylor, 1967).

Situational Variables

Specific situational variables have been shown to be significant determinants of the level of disfluency or stability or disfluency in preschool stutterers (Silverman, 1971; Martin, Kuhl, and Haroldson, 1972a). The results of other studies have indicated that situational variables

are relatively non-influential as stuttering determinants (Martin, Kuhl, and Haroldson, 1972b).

Supportive data. Silverman (1971) conducted a study designed to determine if preschoolers' disfluency systematically varies as a function of the speaking situation in which they are involved. Speech samples were obtained from three four-year-old non-stutterers in three different speaking situations: in a preschool classroom during free play activities; in a testing room while they told stories, responded to questions, and verbalized while playing with toys; and in their homes talking with family members. The subject's speech was tape recorded twice, in each of the three situations, on two consecutive days. Results of sample analysis indicated that the frequency of disfluency systematically varied (0,04) across situations. From these results, the author concluded that sampling preschoolers' disfluency in only one situation is inadequate for either theoretical or clinical purposes.

Martin, Kuhl, and Haroldson, (1972a) conducted an experimental treatment with two preschool stutterers, one three years and six months of age, the other four years and six months of age. Both children were allowed to converse with a "talking" puppet for a number of twenty minute sessions. Baserates of stuttering frequency were established for each subject. "Time-out" procedures, during which the subjects were not allowed to see or speak with the puppets, were contingent on each disfluency.

Results indicated that the stuttering frequencies of both subjects reduced to zero during the treatment sessions and remained at that low frequency throughout generalization, carry-over, and follow-up sessions conducted approximately a year later.

Non-supportive data. Situational variations of disfluencies in preschool non-stutterers were also studied by Martin, Kuhl, and Haroldson (1972b). Their subjects were twenty children ranging in age from three years, six months to five years, and their mothers. In a total of five sessions, each child spoke with his mother for ten minutes, then with another child for ten minutes. Results indicated that the percent of disfluent words produced by the children when they talked with another child was not significantly (no probability figure indicated) different from the percent when they talked with their mothers. No statistically significant difference was reported as being found for total number of words produced in the two speaking situations for the children as a group. In addition, the percent of disfluent words for the group was reported as not varying significantly across the five sessions.

The frequency of disfluency in the speech of preschool stutterers has been shown to vary systematically across variously structured speaking situations (Silverman, 1971). This phenomenon has been demonstrated by varying speaking environments, manipulating the nature of the verbalization, and by alternating the communicative

participants. In addition, the modification of stuttering has been shown (Martin, Kuhl, and Haroldson, 1972a) to be enhanced by the use of specific situations. One study involving preschool stutterers (Martin, Kuhl, and Haroldson, 1972b) yielded results that indicated a lack of significance for situational variables in determination of disfluency.

Age Variables

The question as to whether disfluency varies relative to chronological age has been examined by various researchers (Bloodstein, 1960; Yairi and Clifton, 1972; Haynes and Hood, 1977). It has been noted (Bloodstein, 1975) that the decrease in disfluency of non-stutterers with age may have significance in light of the decline in the frequency of newly reported cases of stuttering during the preschool years.

Davis (1939) measured the repetitions in the speech of preschoolers in relation to language maturity and situational factors. This was done on the premise that, at preschool age, the difference between stuttering and normal disfluency is one of quantity rather than quality. Upon the conclusion of this study, Davis (1940) stated:

> When chronological age was held constant, the correlations (between disfluency and language maturity) tended to become even lower, although the relation to chronological age itself was not marked. To say that chronological age is important to a certain degree has no meaning, for in all probability it is not mere age that

> exerts the influence, but some as yet not uncovered factor of maturity which correlates with age. (1940, p. 241)

Bloodstein (1960) examined the case records of 418 stutterers, ranging in age from two to sixteen years and suggested that young stutterers tend to be more disfluent at the beginning of sentences than do older stutterers.

Bloodstein and Gantwerk (1967) sampled the speech of thirteen stutterers ranging in age from two years, eleven months to six years, six months. The samples were analyzed to determine the nature of the relationship between grammatical factor and disfluency. The results were interpreted as indicating the non-existance of the grammatical factor in children, findings which were markedly different from those reported on adult stutterers.

Corroborating evidence to Bloodstein's (1960) findings were reported by Williams, Silverman, and Kools (1969). They divided seventy-six stutterers and seventy-six non-stutterers, aged five through thirteen years, into three groups: kindergarten and first grade; second and third grades; and fourth, fifth, and sixth grades. Speech samples for the groups were analyzed for the variables of grammatical function, word length, and sentence position. A developmental trend was reported as being indicated only for sentence position. In group comparisons, a higher percentage of the kindergarten and first grade children were classified as being disfluent on the first words of utterances.

Muma (1971) noted that it is during the late preschool years that the timetables for the peak frequency of normal disfluency and the most rapid mastery of syntactic processing occur. On the basis of this knowledge he stated that:

> ...it is logically appealing to study a possible interaction, or cause and effect, between normal disfluency and the acquisition of syntax by four-year-old children. (1971, p. 429)

Yairi and Clifton (1972) investigated the types and frequency of disfluencies in three groups: preschool children, high school seniors, and geriatric persons. Each group was composed of 15 non-stutterers, approximately half male and half female. Spontaneous speech samples were elicited through the use of picture stimuli. The samples were analyzed for occurrence of interjections of sounds, syllables, words, or phrases; part-word repetitions; word repetitions; phrase repetitions; revisions or incomplete phrases; disrhythmic phonations; and tensions. Results indicated that the preschool and geriatric groups exhibited similar disfluency patterns. Also a significantly (0.05) greater occurrence of disfluencies was found for the preschool and geriatric groups than for the high school group.

Haynes and Hood (1977) in reporting the results of their study of language and disfluency variables in 4-, 6-, and 8-year old subjects, stated that a decrease in disfluency apparently begins around eight years of age. Their findings also indicated that although amount of disfluency

did not change between the ages of 4 and 8, the nature of the disfluency was significantly altered. Results revealed that interjections were significantly (no probability figure cited) increased between 4 and 8 years of age. Also, with an increase in chronological age, word repetitions exhibited a downward shift which approached statistical significance (0.08).

The relationship of language maturity to stuttering (Davis, 1940; Haynes and Hood, 1977) the position of the stuttered word in sentences (Bloodstein and Gantwerk, 1967), and elements of syntactic processing relative to disfluency (Muma, 1971) have been investigated relative to chronological age. The results of these studies indicate that the nature and frequency of disfluencies vary relative to chronological age. On the basis of this information, it would appear that even if stuttering does not change as a function of chronological age as noted by Davis (1940), chronological age can possibly be used as a predictive factor in fluency behavior as it is used in predicting language behavior.

Language Development Relative to the Development of Stuttering

The possibility of inter-relationships between the phenomenon of stuttering and language delay or language differences has been held by researchers to be worthy of systematic investigation. Results have often been

contradictory, but the weight of the evidence would appear to indicate a possible correlation between language development and the development of stuttering.

General Language Development

The speed of the general language development of stutterers has been indicated to be slower as compared with non-stutterers (Milisen and Johnson, 1936). This finding would appear to hold implications, not only for considerations of language development, but for considerations of the development of stuttering as well. Subsequent replications have resulted in both supportive and non-supportive evidence for delayed language development for stutterers.

Supportive data. Berry (1938) compared 243 stutterers to 252 non-stutterers on basis of use of first words and 140 stutterers to 154 non-stutterers on speech intelligibility to listeners outside the immediate family. She found significant differences (no probability figure indicated) between the stutterers and non-stutterers, with the non-stutterers indicating an earlier use of first words and a higher level of speech intelligibility than the stutterers.

Morley (1957) compared 29 stutterers to 111 non-stutterers on measures of the use of first words, phrase usages, and the speech intelligibility. The non-stutterers were found to have significantly higher scores than the stutterers on all three measures.

Andrews and Harris (1964) corroborated the above

findings in their Newcastle upon Tyne study. Unlike the results of Milisen and Johnson (1936), Berry (1938), and Morley (1957), who relied on the recollections of parents, the results of Andrews and Harris were based upon observation of 1000 children followed from birth to sixteen years of age. During the course of the study, 78 stutterers were compared with 76 non-stutterers on the use of phrases. The non-stutterers performed significantly better than the stutterers on this measure.

Non-supportive data. Johnson, et al. (1942), compared 46 stutterers to 46 non-stutterers on their use of first words and sentence usages. No significant difference (0.05) was found on either measure.

Darley (1955) compared 50 stutterers with 50 non-stutterers on measures of first word usages, phrase uses, and sentence uses. A significant difference (no probability figure indicated) was found only for the usages of sentences.

Johnson and Associates (1959) compared 137 stutterers to 131 non-stutterers on measures of first word usage and sentence usage. No significant differences (0.05) were reported. Johnson reported that in this study it was found that the stutterers had been regarded as late talkers by their parents substantially more often than had the non-stutterers. However, the ages at which the parents reported the children as having said their first words and sentences proved to closely correspond, suggesting, according to Johnson, that the difference was principally

in the parents evaluations of what they had observed rather than in the actualities.

Several early investigations (Milisen and Johnson, 1936; Berry, 1938) and later replications (Morley, 1957; Andrews and Harris, 1964) have indicated that stutterers tend to be slower in speed of general language development than non-stutterers.

Findings that indicate slight or non-existant differences in the general language development of stutterers as compared with non-stutterers have also been produced. Collectively, these studies constituted the Iowa Studies.

Specific Linguistic Skills

As a refinement of the studies on speed of general language development in stutterers, studies have also been designed to assess and compare stutterers with non-stutterers on measures of specific linguistic skills. The majority of these studies have produced largely negative results. Of possible significance in considering these results, however, is the fact that most of the studies on specific linguistic skills have used elementary school age stutterers.

Silverman and Williams (1967) reported a tendency for their Kindergarten and first-grade stuttering subjects to be poorer in mean length of response, mean of the five longest responses, standard deviation of response length and structural complexity of their utterances. A statistically significant difference (0,05) was found between their

stuttering and non-stuttering groups only on the measures of number of one-word responses.

Peters (1968) replicated the Silverman and Williams (1967) study, matching 30 elementary school age stutterers with 30 elementary school age non-stutterers. Picture stimuli were used to obtain three separate fifty-response language samples from the subjects. The data were interpreted to obtain the language measures of mean length of response, standard deviations of response length, mean of the five longest responses, number of one-word responses, structural complexity score, number of different words used, and type-token ratio. No significant differences between the two groups of children on the seven language measures were found. Also, no significant differences were found in the temporal reliabilities of the two groups of children for six of the seven language measures. And lastly, correlations computed between the language measures and between the language measures and the subject's chronological age, mental age, and socioeconomic status, indicated no significant differences between the two groups.

Perozzi and Kunze (1969) compared ten second and ten third grade stutterers and controls with the Illinois Test of Psycholinguistic Abilities (ITPA) (Kirk, McCarthy, and Kirk, 1968) and Van Alstyne Picture Vocabulary Test (1960), and measures of verbal output and structural complexity. The stutterers performed significantly (0.05) lower only on the visual motor sequencing subtest of the ITPA.

Boysen and Cullinan (1971) compared eight male stutterers, ranging in age from seven to ten years, with 20 male non-stutterers, ranging in age from seven to nine years. Slides of single line drawn objects were presented as stimuli and the latency of object naming for each child was recorded. No significant differences (0.01) were found between the two groups on reaction time.

Williams and Marks (1972) compared the performance of young stutterers on the Illinois Test of Psycholinguistic Abilities (ITPA) and the Peabody Picture Vocabulary Test (PPVT). Subjects included 28 children ranging in age from five years, three months to nine years, six months. Results indicated that the stutterers demonstrated significant (0.05) deficits in auditory-vocal sequencing ability in comparison with the other ITPA subtest scores.

Muma (1971) used transformational analysis techniques to analyze the fluent and disfluent speech of preschool age subjects. Speech samples were obtained from 13 four-year-old subjects rated as highly disfluent. The samples were subjected to a syntactic analysis designed to indicate the kernel and matrix sentence frame types and transformational usage. Analysis procedures indicated that the fluent group used significantly (0.01) more double-base transformations than the disfluent group, however the two groups performed similarly on the distribution of usage for sentence frame types. Muma interpreted these data as indicating that a non-loci explanation of disfluency should

be cast in terms of the nature of transformational operations in grammatical performance.

The results of several studies designed to compare stutterers with non-stutterers on measures of specific linguistic skills have indicated that stutterers tend to produce more one word utterances than non-stutterers (Silverman and Williams, 1967); are deficient in visual-motor sequencing abilities (Perozzi and Kunze, 1969); are deficient in auditory-vocal sequencing abilities (Williamson and Marks, 1972); and use significantly less double-base transformations than do non-stutterers (Muma, 1971). Other similar studies, however, have indicated minimal differences between stutterers and non-stutterers in linguistic skills abilities (Peters, 1968; Boysen and Cullinan, 1971).

Linguistic Differences Relative to Early Disfluency

Muma (1971) noted that psychologists, psycholinguists, and speech pathologists have sought a linguistic explanation of normal disfluency but that empirical support for this explanation, as well as support for a linguistic explanation of stuttering, has been limited. Haynes and Hood (1978) commented that although it has been postulated that language complexity is related to disfluency in children, "...there has been no widespread support for the premise.... In fact, most published research has found little or no relationship between language behavior and disfluency

in youngsters...." (1978, p. 79) Regardless of this information, isolated studies which would tend to support a relationship between language behavior and disfluency have been reported.

Supportive data. The evidence in support of a relationship between linguistic factors and fluency is more limited than that which is non-supportive. The bulk of this evidence is found in two articles designed to investigate linguistic complexity, relative to fluency in preschool children.

Muma (1971) obtained speech samples from 13 four-year-olds who were classified as highly fluent and 13 four-year-olds classified as highly disfluent. None of the subjects, however, were identified as stutterers. The children were reported as being comparable as to sex, intelligence, socioeconomic status, race, and educational history. Spontaneous speech samples elicited with picture stimuli were obtained from each subject along with teacher daily ratings of fluency, investigator ratings of the speech sample, and supplementary information (age, sex, intelligence rating, father's occupation, sibling status, race, and educational history) on each child. Transformational analysis procedures were used to determine the distribution of usage of various matrix sentence types, the distribution of kernel and transformed sentences and the distribution of usage of each transformation type according to matrix sentence type, the number of single-base transformations per

sentence, and composite of the number of single- and double-base transformations per sentence. Data analysis revealed that fluent speakers used more double-base transformations than do disfluent speakers. The site of transformation was found to vary according to sentence frame type but there were comparable variations between fluent and disfluent subjects. The author interpreted these results as implying that a non-loci explanation of disfluency appears to be related to the nature of transformational operations. This interpretation indicates that more complex language and fluency are positively correlated.

Haynes and Hood (1978) corroborated Muma's (1971) results by systematically increasing the complexity of kindergarten children's spontaneous expressive language in order to vary the grammatical load on their encoding systems. This technique afforded an assessment of the disfluency type and frequency when the children used consistently simple or complex language behavior. Subjects were comprised of 20 male and 20 female children between 60 and 72 months of age. A language sample of 50 sentences was obtained from each child from a baserate phase, a simple language modeling phase, and a complex language modeling phase. The samples were analyzed to determine if the children's language had changed in its complexity as a function of the simple and complex modeling conditions as determined by the variables of total words in condition, mean words per sentence, total morphemes in condition,

mean morphemes per sentence, and developmental sentence score. Also the samples were analyzed for the location and types of disfluency occurrences. Seven disfluency categories were used: interjections, part-word repetitions, word repetitions, phrase repetitions, revisions-incomplete phrases, disrhythmic phonations, and tense pauses. The authors reported the results between total disfluency and language as follows:

> The results demonstrated that significantly more disfluency occurred when the children were using complex as opposed to simple language and that the disfluency topography differed between the conditions. When a child used more complex language, he increased the probability of dealing with a higher grammatical load (Lee, 1974). As the linguistic complexity of the intended utterance increased, the process of encoding language may have been interrupted more frequently. However, the breakdown point and the extent of speech interruption appear to be highly individual phenomena since some children exhibited more disfluency differences than others between the modeling conditions. Thus, it may not be a question of the complexity of language per se, but rather the "linguistic stress" it places on the processing system that causes the breakdown. (1978, p. 89)

In addition to the above results, the authors reported a lack of uniformity of the increases in disfluencies during the complex modeling condition. Word repetitions were found to be more frequent in the complex condition as compared to the simple condition. The authors contended that the findings were in support of the position that the use of simpler language could reduce children's disfluencies.

Citing the foregoing supportive data, Falck, Phelps-Terasaki, and Sartin-Lawler (1979) hypothesized that an

improvement in the oral speech fluency of a six years, six months old stutterer would result in improved expressive language as measured by standard language evaluation procedures. Testing involved one pre-remediation and one post-remediation sampling session during which the subject's language and fluency were both assessed. Language measures consisted of the Illinois Test of Psycholinguistic Ability (ITPA) (Kirk, et al., 1968), the Test of Auditory Comprehension of Language (TACL) (Carrow, 1973), the Carrow Elicited Language Inventory (CELI) (Carrow, 1974), the Structured Photographic Language Test (SPLT) (Werner and Kresheck, 1974), and the Development Sentence Scoring Instrument (DSS) (Lee, 1974). Fluency was assessed by tabulation of the total number of stuttered words during the pre and post CELI and DSS testing. Additionally, pre and post tabulations were made of the number of words, syllables and morphemes used by the subject on the CELI and the DSS. The subject was seen for seven 30 minute sessions of speech therapy between the sampling sessions. Results of the pre- and post-remediations testing indicated that the subject's performance did not change significantly on the ITPA, the SPLT, or the DSS. However, the authors did report post-test improvements on the TACL (from the sixth percentile on the pre-test to a post-test score in the fourteenth percentile) and on the CELI (total errors decreased from 137 to 114). Additionally, it was reported that , on the CELI, the subject's disfluencies decreased 31 percent during the prompted post-test

while the total number of words, syllables and morphemes used increased. On the DSS, the subject's total disfluencies decreased 24 percent during the post-test while the number of syllables and morphemes contained within the sentences increased. These findings led the authors to conclude that a relationship appears to exist between fluency and oral language usage and should be considered with planning therapeutic intervention.

Non-supportive data. Davis (1939, 1940) in a hallmark tripartite study designed to assess the relation of repetitions in the speech of young children to certain measures of language maturity and situational factors, found only limited support of a linguistic explanation of stuttering. Spontaneous speech samples were gathered for each of 62 preschool children between the ages of two and five years. The speech samples were initially analyzed to determine the limits of each response and to establish the mean length of response for each child. The speech samples were next analyzed for indices of language maturity. Five measures of repetition were then correlated with the following measures of language maturity and general development: chronological age, mental age, intelligence quotient, verbal output, mean length of response, vocabulary, number of correct speech sounds, percent intelligibility, percent incomplete responses, percent simple responses, and percent complex responses. Correlations were obtained for all the above measures and Davis reported that: (1) none

of the correlations were sufficiently large to be considered the key to an explanation of repetitions. The largest was the correlation of -.56 between syllable, word and phrase repetitions divided by verbal output and mean length of response; (2) that chronological age showed correlations of approximately the same magnitude with each of the measures except syllable repetition divided by verbal output. This was interpreted as indicating that there was a tendency toward a decrease in repetition with age, with the possible exception of syllable repetitions where it was concluded that there was no relationship; (3) mental age showed a slight negative relationship to all measures of repetition divided by verbal output, tending to indicate that with the exception of syllable repetition where no relationship was present, there was a slight tendency for repetition to decrease with increased mental age; (4) I.Q. showed low correlations with all measures; it was concluded that there was no relationship present; (5) verbal output showed no particular relationship except with word repetition divided by verbal output and instances of syllable, word and phrase repetitions divided by verbal output where there was a slight negative relationship; (6) vocabulary, correct articulation, and the degree of intelligibility showed negative correlations with the measures of repetition except syllable repetition; (7) the percentage of incomplete responses and the percentage of functionally complete but structurally incomplete responses had slight positive correlations with

all measures of repetition; (8) the correlations with percentage of simple and complex responses were all low and negative with the exception of syllable repetitions which was practically zero; and (9) it appeared that the incidence of syllable repetition was not significantly related to any of the above measures. Based on the above findings, Davis concluded that:

> ...if it is desired to find the explanation for the large number of repetitions found in the speech of preschool children it must be sought elsewhere than in the area of language maturity, that is, that the child repeats because he is not adept at using language in the conventional manner. (1940, p. 241)

Knabe, Nelson, Williams (1966) used older subjects, 16 stutterers and 16 non-stutterers ranging in age from 18 to 25 years, to investigate linguistic variables in stuttering. A number of personal and impersonal questions were used to elicit oral responses from the subjects. Each subject's responses were analyzed for measures of ten dependent variables: degree of disfluency, latency of response, time of response, rate of response, total word output, total different word output, total semantic word output, total function word output, total personal pronoun output, and total nonpersonal pronoun output. Results revealed that the only significant difference (0.05) between the stuttering and non-stuttering subjects was on disfluency. The authors concluded that, if their measures were valid, stutterers may be more similar to non-stutterers than previously indicated. Secondly, they concluded

that, in light of the similarity of linguistic output between stutterers and non-stutterers, disfluency may be the cause of a reduced fidelity in the stutterer's speech rather than general output characteristics.

Silverman (1972) investigated preschoolers' egocentric and socialized speech for variations in syntactic complexity and indices of increased disfluency in socialized speech which was presumed to be more syntactically complex. Speech samples were gathered from ten four-year-old males and divided into egocentric speech and socialized speech categories. The syntactic complexity of each utterance in both categories was then determined by means of a seven-point equal-appearing-interval scale, where one represented least intricacy and seven most intricacy. Results indicated that no difference existed in intricacy between the subjects' egocentric and socialized utterances and that the intricacy of the subjects' language could not have accounted for observed disfluency differences. The author suggested that the subjects' semantic reaction to some attribute of the communicative process would more likely account for the increased disfluency level associated with their socialized speech.

Berryman and Kools (1975) collected speech samples from 92 first-grade children and quantified them on the basis of nine disfluency types: interjections, part-word repetitions, word repetitions, phrase repetitions, incomplete phrases, revisions, disrhythmic phonations, tense

pauses, and total disfluency per 100 words. The speech samples were also rated by 36 judges as to language level using a low-high seven point scale. In addition, intelligence and reading scores were obtained for each subject. Results of correlational analysis indicated that the measures of language, intelligence, and reading ability were not significantly (0.05) associated with frequency of disfluency.

Haynes and Hood (1977) examined language and disfluency variables in subjects from three chronological age groups: four-, six-, and eight-year-old children. Speech samples comprising 50 complete sentences per child were collected and analyzed using the DSS system (Lee, 1974). Fluency variables included interjections, part-word repetitions, word repetitions, phrase repetitions, revisions, incomplete phrases, disrhythmic phonations, and tense pauses. Language variables included noun modifiers, personal pronouns, main verbs, secondary verbs, negatives, conjunctions, interrogative reversals, and wh-questions. Results of a multivariate analysis of variance indicated no significant differences between the disfluency and language variables studied.

The concept that early disfluencies in non-stuttering children may be predicated upon specific linguistic variables, has led to investigations of possible correlations between language and disfluency. The bulk of resulting evidence has by and large indicated that no significant

correlations exist between language variables and early disfluencies (Davis, 1939, 1940; Knabe, Nelson, and Williams, 1966; Silverman, 1972; Berryman and Kools, 1975; Haynes and Hood, 1977). The results of other, more limited, studies have suggested that significant correlations do in fact exist between language variables and early disfluencies (Muma, 1971; Haynes and Hood, 1978; Falck, et al., 1979).

Methodological Techniques in the Study of Linguistic Variables in Stuttering

A review of the literature on linguistic variables in stuttering has revealed that various methodological approaches bearing similarities in design have been employed. A closer examination of these techniques was included to provide insight into the methodological needs of the current study. Studies designed to assess linguistic involvement in stuttering were reviewed as to: (1) the sampling procedures employed in each study and (2) the temporal designs of the data collection periods.

Sampling Techniques

Davis (1939) recorded verbatim the spontaneous speech of 36 boys and 26 girls of preschool age. The recording sessions consisted of two half-hour periods which were within one week of the day of the month corresponding to the birth date for each child. The sampling date was recorded as the midpoint of the two half-hour sessions. The

speech samples were gathered during free-play activities within the regular preschool routine when direct teacher supervision was at a minimum. The samples were then analyzed for the fluency and language variables.

Knabe, Nelson, and Williams (1966) used two categories of questions to elicit responses from their subjects: personal and impersonal questions. Personal questions were defined as those containing the pronoun "you" and involving aspects of the subject's ego. An example given as a personal question was: "How do you feel when someone laughs at the way you are talking?" Topical matter for the personal questions included family, speech, ability to accept criticism, and views on interracial marriage. Impersonal questions were defined as those not containing the pronoun you and dealt with neutral topics such as weather, vacations, social problems of the aged, and student housing. The subjects were seated across the table from the experimenter in a soundproofed, windowless room and asked to give an unlimited, verbal response to five personal and five impersonal questions. Order effects were avoided by systematically varying the sequence of question presentation. To requests for question interpretation, the experimenter replied, "It means whatever you want it to mean" and thus avoided biasing the subjects' linguistic output by vocabulary or direction. The responses were all tape recorded and then transcripts made of those responses. The 10 dependent variables of stuttering severity and

language (discussed above) were analyzed by two trained judges. Degree of disfluency was determined with a modification of the Iowa Scale of Rating Severity of Stuttering (Johnson, et al., 1963).

Muma (1971) used teacher referrals to obtain his disfluent subjects from nursery school environments. When a potential subject had been identified, the examiner entered into the subject's environment and interacted with the subject until the child would respond in a spontaneous manner. Speech samples were then elicited using the CAT pictures and rated according to a five-point scale: superior fluency, above average fluency, average fluency, below-average fluency, and highly disfluent. For each disfluent subject obtained in this manner, a comparable fluent subject was obtained using the same procedures. Potential subjects were assigned to either a highly fluent or highly disfluent group as determined by the teachers' daily ratings of fluency, the investigator rating of the obtained speech sample, and the average length of fluency. The average length of fluency was determined by dividing the total number of words in the fluent portion of each speech sample by the total number of T units (one main clause plus a subordinate clause or nonclausal structure that is attached to or embedded in it). Subjects having a length of fluency index value above 20 were assigned to the highly fluent group and those with an index value below 15 were assigned to the highly disfluent group. Transcription and segmentation

techniques were used so that the reliability of the quantified linguistic data could be assessed, to permit selection of subjects by matching teacher and investigator ratings with an empirical measure of fluency, so that the fluent portions of speech samples could be equated on length and a comparison of frequency of usage of syntactic structures facilitated, and so that syntactic analysis could be performed on the fluent portions of the speech samples.

Berryman and Kools (1975) obtained speech samples from 92 non-stuttering first-grade children, 46 males and 46 females. Recorded speech samples were obtained for each child over a two month period using the Children's Apperception Test Cards (Bellak and Bellak, 1961). The reading ability of each subject was measured by the word recognition and paragraph recognition subtests of the Gates Primary Reading Test (Gates, 1943) and mental ability was measured by the California Short-Form Test of Mental Maturity S-Form (Sullivan, Clark, and Tiegs, 1963). The recorded speech samples were transcribed and broken down into eight disfluency categories. The disfluency categories used were those originally described by Johnson and Associates (1959) and subsequently modified by Williams, Silverman, and Kools (1968). This system consisted of eight disfluency categories: interjections, part word repetition, word repetition, phrase repetition, incomplete phrases, revisions, disrhythmic phonations, and tense pauses. In addition, the mean number of disfluencies per

100 spoken words was computed for each category of disfluency and for all categories combined. Degree of language development was determined by having 36 judges rate each language sample of 150 words on a seven point scale in which one represented a low degree of language development and seven a high degree of language development. Intercorrelation analysis was then used to determine if a statistically significant relationship existed among the measured disfluency and language variables.

Haynes and Hood (1977) used trained speech clinicians to obtain speech samples from four-, six-, and eight-year-old subjects in a structured interview situation. The samples consisted of spontaneous conversation, facilitated by picture stimuli when necessary. A corpus of a minimum of 50 sentences was obtained for each child and analyzed with the DSS system for fluency and language variables (described above).

Haynes and Hood (1978) employed sampling procedures that were divided into three phases: a baserate phase, a simple language modeling phase, and a complex language modeling phase. In the baserate phase, samples were obtained of the preschool children's expressive language and fluency in conversation as a general index of their habitual levels. The authors stated their rationale for the baserate in that the unmanipulated language sample would insure that each child had no significant language deviation and to demonstrate that the "static" data obtained in

the baserate condition could not adequately show a relationship between language and disfluency. In the second phase of sampling, simple language was elicited from the subjects. Two basic syntactic constructions were modeled in order to create the modeling effect and to avoid confusion from too many stimuli. Simple language was defined as constructions that were extensions of basic kernel sentences and contained no major transformations. Randomly ordered simple sentence constructions were modeled that corresponded to pictures that were selected for their depiction of simple objects and events familiar to five-year-olds. One simple sentence was modeled for each of 10 modeling stimulus pictures while the subject watched and listened. The subject was then given a turn to make up one sentence for each of 10 new stimulus pictures. The experimenter/subject alternation was continued in blocks of 10 pictures until the subject had produced 30 - 40 pictures. Intermittent verbal reinforcement was used. The last phase consisted of increasing the complexity of the models by presenting constructions containing coordination or embedded infinitives. This involved the use of more difficult transformational rules and an inconsistent use by the experimenter of pronouns and negatives in the constructions. The same modeling procedures were used in this phase as in the simple language modeling phase. Comparison of the two conditions were made using the DSS system. The authors stated that the study was not intended to be an in-depth

linguistic analysis but rather to be a preliminary step in determining if disfluency is related to changes in linguistic complexity. They suggest that the modeling procedure used in this study may be a technique that would provide a more complete picture of the variability of a child's disfluency in a clinical setting. The system employed to identify disfluencies was that described by Berryman and Kools (1975).

In a review of the methodological techniques employed in the investigation of language variables in stuttering, several procedural points recur across studies. These include the collection of a corpus of 50 or more spontaneously produced sentences for both language and fluency analysis. Level of language functioning has been determined by various techniques including syntactic analysis (Muma, 1971), listener rating of language maturity (Berryman and Kools, 1975), and scoring with the DSS system (Haynes and Hood, 1977, 1978). Fluency variables have been accounted for either by use of a degree of disfluency continuum (Muma, 1971) or by use of a disfluency categorization system to quantitatively and qualitatively account for individual disfluencies (Berryman and Kools, 1975; Haynes and Hood, 1978).

Temporal Aspects

Muma (1971) used a single sample design to examine the syntax of preschool fluent and disfluent speech. His

results indicated the existance of a significant relationship between the structure of language and disfluent behavior but was limited in terms of defining the specifics of this relationship. Rather than a different temporal design, Muma suggested that different interpretative procedures might yield more precise data.

Haynes and Hood (1977) used a single sample design to investigate language and disfluency variables in normal speaking children. They concluded that:

> Research on the language-disfluency relationship involving a single sample of language cannot tap the aspect of grammatical load or uncertainty since observations of the child's fluency as he uses language of varied complexity is not evaluated. (1977, p. 72)

Haynes and Hood further stated that the need for more "within subject" research and longitudinal study of the language-disfluency relationship is needed.

In a later study on the relation between linguistic complexity and disfluency, Haynes and Hood (1978) suggested that their study:

> ...indicates the inadequacy of a single sample design in researching the language-disfluency relationship because the single sample approach fails to tap the aspect of grammatical load that appears to be a factor in the variability of disfluency. (1978, p. 88)

Falck, et al. (1979) employed four standard language measures and fluency analysis in a pre- and post-test sampling design. The post-test followed three and a half weeks of therapy for their single subject and differed from pre-test conditions only in the instructions given to

the subject. On the post-test language measures, the subject was instructed to use his "easy speech" in responding to the language test items. The language tests were tape recorded and reviewed by the three authors. Particular segments were replayed and discussed so that a consensus could be reached on all test items. The authors noted that while a positive relationship was observed between improved fluency and oral language for their subject, this was an immediate relationship and said nothing about long range relationships.

As to the temporal design employed in the study of linguistic variables in stuttering, the single sample design has been the procedure most often used. The need to go to more temporally expanded designs has been indicated by some researchers as the needed direction for future studies designed to investigate linguistic variables in stuttering (Haynes and Hood, 1977; 1978; Falck, et al., 1979) while others have placed more stress on data interpretation procedures (Muma, 1971).

Language Development and Measurement

Studies designed to measure the human language acquisition process have resulted in the development of instruments designed to assess incipient language abilities as well as in data on the longitudinal aspects of normal language development. A review of several of these studies are included for consideration of their clinical and

theoretical relevance to the current study. Previous studies (Muma, 1971; Haynes and Hood, 1977; 1978) have demonstrated the applicability of this language information and instruments to the investigations of language variables in stuttering.

Fraser, Bellugi, and Brown (1963) investigated the control of grammar in imitation, comprehension, and production tasks in preschool children. Twelve three-year-old children were presented tasks which contained ten different grammatical contrasts. A combination of the imitation, comprehension and performance scores yielded a compendium of grammatical contrasts from the least to the most difficult.

Carrow (1968) investigated auditory comprehension of vocabulary, morphological structures, and syntactic structures in young children. Her subjects included 40 children ranging in age from six months to six years six months. Data consisted of non-verbal responses to picture stimuli which represented contrasts in form classes and function words, morphological constructions, grammatical categories, and syntactic structure. Results indicated significant differences in mean comprehension scores at six month intervals from three years of age to four years six months. Significant differences were also indicated in mean comprehension scores at one year intervals from four years six months to seven years of age.

The investigations by Carrow (1968) led to the

development of two evaluative instruments: the Test of Auditory Comprehension of Language (TACL) and the Carrow Elicited Language Inventory (CELI). The TACL (Carrow, 1971) was designed to measure the auditory comprehension of language structure in children and to subsequently assign the subject to a developmental level of comprehension. The test was also designed to allow the examiner to identify areas of linguistic difficulty on a diagnostic basis. The CELI (Carrow, 1973) was also designed as an aid in the identification of children with language problems. It was designed specifically to measure the subject's productive control of grammar and for determining which specific linguistic structures may be contributing to the subject's inadequate linguistic performance.

As a result of interest generated by the Fraser, Belugi, and Brown study (1963), Lee (1969) developed the Northwestern Syntax Screening Test. Normative data was collected on 344 children (Lee, 1971) indicative of expressive and receptive syntactical development relative to chronological age.

Brown (1973) suggested an alternative method for equating language development than with chronological age. Brown studied the language development of three preschool children on a longitudinal basis. A minimum of two hours transcription of spontaneous speech was gathered on each child every month and was then subjected to linguistic analysis. Brown reported that the subjects were of different

chronological ages and that no attempt had been made to equate for age due to the widely varying rates at which children acquire language. Rather, Brown equated his subjects on the basis of two measures of length of utterance: the mean length of utterance (MLU) and the upper bound (longest utterance). Brown noted that the mean length of utterance is particularly well suited to the measure of grammatical development since almost every new kind of knowledge is evidenced by an increase in length. Brown's data indicated that the length of utterance is increased by the number of semantic roles expressed in a sentence, the addition of obligatory morphemes, coding modulations of meaning, the addition of negative forms and auxiliaries used in interrogative and negative modalities, and embedding and encoding. This particular methodology led Brown to the development of nine rules for the calculation of mean length of utterance and upper bound and ultimately, based on the results of his longitudinal data, to the specifiction of five stages of language development based on mean length of utterance. Although Brown concluded that MLU is a better base for comparison than age, he stated that chronological age can be used in the prediction of grammatical maturity.

Lee (1974) reported on the development of the Development Sentence Scoring (DSS) procedure. The initial version of the DSS (Lee and Canter, 1971) consisted of a developmental sequence of grammatical forms in each of the

following categories: indefinite pronouns, personal pronouns, main verbs, secondary verbs, negatives, conjunctions, interrogatives, and wh-questions. Structures which the authors had hypothesized developed later in language learning were given higher scores. Subsequently, Koenigsknecht and Lee (1971) obtained language samples from 200 children aged two years to two years eleven months. A computer analysis was used for comparison with and correction of the developmental order of structures in each grammatical category in the original DSS version. On the basis of the interpreted data, the order of structures in each grammatical category was altered since passive main verbs, passive infinitives, and negative on auxiliary 'have', were indicated to appear earlier than the original DSS had estimated. A third version of the DSS technique (Lee, 1974) however, resulted in the structures of each grammatical category being returned to the order of the original version. The third version also included a reassignment of scores within each category, allowing for comparison of grammatical growth across categories as well as within categories. This allowed for grammatical growth to be compared across categories as well as within categories.

A review of the literature on language development has indicated that relatively recent research into the processes of normal and disordered language has resulted in significant data and evaluative instruments designed to assess language processes. The measurement of the integrity

of language components was facilitated by Brown's (1973) concept of MLU and by the development of such evaluative instruments as the TACL (Carrow, 1971); the NSST (Lee, 1971); the CELI (Carrow, 1973); and the DSS procedure (Lee, 1974).

CHAPTER III

METHODS AND DESIGN

Subjects

Subjects for this study were four preschool stutterers selected from the clinical caseload at the Speech and Hearing Center, Department of Communicative Disorders, University of Mississippi. In addition to having been identified as a stutterer, criteria for including a child in the study were: normal intelligence (Slosson Intelligence Test, Slosson, 1963); normal hearing, determined through pure-tone air and bone conduction audiometric screening; no gross deviances in language, determined from prior informal observation and from the results of the initial sampling session; and normal articulation, measured with the Arizona Articulation Test (Fudala, 1970). All subjects were male and were from white, middle-class families. The only age control requirement was that all subjects were of preschool age at the time they entered the study.

Each of the subjects were in their first semester of stuttering therapy upon their selection for participation in this study. Each subject had been judged to be a moderate-severe stutterer through standard evaluative

procedures conducted at the above Center during the Fall Semester, 1977 and subsequently enrolled in fluency therapy at the start of the Spring Semester, 1978. The four subjects were placed in a fluency program designed to increase fluency at increasing complex linguistic levels through a stimulus-response paradigm (Fields, 1977). Each subject was seen for two 60-minute individual therapy sessions per week. Conjunctive with individual therapy, parent counseling was conducted to enhance carryover of therapeutic success. The parents were counseled as to techniques for reducing communicative stress in the home environment and for encouraging and rewarding verbal behavior in their children.

Subject One and Subject Two, identical twins, were five years, three months of age at the time of their initial data collection session. During the pre-therapy evaluation the subjects' mother reported that she considered Subject One to be a severe stutterer with an introverted personality. She considered Subject Two to be a mild stutterer and more extroverted than his twin brother. Testing indicated that both subjects could be classified as moderate to severe stutterers although Subject Two was consistently more verbal and outgoing in personality than Subject One. Both subjects' patterns of disfluency were characterized primarily by interjections and initial sound repetitions. At the outset of this study, neither Subject one nor Subject Two demonstrated any physical behaviors that were judged to be secondary mannerisms associated with their

stuttering. Subject Two displayed pitch rises which were judged to be vocal secondary concomitants of his disfluencies.

Subject Three was six years, three months of age at the time of his first sampling session in Feburary, 1978. He had not started elementary school but did enter the following school year. During preliminary testing prior to entering therapy, he was classified as a moderate to severe stutterer whose disfluencies were characterized primarily by initial sound repetitions. No physical or vocal secondary concomitants were noted during the initial evaluation. Subject Three was judged as being a very verbal child and, at the outset of this study, could read, write, and perform arithmetic functions on a second-grade level. All of these abilities were reportedly self-taught.

Subject Four was the youngest of the four stutterers selected for this study. At the time of his first data collection session he was three years, nine months of age. The initial evaluation session indicated that Subject Four was a severe stutterer whose disfluencies were accompanied by an array of secondary concomitants. Disfluencies consisted largely of initial sound repetitions although frequent word repetitions and prolongations were also noted. Physical secondary mannerisms included lack of eye contact during speech, placing his hand in front of his mouth during speech, nodding of his head during disfluent moments, and pulling his chin downward with his hand during lengthy

repetitions. Pitch rises and pitch breaks were also noted to frequently accompany disfluencies.

None of the subjects had received speech therapy prior to the semester in which the study was initiated. All of the subjects indicated an awareness of their stuttering and participated willingly in both therapy and assessment sessions. Parental consent was obtained with an explicatory letter of the study and subject consent form (Appendix A).

Materials

The language of each subject was measured at five separate sessions for each subject with the following tests: the Northwestern Syntax Screening Test (NSST); the Peabody Picture Vocabulary Test (PPVT), the Carrow Elicited Language Inventory (CELI), and the Test for Auditory Comprehension of Language (TACL).

The PPVT (Dunn, 1965) was standardized for children from one year, nine months to 18 years of age. The test was designed to provide an estimate of a child's intelligence by a sampling of his receptive vocabulary. The subject's performance is recorded as a raw score, an intelligence quotient, a percentile score, and a mental age. Higher raw scores indicate better performance.

The NSST (Lee, 1969) was designed for children three to eight years of age. It is used to compare receptive and expressive use of grammatical features elicited through selective picture identification of 40 sentence-pairs.

Grammatical features measured include: prepositions, negatives, personal pronouns, reflexive pronouns, subject-object identification, verb tenses, possessives, wh-questions, yes-no questions, indirect objects, and passives. The sentence pairs include grammatical contrasts of increasing difficulty. A subject's performance is recorded as a receptive score with percentile ranking and an expressive score with percentile ranking. Higher raw scores indicate better performances. Lee considered the NSST useful for quickly assessing syntactic development as part of a detailed speech and language evaluation.

The TACL (Carrow, 1971) was standardized for children from two years, ten months to seven years, nine months of age. It was designed to provide a measure of a child's auditory comprehension of language structure and to indicate any areas of linguistic difficulty. Items tested include: form classes and function words (nouns, verbs, adjectives, adverbs, and prepositions); morphological constructions; grammatical categories (case, number, gender, tense, status, voice, and mood); and syntactic structures of prediction, modification, and complementation. The subject's performance is recorded as a raw score, percentile rank, age equivalency, mean for age, and standard deviation from the mean. A higher raw score indicates better performance.

The CELI (Carrow, 1973) was standardized for children from three years to seven years eleven months of age.

It was developed as a measure of a child's productive control of grammar. The test was designed around the technique of eliciting imitations of a sequence of sentences that have been systematically developed to include basic sentence construction types and specific grammatical morphemes. The test results in the assignment of a numerical error score and allows for the quantification of language status. A subject's performance is recorded as a raw score, percentile rank, and stanine score. A lower raw score indicates better performance. Supplementary to this test the CELI Verb Protocol and Summary Sheet form was completed for each client at each sampling session. This form facilitates analysis of verb errors through recording of the type of error verb, verb context, and the error type (tense, person, and number).

Picture stimuli used to elicit spontaneous speech samples during testing included Game Oriented Activities for Learning (Milton Bradley Company, 1972) pictures and posters from the Peabody Language Development Kits (Dunn and Smith, 1967). Specific pictures and posters from these sets of stimuli were changed for each data collection session to reduce the possibility of patterned responses to picture stimuli.

Each data collection session was recorded with Panasonic cassette recorders. A Sony TC-520CS stereo cassette recorder was employed for tape transcription and for language and fluency analysis of the spontaneous speech samples.

Procedure

Language evaluation and fluency assessment were performed five times for each subject over a maximum period of 19 months (Appendix B). Shortly after their third data collection periods, Subjects One, Two, and Three were dismissed from therapy. Subject Three later continued therapy through his public school. Subjects One and Two were judged to have modified their disfluencies sufficiently to facilitate a home program designed for carry over. Subject Four remained in therapy throughout the five data collection sessions.

The sampling sessions were conducted in therapy rooms at the Speech and Hearing Center, University of Mississippi. Testing was performed by graduate student clinicians enrolled in fluency practicum. The clinicians had passed competencies on all the formal measures administered. The testing clinicians were not the same clinicians that were engaged in therapy with each subject, and no clinician evaluated the same subject more than once.

Each clinician was instructed by the experimenter prior to each sampling session. Instructions to clinicians included order of test presentation (the same order was used for all sampling sessions: NSST, CELI, PPVT, and TACL followed by spontaneous conversation), the use of the tape recording equipment in the testing situation, the taking of breaks (one ten-minute break after administration of the NSST and CELI and another break after administration

of the PPVT and TACL), and specific information regarding spontaneous speech elicitation. The clinicians were instructed to present the picture stimuli and utilize wh-questions to elicit spontaneous conversation but not to model or structure utterances in any manner. They were instructed to not indicate approval or disapproval with the client's spontaneous utterances and to continue elicitation procedures until the client had produced a minimum corpus of 50 spontaneous sentences. The same set of instructions was given to each tester before each sampling session.

Instructions to the clients were minimal. On sampling days, they were introduced to their respective testers and told by the testing clinician that they would be working together that afternoon, looking at some pictures, and talking. The formal test instructions were read to the client and testing proceeded according to the individual tests' protocols. For the collection of spontaneous conversation, the clinician would say, "Now we are going to look at some pictures and I would like for you to tell me about them." The picture stimuli were used to initiate conversation and wh-questions were used to continue and expand the conversation. The subjects were also encouraged to tell stories relating to the picture stimuli and to relate stories and experiences of their own choosing.

All testing for each sampling session was performed in the same afternoon. The clinician/tester and client

were seated at a table in a closed therapy room devoid of stimuli other than that pertinent to the experiment. The experimenter observed each sampling session via a two-way mirror located in one wall of the testing room. The subjects did not know they were being observed. The sessions were tape-recorded in their entirety for later analysis.

Evaluation

The formal tests of language were scored and interpreted according to the normative data reported for each instrument. The scoring on each instrument was performed by both the experimenter and the testing clinician, then checked for accuracy by a third clinician. The recorded spontaneous speech samples were orthographically transcribed and scored through the Developmental Sentence Scoring technique (DSS) and with the Syntactic Language Computer Analysis program (SLCA-III).

The DSS (Lee, 1974) technique was designed to analize the grammatical categories of indefinite pronouns, personal pronouns, main verbs, secondary verbs, negatives, conjunctions, interrogatives, and wh-questions. It has been shown to discriminate between different levels of developmental language complexity (Lee and Canter, 1971; Koenigsknecht and Lee, 1971; Lee, 1974). It also provides a total score that indicates the syntactic complexity of the entire corpus of fifty sentences. Each language sample contained combinations of spontaneous conversational productions by

the subject, utterances elicited through the use of visual stimuli, responses to auditorily presented wh-questions, and related stories and experiences prompted verbally by the tester. These elicitation techniques resulted in a single representative sample of the subject's spontaneous language at each data collection session.

The SLCA-III Program (Cummings and Renshaw, 1979) analyzed the complex grammatical characteristics of each language sample. The program is designed to assess language through measurement of eight variables: (1) social perception with the sub-categories of inanimate perception, audience perception, self-perception, generalized - other perception, and authority - other perception; (2) measures of sensation with the sub-categories of sensed information, unsensed information, sensed qualifiers, and unsensed qualifiers; (3) measures of existence with the sub-categories of negative information, positive information, negative qualification, positive qualification, negative relation, and positive relations; (4) measures of motion with the sub-categories of non-motion language and motion language; (5) measures of disposition with the sub-categories of disposition language and assertion language; (6) measures of time with the sub-categories of past time, present time and future time; (7) measures of symmetry with the sub-categories of symmetric relation and asymmetric relation; and (8) measures of conditionality with the sub-categories of qualified information, unqualified information, qualified

relation, and unqualified relation. This accounts for a total of 36 SLCA-III variables designed to represent the perceptual-cognitive properties of language. The technique distinguishes nouns (including proper nouns), verbs and verb phrases, and pronouns within a corpus of language. For purposes of this study, the same corpora of 50 sentences used for DSS analyses were tagged for use with the SLCA-III program.

The tape recorded spontaneous speech samples were transcribed and marked for disfluencies independently by the experimenter and by four graduate students studying in speech-language pathology. One student for each subject was assigned to transcribe all five sampling segments for their subject. None of the transcribing students had participated in the data collection process. The experimenter transcribed all 20 spontaneous speech segments for the four subjects. The first fifty sentences of each of the 20 language samples were then selected for DSS, SCLA-III, MLU, and fluency analyses.

During transcriptions of the taped speech samples, disfluencies were classified by the experimenter and student raters as interjections, sound repetitions, word repetitions, phrase repetitions, prolongations, hesitations, revisions, substitutions, or broken words (Johnson and Associates, 1959; Berryman and Kools, 1975; Bloodstein, 1975). Pitch rises and pitch breaks were also marked.

Comparison was then made between the experimenter's

transcription and the students' transcription for agreement between the texts of the samples and between the perceived disfluencies. Both Pearson product-moment coefficients of correlation and Spearman's coefficients of rank correlation were determined for experimenter versus clinician agreement in identifying the subject's disfluencies. The initial experimenter and students' ratings were compared through the variables of: (1) disfluencies marked by the experimenter that were not marked by the students; (2) disfluencies marked by the student that were not recognized by the experimenter; (3) type of disfluency disagreements; and (4) total disagreement. Results of the two statistical rests indicated generally good agreement between the experimenter's and students' recoginition and classification of disfluencies. Statistical significance was consistently indicated only in the correlations between total disagreements and disfluencies marked by the experimenter that were not marked by the student raters across all four subjects (Appendix C).

Segments of language samples in which experimenter-student disagreement occurred were replayed until agreement could be reached as to word identity, presence or abscence of disfluency, and type of disfluency. The consensus ratings of disfluencies were later categorized by the experimenter according to parts of speech: noun, verb, adjective, adverb, article, preposition, pronoun, and conjunction.

Data Analysis Procedures

The accumulated data were separated into three data sets and statistically examined as follows:

(I) The scores of the NSST (separated into two variables: receptive-NSSTR and expressive-NSSTE), CELI, PPVT, TACL, MLU, and DSS along with the number of disfluencies by type and total number of disfluencies and total words for each of the five data collection sessions for each subject (a total of 20 data collection sessions) were punched into the Statistical Analysis System (SAS) computer program (Barr and Goodnight, 1971) available through the Louisiana State University Computer Center. This program facilitated examination of the fluency and language variables through determination of: (1) Pearson's product-moment coefficients of correlation for all the variables by time (across the five sessions); (2) Spearman's coefficients of rank correlation of the variables by time (across the five sessions); (3) linear regression of the fluency and language scores on time (across the five sessions); (4) regression of each fluency and language variables by time (across five data periods) for each subject; and (5) Friedman's two-way analysis of variance by ranks (subject profile analysis). For the regression measures and Friedman's analysis of variance, the disfluencies were grouped. Interjections, sound repetitions, word repetitions, and phrase repetitions comprised one group. The other group included prolongations, substitutions, hesitations,

broken words, revisions, pitch rises, and pitch breaks. The rationale for this grouping was that early disfluencies tend to be characterized primarily by interjections and repetitions while the other forms of disfluency usually develop later chronologically (Bloodstein, 1975). Total disfluencies and total words were also observed across time. Additionally, graphs of each fluency and language variable by time for each subject were computed as were profiles of each subject across the seven language variables and four "summary" fluency variables (repetition group, "other" disfluency group, total disfluencies, and total words).

(II) The Statistical Package for the Social Sciences (SPSS) (Nie, Hull, Jenkins, Steinbrenner, and Brent, 1975) computer program was used to assess the variability across time in the number of disfluencies relative to the eight parts of speech variables. The data were analyzed to determine: (1) means and standard deviations of the eight variables across the five data collection periods; (2) analysis of variance for each part of speech variable across the five data collection periods; and (3) regression of the eight parts of speech grouped to form two variables (content versus function words) across time (five data periods) for each subject.

(III) The 36 SLCA-III variables were also assessed through the SPSS program. This program was used to determine: (1) means and standard deviations of the 36 variables across five data collection periods; (2) analyses of

variance among the four subjects across five data collection periods for each of the 36 SCLA-III variables; and (3) regression of each SLCA-III variable by time (five data periods) for each subject.

The data from the three sets of analyses were studied for possible intra- and inter-subjects trends across time in patterns of disfluency and language usage. The data were also observed, to determine if periods of increased and/or improved expressive/receptive language usage corresponded to improved speech fluency for these four subjects.

CHAPTER IV

RESULTS

Introduction

The purpose of this study was to longitudinally observe the language and fluency behavior of preschool aged stutterers. Four standard tests of language were administered to four preschool aged stutterers (three of the subjects began first grade prior to the study's completion) at five data collection periods for each subject covering a maximum observation period of 19 months. Spontaneous language samples were also taken at each data collection session for further language analyses and fluency measurement. The compiled data were arranged by subject and data collection period so as to facilitate examination of the data for possible trends in language and fluency behaviors across time. Additionally, data analysis procedures utilizing computer programs were completed through treatment of the tests results and spontaneous language sample interpretations as three distinct data sets: (1) the seven language measures (NSSTE, NSSTR, CELI, PPVT, TACL, DSS and MLU) and the measures of fluency across time for each

subject were examined through both parametric and non-parametric tests for correlation, linear regression, and Chi-square; (2) the disfluencies, classified as to parts of speech, exhibited by each subject at each data collection period were analyzed for variance across time and examined through linear regression analyses; and (3) the 36 SLCA-III variables were analyzed for variance between the four subjects across the five data sessions and the 36 variables were examined through linear regression analyses.

Results of Analyses of Standard Language Measures and Fluency Measures Across Time

Appendixes D through H include the scores on the standard language measures completed for each subject at each sampling session: NSST (separated for analyses into expressive and receptive parts), CELI, PPVT, TACL, DSS, and MLU. The results of fluency analyses for each subject are displayed by sampling session in Appendix I. The degree of and nature of disfluency at each sampling session was measured through the 13 variables indicated in Appendix I. For statistical analyses, three additional fluency variables were added: (1) a repetition category which included interjections and sound, word, and phrase repetitions; (2) an "other" category which included the remaining disfluency types (excepting total word and total disfluencies); and (3) a ratio category which represented the ratio of total disfluencies to total words at each sampling session

for each subject. Appendix J includes the means and standard deviations of the language and fluency scores for the four subjects by time.

Results of Correlation Analyses

Each of the seven language variables for the four subjects were compared by time (across five data collection periods) with each of the 16 fluency variables. Tables 1 and 2 provide the correlation coefficients indicated as being statistically significant for these comparisons. The parametric measures of correlation (Pearson's product-moment coefficients of correlation) included in Table 1 indicated that, while several significant correlations were noted within specific sampling sessions, there were no significant correlations of language and fluency variables across all five sampling sessions for the four subjects. Not only were these correlations sporadic as to significance across sessions, they were also observed to fluctuate as to the direction of correlation across the different sessions where significance was indicated. For example, phrase repetitions were indicated as being negatively correlated with performance on the receptive portion of the NSSTR in sampling session three and positively correlated with the NSSTR in sampling session five. The most frequently recurring correlation of significance was found between total words and MLU for sampling sessions one (r = .997), two (r = .975), and three (r = .965). These

TABLE 1

Pearson's Product-Moment Coefficients of Correlation Indicating the Significant Relationships Between Language and Fluency Measures for Four Subjects by Time

Session	Fluency Measures	Language Measures						
		NSSTR	NSSTE	CELI	PPVT	TACL	DSS SCORE	MLU
1	Phrase Repetition			-.980*			-.980*	.994*
	Substitution			-.973*				.981*
	Breaks			-.975*				
	Total Words			-.952*			-.969*	.997*
2	Hesitations							.987*
	Revisions	.966*	.958*					
	Breaks							.987*
	Total Words							.975*
	Repetitions			.931*				
3	Interjections			.989*				
	Sound Repetition				.954*			
	Phrase Repetition	-.953*						
	Prolongations			.952*				
	Breaks				-.942*			
	Total Words							.964*
	Other	-.969*		-.965*				
	Ratio							.981*
4	Word Repetition					.998*		
	Hesitations	-.987*	-.992*					
	Revisions					.971*	.979*	
	Breaks	-.965*	-.984*					
	Total Words			-.978*				
	Repetitions		.974*					
5	Interjections	-.973*		.948*			.944*	
	Phrase Repetition	.952*					-.984*	
	Hesitations			.976*				
	Revisions			.976*				
	Rises				-.943*			
	Total Disfluencies							.963*

*Significant at the .05 level of confidence.

TABLE 2

Spearman's Coefficients of Rank Correlation Indicating the Significant Relationships Between Language and Fluency Measures for Four Subjects by Time

Session	Fluency Measures	Language Measures						
		NSSTR	NSSTE	CELI	PPVT	TACL	DSS Score	MLU
1	Phrase Repetitions						1.00*	1.00*
	Total Words						1.00*	1.00*
2	Interjections			1.00*				
	Sound Repetitions	-1.00*			-1.00*			
	Word Repetitions			.948*				
	Phrase Repetitions			.948*			-.948*	
	Prolongations		1.00*					
	Rises							-.948*
	Total Words							.948*
	Total Disfluencies			1.00*				
	Repetitions			1.00*				
	Other		1.00*					
	Ratio			1.00*				
3	Interjections			.948*		-1.00*		
	Sound Repetitions				1.00*			
	Word Repetitions	-.948*						
	Phrase Repetitions	-.948*						
	Hesitations				.948*			
	Rises				-.948*			
	Breaks				-1.00*			
	Other	-.948*			-.948*			
	Ratio		1.00*					-1.00*
4	Word Repetitions	.948*	1.00*			1.00*		
	Hesitations	-.948*	-1.00*			-1.00*		
	Revisions						1.00*	
	Rises	-.942*						
	Breaks	-1.00*	-.948*			-.948*		
	Total Words			-1.00*				
	Repetitions	.948*	1.00*			1.00*		
5	Interjections	-1.00*		1.00*			1.00*	
	Sound Repetitions							1.00*
	Phrase Repetitions	.948*		-.948*			-.948*	
	Prolongations				-.948*			
	Total Disfluencies							1.00*
	Ratio							1.00*

* Significant at the .05 level of confidence.

correlations account for 99 percent, 95 percent, and 93 percent of the variances, respectively, and are correlations perhaps more to be expected than among the other variables. The general results of these interval data correlations, however, do not demonstrate significance between any of the language and fluency variables that could be construed as a possible trend across time.

Table 2 displays the correlation coefficients for the seven language variables and 16 fluency variables ranked and analyzed with Spearman's coefficient of rank correlation. More significant correlations are seen with this test than with the foregoing parametric measure, possibly due to the intrinsically higher correlation tendency with ranking procedures. However, no significant correlations between specific language and fluency variables are seen repeated across time. On this test, significant correlations were seen for phrase repetitions and DSS scores in sampling sessions one (r = 1.00), two (r = -.948, r^2 = .90) and five (r = -.948, r^2 = .90). These findings appear of interest particularly in cognizance of the views that phrase repetitions may be a linguistic phenomenon as well as one of fluency (Lee, 1974). Noteworthy perhaps is the correlation in sampling session five between total disfluencies and MLU (r = 1.00). This correlation would appear to indicate that within this sampling session, the subjects had either dramatically increased the length, and therefore the complexity, of their utterances or had

reverted to a more simplistic linguistic level with total disfluencies behaving similiarly. Inspection of Appendix H, however, indicates that this is not the case with no sharp fluctuations in MLU evident across subjects for sampling session five. As with the Pearsons' analyses, no relationships are indicated in the Spearman's correlations that could be interpreted as possible trends across time. These tests do appear to suggest, however, that, for these four subjects, the changes (increases) in total disfluency across time were characterized most frequently by phrase repetition increases, a disfluent behavior that is generally viewed by researchers to develop chronologically later than sound and word repetitions (Bloodstein, 1975) and, perhaps more pertinently, is sometimes viewed as "normal" disfluent behavior as a child moves into new and more complex linguistic behaviors (Lee, 1974). Lastly, these data suggest that the DSS procedure and MLU measures are possibly more sensitive techniques in assessing language change across time relative to the degree and nature of disfluency.

Results of Regression Analyses

The seven language and five fluency (repetition category, "other" category, total words, total disfluencies, and ratio) scores for the four subjects were examined by linear regression analyses across the five sampling sessions for each subject. Coefficients of these regression analyses are reported in Table 3. Significant positive increases

TABLE 3

Regression Coefficients Indicating Relationships of Seven Language Measures Combined for Four Subjects to Time (Five Data Collection Periods)

Language and Fluency Measures	Correlation Coefficients
NSSTR	.579**
NSSTE	.451*
CELI	.130
PPVT	.403
TACL	.474*
DSS Score	.091
MLU	.020
Repetitions	.634**
Other	.178
Ratio	.460*
Total Words	.037
Total Disfluencies	.422

*Significant at the .05 level of confidence.
**Significant at the .01 level of confidence.
(Error df = 18)

were demonstrated over time in both the NSSTR scores ($\underline{R}$ = .579) and NSSTE scores ($\underline{R}$ = .451), accounting for appreciable portions of their variances ($\underline{R}^2$ = .335, $\underline{R}^2$ = .202, respectively). The NSSTR scores resulted in a significant slope of 1.37 (x = 21.17, y = 29.68) and the NSSTE in a significant slope of 1.20 (x = 26.08, y = 31.3). A significant correlation was also demonstrated for the TACL scores ($\underline{R}$ = .474, $\underline{R}^2$ = .225). The regression line indicated that the TACL increased significantly and positively over time (slope = 2.90, x = 26.60, y = 77.15). No significant differences were found in the CELI, PPVT, DSS, and MLU scores over time. Although MLU and DSS measures appeared to be sensitive measures within sampling sessions relative to changes in degree and nature of disfluencies, they did not significantly indicate increased linguistic skills across time for these four subjects.

Table 3 also includes the regression coefficients for the summary fluency scores over time for the four subjects. A significant drop ($\underline{R}$ = .634) was demonstrated for the repetition category, with the regression line accounting for 40 percent of the variances. The regression line displayed for this category was significant and negative (slope = -.523, x = -7.85, y = 40.98). This finding may reflect the emergence of other disfluent behaviors during later sampling sessions (Appendix I), primarily hesitations, revisions, broken words, and pitch rises. It has been suggested that early stages of stuttering development are

characterized by repetitions whereas the later stages are dominated by other types of disfluent behavior (Bloodstein, 1975). On the other hand, the decrease in the repetition category across time may simply be viewed as reflecting the decrease in total disfluencies which, while not indicated by the regression analysis as being statistically significant, did approach significance in decreasing across the five sampling sessions. The disfluency category which included the disfluencies other than interjections and repetitions did not display significant change over time but the regression line indicated that the amount of change observed was toward an increase (slope - 0.95, $x = 12.63$, $y = 12$). Total words displayed no significant change due to time but a high correlation across time was found for the ratio of total disfluencies to total words ($\underline{R} = .460$, $\underline{R}^2 = .212$). The slope of the regression line was negative indicating a significant decrease in one of the variables over the sampling sessions. This may reflect the near significant correlation of total disfluencies, which also displayed a negative regression line.

The foregoing results of regression analyses indicate that the language behavior of the four subjects, treated collectively over five sampling sessions, displayed significant increases across time as measured by the NSSTR, NSSTE, and TACL scores. Also, significant decreases in disfluencies were indicated as measured by the repetitions category and the ratio of total disfluencies to total words

with the decrease across time in total disfluencies approaching significance.

Regression analyses were also performed for each language and fluency variable by time for each subject. The regression coefficients for each of these analyses are displayed in Table 4. These results bear out the above findings as to the language and fluency variables which changed significantly across time. Subject One demonstrated a significant decrease in the repetitions category ($\underline{R}$ = .930, $\underline{R}^2$ = .864) and approached significance in increasing DSS scores and increasing disfluencies in the "other" category. Subject Two displayed a significant increase in TACL scores ($\underline{R}$ = .892, $\underline{R}^2$ = .796) across his five sampling sessions and his increase in DSS scores and decrease in the repetitions category approached statistical significance. Subject Three displayed significant increases across time in both NSSTR scores ($\underline{R}$ = .918, $\underline{R}^2$ = .843) and PPVT scores ($\underline{R}$ = .881, $\underline{R}^2$ = .777), while approaching statistical significance for increase in TACL scores. The most language and fluency variables which changed significantly over time were displayed by Subject Four. Significant correlations were found for increases in PPVT scores ($\underline{R}$ = .971, $\underline{R}^2$ = .942) and TACL scores ($\underline{R}$ = .971, $\underline{R}^2$ = .942). Significant decreases were demonstrated in the repetitions category ($\underline{R}$ = .931, $\underline{R}^2$ = .866), in the ratio of total disfluencies to total words ($\underline{R}$ = .933, $\underline{R}^2$ = .869), and in total disfluencies ($\underline{R}$ = .879, $\underline{R}^2$ = .771). Subject Four's linguistic increases

TABLE 4

Regression Coefficients for Each Language and Fluency Variable by Time for Each Subject

	Language and Disfluency Variables											
Subject	NSSTR	NSSTE	CELI	PPVT	TACL	DSS SCORE	MLU	Repeti-tions	Other	Ratio	Total Words	Total Disfluencies
1	.348	.167	.092	.000	.427	.841	.425	.930*	.824	.734	.020	.266
2	.416	.683	.265	.702	.892*	.815	.040	.815	.160	.586	.181	.657
3	.918*	.783	.406	.881*	.860	.620	.110	.118	.131	.021	.501	.042
4	.862	.866	.851	.971**	.971**	.297	.389	.931*	.000	.933*	.092	.878*

*Significant at the .05 level of confidence.
**Significant at the .01 level of confidence.
(Error df = 3)

also approached significance on NSSTR, NSSTE, and CELI scores.

These language and fluency changes for each subject across time can be more clearly seen through the graphs for each language and fluency variable (Appendix K). Examination of these graphs revealed that Subject Four Displayed more consistent increases and decreases across time in the various language and fluency variables than did the other three subjects. Subject Three's graphs suggest a distinctive pattern also. On the language measures, he performed consistently better across time than did the other three subjects except in regard to MLU and DSS scores. In sampling sessions two and three, Subject Three exhibited a sharp decline in performance on these two measures which corresponded to an increase in total disfluencies. Also, whereas the other three subjects demonstrated a decrease in the repetition category of disfluencies across time, Subject Three displayed an increase in this category after the second sampling session. The graphs of Subjects One and Two appeared to be similar on the measures of language with the exception of NSSTE, CELI, and MLU. The graphs of their fluency scores appeared to be more independent, exemplified by the behavior of their total disfluencies across time.

Results of Profile Analyses

In order to assess whether or not the test scores

were independent of subject, the ranking of each subject's scores were compared to the other three subjects for each of the seven language variables and five summary fluency variables. The results of these comparisons are reported in Table 5. Results indicated that in sampling sessions one, two, and four language profiles were similar (test results were not independent of subject); in sampling sessions two and five fluency profiles were similar.

Summary

Seven language measures and 16 measures of fluency were completed on four subjects during five data collection periods for each subject. The results of these tests across time were analyzed through tests of correlation, regression analyses, and Chi-square comparisons. Results of the correlation analyses indicated that no relationships between language and fluency variables were repeated significantly across time. The most frequently repeated correlations were seen between total words and MLU (repeated over three sessions) and between phrase repetitions and DSS scores (repeated over three sessions).

Results of regression analyses indicated significant increases over time in the four subjects' language scores as measured by: NSSTR, NSSTE, and TACL. For the fluency measures over time, combined subject scores showed a significant decrease in the repetitions category and in the ratio of total disfluencies to total words. Regression

TABLE 5

Results of Friedman Two-Way Analyses of Variance by Ranks for Four Subjects Across Five Data Collection Periods

Data Collection Period	Chi-Square value for the Seven Language Scores (NSSTR, NSSTE, CELI, PPVT, TACL, DSS, MLU)	Chi-Square value for the Five Summary Fluency Scores (Total Words, Total Disfluencies, Repetitions, Other, Ratio)
1	$X_r^2 = 9.036^*$	$X_r^2 = 7.08$
2	$X_r^2 = 9.423^*$	$X_r^2 = 12.6^{**}$
3	$X_r^2 = 4.263$	$X_r^2 = 5.22$
4	$X_r^2 = 12.433^*$	$X_r^2 = 5.82$
5	$X_r^2 = 4.22$	$X_r^2 = 8.04^*$

* Significant at .05 level of confidence.
** Significant at .01 level of confidence.
(df = 3)

analyses by subject of each language and fluency variable indicated a significant decrease over time in the repetitions category for Subject One; a significant increase in TACL scores for Subject Two; and significant increases over time in NSSTR and PPVT scores for Subject Three. Subject Four displayed the most changes of significance over time with significant increases in PPVT and TACL scores and significant decreases in the repetitions category of disfluencies, in the ratio of total disfluencies to total words, and in total disfluencies.

Lastly, results of a non-parametric Chi-square analysis of the subjects' performance over time on the language and fluency measures relative to one another indicated similar subject profiles for sampling sessions one, two, and four for the language scores and in sessions two and five for the fluency scores.

Results of Analyses of Disfluencies Classified as to Parts of Speech Across Time

Table 6 provides the means and standard deviations for the number of disfluencies classified as to parts of speech for the four subjects across five data collection periods each (20 observations). No attempt was made to classify words on which interjections, hesitations, or substitutions occurred. The means indicated that the subjects' disfluencies occurred most frequently on pronouns and verbs across the 20 observations, followed by nouns and

TABLE 6

Means and Standard Deviations for the Number of Disfluencies Classified as to Parts of Speech for Four Subjects Across Five Data Collection Periods Each

Parts of Speech	Means	Standard Deviation
Nouns	4.65	3.746
Verbs	6.3	4.118
Adjectives	2.6	2.437
Adverbs	2.3	2.452
Articles	2.15	2.54
Prepositions	1.65	1.348
Pronouns	6.6	3.485
Conjunctions	4.05	2.892

conjunctions. The mean number of disfluencies for the other parts of speech fall off sharply from these four means demonstrating an even split between content and function words in the grammatical loci of disfluencies for the four subjects in this study. The literature on stuttering includes data on the grammatical factor for loci of disfluencies in adult stutterers suggesting that the majority of disfluencies tend to occur on content words as opposed to function words (Bloodstein, 1975). The data reported in Table 6 would appear to support the evidence indicating that this factor might not hold for preschool stutterers (Bloodstein, 1960; Soderberg, 1967; Bloodstein and Gantwerk, 1967; Helmreich and Bloodstein, 1973; Silverman, 1974), bearing in mind the limited sampling of this study.

Results of Analyses of Variance

Results of analyses of variance between the four subjects across time with disfluncies classified as to parts of speech are displayed in Table 7. Adjectives were the only disfluent part of speech on which a significant relationship ($F = 4.126$) was demonstrated between the subjects over the data collection periods. None of the other disfluent parts of speech even closely approached significance between subjects.

Results of Regression Analyses

For regression analyses of each subject's disfluencies classified as to parts of speech over time, the disfluencies

TABLE 7

Results of Analyses of Variance Between Four Subjects Across Five Data Collection Periods Each with Disfluencies Classified as to Parts of Speech

Parts of Speech	F - Ratio
Nouns	1.024
Verbs	1.069
Adjectives	4.126*
Adverbs	2.942
Articles	0.042
Prepositions	0.892
Pronouns	0.986
Conjunctions	0.395

* Significant at .05 level of confidence.
(df between groups = 3; df within groups = 16)

were combined into two categories, content words and function words, for each data collection period. Results of these analyses are displayed in Table 8. Subject Two demonstrated a significant decrease ($\underline{R}$ = .922, $\underline{R}^2$ = .851) over time in content words and approached a significant decrease in function words. Subject Four displayed significant decreases across the sampling sessions in both content words ($\underline{R}$ = .904, $\underline{R}^2$ = .818) and in function words ($\underline{R}$ = .903, $\underline{R}^2$ = .865). These findings could merely reflect a decrease in total disfluencies and indicate nothing as to the relationship of content versus function words as determinants of the loci of disfluencies. Subjects One and Three displayed no significant change over time in either category.

Summary

The disfluencies of the four subjects in each sampling session were classified as to parts of speech. The group means for these classifications indicated that the majority of disfluencies across the 20 observations occurred on nouns, verbs, pronouns, and conjunctions. Results of analyses of variance between the four subjects across time with disfluencies classified as to parts of speech, indicated that a relationship was displayed between the subjects across time only for the variable of adjectives.

Regression analyses were performed for the four subjects, grouping the parts of speech into content and function words. Significant linear decreases were displayed

TABLE 8

Regression Coefficients for Four Subjects' Disfluencies Classified as to Content and Function Words Across Five Data Collection Periods

Subject	Correlation Coefficient for Content Words	R^2	Slope	Y Intercept	Correlation Coefficient for Function Words	R^2	Slope	Y Intercept
1	.709	.503	.320	.600	.750	.562	-.300	.230
2	.922*	.851	-.390	.269	.801	.641	-.440	.302
3	.294	.087	.190	.161	.119	.014	.400	.136
4	.904*	.818	-.460	.246	.930*	.865	-.300	.210

* Significant at .05 level of confidence.
(Error df = 3)

by two subjects while the other subjects displayed no linear changes in the two categories. The results of regression analyses were judged to reflect a decrease in total disfluencies rather than changes in the grammatical loci of disfluencies across time.

Results of SLCA-III Analyses

The five spontaneous speech corpora for each subject were additionally coded and analyzed with the SLCA-III computer program (Cummings and Renshaw, 1979). The group means and standard deviations for each of the 36 SCLA-III variables across five sampling sessions (20 observations) are provided in Table 9. The variables for which appreciable standard deviation (approaching or exceeding ten percent) from the means occurred are marked. The measures of social perception category displayed the most fluctation of scores around the group mean, both in overall category score and sub-group scores. Appreciable deviations of scores from the mean were noted in sub-group scores for five other categories: (1) measures of sensation (sub-groups sensed qualifiers and unsensed qualifiers); (2) measures of existance (sub-group negative information); (3) measures of disposition (sub-group assertion language); (4) measures of symmetry (sub-group symmetric relation); and (5) measures of conditionality (sub-groups qualified information and qualified relation).

TABLE 9

Mean and Standard Deviation for Four Subjects on 36 SCLA-III Variables Across Five Data Collection Periods

SCLA-III Variables	Means	Standard Deviation
Measures of Social Perception	222.600	24.156*
Inanimate Perception	0.401	0.027*
Audience Perception	0.296	0.019*
Self-Perception	0.303	0.034*
Generalized - Other Perception	0.300	0.037*
Authority - Other Perception	0.101	0.028
Measures of Sensation	0.128	0.033
Sensed Information	0.174	0.032
Unsensed Information	0.064	0.023
Sensed Qualifiers	0.337	0.032*
Unsensed Qualifiers	0.294	0.032*
Measures of Existence	0.008	0.010
Negative Information	0.283	0.017*
Positive Information	0.013	0.014
Negative Qualification	0.000	0.001
Positive Qualification	0.018	0.014
Negative Relation	0.009	0.007
Positive Relation	0.095	0.042
Measures of Motion	0.003	0.004
Non-Motion Language	0.090	0.036
Motion Language	0.001	0.002
Measures of Disposition	0.018	0.015
Disposition Language	0.167	0.052
Assertion Language	0.399	0.028*
Measures of Time	0.002	0.003
Past Time	0.123	0.028
Present Time	0.173	0.036
Future Time	0.131	0.023

* (10 percent deviation from the mean)

TABLE 9 - Continued

SCLA-III Variables	Means	Standard Deviation
Measures of Symmetry	0.165	0.026
Symetric Relation	0.228	0.024*
Asymmetric Relation	0.068	0.027
Measures of Conditionality	0.038	0.018
Qualified Information	0.256	0.028*
Unqualified Information	0.002	0.003
Qualified Relation	0.275	0.021*
Unqualified Relation	0.022	0.017

* (10 percent deviation from the mean)

Results of Analyses of Variance

The subjects were then compared to each other on each of the 36 SLCA-III variables by time (across five sampling sessions for each subject). Results of these analyses are reported in Table 10. Siginficant relationships were demonstrated across time between the subjects' scores on the following measures: sensed (F = 4.059) and unsensed (F = 4.448) information, measures of sensation: positive information (F = 4.996), a measure of existence; future time (F = 5.150), a measure of time; the measures of symmetry total score (F = 4.913); and unqualified relation (F = 4.019), a measure of conditionality. These results might appear to suggest that in assessing the language behavior of preschool disfluent dhildren these six measures of perceptual-cognitive activity may have implications as a common base of language status. That is, since the above six measures appear to be longitudinally related across subjects, they could possibly be useful in assessing temporally related fluctuations in the language behavior of preschool stutterers. Looked at in another way however, these significantly related measures might have less sensitivity in distinguishing between the language behavior of preschool stutterers at different points in time. All of this is highly speculative, however, due to the small number of subjects used in this study. The determination of the measures most sensitive to assessing language variations across time for stutterers would appear to be a

TABLE 10

Results of Analyses of Variance of 36 SLCA-III Variables Between Four Subjects Across Five Data Collection Periods

SLCA Variable	F-Ratio
Measures of Social Perception	1.333
Inanimate Perception	1.108
Audience Perception	2.627
Self-Perception	2.715
Generalized - Other Perception	1.146
Authority - Other perception	0.272
Measures of Sensation	0.336
Sensed Information	4.059*
Unsensed Information	4.448*
Sensed Qualifiers	2.295
Unsensed Qualifiers	0.971
Measures of Existence	4.996*
Negative Information	0.309
Positive Information	2.755
Negative Qualification	2.666
Positive Qualification	0.614
Negative Relation	0.585
Positive Relation	2.704
Measures of Motion	1.166
Non-Motion Language	1.994
Motion Language	0.689
Measures of Disposition	2.864
Disposition Language	1.821
Assertion Language	0.938
Measures of Time	1.485
Past Time	5.150*
Present Time	4.913*
Future Time	1.152
Measures of Symmetry	0.386
Symmetric Relation	0.778
Asymmetric Relation	0.650

* Significant at .05 level of confidence.
(df between groups = 3, df within groups = 16)

TABLE 10- Continued

SLCA Variable	F-Ratio
Measures of Conditionality	1.086
Qualified Information	1.116
Unqualified Information	1.401
Qualified Relation	0.475
Unqualified Relation	4.019*

* Significant at .05 level of confidence.
(df between groups - 3, df within groups = 16)

valid course of investigation in future fluency studies employing SLCA-III.

Results of Regression Analyses

Regression analyses were also used to assess each subject's performance on the 36 SLCA-III variables across time. Table 11 includes the results of these analyses. Regression analysis was performed only on those variables determined by the computer program to have significant variation across time for each subject. The results indicated that few of the SLCA-III variables displayed significant linear variation across the five sampling sessions.

Subject One displayed a significant increase ($\underline{R}$ = .999, $\underline{R}^2$ = .99) over time in negative relation. This category relates specifically to verbs having "not" or certain prefixes such as "un" in the verb phrase. Subject One also displayed a significant decrease ($\underline{R}$ = .999, $\underline{R}^2$ = .99) on future time (measures of time category). Future time concerns the frequency of usage of verbs or verb phrases in the future tense. His increase in the usage of sensed information and decrease in usage of non-motion language approached significance.

Subject Two displayed significant decreases across the five sampling sessions in negative relation ($\underline{R}$ = .999, $\underline{R}^2$ = .99) and in measures of disposition ($\underline{R}$ = 1.00, $\underline{R}^2$ = .99). Measures of disposition include disposition language (measures of verbs of the subjunctive mood) and assertion

TABLE 11

Regression Coefficients for Analyses of the 36 SLCA-III Variables for Four Subjects by Time

Subject	SLCA-III Variables	Correlation Coefficients	R^2	Slope	Y Intercept
	Inanimate perception	.806	.650	-0.513	.133
	Sensed information	.995	.990	.313	.133
	Unsensed information	.910	.830	.659	.133
	Sensed qualifiers	.901	.813	-0.387	.151
	Negative qualification	.972	.946	.204	.151
1	Negative relation	.999*	.999	.478	.151
	Non-motion language	.984	.968	-0.621	.326
	Assertion language	.797	.636	-0.495	.326
	Future time	.999*	.998	-0.385	.326
	Assymetric relation	.684	.468	-0.391	.151
	Measures of Conditionality	.888	.788	.204	.151
	Unqualified relation	.631	.398	.510	.151
	Self-perception	.801	.642	-0.151	.500
	Sensed information	.994	.988	-0.357	.500
	Unsensed information	.950	.902	.955	.500
	Unsensed qualifiers	.892	.688	-0.253	.966
	Positive information	.987	.975	.567	.966
2	Negative relation	.999*	.999	-0.437	.966
	Measures of Disposition	1.000**	.999	-0.471	.940
	Past time	.998	.996	-0.870	.940
	Present time	.999*	.999	.819	.940
	Symmetric relation	.984	.967	.183	.814
	Asymmetric relation	.885	.783	.666	.814
	Measures of Conditionality	.965	.931	.503	.814

* Significant at .05 level of confidence.
** Significant at .01 level of confidence.
(Error df = 1)

TABLE 11- Continued

Subject	SLCA-III Variables	Correlation Coefficients	R^2	Slope	Y Intercept
	Audience perception	.591	.349	.147	.246
	Self-perception	.927	.860	-0.202	.246
	Unsensed information	.981	.963	.333	.246
	Unsensed qualifiers	.999*	.999	-0.227	.404
	Negative information	.979	.959	-0.965	.404
3	Positive relation	.902	.813	-0.629	.404
	Motion language	.707	.500	.951	-.152
	Past time	.994	.987	.397	-.152
	Present time	.926	.857	.772	-.152
	Asymmetric relation	.999*	.999	-0.114	-.292
	Measures of conditionality	.998	.997	.644	-.292
	Qualified relation	.854	.729	.115	-.292
	Measures of Social perception	.980	.961	-0.279	.946
	Authority - other perception	.999*	.999	.205	.946
	Sensed information	.962	.924	.448	.946
	Unsensed qualifiers	.989	.978	-0.239	.235
	Positive qualification	.733	.538	-0.118	.235
4	Positive relation	.942	.887	-0.971	.235
	Disposition language	.992	.985	.338	.767
	Measures of time	.773	.597	.309	
	Present time	.596	.356	-0.632	
	Asymmetric Relation	.999*	.999	-0.104	.314
	Qualified information	.422	.178	.192	.314
	Qualified relation	.570	.324	-0.163	.314

* Significant at .05 level of confidence.
** Significant at .01 level of confidence.
(Error df = 1)

language (frequency of occurrence of verbs of the indicative mood). A significant increase ($\underline{R}$ = .999, $\underline{R}^2$ = .99) in present time was also displayed for Subject Two. The measure of present time concerns the frequency of usage of verbs and verb phrases. Subject Two also demonstrated near significant decreases in sensed information and past time measures and near significant increases in positive information and symmetric relation measures. Subject Two displayed more significant and near significant decreases on SLCA-III variables over time than did the other three subjects. His total disfluencies however, decreased steadily over the same time frame (Appendix I).

It is perhaps of interest to note here the similarities displayed by Subject One and Subject Two in significant linear relationships on SLCA-III variables. Both displayed significant correlations for negative relation and measures of time. The direction of the regression lines for these categories were reversed for the two subjects. Both subjects also approached significant linear decreases across time as measured by sensed information.

Subject Three displayed a significant decrease ($\underline{R}$ = .999, $\underline{R}^2$ = .99) in unsensed qualifiers (modifiers which refer to qualities or quantities that cannot be sensed) across the five sampling sessions. A significant decrease ($\underline{R}$ = .999, $\underline{R}^2$ = .99) was noted for asymmetric relation, a measure of symmetry. Asymmetric relation measures the frequency of usage of verbs and verb phrases which do not

have a noun object. Subject Three also approached significance in decrease in measures of conditionality.

Subject Four demonstrated a significant increase ($\underline{R}$ = .999, $\underline{R}^2$ = .99) over time in authority - other perception, a measure of social perception which refers to the frequency of usage of names of persons or groups of persons. Like Subject Three, Subject Four also displayed a significant decrease ($\underline{R}$ = .999, $\underline{R}^2$ = .99) in asymmetric relation and approached significance in disposition language increases over time.

Summary

The group means and standard deviations across five sampling sessions per subject were computed and each standard deviation observed for amount of variation from the means. Appreciable deviations of scores from the means were noted within measures of sensation, measures of existance, measures of disposition, measures of symmetry, and measures of conditionality.

Analyses of variance of the 36 SLCA-III variables by time for the four subjects, indicated significant relationship between the subjects' performance on sensed and unsensed qualifiers, positive information, future time, measures of symmetry, and unqualified relation.

Regression analyses were also performed on scores on the 36 SLCA-III variables across five sampling sessions for each subject. Subject One demonstrated a significant linear

increase over time in negative relation and a significant decrease in measures of disposition, and a significant increase in present time. Subject Two displayed a significant decrease over time in measures of motion, a significant decrease in assertion language, and a significant increase in measures of symmetry. Subject Three displayed a significant decrease in unsensed qualifiers and in asymmetric relation across the five sampling sessions. Subject Four demonstrated a significant increase in authority - other perception and a significant decrease in asymmetric relation.

Several similarities were noted in the subjects' scores: both Subject One and Subject Two demonstrated significant linear changes in negative relation and in measures of time although the direction of changes were opposite; both Subject Three and Subject Four displayed significant linear decreases in asymmetric relation over time. The results of SLCA-III analysis over time for the four subjects, however, were found to be limited and inconsistent as to observations of possible trending tendencies. Furthermore, the present lack of normative data for the SLCA-III variables with preschool children, limit discussion of the data to hypothetical supposition.

CHAPTER V

SUMMARY AND DISCUSSION

Standard Language Measures and Fluency Assessment

Results of analyses of variance of the four subjects' performance on the seven standard language measures and 16 fluency variables employed in this study indicated that no relationships between language and fluency measures were repeated significantly across time. Significant relationships between total words used and MLU and between phrase repetitions and DSS scores, however, were repeated over three sampling sessions. These findings may suggest that the MLU and DSS techniques for assessing language performance may have some merit as "barometers" of fluctuations in speech fluency across time. If so, this might hold possible implications for both the evaluation and remediation of stuttering in children. It is possible that with conventional fluency evaluation techniques, those which measure frequency and type of the immediate stuttering behavior, related co-existing factors are being overlooked. Researchers have indicated that these determinants of degree and nature of disfluency may reside in language

based phenomena (Muma, 1971; Haynes and Hood, 1977; Falck, et al., 1979). Brown (1973) noted that MLU is an excellent simple index of grammatical development because almost every new kind of knowledge results in an increase in length of utterance. By periodically sampling MLU with a disfluent child, the clinician could note subtle variations in the child's oral expressive language perhaps related to increased or decreased struggle or anxiety associated with disfluency. Since it was indicated in this study MLU and total words positively correlated across time for the four subjects and both measures fluctuated appreciably, the question is raised as to whether these behaviors were influenced by the stuttering behavior across time. This is of particular interest when considering the subliminal preschool stutterers who present the clinician with little overt behavior with which to assess the efficacy of therapy.

In this context, the relationships displayed between DSS scores and phrase repetitions are also perhaps worthy of note. Lee (1974) indicated that speech disfluencies may at times indicate a delay in development of grammatical rules as well as difficulty in formulating sentences with rules already possessed. This would appear to imply that, for some stutterers, the DSS technique might have prognostic or predictive implications. If it did prove to be a viable instrument with stutterers in this regard, therapy might be restructured to be inclusive of linguistic considerations rather than just speech factors. In other

words, this could possibly facilitate a therapeutic move towards treatment of the whole person in terms of his communicative abilities.

The absence of apparent trends across all five data collection sessions for any of the language and fluency measures is perhaps noteworthy in itself. Rather than demonstrating consistent, predictable behavior, both language and fluency, for these four subjects, fluctuated widely over time. This would appear to imply that the sporadic nature of communicative behavior in stuttering (Bloodstein, 1975) might involve more than oral speech fluency. If so, and if the exact nature of the influences could be more precisely specified, stuttering evaluation and treatment might feasibly be enhanced through language based techniques.

However, these findings and the speculations associated with them should be viewed with reservation. The small number of subjects employed in the study and the insubstantial amount of longitudinal relationships found between language and fluency variables preclude generalization of these results and descriptive discussion of trends. These data are felt to be of possible significance, however, in indicating two measures, MLU analysis and DSS techniques, which may be of value in future investigations of stuttering among preschoolers.

Results of regression analyses of the language and fluency variables for each subject over time indicated

that significant changes were reflected in TACL scores for two subjects and approached significance for a third; PPVT scores changed linearly across time for two subjects; and significant changes were displayed in the repetitions category of disfluencies for two subjects and approached significance for a third. As to the TACL and PPVT, it might be speculated that these instruments were sensitive to language fluctuations across time and may possibly be viable standardized language tests to use with stutterers. On the other hand, it can be just as easily surmised that subject adaptation to these tests were greater than for the other measures. The limitations of the data do not permit more productive discussion of the measures. The most statistical significance over time found for any one of these measures were for two of the subjects.

The repetitions category fluctuations may, as mentioned previously, merely represent decreases over time in overall disfluencies. However, inspection of Appendix I indicates that total disfluencies actually increased for Subject One and Three over time. These overall increases in total disfluencies were characterized by decreases in the repetitions category of disfluencies and increases in the "other" category of disfluencies, primarily in broken words. Broken words, or "blocks," are one of the types of disfluency that mark the more advanced stutterer (Bloodstein, 1975). Another noteworthy point was the dissimiliar fluency patterns for Subjects One and Two, twins, over time.

Subject One demonstrated increases in disfluency while Subject Two's disfluencies decreased over time. The literature on stuttering indicates in cases of stuttering twins, one is usually more disfluent (Bloodstein, 1975).

Assessment of the speech of preschool stutterers might be enhanced through observation of these two disfluency categories and their interaction across time. Future studies might investigate this phenonemon and the involvement of language variables more specifically, enhancing the results of this study through the use of more subjects, closer matching of subjects in terms of age, and equal time intervals between the sampling sessions.

Parts of Speech Assessment

The disfluencies identified for each subject across sampling sessions were marked as to parts of speech. The number of disfluencies as to parts of speech were then compared using analysis of variance and regression analyses. Results indicated a significant relationship between the subjects across time only for adjectives. Regression analyses results indicated significant decreases over time for two subjects with the parts of speech classified as to content and function words.

The most interesting result of this aspect of the study was seen in the mean numbers of disfluencies classified as to parts of speech over time. Disfluencies occurred predominately on pronouns (function words) and verbs

(content words). The second most frequent categories of disfluencies were also split between function and content words, occurring on conjunctions and nouns. The conjunctions might possibly be implicated in the move to increased linguistic complexity, from simple to complex-compound sentences. This finding is not consonant with the literature which suggests that adult stutterers' disfluencies tend to occur predominately on content words as opposed to function words. It does support research findings that the grammatical factor does not exist in preschoolers' disfluencies (Bloodstein and Gantwerk, 1967; Helmreich and Bloodstein, 1973; Silverman, 1974).

SLCA-III Assessment

No significant trending tendencies were noted among the four subjects compared to time with the 36 SLCA-III variables. The exact nature of the role of the variables in the speech of these preschool stutterers could not be ascertained in this study nor could the pertinent variables be significantly defined.

Several points of interest were observed, however, in the results of SLCA-III analyses. Subjects One and Two both demonstrated significant regression coefficients for measures of time and measures of symmetry. However, the regression lines of these measures were reversed for the two subjects. This point is of interest in relation to the fluency patterns of the subjects across this study. Subject

One experienced an increase in total disfluencies over time whereas Subject Two experienced an overall decrease. This raises questions as to whether or not the reversals in SLCA-III performances were related to the opposite directions of fluency behavior across time.

Another point of interest in the SLCA-III data is seen in Subject Two's significant decreases over time on several SLCA-III measures. It was noted above that Subject Two's fluency improved over time. The results of SLCA-III analyses then, for Subject Two, would appear not to support the hypotheses that decreases in usage of expressive language variables would result in decreases in overall speech fluency in stuttering children (Falck, et al., 1979). The point could be made here though that those SLCA-III variables that significantly decreased across time did not represent a comprehensive status of expressive language usage for Subject Two.

Conclusions

Temporal Aspects

This study represents the first attempt, according to a review of the literature on stuttering, to assess the language and fluency behaviors of preschool stutterers longitudinally. Four stutterers represented the total subject group, primarily due to the low incidence of stuttering (Bloodstein, 1975) and the relative rarity of preschool aged stutterers who could be used in a study of longitudinal

design. Additionally, subject availability is hampered simply by the demands of a longitudinal design. Subjects move, become tired of the study and wish to withdraw, and parents can withdraw their consent. But, as has been noted by other researchers (Haynes and Hood, 1977; Falck, et al., 1979), larger groups need to be assessed through research if the nature of the relationships between language and fluency are to ever be conclusively determined.

Determination of Normative Data

Use of larger subject groups may lead not only to the determination and definition of language-fluency relationships but also to the establishment of normative data relative to the relationships, if they exist. In order to establish normative data, equally-spaced intervals between data collection sessions might be considered. The original design for this study included sampling sessions uniformly separated by three month intervals. Subject illness, vacations, and unpredictable parental schedules precluded use of this procedure.

The time intervals between sampling sessions is another point to consider for future research designs. By using closer time between sampling sessions, more data points will be accrued, depicting the nature of language and fluency changes across time in a more detailed and precise manner. This procedure would appear to be requisite in the determination of normative data.

Equipment Considerations

Another point that future studies of this type might consider is the equipment employed. Tape recorders of high fidelity proved valuable in distinguishing between hesitations and broken words, between laughter and blocks, and between pitch breaks and blocks. High fidelity recorders also facilitate easier recognition of words and aid in distinguishing meaningful speech from jargon. The Panasonic cassette recorders used in the current study for recording the speech samples proved inadequate for tape transcription and analysis. Also, acoustically treated rooms were not used for collecting the language and fluency samples and the tape recordings were frequently difficult to transcribe due to the presence of ambient noise.

Age-Related Variables

Although the subjects were all of preschool age at the initiation of this study, their ages varied a maximum of two and a half years. This may have had significant bearing on their performances across time. Subjects One and Two were twins and more closely corresponded in language measures across time than die the other subjects. Subject Three demonstrated better and more stable language scores across time but he was the oldest of the subjects. Subject Four, the youngest, changed most dramatically of the subjects across time in several measures. These findings bring

into question how much of the data was an artifact of age, both in language and fluency behaviors. Increased subject group size, with age carefully controlled, might possibly clarify this important point.

Implications for Future Research

This study was felt to be valuable in providing a longitudinal picture of four preschool stutterer's language and fluency behavior, in light of the paucity of information reported in the literature for these behaviors. Also, through this study, several language and fluency measures warranting further research were indicated. Specific language and grammatical factors were revealed as being significantly related to the disfluency patterns demonstrated by the four subjects.

Future studies designed to assess the language behavior of preschool stutterers might plan the data analysis procedures around SLCA-III. By using SLCA-III as the primary measure for a larger subject group, more extensive data apposite to the language behavior of preschool stutterers as measured by SLCA-III variables might be ascertained. It would appear that longitudinal collection of SLCA-III data, with a larger group of stutterers, at closely spaced intervals for the individual sampling sessions, would facilitate examination of SLCA-III sensitivity to the language variances of preschool stutterers. This type of design could also result in the establishment of SLCA-III

normative data for preschool stutterers.

Future research designed to assess the language and fluency behaviors of preschool stutterers might enhance and expand on the results of the current study through: (1) utilization of a more representative population; (2) assessing language through specific techniques such as MLU, DSS, and SLCA-III relative to fluency changes over time; (3) closer control of age and time variables between subjects and sampling sessions; and (4) the use of smaller intervals between sampling sessions allowing for more data points and the establishment of normative information.

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APPENDIX A

NOTE OF CONSENT FOR RESEARCH PARTICIPATION

Your children, _____,
have been selected for participation in a program designed to determine their current level of language comprehension and expression in relation to their displayed stuttering. The initial step in the program will involve an assessment of your children's language competency with several standardized language tests. Next, information as to each child's stuttering severity will be obtained through observation techniques and standardized tests. We feel there may be an intrinsic relationship between specific levels of language integrity and stuttering severity in preschool children. The gathered data will be analyzed and compared so as to determine if any significant relationships exist and, if so, the extent of those relationships. The results of these procedures will be entered into your children's records at the Center for Communicative Disorders for use in determining future therapy programming needs.

The testing procedures that we will be using do not involve risk to your child. However, we believe that informed consent by the parent is an essential protection of the rights of individuals participating in all types of research. Therefore, we respectfully request your consent to allow _____
to participate in this project. We are willing to answer any questions you may have concerning the procedures and be assured that the participants names will not be associated in any way with the findings. You may terminate your children's participation at any point with no adverse consequences to them.

Thomas A. Crowe, M.A.
Acting Assistant Professor
Department of Communicative Disorders

jmw

I, as parent, have read the above and do approve of _____ participating in the research program, "Language-Based Variables in the Disfluent Speech of Preschool Children: A Case Study."

_____ _____

Signature of Parent Date

jmw

APPENDIX B

Dates of Sampling Sessions and Corresponding Ages of Subjects

Sampling Session	Subject 1		Subject 2		Subject 3		Subject 4	
	Date	Age	Date	Age	Date	Age	Date	Age
1	1-25-78	5-3	2-3-78	5-3	2-28-78	6-3	2-24-78	3-9
2	5-1-78	5-6	5-1-78	5-6	8-4-78	6-8	6-26-78	4-1
3	7-6-78	5-8	7-27-78	5-8	3-27-79	7-3	2-22-79	4-9
4	10-16-78	5-11	10-16-78	5-11	6-25-79	7-6	6-28-79	5-1
5	6-26-79	6-8	6-26-79	6-8	10-30-79	7-10	10-3-79	5-4

APPENDIX C

Pearson's and Spearman's Coefficients of Correlation Indicating Source of Error Between Experimenter's and Students' Markings of Disfluency by Sampling Session

Sampling Session	Errors Marked by Experimenter Not Marked by Student Raters	Total Disagreement	
		Pearson's Coefficient of Correlation	Spearman's Coefficients of Rank Correlation
1		.946*	.949
2		.989*	1.00*
3		-	1.00*
4		.975*	1.00
5		.982*	1.00*

* Significant at the .05 level of confidence.

APPENDIX D

Northwestern Syntax Screening Test (NSST) Scores for Four Disfluent Subjects Across Five Data Collection Periods Encompassing One Year, Ten Months Development

Data Collection Period		Subjects			
		1	2	3	4
1	Receptive Score	33	34	31	28
	Percentile	75	75	25	90
	Expressive Score	32	31	36	29
	Percentile	75	50	75	90
2	Receptive Score	32	33	35	24
	Percentile	50	75	50	25
	Expressive Score	38	40	36	27
	Percentile	90	90	75	50
3	Receptive Score	36	35	37	33
	Percentile	90	75	25	90
	Expressive Score	29	37	36	32
	Percentile	50	40	25	90
4	Receptive Score	32	36	36	35
	Percentile	50	90	10	75
	Expressive Score	32	38	39	36
	Percentile	75	90	90	90
5	Receptive Score	35	34	40	37
	Percentile	50	50	90	90
	Expressive Score	37	40	38	35
	Percentile	75	90	75	90

APPENDIX E

Carrow Elicited Language Inventory (CELI) for Four Disfluent Subjects Across Five Data Collection Periods Encompassing One Year, Ten Months

Data Collection Period		Subjects			
		1	2	3	4
1	Raw Scores	11	12	4	10
	Percentile Rank	65.6	62.5	89	97
	Stanine	6	6	8	9
2	Raw Score	7	10	0	6
	Percentile Rank	84.4	68.8	97.8	95.1
	Stanine	7	6	9	9
3	Raw Scores	2	8	0	2
	Percentile Rank	99	80.2	97.5	99.2
	Stanine	9	7	9	9
4	Raw Score	9	19	3	4
	Percentile Rank	49.5	20.8	88.8	95.8
	Stanine	5	3	8	9
5	Raw Scores	9	11	0	2
	Percentile Rank	49.5	34.1	97.5	99
	Stanine	5	4	9	9

APPENDIX F

Peabody Picture Vocabulary Test (PPVT) For Four Disfluent Subjects Across Five Data Collection Periods Encompassing One Year, Ten Months

Data Collection Period		Subjects			
		1	2	3	4
1	Raw Score	60	59	65	38
	Intelligence Quotient	118	116	121	94
	Percentile Score	93	89	93	32
	Mental Age	6.10	6.8	7.10	3.8
2	Raw Score	58	61	68	44
	Intelligence Quotient	105	111	114	103
	Percentile Score	68	79	82	59
	Mental Age	6.6	7.1	8.5	4.4
3	Raw Score	61	63	70	54
	Intelligence Quotient	112	117	118	107
	Percentile Score	84	89	90	65
	Mental Age	7	7.5	8.9	5.9
4	Raw Score	60	59	73	54
	Intelligence Quotient	110	108	112	107
	Percentile Score	81	76	78	65
	Mental Age	6.10	6.8	9.4	5.9
5	Raw Score	59	72	71	61
	Intelligence Quotient	96	122	109	120
	Percentile Score	44	92	76	93
	Mental Age	6.8	9.1	8.11	7.1

APPENDIX G

Test For Auditory Comprehention of Language (TACL) For Four Disfluent Subjects Across Five Data Collection Periods Encompassing One Year, Ten Months

Data Collection Period		1	2	3	4
1	Raw Score	87	80	91	63
	Percentile Rank	95	73	78	67
	Age Equivalency	6.6	5.9	6.9	3.9
	Mean for Age	72.9091	72.9091	84.1935	62.1000
	Standard Deviation from Mean	10.5465	10.5465	8.7955	11.6930
2	Raw Score	86	79	96	70
	Percentile Rank	75	46	90	65
	Age Equivalency	6.5	5.8	6.11	4.8
	Mean for Age	79.5667	79.5667	90.0526	69.3750
	Standard Deviation from Mean	9.6515	9.6515	6.7121	11.0506
3	Raw Score	84	81	97	82
	Percentile Rank	71	54	95	94
	Age Equivalency	6.3	5.11	6.11	6.1
	Mean for Age	79.5667	79.5667	90.0526	69.6471
	Standard Deviation from Mean	9.6515	9.6515	6.7121	9.7012
4	Raw Score	84	87	96	86
	Percentile Rank	71	77	98	93
	Age Equivalency	6.3	6.6	6.11	6.5
	Mean for Age	79.5667	79.5667	no norms	72.9091
	Standard Deviation from Mean	9.6515	9.6515	no norms	10.5465
5	Raw Score	93	87	99	89
	Percentile Rank	96	30	99	96
	Age Equivalency	6.10	6.6	6.11	6.8
	Mean for Age	90.0526	90.0526	no norms	72.9091
	Standard Deviation from Mean	6.7121	6.7121	no norms	10.5465

APPENDIX H

Developmental Sentence Scores (DSS) and Mean Lengths of Utterance (MLU) For Four Disfluent Subjects Across Five Data Collection Periods

Subjects		DSS					MLU				
		1	2	3	4	5	1	2	3	4	5
1	Total Points	306	378	399	366	463	5.96	8.12	7.04	7.54	7.32
	DSS Score	6.12	7.56	7.98	7.32	9.26					
2	Total Points	344	295	388	374	491	6.46	6.48	5.72	5.98	6.66
	DSS Score	6.88	5.90	7.76	7.48	9.82					
3	Total Points	556	471	231	471	286	9.42	6.48	6.56	7.92	7.44
	DSS Score	11.12	9.42	4.62	9.42	5.72					
4	Total Points	422	343	388	415	417	6.68	6.18	6.84	7.26	6.62
	DSS Score	8.44	6.86	7.76	8.30	8.34					

APPENDIX I

Fluency Analysis For Four Disfluent Subjects Across Five Data Collection Periods

SUBJECT I

Types of Disfluencies	Data Collection Period 1	2	3	4	5
Interjections	3	6	5	1	3
Sound Repetitions	10	8	5	3	2
Word Repetitions	14	11	8	3	1
Phrase Repetitions	1	3	1	-	1
Prolongations	4	12	7	13	11
Hesitations	9	3	-	13	4
Revisions	1	4	2	-	4
Substitutions	-	-	-	-	-
Broken Words	1	-	2	-	21
Pitch Rises	-	-	1	1	3
Pitch Breaks	-	1	3	2	1
Total Words	247	351	313	303	417
Total Disfluencies	43	47	30	33	49

SUBJECT II

Interjections	12	17	13	11	8
Sound Repetitions	12	7	9	10	1
Word Repetitions	9	11	13	5	3
Phrase Repetitions	2	7	2	2	1
Prolongations	6	17	13	6	4
Hesitations	2	1	3	3	4
Revisions	1	4	1	1	4
Substitutions	-	-	-	-	-
Broken Words	-	-	-	-	3
Pitch Rises	9	3	-	-	-
Pitch Breaks	-	-	1	-	-
Total Words	289	299	257	279	278
Total Disfluencies	44	64	54	38	28

SUBJECT III

Types of Disfluencies	Data Collection Period 1	2	3	4	5
Interjections	2	2	4	3	-
Sound Repetitions	13	5	12	18	8
Word Repetitions	9	7	6	10	17
Phrase Repetitions	12	2	1	1	6
Prolongations	11	9	4	4	5
Hesitations	2	1	4	1	2
Revisions	5	4	8	6	3
Substitutions	2	-	-	-	-
Broken Words	-	-	-	-	10
Pitch Rises	-	1	-	-	1
Pitch Breaks	-	-	-	-	-
Total Words	450	283	290	335	317
Total Disfluencies	56	30	39	43	52

SUBJECT IV

Interjections	5	4	6	8	3
Sound Repetitions	23	9	3	1	-
Word Repetitions	18	8	13	4	-
Phrase Repetitions	4	3	5	3	2
Prolongations	-	5	4	3	5
Hesitations	2	1	-	5	2
Revisions	5	1	11	2	3
Substitutions	-	-	-	-	-
Broken Words	-	-	-	-	-
Pitch Rises	1	5	2	1	2
Pitch Breaks	2	-	4	1	-
Total Words	302	270	319	331	279
Total Disfluencies	57	31	42	26	15

APPENDIX J

Means and Standard Deviations of Language and Fluency Ratings for Four Subjects Involving Five Data Collection Periods

Language and Fluency Measures	Means	Standard Deviation
NSSTR	31.50	2.64
NSSTE	32.50	2.94
CELI	9.25	3.59
PPVT	55.50	11.95
TACL	80.25	12.36
DSS Score	8.14	2.20
MLU	7.13	1.55
Interjections	5.50	4.50
Sound Repetitions	14.50	5.80
Word Repetitions	12.50	4.35
Phrase Repetitions	4.75	4.99
Prolongations	5.25	4.57
Hesitations	3.75	3.50
Revisions	3.00	2.30
Substitutions	.50	1.00
Broken Words	.25	.50
Pitch Rises	2.50	4.35
Pitch Breaks	.50	1.00
Total Words	322	88.50
Total Disfluencies	50	7.52
Repetition Group	37.25	9.21
Other Disfluencies	12	5.88
Ratio	0.159	.027

APPENDIX K

Graphs Representing Scores for Four Subjects on Seven Language Measures and Five Measures of Fluency Across Five Sampling Sessions

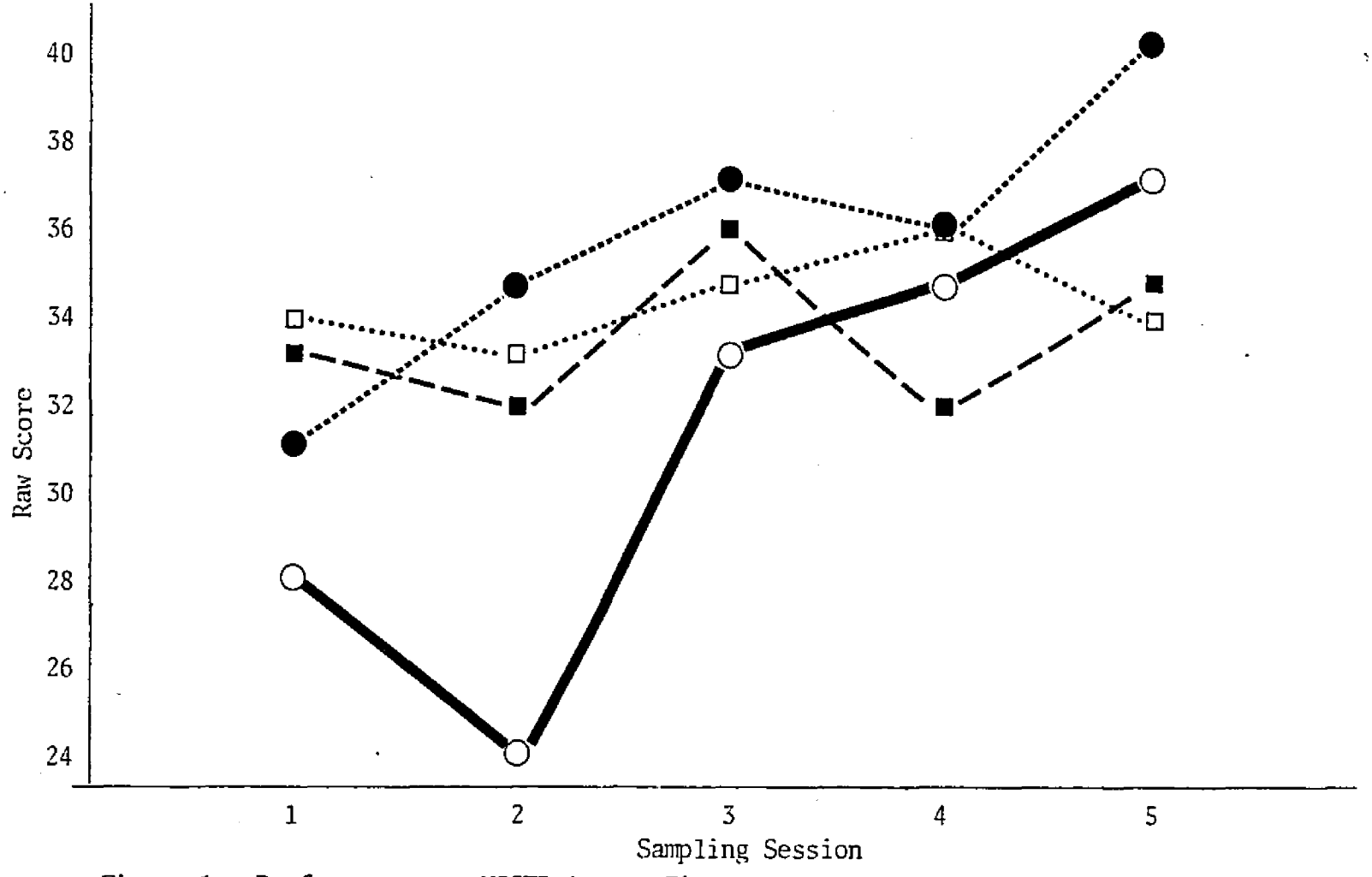

Figure 1. Performances on NSSTR Across Five Data Collection Sessions for Subject One, ■ ; Subject Two, □ ; Subject Three, ● ; and Subject Four, ○ .

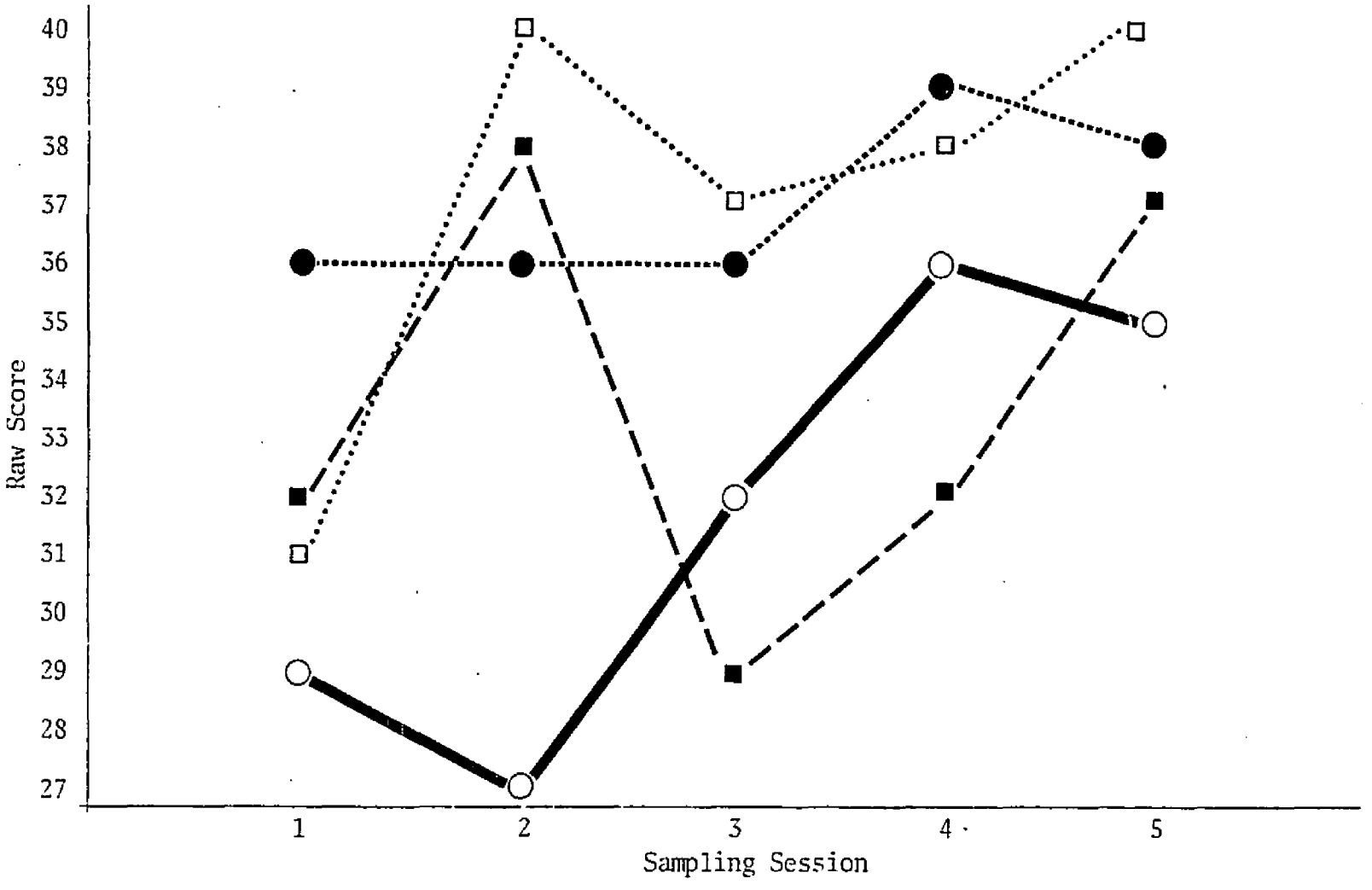

Figure 2. Performances on NSSTE Across Five Data Collection Sessions for Subject One, ■ ; Subject Two, □ ; Subject Three, ● ; and Subject Four, ○ .

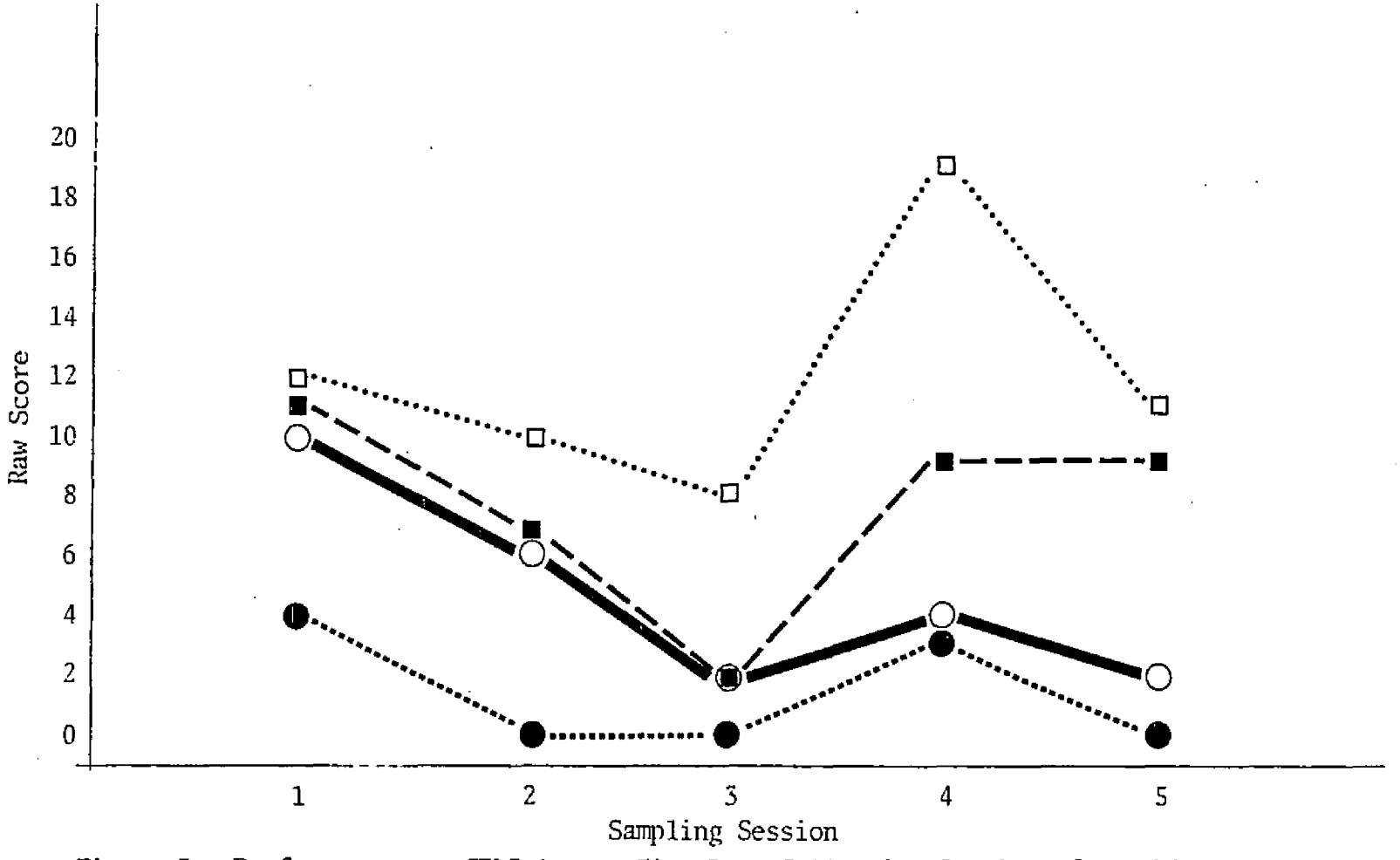

Figure 3. Performances on CELI Across Five Data Collection Sessions for Subject One, ■ ; Subject Two, □ ; Subject Three, ● ; and Subject Four, ○ .

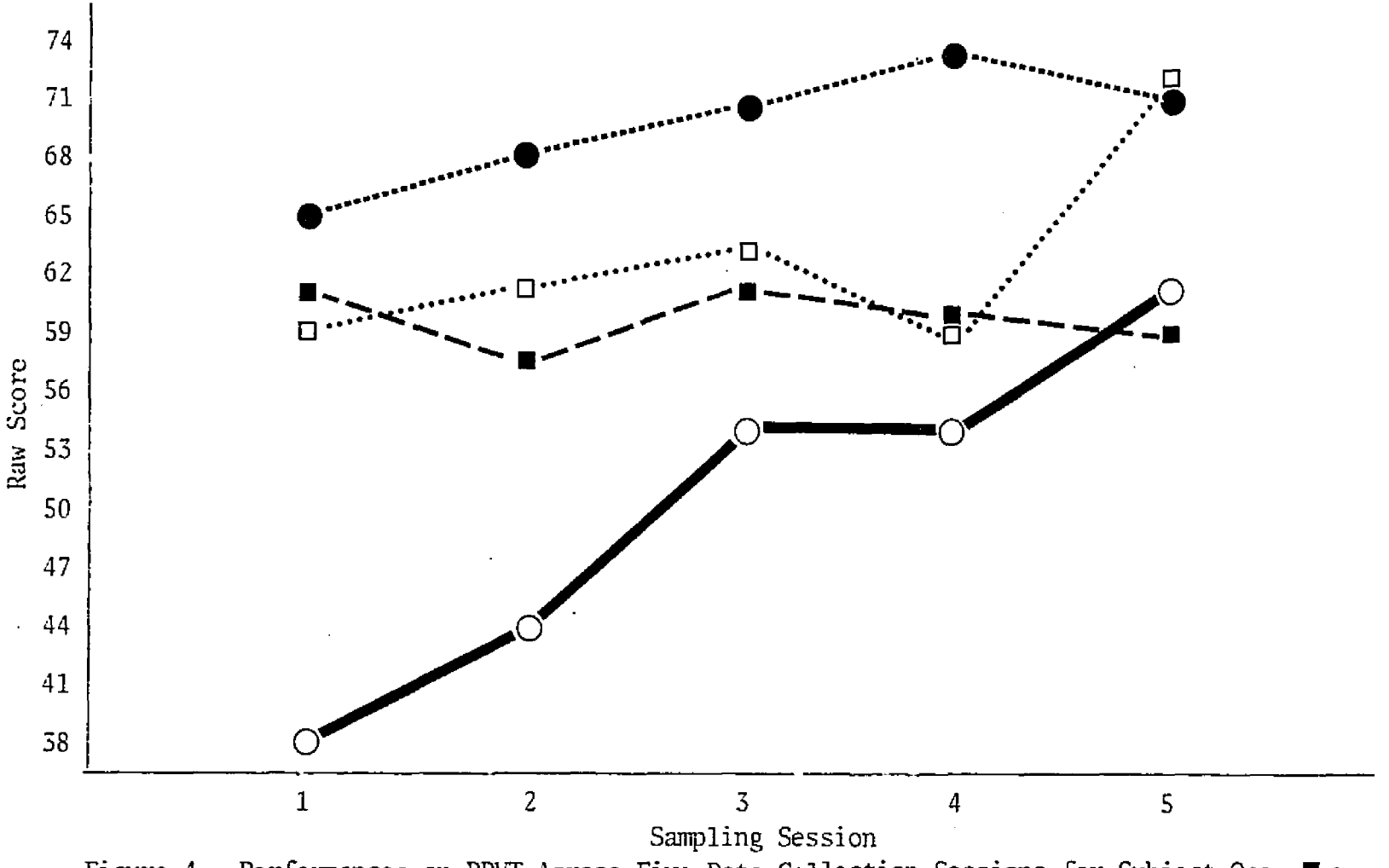

Figure 4. Performances on PPVT Across Five Data Collection Sessions for Subject One, ■ ; Subject Two, □ ; Subject Three, ● ; and Subject Four, ○ .

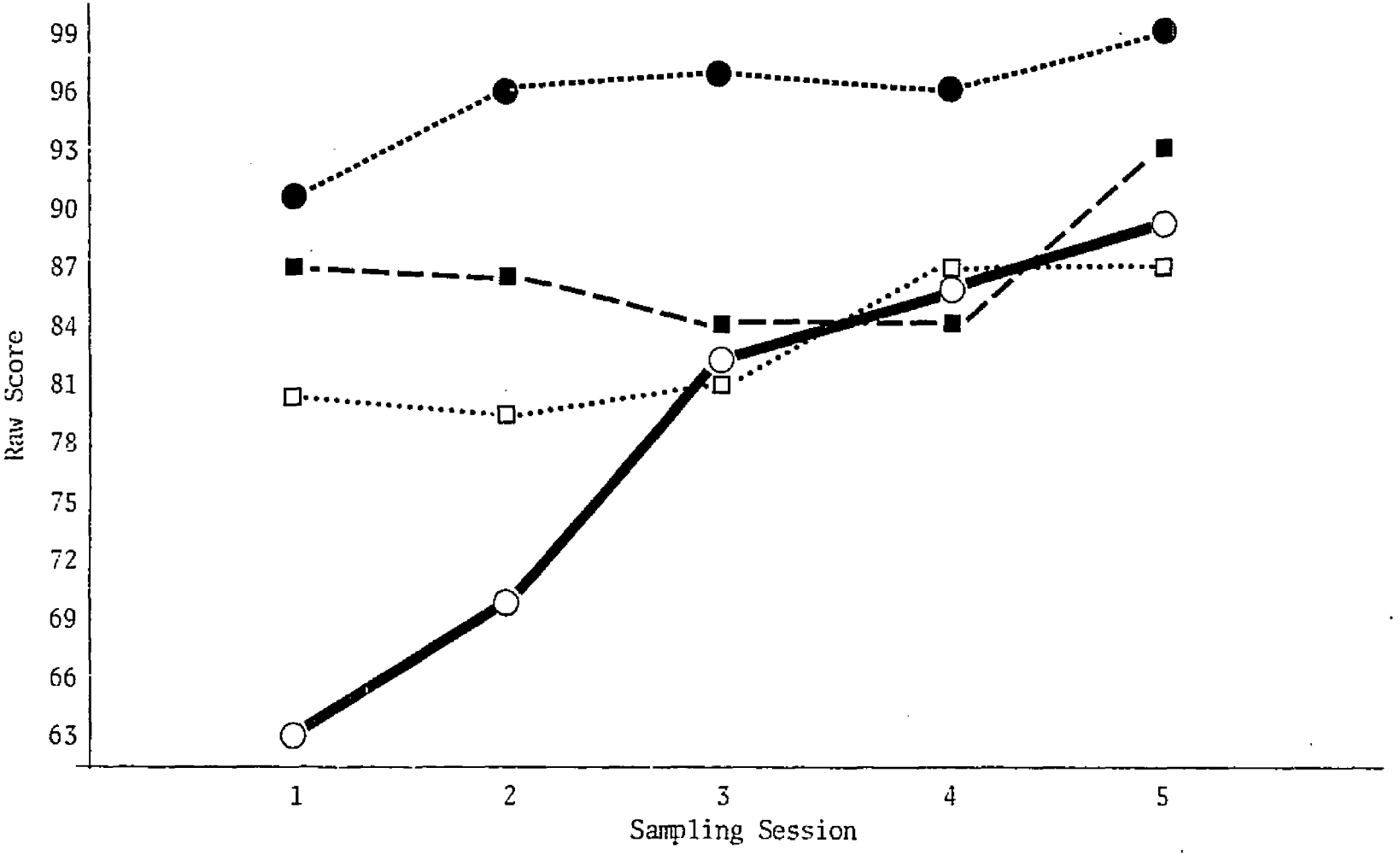

Figure 5. Performances on TACL Across Five Data Collection Sessions for Subject One, ■ ; Subject Two, □ ; Subject Three, ● ; and Subject Four, ○ .

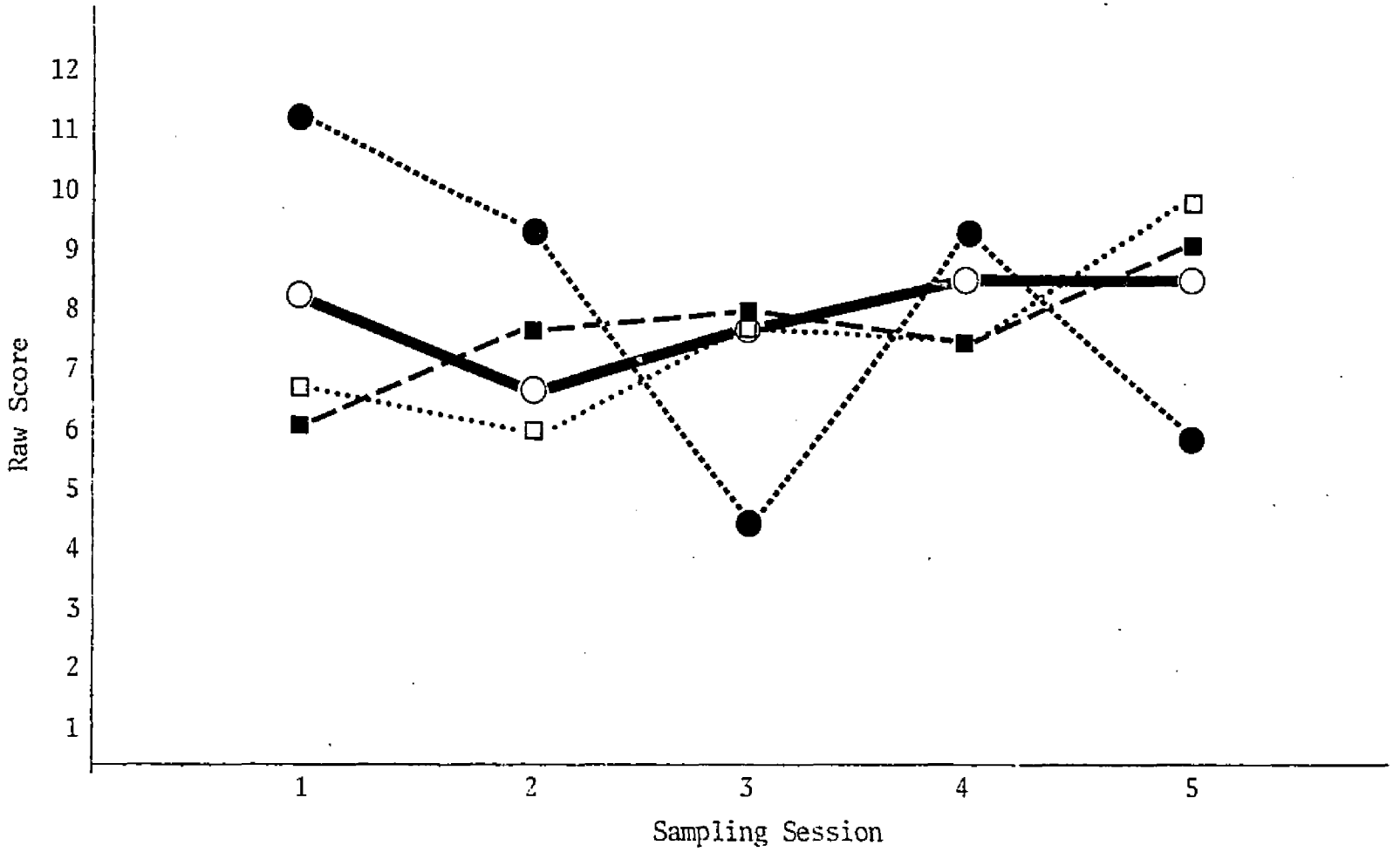

Figure 6. Performances on DSS Scores Across Five Data Collection Sessions for Subject One, ■ ; Subject Two, □ ; Subject Three, ● ; and Subject Four, ○.

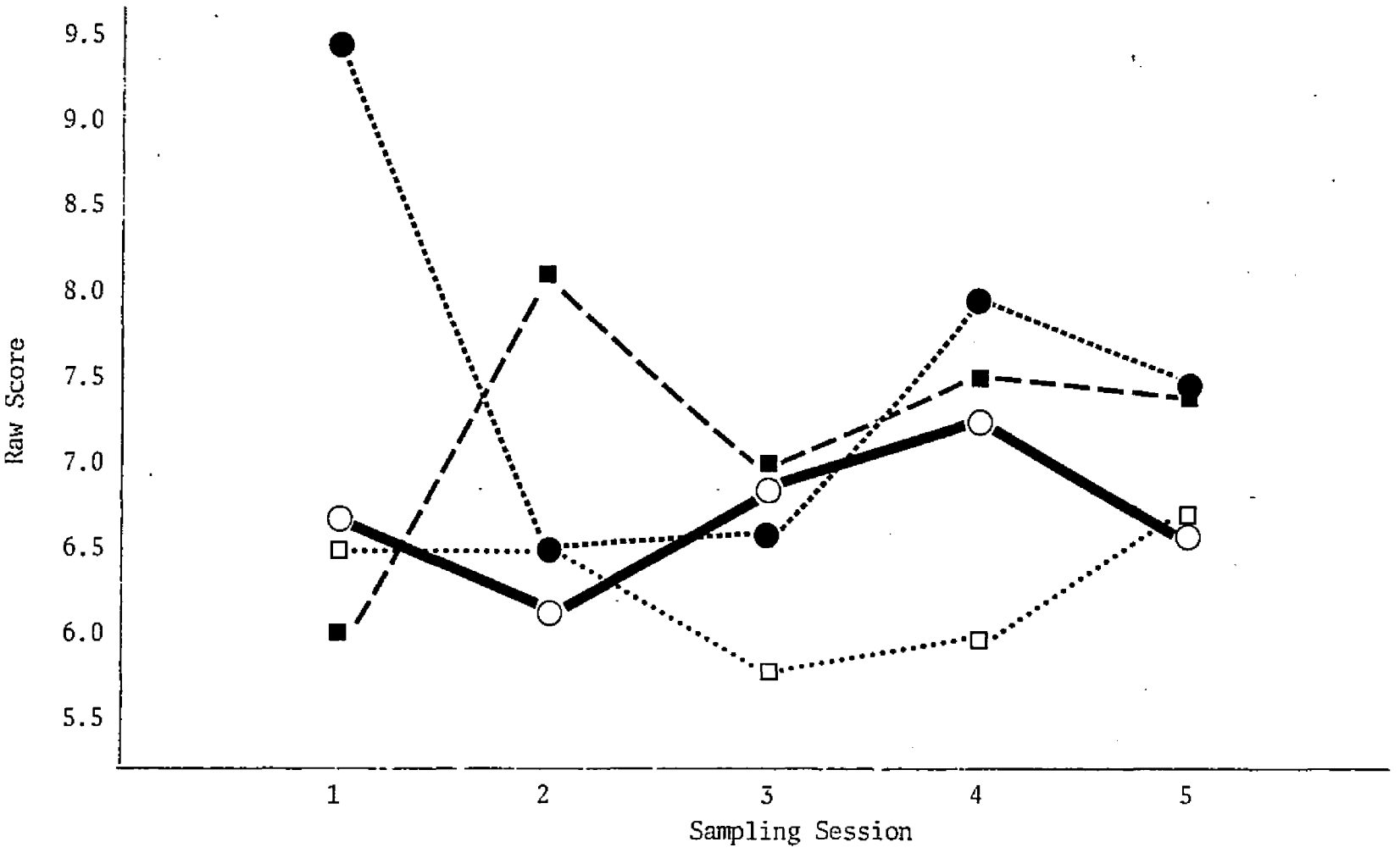

Figure 7. Performances on MLU Across Five Data Collection Sessions for Subject One, ■ ; Subject Two, □ ; Subject Three, ● ; and Subject Four, ○ .

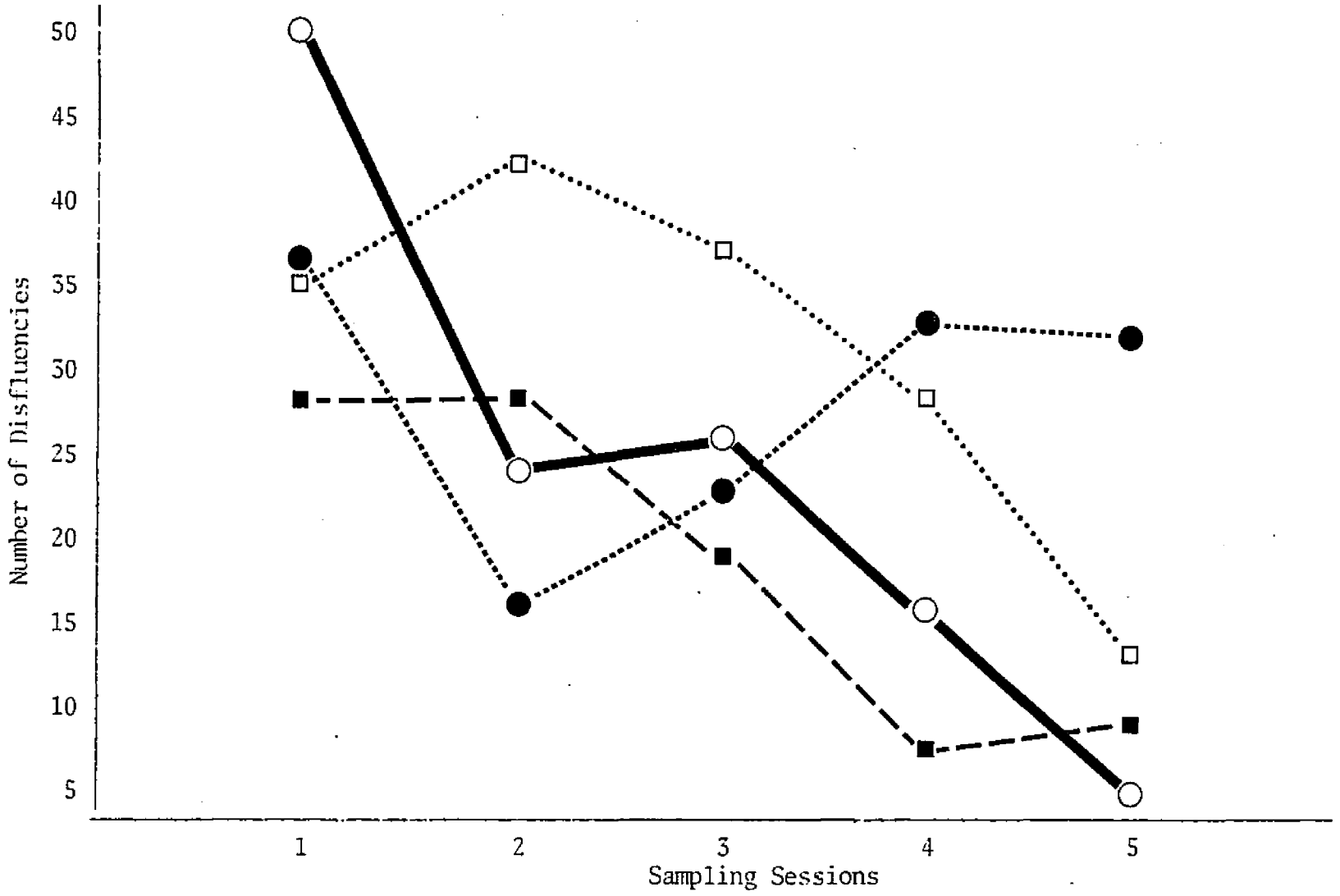

Figure 8. Numbers of Disfluencies in the Repetitions Category Across Five Data Collection Sessions for Subject One, ■ ; Subject Two, □ ; Subject Three, ● ; and Subject Four, ○.

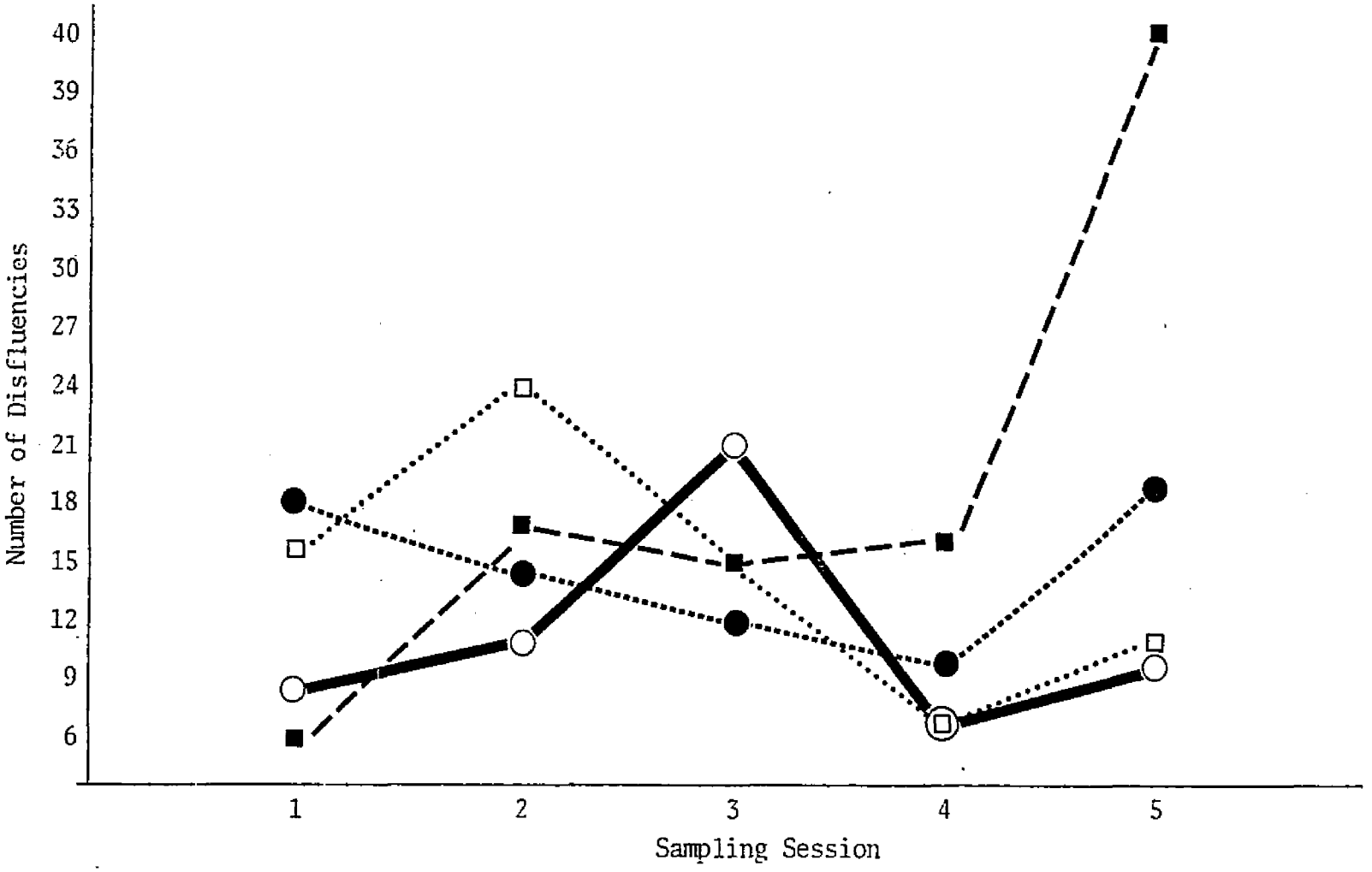

Figure 9. Number of Disfluencies in the "Other" Category Across Five Data Collection Sessions for Subject One, ■ ; Subject Two, □ ; Subject Three, ● ; and Subject Four, ○.

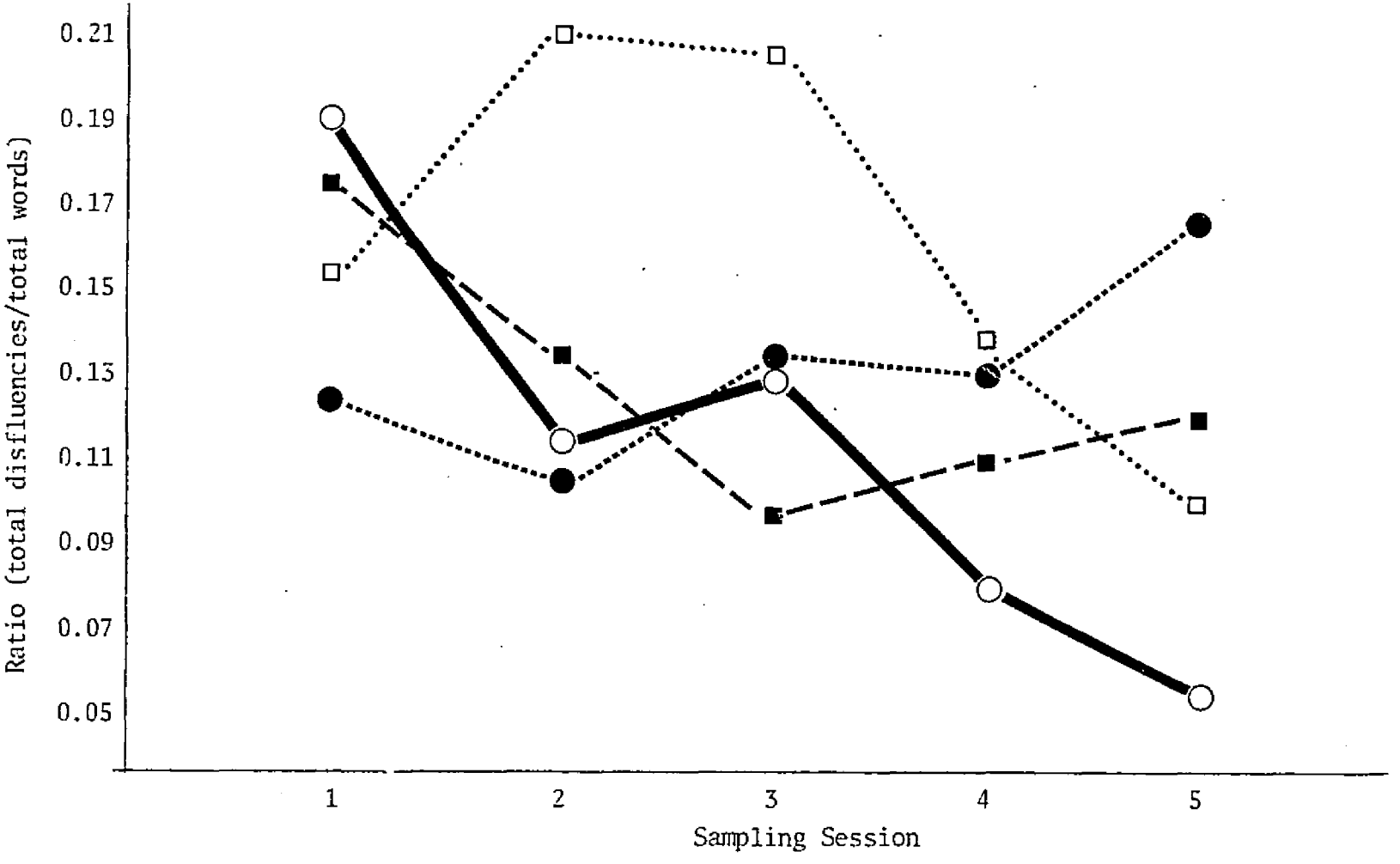

Figure 10. Ratio of Total Disfluencies to Total Words Measured in Five Data Collection Sessions for Subject One, ■ ; Subject Two, □ ; Subject Three, ● ; and Subject Four, ○.

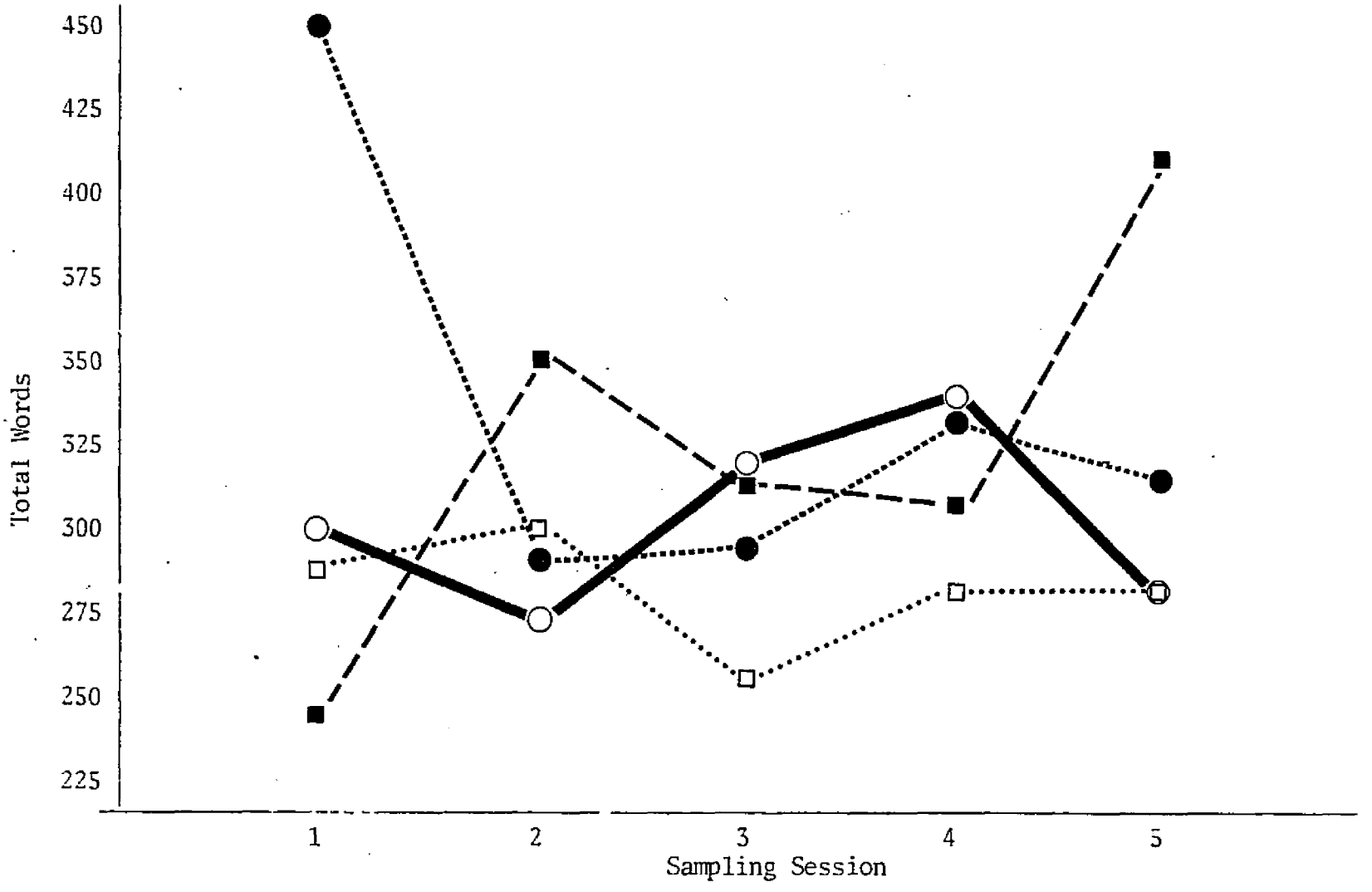

Figure 11. Total Words Measured in Five Data Collection Sessions for Subject One, ■ ; Subject Two, □ ; Subject Three, ● ; and Subject Four, ○.

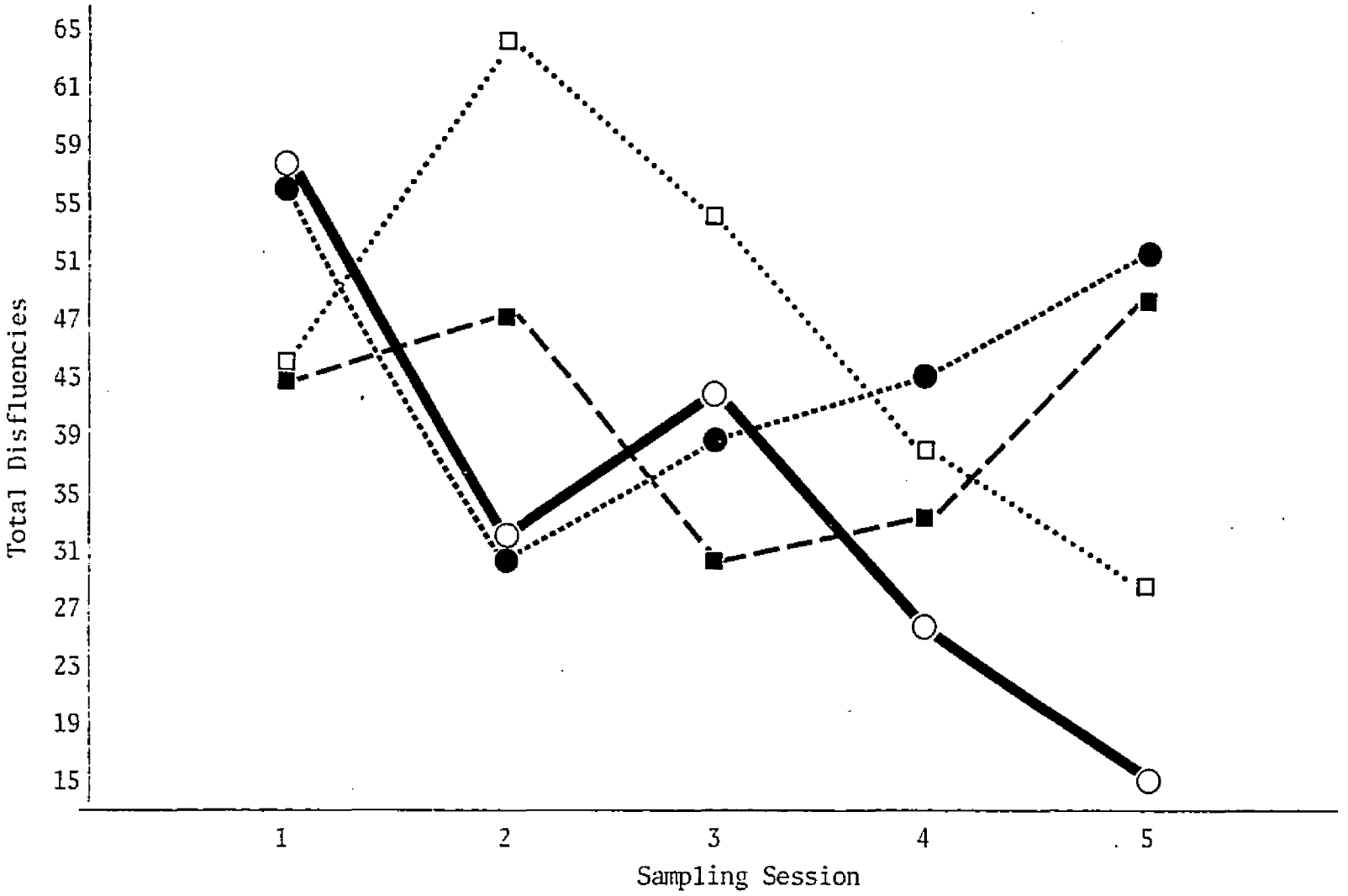

Figure 12. Total Disfluencies Measured in Five Data Collection Sessions for Subject One, ■ ; Subject Two, □ ; Subject Three, ● ; and Subject Four, ○ .

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