# Language abilities and fluency disorders:

# Analysis of spontaneous language samples of children who stutter during treatment with the Lidcombe Program

**Christina Lattermann**

School of Communication Sciences and Disorders

McGill University

Montreal, Canada

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## Abstract

The present study traces changes in linguistic complexity in the context of fluency development in four preschool children treated with the Lidcombe Program for Early Stuttering Intervention. Standardized tests of language and phonology were administered pre- treatment. Spontaneous language samples were collected for each participant at 5 preset intervals during the treatment phase. Samples were analyzed for Mean Length of Utterance, Number of Simple and Complex Sentences, Number of Different Words, Morphosyntactic Accuracy, Percentage of Stuttered Syllables and Normal Speech Dysfluencies, and Loci of Stuttered Moments. Analysis of the data revealed that all participants presented with language skills in the average and above average range, and achieved an increase in stutter-free speech without decreasing their linguistic complexity. However, all children scored consistently below the average range in Number of Different Words. Theoretical implications, as well as clinical implications and directions for future research are discussed.

## Resumé

Cette étude retrace les changements de complexité linguistique qui s'opèrent parallèlement au développement de la fluidité verbale chez quatre enfants d'âge préscolaire qui reçoivent un suivi orthophonique conforme au Programme Lidcombe d'intervention précoce pour jeunes bègues. Des tests standards de langage et de phonologie ont été administrés préalablement. Un échantillon de langage spontané fut recueilli auprès de chaque participant à cinq intervalles prévus durant le traitement.Les échantillons furent analysés en fonction de la longueur moyenne d'un énoncé, du nombre de phrases simples et complexes, du nombre de mots différents utilisés, de l'exactitude morphosyntaxique, du pourcentage de syllabes bégayées par rapport à celles de dysfluidité normale, et finalement en fonction des moments spécifiques de bégaiement. L'analyse des data a révélé que tous les participants présentaient des habilités langagières dans la moyenne et au-dessus de la moyenne, et qu'ils avaient atteint une plus grande fluidité verbale sans avoir recours à une diminution de complexité linguistique. Toutefois, tous les enfants ont démontré un résultat inférieur à la moyenne quant au nombre de mots différents utilisés. Les implications au niveau théorique et clinique, de même que d'éventuelles pistes de recherche sont discutés.

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"Stuttering is characterized by an abnormally high frequency or duration of stoppages in the forward flow of speech. These stoppages usually take the form of (a) repetitions of sounds, syllables, or one-syllable words, (b) prolongations of sounds, or (c) "blocks" of airflow or voicing in speech. Individuals who stutter are usually aware of their stuttering and are often embarrassed by it. Children who are just beginning to stutter may not seem bothered or aware of it, but they often show signs of physical tension and increased speech rate, which suggests they are reacting, at least minimally, to their speech difficulty" (Guitar, 1998).

There is a general consensus that the onset of stuttering may occur at any time during childhood. However, a large number of young children who stutter recover naturally. The data regarding estimates of spontaneous or natural recovery vary considerably from a low of 32% (Johnson, 1959) to 79% (Andrews & Harris, 1964) and possibly even higher (Yairi & Ambrose, 1992b). Findings indicate that spontaneous recovery frequently occurs during the first six months after stuttering onset. There is an ongoing debate in the literature about the definition of a persistent fluency disorder. Following Conture, (2001) children who exhibit stuttering for more than six months can be considered as early persistent stutterers. In contrast Yairi and Ambrose (1999b) classified a child's stuttering as persistent when it has been present for 48 months or longer.

Some children may start stuttering with the beginning of multiword utterances (around 18 months) whereas others start as late as the time of puberty (around 11 or 12 years). However, according to Andrews and Harris (1964) stuttering onset is most likely to occur between the ages of 2 and 5 years, a period during which not only motor skills but also language abilities expand rapidly. This fact suggests that stuttering may not only be a disorder simply related to difficulties in motor-speech production, but may also be linked to development of language use and verbal communication.

## Relationship between stuttering and language

During the last decades several studies have suggested that stuttering in young children occurs concomitantly with other speech and language problems (e.g., Blood & Seider, 1981; Bloodstein, 1984; Curlee, 1984; Starkweather, 1987; Wall & Myers, 1982).

Yet, it has not been consistently shown that children who stutter, as a group, are more likely than their fluent peers to have a delayed or disordered language development (e.g., Andrews & Harris, 1964; Berry, 1938b; Johnson, 1955; Okasha, Bishry, Kamel & Hassan, 1974; Seider, Gladstein & Kidd, 1982).

However, considering the fact that some children who stutter present with concomitant speech and language disorders, it has become increasingly important to investigate the relationship between fluency disorders and language development. Several researchers suggest that a language disorder may contribute to the onset of stuttering (e.g., Homzie & Lindsay, 1984; Van Riper, 1982; Westby, 1974), whereas others speculate that instances of stuttering may be a by-product of disruptions in syntactic, lexical, and/or phonological processing skills (Anderson & Conture, 2000; Au-Yeung & Howell, 1998; Ratner, 1997; Howell, Au-Yeung, & Sackin, 2000; Kolk & Postma, 1997; Wijnen & Boers, 1994). A third group argues that stuttering itself contributes to poor language performance (e.g., Stocker & Parker, 1977).

One possible link between stuttering onset and language development is suggested by the observation of several authors that stuttering onset often coincides with a period of rapid expansion of speech and language skills, frequently referred to as "language spurts" (summarized by Conture, 2001). Another likely relationship is based on Brown's hypothesis (summarized by Bloodstein, 1995) suggesting that stuttering in adults varied lawfully with seven grammatical factors during reading aloud. For example, his findings showed that most adults who stutter do so more frequently on nouns, verbs, adjectives, on sounds in word-initial position, on consonants and on longer words.

Later researchers (Ratner, 1997; Silverman, 1974; Wall, Starkweather, & Cairns, 1981) applied this hypothesis to the speech of elementary and preschool stuttering children. They discovered that stuttering in elementary school children followed the same linguistic rules as stuttering in adults. However, their findings showed that the stuttering preschool children followed a different pattern. Their fluency disorders manifested as repetitions of whole words in sentence-initial positions. Stuttering was primarily located at the beginning of syntactic units like sentences and phrases. The authors hypothesized that in preschool children who stuttered the task of linguistic planning and preparation was a key factor in contributing to the dysfluencies.

In the last several years more researchers have begun to investigate a possible relationship between early stuttering and language acquisition (e.g. Murray & Reed, 1977; Rommel, Hage, Kalehne & Johannsen, 1999; Ryan, 2001; St.Louis, Hinzman & Hull, 1985; Wall, 1980). These studies may help us to better understand the nature of early stuttering. In addition, they might provide valuable information to enhance current models for assessment and treatment.

The purpose of the following study is to investigate the relationship between fluency development and language complexity used by the child in a specific treatment program for early stuttering intervention (The Lidcombe Program, Onslow, 1996). The Lidcombe Program is a parent conducted, operant treatment method for early stuttering. Data suggest that this program is able to establish and generalize stuttering reductions and maintain those benefits, however, little is known about the underlying mechanisms that cause these treatment effects. The parents are trained to administer verbal response contingent stimulation, without explicitly targeting the child's or the adult's used language complexity and sentence length. Based on the hypothesis of several authors (i.e., Bernstein, 1981; Colburn & Mysak, 1982a, 1982b; Tetnowski, 1998; Wijnen, 1990;) that the effects of word length and function, and language complexity stress the language operating system resulting in fluency breakdown, it can be speculated that reduction of language complexity, and word and sentence length would result in increased fluent speech production. Therefore, the purpose of the following study is to investigate if treatment with the Lidcombe Program results in the child's usage of less complex language and a reduced mean length of utterances, this leading to increased fluent speech production in the stuttering child.

## A review of the literature

Investigation into the relationship between stuttering and language abilities in children has produced only a limited amount of research and has led to equivocal results. The following sections provide an overview of studies investigating the relationship between language abilities and fluency disorders in stuttering children of different age groups, followed by studies investigating the relationship between language and fluency in children with developmental language disorders. Finally, studies examining the

relationship between persistent versus recovered stuttering and language abilities are presented.

**Studies investigating children under age 3**

Several studies have investigated the language abilities of children under age 3 who stutter (Chevekeva, 1967; Levina, 1963; Ratner, 1997; Watkins, Yairi, & Ambrose, 1999) Findings suggested that stuttering onset in very young children often coincided with qualitative and quantitative advances in the children's language development. These children presented with precocious rather than delayed skills in the areas of morphological, syntactical and semantic development. It is of importance to note that the children's speech production was always regarded by the authors as being normally fluent before the onset of stuttering. The fluency failure presented as an interruption of already established skills. This is in contrast to the phenomenon that language and phonological disorders are often characterized by a failure of normal development.

**Studies investigating preschool- aged children, revealing differences in language abilities**

Other studies investigated language abilities in preschool children, aged three years and older, who stutter compared to fluent, age matched children.( Anderson & Conture, 2000; Bernstein Ratner & Silverman, 2000; Blood & Seider, 1981; Kline & Starkweather, 1979; Meyers & Freeman, 1985; Murray & Reed, 1977; Ryan, 1992; Silverman & Bernstein Ratner, 2002; Silverman & Williams, 1967; Wall, 1980; Westby, 1979). Some of the findings suggested significant differences in areas of semantics, syntax and phonology between stuttering and non stuttering children.

Five authors, who assessed language comprehension, reported that children who stutter scored significantly lower on the Peabody Picture Vocabulary Test (PPVT) (Dunn and Dunn, 1965, 1981, 1997) compared to their normally fluent peers. Kline and Starkweather (1979) also found results showing lower scores on the Test of Auditory Comprehension of Language (TACL) (Carrow-Woolfolk, 1989) for children who stutter compared to fluent peers.

In this respect, it is interesting to point out that Westby (1979), Murray and Reed (1977), and Ryan (1992) reported scores ranging significantly below those of the fluent controls, however, still falling within the average range in relation to test norms. Bernstein Ratner and Silverman (2000) assessed children within four months of stuttering onset with a large test battery and confirmed this observation. Their speech and language abilities, while ranging firmly within normal limits, were not found to be as advanced as those of the fluent controls. Results of an additional Vocd analysis (Malvern & Richards, 1997), used to measure lexical diversity, revealed a lower profiency in the lexical domain for the group of nonfluent children. They also performed significantly more poorly, as a group, on the Expressive One Word Picture Vocabulary Test – Revised (Gardner, 1990), than fluent peers (Silverman & Bernstein Ratner, 2002).

Some authors used complex standardized tests to assess both comprehension and verbal expression. Anderson and Conture (2000) examined preschool children who stuttered. They showed significant differences between measures of receptive and expressive language compared to the fluent controls. The results showed that the children who stuttered compared to their fluent peers, exhibited a significantly greater direction of the imbalance between receptive vocabulary and expressive/receptive language. Ryan (1992) found small but significant differences on the Test of Language Development (TOLD-R) (Newcomer and Hammill, 1997) between children who stutter and their fluent peers. Additionally, Murray and Reed (1977) reported lower scores on the verbal abilities scales of the Zimmerman Preschool Language Scale (Zimmerman, Steiner, & Pond, 1979).

Several studies assessed syntactic abilities in children who stutter. Findings by Wall (1980) indicated that children who stutter used simpler, less mature language on a constituent syntactic analysis task. Murray and Reed (1977) also reported lower scores on the Northwestern Syntax Screening Test for nonfluent children. Kline and Starkweather (1979) presented data indicating a lower mean length of utterance for preschoolers who stutter. These findings are in agreement with Silverman and Williams (1967) who showed that there was a slight tendency for nonfluent children to be poorer in mean length of utterance (MLU), mean of the five longest responses, and structural complexity of their utterances. Finally others have investigated the phonological skills of stuttering children.

Louko, Conture, and Edwards (1999) concluded on the basis of review of thirteen studies, that the prevalence of articulation/phonological disorders in children who stutter far exceeds that of the fluent population.

In summary, the above-mentioned studies lend evidence to the hypothesis that stuttering and non-stuttering preschool children differ regarding their expressive and receptive language development. Several studies show significant differences between the two groups, indicating delayed or less developed language skills for the stuttering preschool children. Some authors stress that the stuttering children scored significantly lower than the non-stuttering children on the various language tests, however, these lower scores were still within normal limits.

**Studies investigating preschool aged children, revealing no differences in language abilities**

In contrast, some studies found no differences in particular areas of language abilities between children who stutter and their fluent controls. First, Meyers and Freeman (1985) investigated the relationship between parental verbal behavior and development of stuttering. They analysed spontaneous language samples of mothers interacting with their children. Their data indicated that stuttering 4-5 year old children did not differ significantly from their controls on total number of words or on total fluent words.

Second, Bernstein Ratner and Sih (1987) evaluated the task demands of changes in utterance length and complexity to appraise their effects upon fluency and accuracy of sentence reproduction. They analyzed the sentence imitation accuracy for 7 versions of 10 sentence types in children who stuttered and fluent children. Their results suggested no significant differences on the ability to accurately reproduce a variety of sentence types between stuttering and normally fluent children.

Third, Rommel, Hage, Kahlene and Johannsen (1999) reported that German-speaking children who stutter showed language abilities at or above expected norms in the early childhood years. The 62 participants of this study were between 2.8 and 7.6 years old. The fact that they found language skills above expected norms is in agreement with the above mentioned studies which report qualitative and quantitative advances in the language development for stuttering children under age three. Thereby, these findings

also indicate a difference in the developmental pathway of language development at least for a subset of children who stutter.

In summary, there are some studies indicating no differences in the language abilities between stuttering and non-stuttering preschool-aged children.

**Studies investigating school-aged children, revealing differences in language abilities**

Several authors investigated the language abilities of school-aged children who stutter compared to their normally fluent peers, revealing significant differences between both groups: Studies investigating expressive and receptive vocabulary in children who stutter gathered the following information. Williams, Melrose, and Woods (1969) reported that sixth grade children who stuttered performed significantly below their fluent peers as a group on the Vocabulary Section of the Iowa Test of Basic Skills (Lindquist and Hieronymus, 1964). However, the range of scores was nearly identical for the two groups, indicating that not all nonfluent children were delayed in their vocabulary development. Westby's (1979) findings indicated that children who stutter scored significantly below the normally fluent group on the Peabody Picture Vocabulary Test (Dunn and Dunn, 1965). However, it should be noted that their scores still fell within the average range in relation to the test norms and thus were not indicative of a receptive vocabulary deficit. Byrd and Cooper (1989) reported that 5-to-9-year old stuttering children compared unfavorably with test norms on the Test of Language Development (TOLD) (Newcomer and Hammill, 1982), presenting with a significant delay in expressive language skills.

Studies investigating syntactic abilities in school-aged children who stuttered showed the following results: The findings of St.Louis and Hinzmann (1988) demonstrated that stuttering children in grade one to twelve showed a lower mean length of utterance (MLU). Westby's (1979) findings indicated that children who stutter made significantly more grammatical errors in their language samples than the normally fluent group. Results by St.Louis, Hinzmann and Hull (1985) revealed significant differences on complexity with normally fluent children producing a greater number of verbs per utterance.

In terms of phonological abilities in stuttering children the results are the same as for the preschool children. Louko, Conture and Edwards (1999) indicated on the basis of thirteen studies that the prevalence of articulation/phonological disorders in school-aged children who stutter far exceeded that of the normally fluent population. Blood and Seider (1981) surveyed 650 Speech-Language Pathologists and drew a general conclusion. They reported that according to the findings of this questionnaire 68% of the children who stutter up to age 14 were judged to have additional, well-defined language disorders concomitant with their stuttering. This result was not differentiated relative to language and articulation.

In summary, the above mentioned studies lend support to the possibility that school aged children who stutter differ from their fluent peers in regard to their language skills. These findings show that stuttering school-aged children have less developed language abilities in the areas of semantics, syntax, morphology and phonology compared to their age-matched controls. It has to be stressed though, that some of them present with language abilities below the normal range, whereas others may present with language skills that are less developed compared to their fluent peers, but are still in the average range.

**Studies investigating school-aged children, revealing no differences in language abilities**

Conversely, several investigations of language abilities in stuttering school-aged children also revealed no differences. Assessing receptive and expressive language abilities, Perozzi and Kunze (1969) presented results indicating that second grade and third grade stuttering children and controls did not differ on the Van Alstyne Picture Vocabulary Test (Van Alstyne, 1960) or on measures of verbal output. Byrd and Cooper (1989) did not find significant differences on the Test of Auditory Comprehension of Language (TACL) (Carrow-Woolfolk, 1989) between stuttering children and their controls. Findings by Nippold, Schwarz and Jescheniak (1991) revealed no differences between children who stuttered and their fluent controls on the Clinical Evaluation of Language Fundamentals Test (CELF-3) (Semel, Wiig and Secord, 1987).

Studies investigating syntactic skills in school-aged children who stutter showed the following results. Kadi-Hanif and Howell (1992) reported that their stuttering participants showed no difference to fluent controls for mean length of utterance. Westby's (1979) findings indicated that there were no differences on Lee's Developmental Sentence Scoring Test (Lee, 1974) for both groups. Assessing structural complexity, Perozzi and Kunze (1969) did not find significant differences between stuttering children and their fluent controls. Only four studies investigated narrative abilities in stuttering children. Nippold, Schwarz and Jescheniak (1991), Weiss and Zebrowski (1994), Scott, Healey and Norris (1995, 2001) revealed no significant differences between school- age children who stutter and fluent peers in their story retelling and story generation ability.

In summary, similar to many of the studies investigating preschool-aged children who stutter, the above mentioned research findings show no differences in language skills between school-aged children who stuttered and their fluent peers. One possible explanation for this may be that some of the children who stutter do not present with differences in linguistic proficiency compared to their fluent peers, and that it is only a subset of these non-fluent children who do. In addition, it is also possible that more sensitive measurement techniques and test procedures may be required to detect subtle language competence differences in children who stutter, when being compared to their fluent peers.

**Studies investigating the relationship between language and fluency in children with developmental language disorders**

Several authors have explored the psycholinguistic aspects of disfluency in children with language disorders (i.e., Boscolo, Bernstein Ratner, & Rescorla, 2002; Hall, 1977; Meyers, Ghatak, & Woodford, 1989; Meyers, Hall, & Aram, 1990). Findings by Hall (1977) and Merits-Patterson and Reed (1981) indicated increased dysfluencies in the spontaneous speech of children receiving direct language treatment. The authors suggested a relationship between the increased dysfluencies and the greater linguistic complexity and/or heightened communicative pressure experienced through the direct language treatment.

Hall, Yamashita and Aram (1993) assessed 60 preschool-aged children who presented with developmental language disorders using a large battery of expressive and receptive language tests and analyses of spontaneous language samples. Their findings revealed a subset of 10 participants who exhibited significantly more dysfluencies than the other children. Specifically these children presented with better-developed lexical abilities than morphosyntactic skills. The authors interpreted their results according to the neuropsycholinguistic model of dysfluencies (Perkins, Kent, & Curlee, 1991) , which suggests that some children with language disorders are at risk for fluency breakdown because of dissynchronies among aspects of the underlying processes of speech and language, in this study specifically in the development of lexical and syntactic aspects of language.

The findings were further interpreted according to the Demands and Capacities model of dysfluencies (Adams, 1990; Starkweather, 1987; Starkweather & Gottwald, 1990). This model suggests that breakdown in fluency is the result of speaking demands exceeding speech-production capacities. In this study the linguistic demands of well-developed lexical abilities exceeded the morphosyntactic skills, resulting in fluency breakdown.

In a follow-up study, Hall (1996) examined 9 of the 10 children of the above mentioned study, who had been identified as exhibiting increased frequencies of dysfluencies in association with a mismatch between lexical and morphosyntactical abilities. Her findings showed that preschool-aged children with language disorders exhibiting high rates of dysfluencies continue to do so at school age. However, between preschool and seven years of age the frequency of all types of dysfluencies (normal type and stuttering type dysfluencies) appeared to decrease greatly, with slight increases in dysfluencies observed between seven and nine years of age. Although none of the participants was diagnosed with a fluency disorder initially, three subsequently received fluency-focused treatment. When investigating the question of how changes in language may affect fluency over time, Hall extracted two possible patterns of language and fluency development from her data: The first pattern reflected continued mismatches between morphosyntactic and lexical abilities. However, the deficits seemed to be limited to expressive morphosyntactic skills. The author speculated that impairments in the

structural aspects of language (i.e., morphosyntax, phonology) result in more posturing or tension-related dysfluencies as a consequence of diminished automaticity in speech and language production. Overall, the findings suggested that impaired morphosyntactic (and phonologic) skills may contribute to fluency disruptions.

The second identified pattern showed better-developed expressive than receptive language skills, regardless of linguistic component, resulting in increased dysfluencies. However, only two participants revealed this pattern and Hall cautioned that overall further research is needed to analyse how changes in language relate to changes in fluency. Future research should investigate developmental changes in language abilities and changes in fluency over time and in more depth on a microanalytic level.

Conversely, a small collection of case studies presented by Lees, Anderson, and Martin (1999) did not support the hypothesis that language impairments cause an increase in speech dysfluency. Five to six year-old children with language disorders did not present with dysfluency rates elevated by more the 1% compared to their fluent peers. Miranda, McCabe, and Bliss (1998) found similar results, when comparing fluent speech production of 9-year-old boys with Specific Language Impairment (SLI) and their fluent controls during narrative production. These findings are consistent with results by Scott and Windsor (2000), which showed no differences in measures of fluency between 11-year-old children with Specific Language Impairment and two aged-matched comparison groups.

In summary, as for the studies investigating language skills in children who stutter without presenting with an additional language impairment, the above mentioned findings are inconclusive. The contradictory findings may again be related to the hypothesis, that some of the children who present with a language disorder may not demonstrate an increase in dysfluent speech production.

Although researchers have become increasingly interested in the relationship between fluency disorders and concomitant language delays/disorders, so far hardly any research has focused on the relationship between stuttering and advanced language abilities. Enger, Hood and Shulman (1988) investigated language and fluency characteristics of linguistically advanced, fluent preschool and school-aged children. Their data showed that these children with precocious language abilities exhibited slightly

more frequent dysfluencies than would have been expected. The authors suggested the need for future research in this area, which may yield important information to improve assessment and treatment of fluency and language disorders. In this context Cordes and Ingham (1998) stated that there is not only a strong need for systematic study of how treatment for stuttering is influenced by concomitant speech and language disorders, but also an equally strong need to study how treatment is influenced by concomitant expressive and receptive language abilities which are superior. However, to date this line of research has not been followed up.

**Related issues: Persistent versus recovered stuttering and language abilities**

The above mentioned findings lead to inconclusive results relative to language abilities in children who stutter. As a consequence, many central questions related to the issue of a possible relationship between language abilities and stuttering in children remain unanswered. Considering the hypothesis of stuttering onset being related to limitations in language abilities combined with high language demands, it appears to be of interest to investigate, if, in turn the persistence of or the recovery from a fluency disorder may then be linked to an approximation of linguistic competence and language demands. The question of whether linguistic proficiency in some way differentiates children whose stuttering eventually recovers from those whose stutter persists has received only limited research attention. Spontaneously recovered stuttering usually applies to those children who recover from early stuttering without treatment, often within a period of six months following onset of initial symptoms, while persistent stuttering is seen as early stuttering that continues beyond six months.

Yairi, Ambrose, Paden and Throneburg (1996) investigated linguistic variables in children whose stuttering persisted or recovered, administering the Preschool Language Scale (PLS) (Zimmerman, Steiner, & Pond, 1979), and the Assessment of Phonological Processes-Revised (APP-R) (Hodson, 1986) and analysis of a spontaneous language sample. When they applied standardized measures at the children's entry into the study and one year later, the strongest contributors to stuttering status were the PLS-R Verbal and Comprehension Scores. Group analysis revealed that children whose stuttering was persistent scored significantly lower than children who recovered and controls. It has to

be stated, however, that the mean PLS-R scores still ranged well within the average norms for those persistent stuttering children. Similarly, the analysis of the phonological assessment showed a significant difference between the persistent group of stuttering children and their fluent peers with the stuttering children performing on a lower level than would be expected. However, their performance was still within normal limits. Analysis of the spontaneous language sample showed that there were no significant differences between the groups on measures of mean length of utterance (MLU) and number of different words. As already cautioned above, this study examined only mean performance for entire groups, which may have obscured potentially informative developmental pathways followed by individual children.

The authors suggested that although children who stutter chronically do not necessarily perform below average levels, they perform more poorly on phonology and language skills than do children who recovered from stuttering kills. Furthermore, at very early stages of stuttering, children with the potential of developing chronic stuttering may have phonologic skills that are below age norms. The authors concluded, that phonological skills may be an especially useful parameter for children who are being evaluated soon after onset. In order to further investigate the relationship between stuttering and language and phonology the authors suggested that subgrouping of subjects (persistent versus recovered) might provide an important key.

In their longitudinal study, Rommel, Häge, Kahlene and Johannsen (1999) investigated cognitive and linguistic competencies of German preschool children whose stuttering persisted or recovered by administering the Heidelberger Sprachenwicklungstest (H-S-E-T) (Grimm & Schoeler, 1991) and the Aktiver Wortschatztest (AWST 3-6) (Kiese & Kozielski, 1979). Although group analysis revealed language abilities firm within normal limits, the authors were able to lend evidence to discrepancies on language production measures when examining the data for subgroups of these children (Häge, 2001). Retrospectively, the participants were divided into three groups, one group consisting of those children who recovered within 18 months, another consisting of those children who recovered within 54 months and a third group consisting of children whose stuttering persisted after 54 months. The results indicated that children whose stuttering persisted after 54 months had scored higher on both the initially

administered Heidelberger Sprachentwicklungstest and the Aktiver Wortschatztest compared to the two groups of children who recovered. Although these performance discrepancies had not been significant for the H-S-E-T, the results of the AWST 3-6 testing showed a statistically significant difference for the children whose stuttering persisted. The author concluded that children with linguistic abilities in the average and high average range, especially in the area of expressive and receptive vocabulary development, had a worse prognosis to achieve fluent speech production compared to children with a delay in this area. It was stated that high levels of linguistic abilities are suitable to serve as a prognostic factor among others for a possible persistence of a fluency disorder. The researchers speculated that the dysfluent speech production in children who present with a language delay at stuttering onset may be caused in the context of word finding and linguistic planning difficulties. As a consequence, improvement of their linguistic competency might result in achievement of fluency.

Conversely, Watkins and Yairi (1997) analyzed spontaneous language samples of children whose stuttering recovered (early/late) or persisted. Their data did not support the idea of generally limited or advanced linguistic proficiency in children who stutter and did not identify any broad discrepancies on language production measures of children whose stuttering persisted in comparison to peers who recovered. Yet, it is interesting to point out that the children in the persistent group demonstrated more diverse performance for all measures of language production than children in the early-and late recovery groups. Furthermore, there was a higher prevalence of atypical patterns of change, from the initial to one-year visits, for children whose stuttering persisted. The observed atypical patterns involved both decline or limited change in language production over the one-year period. It should be stressed that these declines or plateaus occurred during a developmental period when typical language learners continue to show steady growth in language productions capabilities. The authors concluded that these individual developmental pathways suggested a complex connection between linguistic proficiency and stuttering. From their viewpoint the investigation of the individual patterns of performance is central to clarifying the developmental relationship between language proficiency and the production of fluent speech. It may be necessary to apply more specific measures of linguistic competency to yield differences between the linguistic

proficiency of children whose stuttering is persistent and those children whose stuttering recovered and the normative data. Measurements should include specific speech-and language standardised tests as well as spontaneous language samples. Furthermore, the linguistic skills should be investigated over a longer time period and in more depth on a microanalytic level.

In summary, the findings of the three studies regarding the question whether linguistic proficiency in some way differentiates children whose stuttering eventually recovers from those whose stutter persists are inconclusive. However, all results indicate the possible existence of subgroups of children with different linguistic developmental pathways.

**Summary and critique of the literature**

The above mentioned findings lead to inconclusive results relative to language abilities in children who stutter. Some studies indicate significant differences between stuttering and normally fluent children on phonologic, syntactic, morphologic and semantic measures whereas other results reveal no performance differences. Several factors have to be taken into consideration for further analysis and interpretation of these equivocal findings:

First, when interpreting the above mentioned findings, the age of the children who stutter should be taken into consideration. There is significantly more evidence for differences in language development in preschool aged children compared to school-aged children who stutter. It appears possible that early differences in language abilities may disappear or become less apparent as the stuttering children advance in age. In addition, variability of language development is greater during the preschool years compared to the school years, and therefore actual differences are easier to detect.Since stuttering onset most often occurs between the ages 2 to 5 years and important differences between preschool and school-aged children related to the processes of stuttering and language acquisition are indicated, it would be valuable for future research to continue to investigate this issue in preschool-aged children who stutter.

Second, the fact that both the fluency disorder and language skills are developing simultaneously in young children, should be taken into account. It is possible that both

areas are developing independently from each other and that there is no link between speech fluency and linguistic proficiency. In this case, children who stutter should not reveal differences in language skills compared to fluent peers. However, it also appears possible that there is a complex relationship between the development of stuttering and the development of language abilities in some young children. In this case, it is likely that a link between those two is variable over time as the children grow older and as different cognitive, linguistic, neurophysiological and neuromotor functions are further developed.

Third, the inconclusive findings may be attributed to variations in research methods and study design. Different standardized tests and various subtests have been administered as well as specially designed tests. For example, in order to assess semantic skills researchers administered The Van Alstyne Picture Vocabulary Test, The Vocabulary Section of the Iowa Test of Basic Skills, The Peabody Picture Vocabulary Test, Subtests from the Torrance Test of Creative Thinking, The Test of Language Development-Revised, The Clinical Evaluation of Language Fundamentals, and the Test of Early Language Development. Some authors analyzed spontaneous language samples only, others combined them with standardized tests. The number of utterances in these samples ranged from 50, which is the suggested absolute minimum number of utterances required to analyze a sample (e.g., the Systematic Analysis of Linguistics Transcripts - SALT uses 100 utterances, Miller & Chapman, 1998), to 300 utterances, providing a more valid data base. It must be taken into consideration that differences in language production proficiency between children who stutter and children who do not stutter may appear under certain conditions, such as those elicited by standardized measures, but may not be apparent under certain conditions where the speaker is allowed more control, such as spontaneous language production. Conversely, some children may display better linguistic proficiency in a highly structured, controlled test situation and perform less well in a spontaneous, unstructured play situation. Test environment and the examiner who elicits the language sample may also have an impact on the language performance of the stuttering child by contributing to the child's level of attention, comfort, interest and motivation.

Future research should combine both spontaneous language samples and a set of standardized language tests, which specifically examine the major areas of language

development in preschool children: phonology, semantic, syntax and morphology. The analysis of the spontaneous language samples should also involve these multiple levels of language production. Additionally, the comparison of percentage of stuttered syllables, normal speech dysfluencies and severity should be included.

The stuttering severity of the participants is another important factor that raises extreme difficulties when trying to compare the results of the different studies and to generalize their findings. Different studies included children with mild, moderate or severe stuttering severity. Some studies involved only children from one category while others included two or all categories. In addition, the selected criteria to characterize the stuttering severity varied considerably. Some authors used standardized instruments like the Stocker-Probe Technique (Stocker, 1977) or the Stuttering-Severity-Instrument-3 (SSI-3) (Riley, 1994). Others used perceptual measures of the parents and/or the clinicians on specifically designed scales (e.g., ranging from 0 = normal fluent speech production, 2 = mild stuttering, up to 7 = very severe stuttering). Finally, several authors did not classify the stuttering severity at all. These factors imply an important caveat when interpreting, comparing and generalizing the results of different studies.

The studies also differed widely in sample size with the number of participants ranging from four to 100 children who stuttered and matched controls. Small sample sizes limit the generalizability of study findings. On the other hand group data does frequently not allow for in depth-explorations of participants and individual variation.

Fourth, studies differed not only on age of participants as indicated above, but also on the time since stuttering onset. None of the studies looked at time since onset of stuttering. This factor could have a major impact on the measured outcome. Future research should evaluate children whose stuttering has persisted for periods of more than six months into consideration in order to further define a homogenous subgroup or prevent a heterogeneous subgroup from obscuring findings.

Fifth, several authors indicate the possible existence of subsets of children who stutter who demonstrate with either precocious or delayed/deficient language skills (i.e., Chevekeva, 1967; Hall, Yamashita, & Aram, 1993; Hall, 1996; Levina, 1963; Ratner, 1997; Ryan, 1992; Schwarz & Conture, 1988; Scott, Healey, & Norris, 1995; Yairi, 1983; Yairi & Ambrose, 1992a, 1992b). However, the identification of those possible subgroups

may have been obscured by group means in the above mentioned studies. Preus (1981) suggested examining the performance of individual subjects closely before making assumptions based on group means. Most cited studies examined only mean performance for entire groups and thereby might have masked potentially informative developmental pathways followed by individual children .Future research should include single-subject designs in order to prevent the risk of group means masking individual developmental trends. In addition, many studies presented with a small sample size that led to more difficulty for the identification of possible subgroups and also limited the generalizability of the results.

Sixth, with the exception of Ryan (1992), Hall and Burgess (2000) and Rommel, Hage, Kalehne, and Johannsen (1999) the above mentioned studies determined group trends at discrete chronological ages, but did not offer explorations of changes in fluency and language over time on a more in-depth level. The language abilities of children who stutter should be evaluated in close time intervals with a variety of linguistic measures. Thereby, individual changes in language development could be detected and analyzed. Since language spurts are likely to occur during short time periods frequent monitoring is essential. Without a longitudinal design that assesses a broad variety of language skills and measures speech fluency at different points in time, the variations in fluency, as related to developing linguistic skills, are lost in those analyses.

Seventh, the question whether linguistic performance influences the recovery from early stuttering remains unanswered and should be further investigated. There is some evidence that stuttering severity is a predicting variable for responsiveness to treatment (Jones et al. 2000). However, the relationship between individual language abilities and the responsiveness to stuttering treatment has not been fully investigated in regard to responsiveness to treatment.

In summary, in spite of a body of research, it remains difficult to determine the extent to which linguistic proficiency is a component of the profile of early stuttering. The inconclusive findings appear to result at least partially from differences in the participant selection criteria, as for example the stuttering severity and from methods which may have not been sensitive enough to detect subtle language differences. Overall, these findings indicate the need for ongoing research efforts during critical language stages.

**Language abilities and responsiveness to stuttering treatment**

As mentioned above several authors suggest a possible link between language abilities and stuttering onset or between language skills and stuttering recovery or persistence. Considering the hypothesis that children may develop a fluency disorder during times when their linguistic proficiency is not matching the linguistic demands or that children's fluency disorder may persist, because they present with language abilities below or above average level, one important question emerges: Does linguistic proficiency of children who stutter predict the responsiveness to early stuttering treatment? At the current stage it is not known whether language skills are an important variable when predicting treatment time and treatment results.

The following study will investigate if the language used by the children who stutter during early stuttering intervention will influence the production of fluent speech. There are several theories by Wingate (1988), Kolk and Postma (1997), Perkins, Kent, and Curlee (1991) and Tetnowski (1998) which try to explain the way in which language skills could influence the production of fluent speech.

Wingate (1988) proposed that stuttering results from a dyssynchrony of functions in the left hemisphere, the right hemisphere and subcortical structures. It is suggested that these structures are responsible for different elements of language production and planning, such as consonants, vowels and prosody. In order to produce the initial part of a syllable, consonant, vowel and prosody have to be synchronously blended. The author hypothesized that stuttering is caused by one or more of these components lagging behind the others, when syllable production is attempted, this, in turn, resulting in a disruption of speech production.

Perkins, Kent and Curlee (1991) proposed another theory of stuttering as a deficit in language production. Stuttering is viewed as a result from a dyssynchrony between two components of language production. The authors differentiate between a paralinguistic and a linguistic component. The paralinguistic component is viewed as a right hemisphere social-emotional system that is responsible for vocal tone and prosodic functions. Whereas the linguistic system is a left hemisphere segmental system that is responsible for the content of language, its semantics, syntax, and phonology. In order to

produce language both components must be integrated. A dyssynchrony of the integrative processes is thought to result in dysfluencies. However, there are two other elements necessary to produce stuttering and not just normal speech dysfluencies. The first element is time pressure that has to be experienced by the speaker. This pressure results in a trial to continue to speak even though the delay in paralinguistic or linguistic processing has resulted in an incomplete or anomalous speech motor program. The second element is the experience of a subjective "loss of control" feeling caused by the lacking awareness of why the speaker is not able to say the word.

Kolk and Postma (1997) developed the "Covert Repair Hypothesis" stating that the phonetic plans contain more flaws and therefore more occasions for error corrections in people who stutter. Stuttering is viewed as a "normal" repair reaction to an abnormal phonetic plan. Dysfluencies reflect difficulties in accurately encoding the segment that is stuttered. The authors hypothesize that variation in the position of an error in the word plan leads to variation in when speech is interrupted and, in turn, to different manifestations of the word's repair in form of silent pauses, blocking, prolongations or part-word repetitions.

Tetnowki's (1998) theory about the relationship between language skills and fluency leads to several testable clinical implications. First, when one or more language skill/s is below the level of other language components, "the production of language is then thrown out of balance as different components arrive at a central language integrator at different times and thus have a mistimed impact on the motor production of speech – which may result in stuttering" (Tetnowski, 1998). Second, Tetnowski's idea also provides a theoretical model for the group of children, who present with rather advanced language skills scoring in the higher range or above average age range on standardized test procedures. These precocious abilities may affect the expressive and/or the receptive, and/or the pragmatic abilities again resulting in an imbalance of language components.

If linguistic proficiency has an influence on fluent speech as indicated in the theories above, this is likely to impact on treatment responsiveness. It can be hypothesized that children, whose language skills would increase and/or become more balanced and would in turn approximate the expected language level for the children's chronological age during speech-and language treatment, would develop fluent speech

production more easily. This would imply that for these children who stutter stuttering treatment should combine language and fluency treatment or maybe stuttering treatment should be even preceded by treatment of the not age-appropriate language skills. It would be predicted that as a consequence these children respond faster and more successfully to stuttering treatment.

Only two studies have investigated the responsiveness of early stuttering to treatment in general: Starkweather and Gottwald (1993) indicated that stuttering severity and time since onset influenced treatment outcome. They found that children with more severe stuttering and a longer time period since onset had longer treatment times.

Jones, Onslow, Harrison and Packman (2000) investigated whether age, time since onset, gender, and stuttering severity relate systematically to the time required for treatment with the Lidcombe Program. Their results also indicate that stuttering severity at the first session was a predictor of a longer treatment time. In addition, their findings showed evidence that a longer period since stuttering onset may be associated with quicker treatment. However, the authors caution that this is only suggested for a short period after stuttering onset in the preschool years and that the data cannot be generalized to late childhood or early adolescence.

In summary, both studies provide evidence that stuttering severity is an important variable predicting the responsiveness to treatment. However, no language-related variables have been identified as being predictive of treatment time. In order to further analyse this interesting issue the following study will investigate a possible link between fluency and language used by the child during early stuttering treatment. If decreased or increased language proficiency contributes to stuttering onset and/or maintenance, then in turn a change in linguistic variables during early intervention may also be linked to stuttering reduction and/or complete recovery. The chosen research design for the investigation will be a prospective treatment study with a single subject design. When selecting a treatment method the author decided upon the Lidcombe Program for Early Stuttering Intervention (Onslow, 1996), since it appears to be advantageous in several ways compared to other treatment programs for the purpose of this study. The following section will provide an overview of the Lidcombe Program and

the reasons why this method has been chosen. Subsequently, other stuttering intervention programs will be briefly introduced.

**The Lidcombe Program (Onslow, 1996)**

The Lidcombe Program was chosen because of the following aspects which appear to be advantageously: First, published data (Jones, Onslow, Harrison & Packman, 2000) suggest that the median number of treatment sessions before the child's stuttering reaches near-zero levels is 11 (for details see below). This implicates that approximately half of the treated children who stutter improve their fluent speech production during a relatively short period of time, which allows for close but less time consuming monitoring of language abilities during treatment. Second, medium- and long-term outcome data indicate that the procedure is an effective treatment, being able to establish and generalize stuttering reductions and maintain those benefits for up to seven years post treatment (i.e., Lincoln & Onslow, 1997; Onslow, Andrews & Lincoln, 1994; Onslow, Costa, & Rue, 1990). No other treatment program is supported by such a large amount of efficacy data. Finally, at present, the authors state that the best explanation of the effectiveness of the treatment is in terms of the controlling effects of parental verbal contingencies. However, they indicate the need for further research to determine other variables which may be responsible for the beneficial treatment effects (Onslow, O'Brian, & Harrison, 1997). In this connection it is suggested to investigate effects of the Lidcombe Program on the language development of preschool-age stuttering children (Lincoln & Harrison, 1999).

The Lidcombe Program is an operant approach whose objectives are to increase stutter-free speech based upon parental verbal contingencies for fluency and occasional reminders or prompts to correct stuttering. Therapy is done by the parent in the everyday environment, in consultation with the clinician. The Lidcombe Program calls the child's attention directly to his or her fluency, [the behavior to be increased,] and occasionally to stuttering, by the clinician and the parents. However, it is ensured that the child enjoys therapy and does not feel embarrassed or ashamed of his stuttering. The treatment is divided into two phases. Stage 1 involves parent training, treatment during structured speaking sessions and treatment in unstructured speaking situations in order to facilitate

generalization of fluency. In stage 2 treatment is gradually withdrawn as fluency is maintained.

In Stage 1 parents are taught by the clinician to praise their child's stutter-free speech during a treatment session. In addition they are trained to accurately identify stutters and to rate the severity of the stuttering. These parental measures of children's stuttering in everyday situations and clinician measures of stuttering during clinic visits guide the treatment. The clinician collects the percentage of syllables stuttered (%SS) during a spontaneous speaking sample at the beginning of each session. The parents collect stuttering severity ratings (SR) by charting the severity on a perceptual scale ranging from 10 (most severe stuttering) to 1 (fluent speech) at home on a daily basis. When the clinician feels comfortable with the parent's performance, the parents start to administer at least one short treatment session at home daily, reinforcing their child's fluent speech. Reinforcement involves verbal praise, but may also contain tangible rewards that are faded when no longer needed. Over time the parents are trained to further reward the fluent speech and occasionally to correct stuttered speech in a determined ratio of praise to correction. Corrections are presented in a natural and supportive manner and the child is encouraged to continue talking afterwards. In order to correct a stutter the parent has different possibilities to react which will be chosen according to the individual client and the situation (i.e., The parent provides a correct model of the stuttered word, and goes on with the conversation; The parent comments to the child that a "bumpy word" has occurred, and asks the child to repeat the words correctly; The parent asks the child to repeat correctly the previously stuttered word, and when this occurs, asks the child to repeat the stutter-free word once or twice more. Each successful reiteration is praised.). Following, on-line treatment is introduced. The parents are trained to reinforce and correct the child's speech during natural conversation. Again, a praise to correction ratio is initially introduced. The child and the parents visit the clinic once per week for a 45 – 60 minute session during treatment. As stutter-free speech increases more treatment is done in spontaneous speaking situations outside of the clinic and there is less need for structured sessions. The medium number of such sessions before maintenance is 11 (Jones, Onslow, Harrison & Packman, 2000). This has been replicated by British

(Hayhow, Kingston, & Ledzion, 1998) and Canadian clinicians (Shenker, Conte, Gringras, Courcy, & Polomento, 2001).

When the child's stuttering reaches near-zero levels, according to stuttering rate and percentage of syllables stuttered measured by parents and clinician, and when fluency is consistent for at least 3 – 4 weeks, a maintenance program (Stage 2) is implemented. Maintenance implies the systematic and gradual fading of 30-minute clinic assessments over a period of eight to twelve months. During the maintenance stage the parents continue to correct stuttered speech in natural conversations, but the administration of treatment session at home is terminated. Progress criteria are minimal stuttering in the clinic, on audio-or videotapes of the child's speech outside the clinic, and low overall severity ratings by the parents. In case a child fails on any of these criteria, weekly visits are resumed until the child meets the maintenance criteria again.

A preliminary study by Woods, Shearsby, Onslow and Burnham (2002) using contemporary psychological instruments showed no evidence of behavioral or emotional disturbances in 8 stuttering preschool children. In the past there has been a debate if the Lidcombe Program's treatment success is based on removal of "environmental stressors" that affect speech and communication (i.e., Cook, 1996; Fry, 1996; Onslow, Andrews, & Lincoln, 1994). However, Onslow, O'Brian and Harrison (1997) argue that there is evidence from clinical trials that altering of children's environments to alleviate "environmental stressors" only provides a partial reduction of stuttering, not the near-to-zero-levels that the Lidcombe Program has demonstrated (Egolf, Shames, Johnson, & Kaspirisin-Burelli, 1972; Guitar, Schaefer, Donahue-Kilburg, & Bond, 1992). Moreover, based on reviews of the issue, there is currently not enough evidence supporting the assumption that either "environmental stressors" are responsible for early stuttering or that the manipulation of these "stressors" will reduce children's stuttering (Inhgam, 1994; Nippold & Rudzinski, 1995; Onslow, 1996). One may also speculate that the underlying mechanism of the Lidcombe Program is linked to a reduction in utterance length (MLU) and language complexity. Although the Lidcombe Program places no explicit emphasis on targeting language skills, a reduction of utterance length and/or a decrease in language complexity in order to achieve fluency may be triggered by the intervention. However, Onslow, O'Brian and Harrison (1997) state that currently the best explanation of the

effectiveness of the treatment is based on the controlling effects of parental verbal contingencies, since study findings lead support to the idea that contingent verbal stimulation of stuttering in preschool children can control the condition (Martin, Kuhl, & Haroldson, 1972; Reed & Godden, 1977).

## Indirect Treatment Approaches

Early stuttering can be treated either by direct or indirect methods. Indirect therapy concentrates on training the parents to modify some aspect of their communication to the child in order to modify those elements in the environment that are felt to increase stuttering. Indirect treatment approaches are based upon the model of Demands and Capacities (Adams, 1990). This model suggests that stuttering increases when the child's capacity for fluency is exceeded by environmental demands. These demands include a variety of potential "stressors" such as parental speaking rate, frequent interruptions, insufficient turn takings, complexity of language on input to child. This model provides the rationale for treatments developed by Starkweather, Gottwald and Halfond (1990) and others (e.g., Rustin & Cook, 1995). Indirect treatment is often the initial treatment of choice for early stuttering. In this treatment parents are taught to modify aspects of their verbal interactions with their child by modeling slower rate, fewer questions, fewer interruptions and linguistically less complex sentences.

## Direct Treatment Approaches

Direct treatment for early stuttering is often adapted from procedures developed to treat adults who stutter and is based upon techniques of stuttering modification and fluency shaping. In stuttering modification treatment the goal is to modify hard, tense and struggled moments of stuttering into slow, easy, effortless ones. The child is enabled to stutter "easily". Feelings and attitudes are also touched upon when appropriate; however in early stuttering this aspect of treatment is generally reserved for the parents.

Therapy is often characterized by loosely structured interaction and play activities. Instead of introducing programmed instructions, stuttering modification treatment is frequently performance based. The programs are not based on single steps within hierarchical organized phases, which are carefully controlled so that the child is

given specific instructions, makes a specific response and receives a specific consequence. Therefore, stuttering modification treatment focuses less on the collection of data during therapy. In general, many authors (i.e., Bloodstein, 1975; Dell, 1979; Van Riper,1973) believe that the prognosis for the young child with early stuttering to achieve fluent speech production is excellent and that fluency will be maintained by the positive experiences the child has had. As a consequence, there is little emphasis on maintenance procedures.

Advocates of speech modification therapy are Charles van Riper (1973), Carl Dell (1979), Oliver Bloodstein (1975), Edward Conture (1990), Harold Luper and Robert Mulder (1964). Van Riper emphasizes providing an environment that enhances fluency and providing support to encourage the child to ignore his stuttering. Treatments include modification of stuttering by making the stutters looser and more normal-sounding, or teaching the child to stutter in an easier, more relaxed and looser fashion. Some prefer to start with less direct procedures, such as parent counseling and incorporate direct procedures only when counseling procedures alone are unsuccessful. The individual clinical procedures of the above mentioned authors may vary, but they all share the two key components of reducing fear and modifying moments of stuttering.

In contrast, according to Guitar (1998) the essence of fluency shaping therapy is that some form of fluency is first established in the clinical setting. Treatment is behavioral, based upon programmed, criterion-based goals. The targeted speech behaviors may for example involve the change of speech rate, breathing pattern, or easy phrase initiations. The fluent speech is then reinforced, and gradually modified to approximate normal sounding conversational speech. Finally, the child's new fluency is generalized to his everyday speaking environment.

In general, little emphasis is placed on the reduction of fear and avoidance of words and speaking situations. Fluency shaping therapies include maintenance procedures or periodic rechecks. Therapy is often characterized by tightly structured interaction or programmed instruction. Therefore, the collection of objective data regarding the child's speech production is emphasized during treatment. The child has to pass a particular program step in order to move up to the next level. The steps within each phase are

carefully controlled to ensure that a child successfully progresses from one step to a slightly harder one with complete fluency.

Advocates of Fluency Shaping Therapy are Martin Adams (1980), Janis Costello (1983), Rebekah Pindzola (1987), Bruce Ryan and Barbara van Kirk Ryan (1974), George Shames and Cheri Florance (1980), and Richard Shine (1988). The treatments are programmed, criterion based interventions. Costello and Ryan first elicit short and simple responses from the child, followed by gradual increase of utterance length and complexity. Adams, Pindzola, and Shames and Florance place emphasis on the reduction of speech rate, and the production of continuous phonation which is initially facilitated by slow, prolonged speech. These clinicians use modeling or Delayed Auditory Feedback (DAF) to slow the child's utterances. Shine's treatment requires the child to first whisper, followed by introduction of slow, prolonged speech.

The individual clinical procedures of the above mentioned authors may vary, but they all involve some form of programmed instruction procedures. The child's altered speech pattern is shaped into normal-sounding fluency, then this new fluency is generalized to his or hers everyday speaking environment.

## Changes in language parameters of child or parent speech and their effect on stuttering treatment

Some theories about the etiology and development of stuttering involve "environmental stressors", some of which may be caused by the language habits from parents (for an overview, see Onslow and Packman, 1999). Currently, the most popular theory is the multifactoral model ("Demands and Capacity Model") developed by Starkweather and his colleagues (Starkweather, 1987; Starkweather and Gottwald, 1990; Starkweather, Gottwald and Halfond, 1990). This model suggests that the interaction of the child who stutters with his daily living environment determines the development and maintenance of his stuttering. An imbalance between the environmental demands for language and the child's capacity for language precipitates the fluency disorders. Therefore, the parental verbal interaction style may be involved in the development of stuttering, considering the case of the child being overtaxed by attempting to meet the linguistic demands of language production imposed by the parents. Variables of these

demands may be speech rate, and semantic and syntactic language levels. The latter tie into Logan and Conture's (1995) idea, that encoding of grammatically complex utterances requires more cognitive resources than encoding simpler utterances. In addition, the demand for social speech may be a stress factor imposed on the child.

The influence of parental speech behavior on stuttering of preschool children has received only very limited research attention. Stephenson-Opsal and Ratner (1988) investigated the effects of a reduction in maternal speech rate in the conversation to children who stutter, using different techniques such as elongating syllables and increasing pause time between words and utterances. Their results indicated, that the children reduced their stuttering frequency, however without a corresponding decrease in their speech rate. In a follow-up study Ratner (1992) used a different study design. She instructed mothers of children who had not stuttered either to talk more slowly and use short, simple sentences or only to talk more slowly. The results suggested that those mothers who had been asked to decrease their speech rate had also reduced their utterance length and complexity, while increasing their interspeaker latencies. These changes had been made even though there had been no additional instructions provided.

**A possible role of language parameters in the Lidcombe Program**

Ratner's (1992) findings give raise to the hypothesis that during stuttering treatment one given instruction may trigger various changes in maternal/parental speech parameters. The Lidcombe Program requires the parents to praise stutter-free speech and to correct stuttered speech. These instructions may influence other speech and language parameters and in turn the parent-child interaction, i.e., parents and/or children may reduce the syntactic complexity and the length of their utterances, although these areas are not explicitly targeted during the treatment. Several authors suggested a connection between reduction in length or complexity of utterances in children's speech and a decrease in stuttering (e.g., Gaines, Runyan and Meyers, 1991; Logan and Conture, 1995; Bernstein Ratner and Sih, 1987).

Another possibility may be that the Lidcombe Program alters the pragmatic characteristics of parent-child interaction. The relationship between stuttering frequency and alterations in pragmatic style is also an area that has received very limited research

attention (for reviews see Weiss, 1993; Wilkenfeld and Curlee, 1997). Many authors belief that parent's verbal interactions contribute to the emergence or persistence of children's stuttering (e.g., Kaspirin-Burrelli, Egolf, & Shames, 1972; Langlois, Hanrahan, & Inouye, 1986). This belief is based on the idea that parental verbal demands (questions or requests for verbal information) adversely affect children's fluency, because they place expectations on the child to produce the requested information within a limited time period. As a consequence, children who stutter may increase their speech rates or exhibit other changes in communication behavior in response to these temporal and informational constraints. These changes in turn may compromise or disrupt the child's fluent speech production (Starkweather, Gottwald, & Halfond, 1990). However, currently there is little empirical support for the idea that parents of children who stutter are more verbally demanding or that their verbal demands are functionally related to their children's stuttering (Wilkenfeld & Curlee, 1997).

So far, the only study investigating child and parent speech and language following the Lidcombe Program was done by Bonelli, Dixon, Bernstein Ratner and Onslow (2000). These authors analyzed the video-taped language samples of nine children, aged 2.10 to 5.4 years, who stuttered interacting with their mothers. Since the participants were children in the outcome studies by Onslow, Costa and Rue (1990) and Onslow, Andrews and Lincoln (1994) the study design was retrospective. No data of formal pre-and post-treatment language assessments of the participants were available. The authors measured dysfluency rate (percent syllables dysfluent, %SD), articulation rate, and interturn speaker latency. The three expressive language measures used to assess the children's language and conversational demands on the children were mean length of utterance (MLU) (Brown, 1973), developmental sentence scoring (DSS) (Lee, 1974) and number of different words (NDW) (Leadholm & Miller, 1992; Miller, 1981; Templin, 1957). In order to assess the conversational demand made by each mother the pre-and post-treatment samples were coded for maternal request for clarification (RQCL) and requests for information (RQIN) following Fey's (1986) conventions for coding conversational acts.

Analyzing their data the authors concluded that parental speech rate changes are not a probable mechanism for the effects of treatment with the Lidcombe Program. In

addition, the children's speech showed no consistent change of rate or pattern that may have accounted for the treatment effects. Articulation rate and interturn speaker latency data also showed no significant changes that would suggest that these variables are linked to treatment effects. Likewise, the treatment mechanism could not be explained with changes in the pragmatic area. There was no evident relationship between changes in the variables request for clarification and requests for information.

In both pre-treatment and post-treatment samples all the children's language measures fell within or above normal limits for their chronological age. The authors concluded that "the Lidcombe Program is not associated with clinically significant curtailment of language functioning in children, and it is not likely to be developmentally deleterious".

However, they also suggested that some participants did not meet developmental expectancies for mean length of utterance, developmental sentence scoring and number of different words over the period of study. The authors specified this suggestion stating that the scores for language measures obtained at the conclusion of treatment were not as high as those that might have been predicted by modeling growth from their intake measures over the time elapsed.

The authors provided two caveats on suggestion in the data. First, they stressed that the applied language measures (MLU, DSS and NDW) cannot fully capture children's language proficiency. They suggested the implementation of future studies including also standardized tests to assess receptive and expressive language at the beginning of and the discharge from treatment in order to receive more valid results.

Second, the authors stated that many of the children had pre-treatment language scores that greatly exceeded the mean expectation for their ages. The researchers speculated that the treatment may influence the language development of these preschool children by reducing expressive language demands to age-appropriate levels, this resulting in increased fluency.

Another explanation for the underlying mechanism the authors provided was based on the possible relationship between language complexity and speech dysfluencies, indicating that less complex utterances are more likely to be fluent. Bonelli and colleagues suggested that the Lidcombe Program selectively reinforces fluent speech in

children, which will consequently result in disproportionately reward of short utterance production. Therefore, children who stutter may themselves self-select short utterances when they wish to achieve stutter-free speech (Muma, 1967).

However, Bonelli and colleagues (2000) concluded that, because all of the children's language measures were within or above developmental expectancies during the period of study, the Lidcombe Program did not induce extensive curtailment of language function. None-the-less, they suggest that their findings must be interpreted with caution, because of limitations in the study design and stressed the need for further research to gather more necessary information in this area. Future studies should involve prospective research methods, more in-depth monitoring of children's and parent's language variables, standardized testing of language abilities pre-and post-treatment, and larger sample sizes.

**Rationale for the study**

Currently, it remains unanswered if language variables impact on the underlying mechanism or mechanisms responsible for the beneficial effects of the Lidcombe Program, which has been proven to be able to establish and generalize stuttering reductions and maintenance of these in young children who stutter. Therefore, the purpose of this prospective study is to further explore the relationship between fluency development and language complexity used by the child during treatment with this program. Although the parents are trained to administer verbal response contingent stimulation, the modification of the child's used language complexity and sentence length is not an explicit focus of the Lidcombe Program. However, it is predicted that results will be found indicating a reduction of utterance length and complexity in children's expressive language during treatment with the Lidcombe Program. This would lend support to the hypothesis that a reduction in mean length of utterance or complexity of children's speech promotes fluent speech production.

In the following study a single subject design in combination with close language monitoring intervals was used. This design was beneficial because it allowed for in-depth assessment of individual developmental patterns of children who stutter during treatment. Moreover, the study involved a broad variety of applied measures, which had

been selected to assure a more complete capturing of the children's linguistic proficiency. In addition, standardized test procedures were used to evaluate the children's speech and language status pre-and post-treatment. That was advantageous because it allowed for a more objective assessment of a possible relationship between language skills and treatment effects.

The findings of such a preliminary study may offer much needed additional insight into the question of whether linguistic variables in children who stutter and the production of fluent speech are related. If there is a relationship this will have an impact on further refinement of the Lidcombe Program and also on other treatment approaches for early stuttering treatment. Assessment and treatment may inadvertently put more emphasis on specific linguistic skills and language development in order to increase fluent speech. Furthermore, if the children's speech and language status at the time of treatment influences the treatment outcome, this finding may provide important information to assist clinicians with the currently pressing issue of the timing of early intervention.

## Research Question

The objective of this study is to evaluate the question whether fluency is affected by the complexity of language used by children in the Lidcombe Program:

**Is an increase in the children's speech fluency associated with decreased linguistic complexity?**

## Method

### Participants

Four male preschool children with a history of persistent stuttering participated in this study. The participants were 4.1, 5.1, 5.4, and 5.11 years old. All children came from a Canadian background with English being the first language spoken at home. Three children were in the process of acquiring French, one child was additionally exposed to Italian. All four participants were first-born children and had one younger sibling. They were selected in order of application from the waiting list of children referred to the Montreal Fluency Centre for stuttering treatment.

The subjects met the following selection criteria: (1) age between 4 years 0 month and 5 years 11 months; (2) stuttering of at least 18 months duration, to control for natural recovery; (3) no previous direct treatment for stuttering; (4) English the first language for both parents and child; (5) stuttering at a rate of 3.0% (percentage of syllables stuttered) or greater pre-treatment within the clinic during conversation with the investigator or parent; (6) no language disorder identified or suspected; (7) no history of neurological disorder / no regular medication intake.

### Participant Description

Table 1

| Participant | Age/Months | Gender | Stuttering Severity |
|---|---|---|---|
| P1 | 49 | male | severe |
| P2 | 61 | male | moderate |
| P3 | 71 | male | moderate-severe |
| P4 | 64 | male | moderate |

Stuttering severity was determined using the Iowa Scale for Rating Severity of Stuttering (Johnson, Darley & Spriesterbach, 1963).

Standardized language test results for all four participants (see Tables 2 - 5) revealed expressive and receptive language abilities within the average to high average range and language skills above average, in relation to test norms for other children their age. Tables 2 to 5 show language test scores for each participant individually.

Table 2

**P1: Speech and Language Status at the start of treatment**

| Test Procedure | Percentile Rank | Standard Score |
|---|---|---|
| Peabody Picture Vocabulary Test | 80 | 113 |
| Expressive One-Word Picture Vocabulary Test –R | > 99 | > 145 |
| Goldman Fristoe Test of Articulation-R | 28 | 112 |
| Clinical Evaluation of Language Fundamentals-P | | |
| *Receptive Language Score* | *79* | *112* |
| Linguistic Concepts | 99 | 15 |
| Basic Concepts | 98 | 12 |
| Sentence Structure | 99 | 9 |
| *Expressive Language Score* | *50* | *100* |
| Recalling Sentences in Context | 25 | 8 |
| Formulating Labels | 91 | 14 |
| Word Structure | 84 | 13 |
| ***Total Language Score*** | *77* | |

Table 3

**P2: Speech and Language Status at the start of treatment**

| Test Procedure | Percentile Rank | Standard Score |
|---|---|---|
| Peabody Picture Vocabulary Test | 45 | 98 |
| Expressive One-Word Picture Vocabulary Test-R | 66 | 106 |
| Goldman Fristoe Test of Articulation-R | 42 | 101 |
| Clinical Evaluation of Language Fundamentals-P | | |
| *Receptive Language Score* | *70* | *108* |
| Linguistic Concepts | 37 | 9 |
| Basic Concepts | 91 | 14 |
| Sentence Structure | 63 | 11 |
| *Expressive Language Score* | *75* | *110* |
| Recalling Sentences in Context | 50 | 10 |
| Formulating Labels | 91 | 14 |
| Word Structure | 63 | 11 |
| ***Total Language Score*** | *73* | |

Table 4

**P3: Speech and Language Status at the start of treatment**

| Test Procedure | Percentile Rank | Standard Score |
|---|---|---|
| Peabody Picture Vocabulary Test | 84 | 115 |
| Expressive One-Word Picture Vocabulary Test-R | 66 | 106 |
| Goldman Fristoe Test of Articulation-R | 22 | 94 |
| Clinical Evaluation of Language Fundamentals-P | | |
| *Receptive Language Score* | *42* | *97* |
| Linguistic Concepts | 45 | 10 |
| Basic Concepts | 84 | 13 |
| Sentence Structure | 50 | 10 |
| *Expressive Language Score* | *61* | *104* |
| Recalling Sentences in Context | 63 | 11 |
| Formulating Labels | 63 | 11 |
| Word Structure | 50 | 10 |
| ***Total Language Score*** | ***50*** | |

Table 5

**P4: Speech and Language Status at the start of treatment**

| Test Procedure | Percentile Rank | Standard Score |
|---|---|---|
| Peabody Picture Vocabulary Test | 72 | 109 |
| Expressive One-Word Picture Vocabulary Test-R | 87 | 117 |
| Goldman Fristoe Test of Articulation-R | >86 | 114 |
| Clinical Evaluation of Language Fundamentals-P | | |
| *Receptive Language Score* | *91* | *120* |
| Linguistic Concepts | 95 | 15 |
| Basic Concepts | 91 | 14 |
| Sentence Structure | 63 | 11 |
| *Expressive Language Score* | *75* | *110* |
| Recalling Sentences in Context | 75 | 12 |
| Formulating Labels | 75 | 12 |
| Word Structure | 63 | 11 |
| ***Total Language Score*** | ***84*** | |

**Background characteristics**

The parents completed a background history questionnaire regarding developmental and dysfluency milestones for their child, the family's cultural background, and the child's birth order. Parents also provided information about their educational background. Pre-treatment questionnaires included the Temperament Characteristics Scale and the Parent Perception Scale-R (Oyler, 1996). Parents were asked to bring a video or audiotaped language sample of their child taken at home to the first treatment session. This 10 minute sample of the child's language in out-of-clinic settings included conversation with a parent/caregiver. For those families who were unable to produce this tape because of lack of recording equipment, the pre-treatment sample was taken at the Montreal Fluency Centre.

**Study design procedures for evaluation of treatment effects**

This study applied a single subject design in which repeated measures were made for each subject during the treatment phase for comparison against the baseline. Outcomes are presented for individual subjects and where group comparisons are made they are descriptive in nature.

Language proficiency was evaluated before treatment started with several standardized tests: (1) the Clinical Evaluation of Language Fundamentals-Preschool (CELF-P) (Wiig, Secord, & Semel, 1998), (2) the Peabody Picture Vocabulary Test (PPVT) (Dunn & Dunn, 1981), (3) the Expressive One-Word Picture Vocabulary Test – Revised (EOWPVT) (Gardner, 2000), (4) the Goldman-Fristoe Test of Articulation – Revised (Goldman & Fristoe, 1999) (see Tables 2 - 5).

The children were given 12 sessions of direct treatment with the Lidcombe Program for Early Stuttering Intervention. A Speech-Language Pathologist who completed a 4-day training workshop and has treated more than 10 families using the Lidcombe Program provided all treatment. The treatment block of 12 sessions was chosen, because the median treatment time for the Lidcombe Program is 11 clinic hours to Stage II (Maintenance), (Jones, Onslow, Harrison, & Packman, 2000).

During the course of treatment, language and fluency behaviors were assessed at regular intervals. Measures were taken 2 weeks prior to the start of treatment, and at

weeks 1, 4, 8 and 12 of the treatment phase. In order to evaluate changes in the children's stuttering behavior as treatment proceeded, as well as any concomitant changes in language use, the following dependent variables were evaluated :

**Evaluation of language**

Spontaneous language samples containing a total of 100 utterances were taken at the above mentioned preset points in time: (1) no less than two weeks prior to treatment, (2) at week one of the Lidcombe Treatment (Stage 1) in the clinic, (3) at weeks 4, 8 and 12 during treatment.

The language samples taken in the clinic at the beginning of each treatment session were elicited in conversation and play with the parent within the clinic using the same familiar toys; (1) farm and zoo animals, (2) playground-set, (3) a doll house, and (4) cars.

All samples were videotaped using a Sony Digital Camcorder with a 16 bit stereo sound at 44.1 KHz sampling rate, and a remote wireless FM microphone.

**Language analysis**

Each language sample contained 100 spontaneous utterances, which were transcribed and coded orthographically, including notations for all types of speech dysfluencies, from the videotapes into a computer using the Systematic Analysis of Language Transcripts (SALT) (Miller & Chapman, 1983). Following SALT conventions, mazes were placed within parentheses to identify them as dysfluent events, but they were removed from linguistic analysis, such as mean length of utterance calculation or counts of different words.

The linguistic analysis of the spontaneous language samples included; (1) mean length of utterance, (2) total number of different words, (3) number of simple sentences (these contain a main clause only), (4) number of complex sentences (these include conjoined and embedded sentences. Embedded sentence types were defined by Rhea Paul's (1981) classification: simple infinitive clauses with equivalent subjects, full propositional complements, simple non-infinitive wh-clauses, infinitive clauses with different subjects, relative clauses, gerund clauses, unmarked infinitive clauses, wh-

infinitive clauses, double embeddings, and the clause introducer "let's"), (5) mazes, (6) morphosyntactic accuracy (occurrence correct of bound morphemes).

**Evaluation of stuttering**

Stuttering was measured as percent syllables stuttered (%SS) in the language samples. This measure of stuttering frequency records the number of unambiguous moments of stuttering (Jones, Onslow, Harrison, & Packmann, 2001). Percent syllables stuttered did not include normal dysfluencies, such as interjections, one effortless whole-word repetition, revisions and phrase-repetitions. Measures of %SS were calculated by the treating clinician and verified by a second clinician experienced in treating and measuring stuttering, who had no prior knowledge of the participants.

**Fluency analysis**

The analysis of speech dysfluencies included (1) the percentage of stuttered syllables, (2) the percentage of normal speech dysfluencies for each sample (3) types of speech dysfluencies (4) the loci of speech dysfluencies in each utterance. Speech dysfluencies characterized as stutters were defined according to Conture (2001) as follows: syllable repetition, whole-word repetition, audible and inaudible (so called "blocks") sound prolongations. Normal speech dysfluencies were characterized as interjections of sounds, one effortless whole word repetition, revisions and phrase repetitions.

**Reliability**

All language tests were administered and scored by the author. The scores of the Clinical Evaluation of Language Fundamentals-Preschool (CELF-P), the Peabody Picture Vocabulary Test (PPVT), the Expressive One-Word Picture Vocabulary Test – Revised (EOWPVT), and the Goldman-Fristoe Test of Articulation – Revised were double-checked by the author and a second clinician for accuracy.

In order to ensure consistency of coding, reliability measures were calculated on all of the fluency variables requiring identification and coding. To obtain interjudge reliability, a second experienced speech-language pathologist with expertise in the area of

fluency disorders, identified and coded the speech dysfluencies of three (15% of entire sample) randomly selected samples with 100 spontaneous utterances each. A second clinician, with expertise in the field of developmental language disorders and ample experience with the Systematic Analysis of Linguistic Transcripts System, identified and coded the morphology and syntax in three transcripts which were different from the above mentioned transcripts. The results of each of the analysis performed by the author and the second judge and of the author and the third judge were compared. Percent agreement were tallied to determine interjudge agreement (Sacket, 1978). Reliability was then calculated as a percentage on a point-by-point basis using the following formula: (number of agreements/number of agreements + number of disagreements) X 100. Any disagreements in fluency or linguistic coding were noted, the videotapes and transcripts were reviewed and these differences were resolved by consensus. The interjudge agreement for type of dysfluencies was 95.5% and for frequency of fluency was 100%. Calculation of interjudge reliability for linguistic coding revealed 93% agreement.

## Results

The purpose of the project was to investigate, whether an increase in fluent speech production during treatment with the Lidcombe Program of Early Stuttering Intervention in preschool children who stutter is related to a decrease in linguistic complexity. In this study fluency and linguistic complexity were measured at several points during intervention for each of 4 male preschoolers who stuttered by means of language samples of 100 utterances. Progress was compared to baseline levels. The following section presents a detailed description and graphic representations of the individual results for each participant.

## Participant 1

P1 presented initially with the most severe form of stuttering compared to the other three children. His primary symptoms included sound repetitions, syllable repetitions, whole-word repetitions, prolongations, blockages and an increase in pitch at the end of utterances. However, his stuttering decreased significantly over the course of the 12 weeks of intervention, showing a steep decline from 22.9% to 4.8% stuttered syllables. At the same time his Mean Length of Utterance increased from 3.35 up to 4.8 (see Figure 1). This corresponds to Brown's Late Stage - V , which is appropriate for a child his age. According to Leadholm and Miller (1992) the norm for this age group is 4.22 with a standard deviation of 1.02.

As shown in Figure 2 the number of simple sentences increased over time. P1 also demonstrated a steady increase in the number of complex sentences with only one exception. The number of complex sentences dropped in session 8, but increased clearly again in session 12.

The development of the number of different words did not present a clear trend. However, the number of different words produced did not meet the expected norms, when compared with other children his age. The child scored far below the average range (see Figure 3).

Accuracy of use for bound morphemes as coded by the SALT procedure was 100% (see appendix). The child omitted a few other morphemes, which is considered age appropriate (see appendix). As shown in Table 6 the loci of the boy's speech dysfluencies were at the beginning of syntactic units in 80.7% of cases. This involved the beginning of sentences, clauses, verb phrases, noun phrases, or prepositional phrases. Thirteen percent

of his dysfluencies were located at the middle and 6.09% at the end of the produced syntactic units (see Table 6).

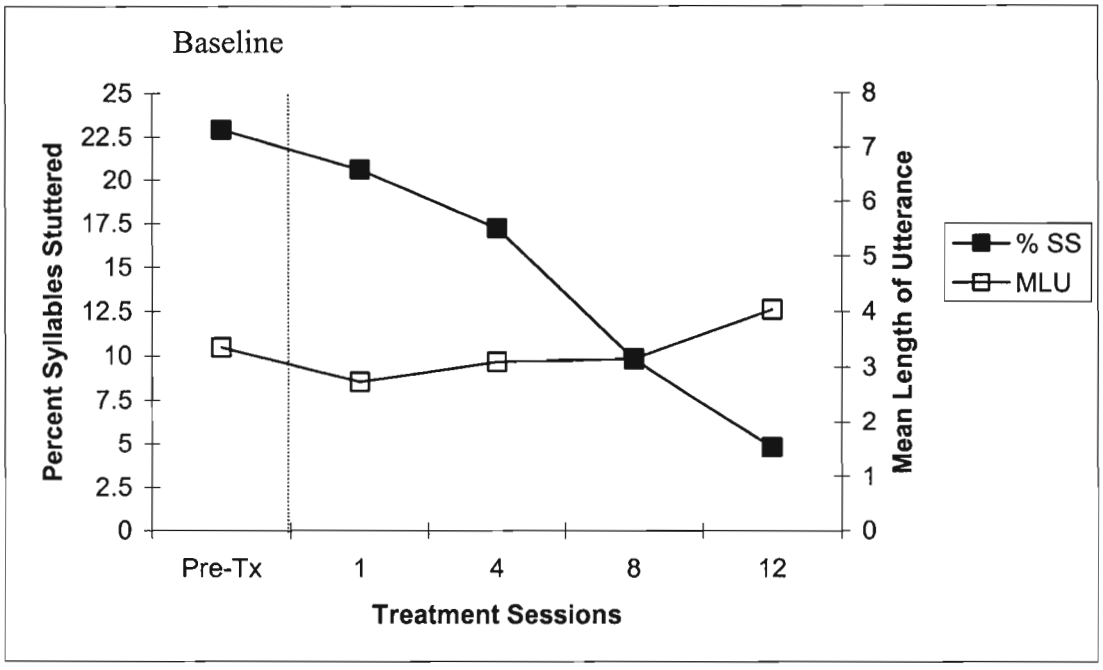


**Figure 1.** P1: Progression of MLU and Fluency

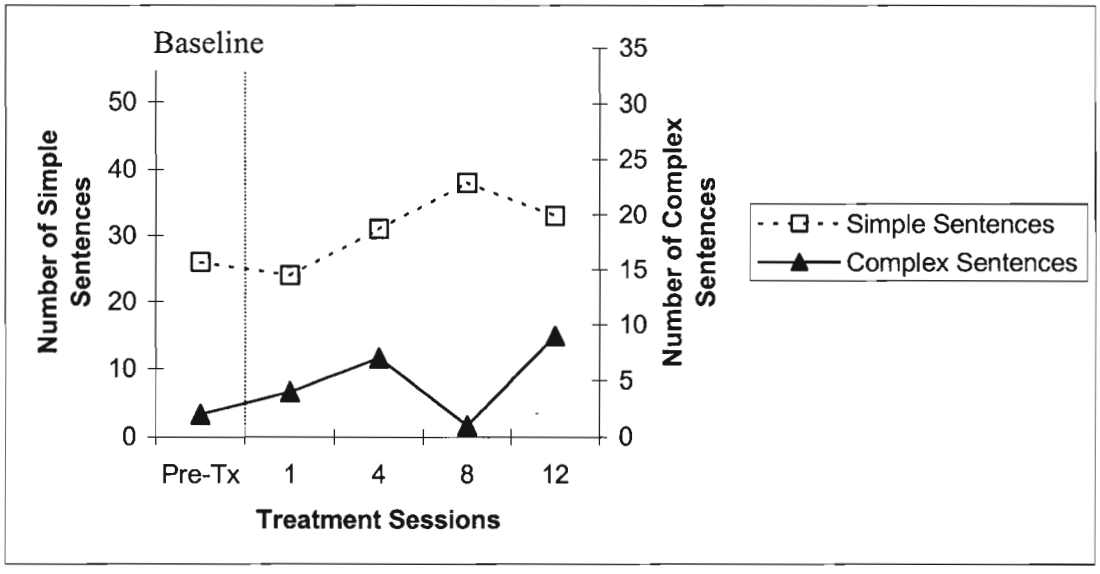


**Figure 2.** P1: Progression of Sentence Complexity

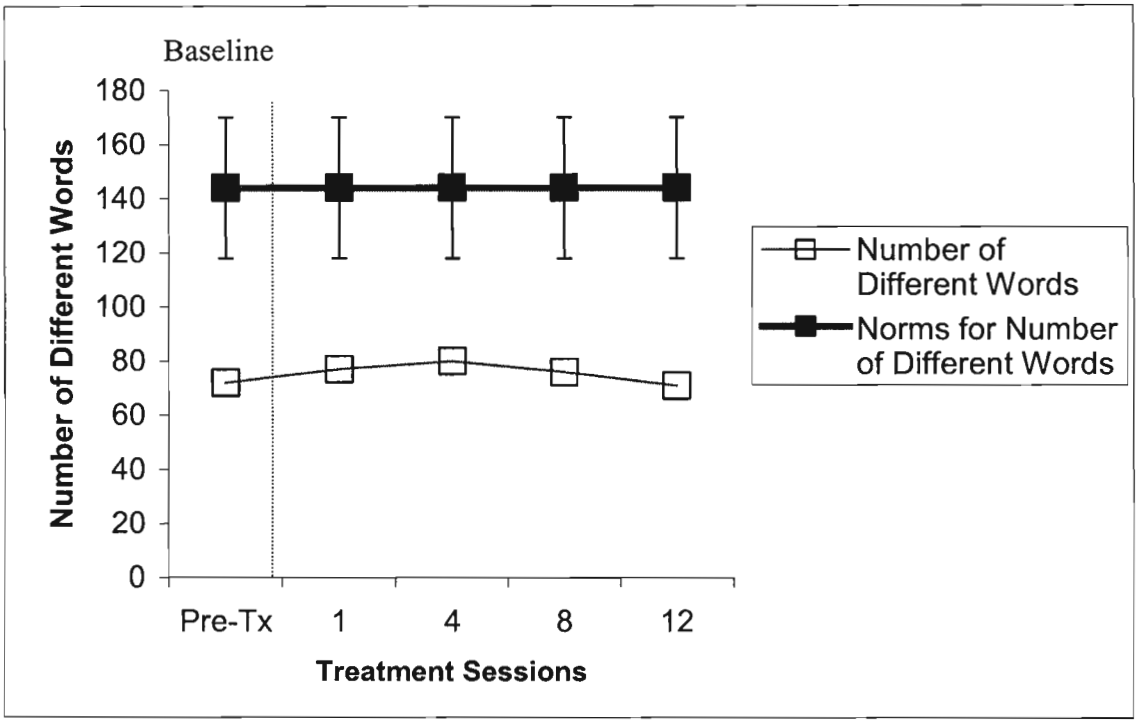


**Figure 3.** P1: Number of Different Words vs. Norms for Number of Different Words

**Table 6.**

P1: Loci of Speech Dysfluencies within syntactic units

| Session | Beginning | Middle | End |
|---|---|---|---|
| Pre-Tx | 42 | 4 | 4 |
| Session 1 | 38 | 5 | 4 |
| Session 4 | 39 | 6 | 3 |
| Session 8 | 24 | 5 | 0 |
| Session 12 | 16 | 6 | 1 |
| *Total Number* | *159* | *26* | *12* |

**Participant 2**

P2 presented initially with moderate speech dysfluencies. His stuttering was characterized by syllable repetitions, whole-word repetitions, prolongations and blockages of his speech production.

Figure 4 shows that this participant demonstrated a modest decrease in dysfluent speech from 5.9% to 4.0% stuttered syllables over time. However, he showed a clear increase of his MLU from 4.41 to 7.47. This corresponds to Brown's Stage Post V, which is age appropriate. According to Leadholm and Miller (1992) the MLU norm for the boy's age group is 5.71 with a standard deviation of 0.91, this indicating a precocious linguistic performance in this area.

In addition, the boy showed an increase of the number of both simple and complex sentences over the course of the treatment with the Lidcombe Program , as shown in Figure 5. The number of complex sentences more than doubled during the period from the first measure to session 12.

As shown in Figure 6, P2 presented with an increase in the number of different words over the course of treatment, but as for P1, he failed to meet the expected norms for his age group and scored below the average range.

P2 produced all bound morphemes with 100% accuracy and produced nearly all other morphemes correctly (see appendix). His speech dysfluencies were found at the beginning of syntactic units in 79.4% of cases. Only 17.8% of his stuttering moments were located at the middle and 2.6% at the end of his utterances (see Table 8).

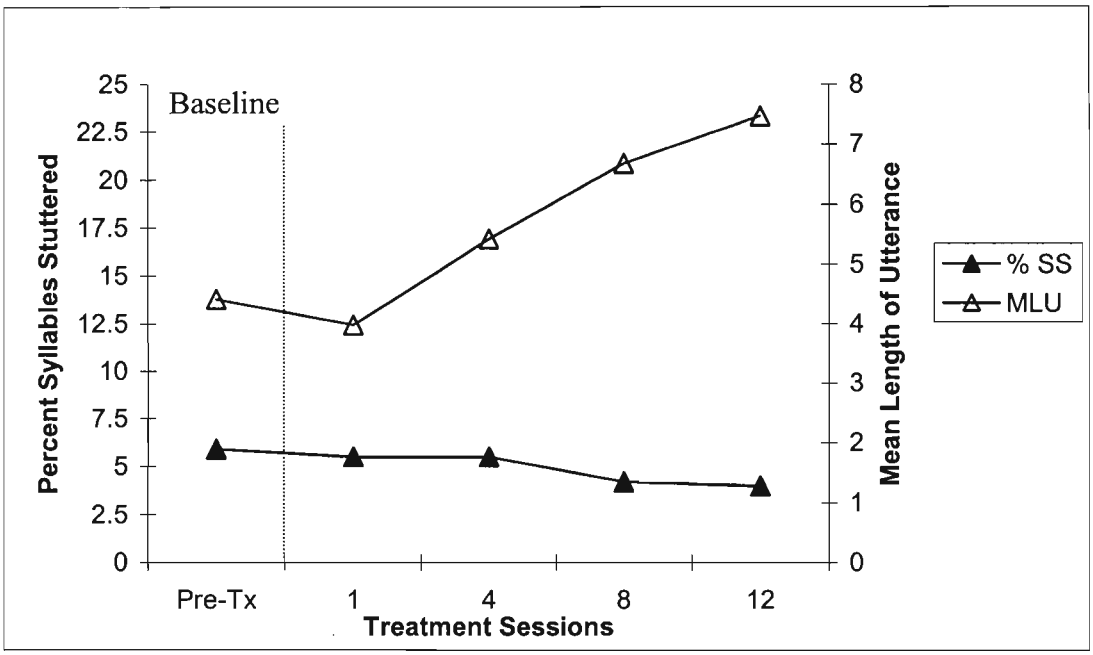


**Figure 4.** P2: Progression of MLU and Fluency

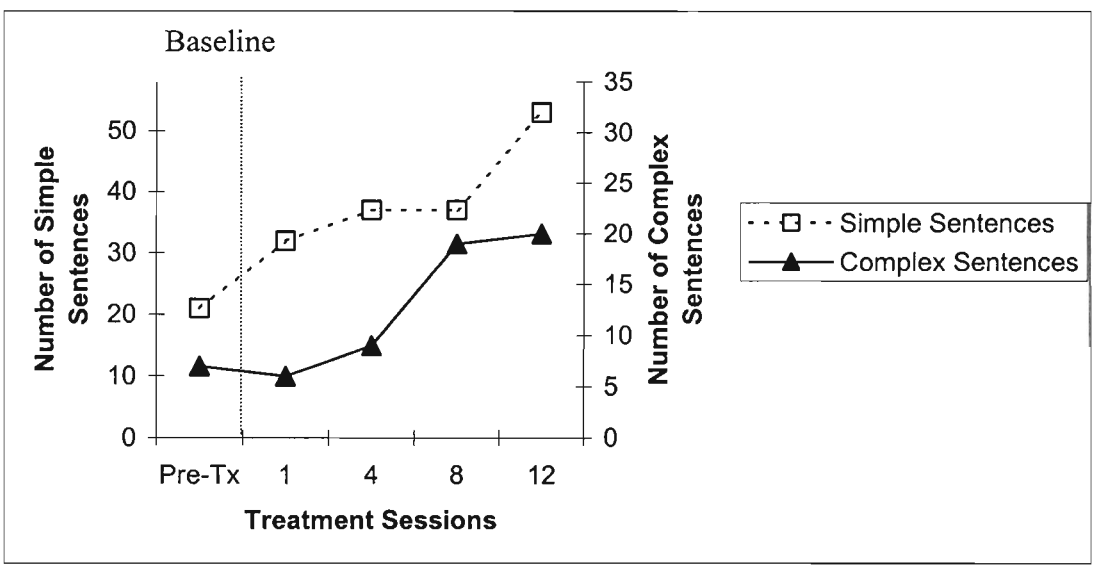


**Figure 5.** P2: Progression of Sentence Complexity

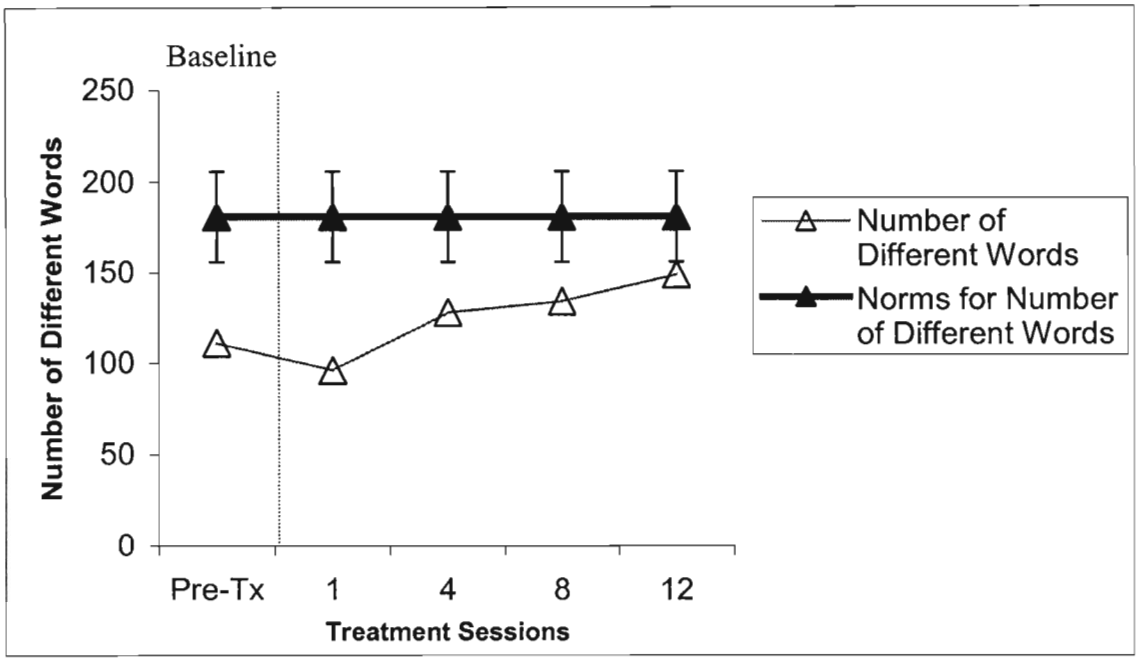


**Figure 6.** P2: Number of Different Words vs. Norms for Number of Different Words

**Table 8.**

P2: Loci of Speech Dysfluencies within the syntactic units

| Session | Beginning | Middle | End |
|---|---|---|---|
| Pre-Tx | 17 | 7 | 1 |
| Session 1 | 13 | 4 | 2 |
| Session 4 | 25 | 2 | 0 |
| Session 8 | 16 | 4 | 0 |
| Session 12 | 18 | 3 | 0 |
| *Total Number* | *89* | *20* | *3* |

**Participant 3**

P3 presented initially with moderate to severe stuttering. Stuttering was characterized by sound repetitions, syllable repetitions, whole-word repetitions and prolongations. His performance was characterized by a high variability of stuttering severity during the first 4 sessions in the clinic and at home ranging from 6% – 14% SS. Therefore, it is not certain whether the baseline measure is representative of his actual stuttering severity at that point in time. During the course of the 12 weeks the boy's fluent speech production improved from 6.5% to 3.8% stuttered syllables. This decrease in dysfluencies from first to last treatment session, although relatively small in percentage, resulted in a noticeable improvement of the child's speech production. In addition, the final rate of 3.8% SS is markedly lower than the high levels of stuttering seen in some of the first 4 sessions, and thus, represent a marked improvement, with consistently low levels of stuttering in sessions 8 and 12. His MLU showed a consistent performance level of Brown's Stage Post V with his utterance length increasing over time from 5.72 to 7.35 (see Figure 7). The MLU norm for his age group is 5.71 with a standard deviation of 0.91 (Leadholm & Miller, 1992), indicating a precocious performance in this area.

As shown in Figure 8, the number of complex sentences for P3 increased by almost three times compared to his initial sentence production. At the same time the number of his simple sentences decreased slightly, but remained fairly stable after that.

Figure 9 shows that P3 increased his number of different words slightly during the 12 week treatment. However, as for the other boys he did not meet the expected age norms and scored below the average range, when compared with other children of his age group.

P3's accuracy for bound morpheme production was 100%. He showed a few omissions of other morphemes, which was considered to be age appropriate (see appendix). The loci of his speech dysfluencies were in 88.8% of all cases at the beginning of the produced syntactic units, with 8.8% being located in the middle. P3 displayed only 2.2% of his moments of stuttering in the final position of syntactic units (see Table 9).

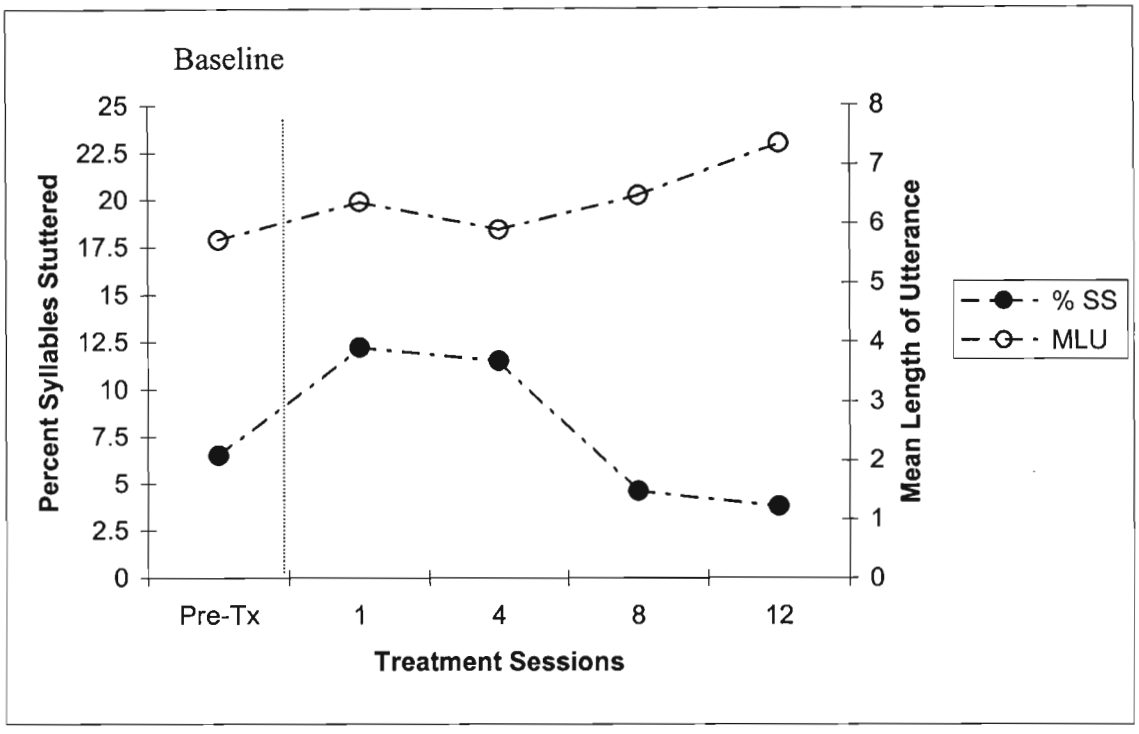


**Figure 7.** P3: Progression of MLU and Fluency

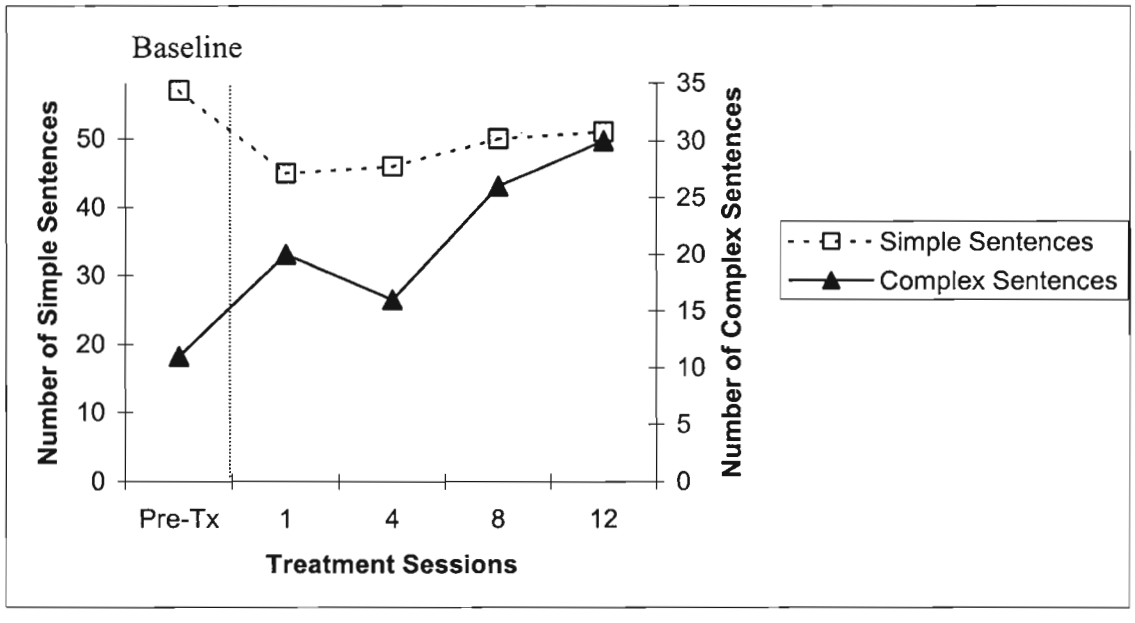


**Figure 8.** P3: Progression of Sentence Complexity

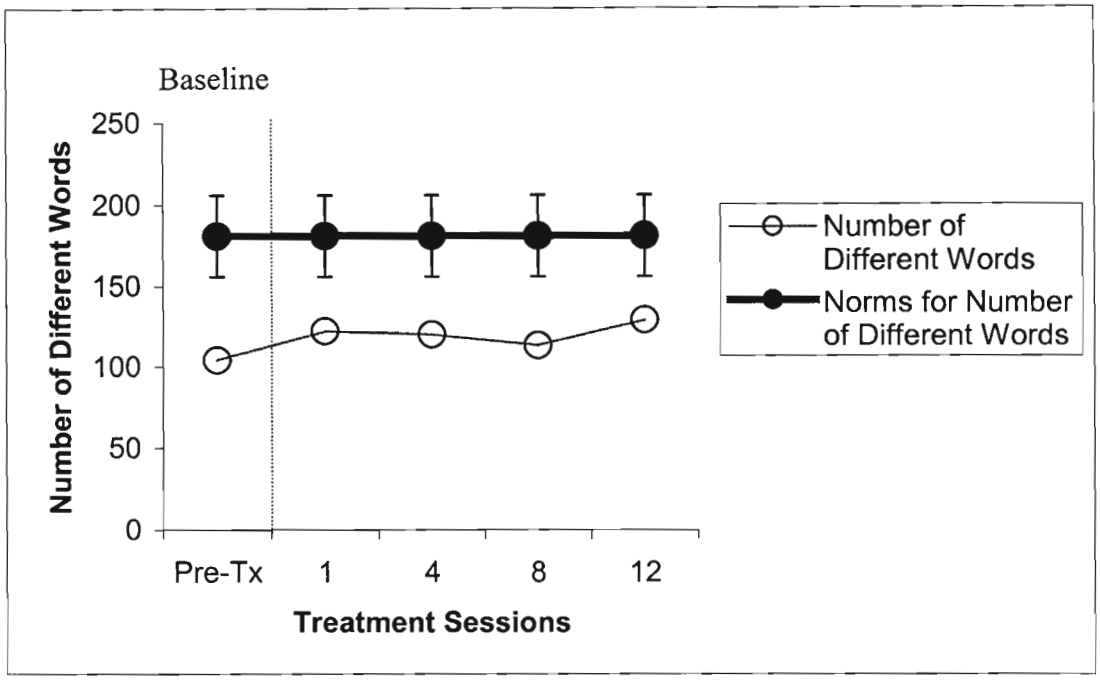


**Figure 9.** P3: Number of Different Words vs. Norms for Number of Different Words

**Table 9.**

P3: Loci of Speech Dysfluencies within the syntactic units

| Session | Beginning | Middle | End |
|---|---|---|---|
| Pre-Tx | 13 | 1 | 1 |
| Session 1 | 41 | 3 | 0 |
| Session 4 | 20 | 2 | 1 |
| Session 8 | 20 | 4 | 0 |
| Session 12 | 26 | 2 | 1 |
| *Total Number* | *120* | *12* | *3* |

**Participant 4**

P4 showed a moderate form of stuttering during the initial assessment. His stuttering symptoms included sound repetitions, syllable repetitions, and whole-word repetitions. The child presented an increase in stuttered speech production in session 4. His speech production subsequently became increasingly fluent during session 8 and session 12. Overall, his percent syllables stuttered decreased from 6.5% to 3.3 %. Although the decrease in percentage was not significant, it led to a noticeable improvement in the child's speech production. The boy's MLU showed a steady increase from 4.32 to 6.58, placing him at Brown's Stage Post V (see Figure 10). The MLU norm for his age group is 5.71 with a standard deviation of 0.91 (Leadholm & Miller, 1992), indicating precocious language abilities at this level.

As shown in Figure 11, the number of simple and complex sentences increased over time, with the number of complex sentences showing a larger increase compared to the simple sentences.

P4 showed a slight increase in the number of different words. As for the other three children, he failed to meet the expected age norms and presented with scores below the average range (see Figure 12).

The accuracy for this child's production of bound morphemes was 100% and he showed only a few omissions when producing other free-standing morphemes, which is within the normal range for his age. The boy's speech dysfluencies appeared in 95.2 % of all cases at the beginning of the produced syntactic units. Three point one percent of his stuttered moments were located at the middle and 1.6% at the end of an syntactic unit (see Table 10).

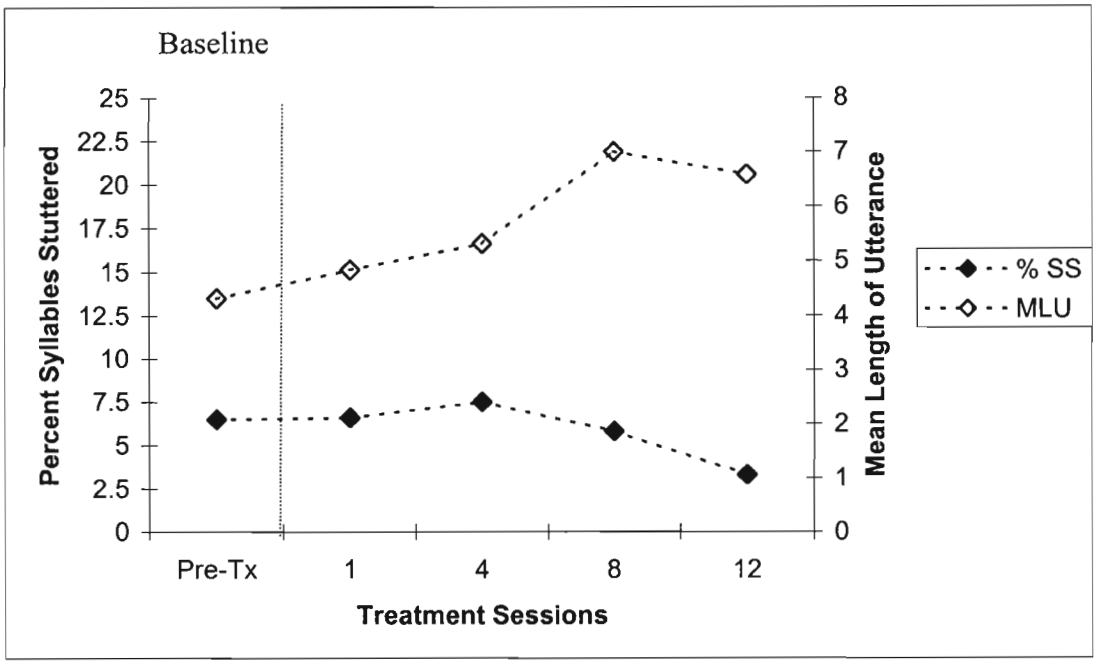


**Figure 10.** P4: Progression of MLU and Fluency

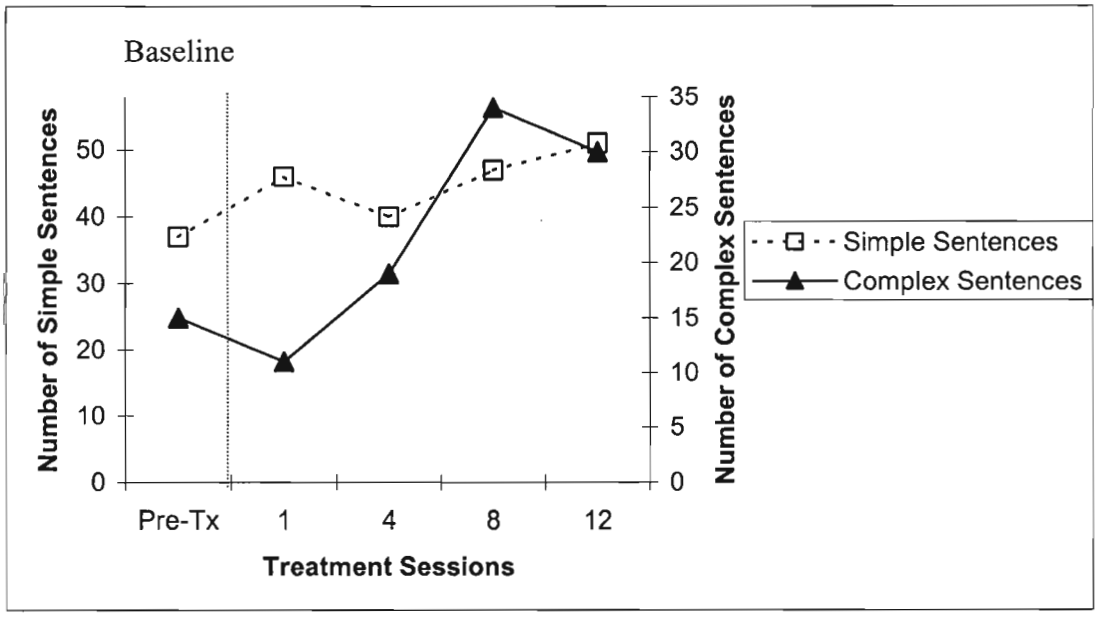


**Figure 11.** P4: Progression of Sentence Complexity

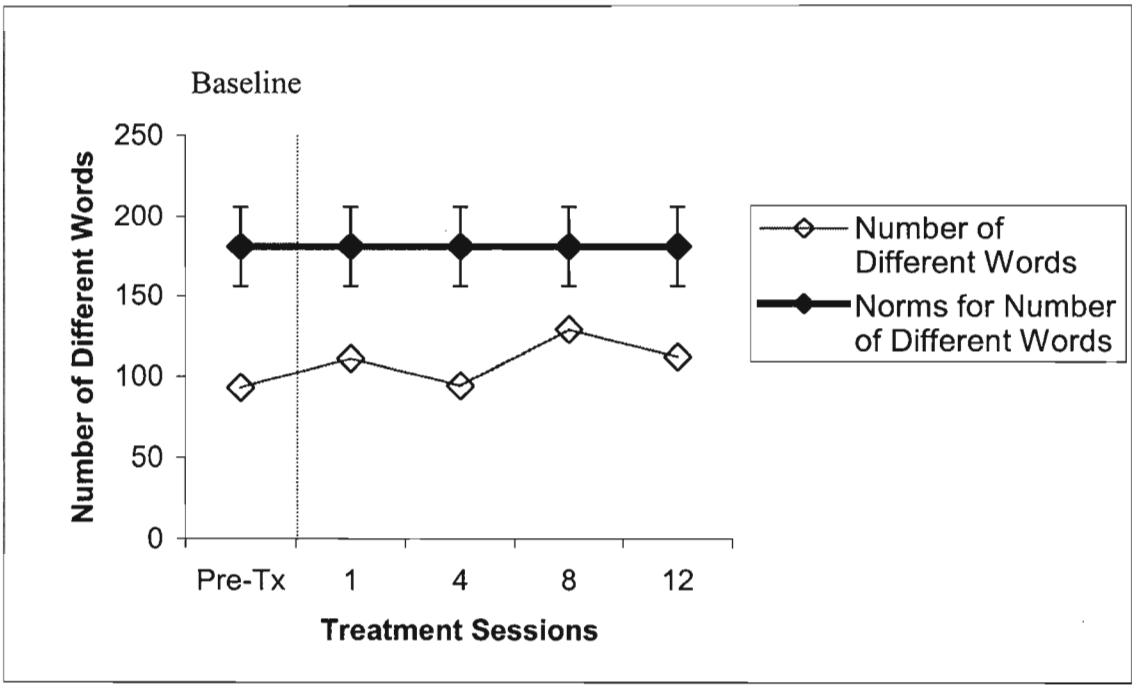


**Figure 12.** P4: Number of Different Words vs. Norms for Number of Different Words

**Table 10.**

P4: Loci of Speech Dysfluencies within the syntactic units

| Session | Beginning | Middle | End |
|---|---|---|---|
| Pre-Tx | 10 | 0 | 0 |
| Session 1 | 10 | 2 | 0 |
| Session 4 | 19 | 0 | 1 |
| Session 8 | 18 | 0 | 0 |
| Session 12 | 24 | 0 | 0 |
| *Total Number* | *60* | *2* | *1* |

## Summary

The following graphs (Figures 13 – 16) provide a summary of results for all four children together, showing separately the progression in MLU (Figure 13), the development of fluency (Figure 14), the progression of sentence complexity (Figure 15) and the loci of speech dysfluencies (Figure 16).

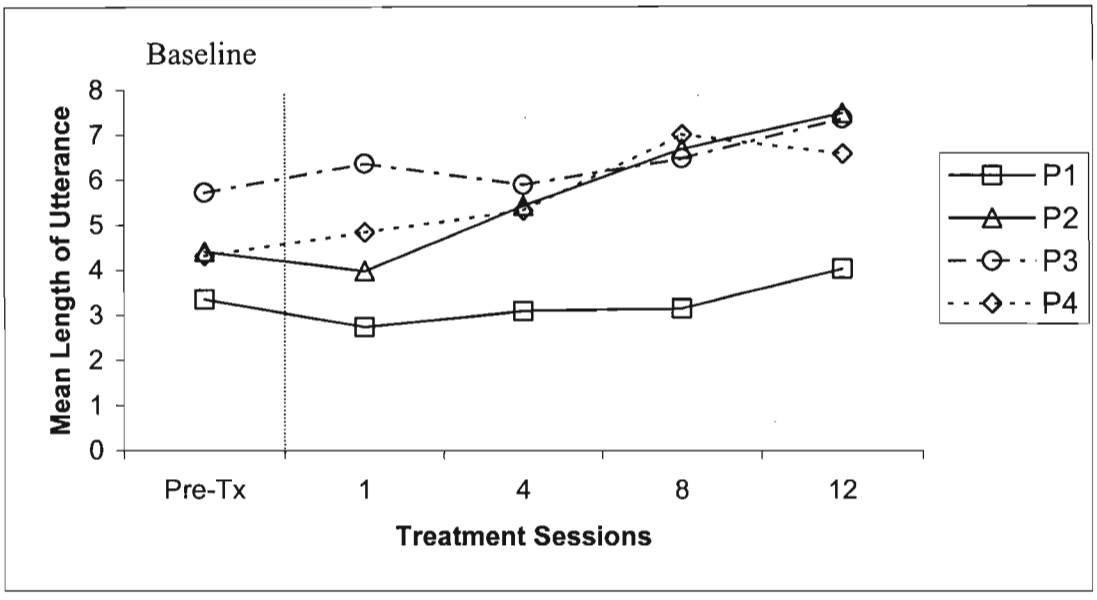


**Figure 13.** Progression of Mean Length of Utterance

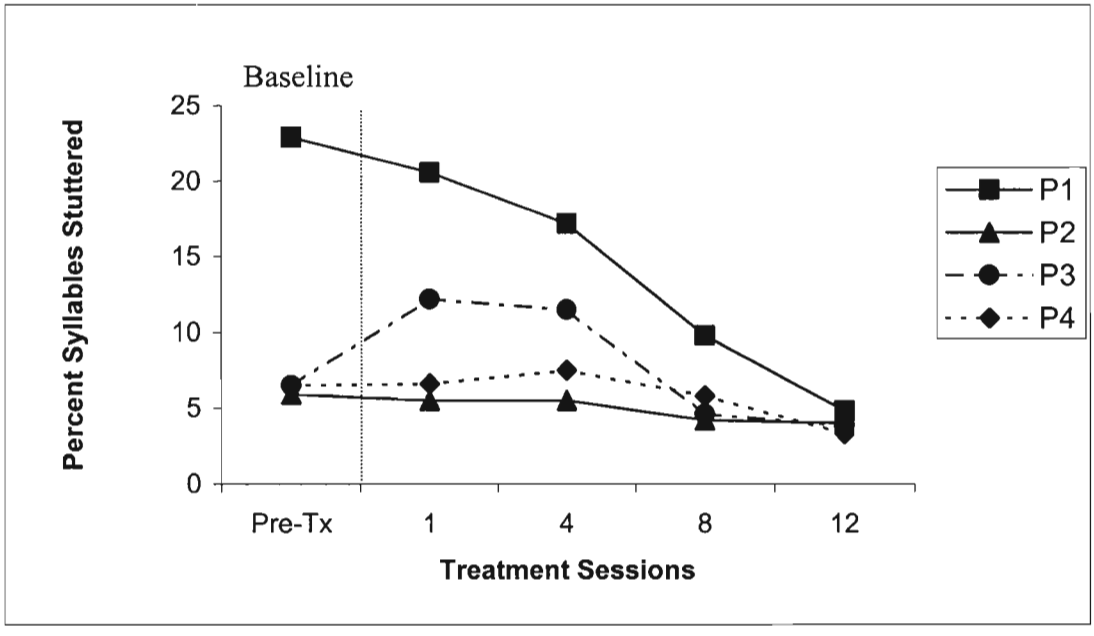


**Figure 14.** Development of Fluency

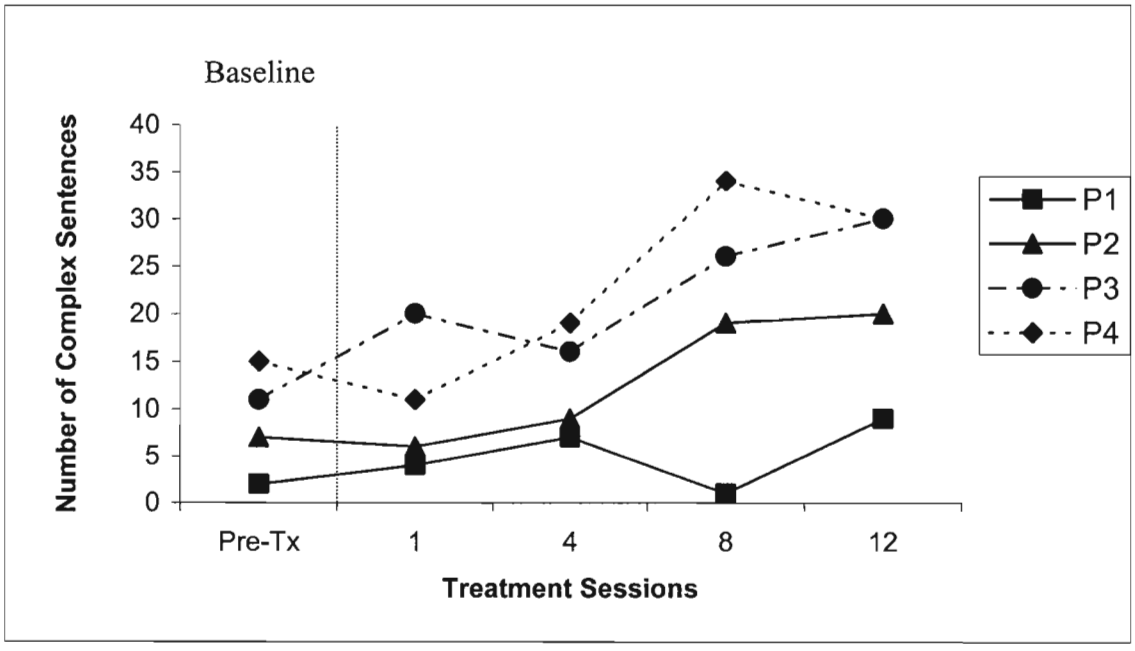


**Figure 15.** Progression of Sentence Complexity

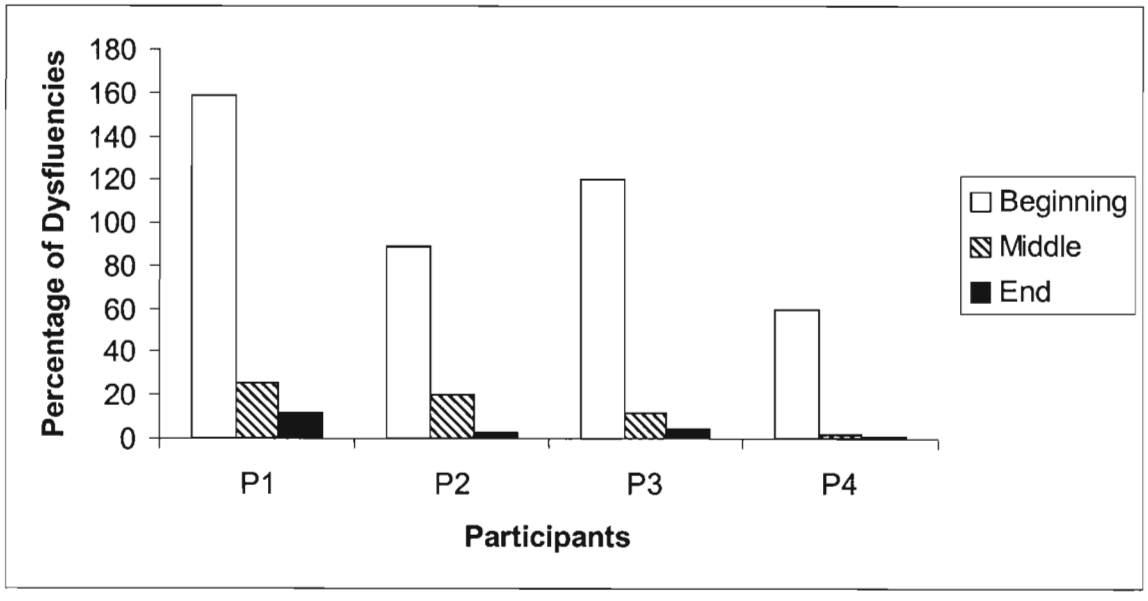


**Figure 16.** Loci of Speech Dysfluencies

## Discussion

The results of the present study provide insight into the progression of linguistic complexity in preschool children who stutter during treatment with the Lidcombe Program for Early Stuttering Intervention. This study was designed to investigate if an increase in the children's speech fluency would be associated with decreased linguistic complexity during treatment with the Lidcombe Program. If increased fluency is achieved at the cost of reduced linguistic complexity, then sentence complexity, mean length of utterance and number of different words should show a decrease as fluency increases. If, however, the improved fluent speech production is not gained by a decrease in linguistic complexity, then the level of sentence complexity, mean length of utterance and number of different words should remain stable or should display an increase over the course of treatment.

### Changes in language complexity, distribution of number of different words and localization of stuttered moments

The results of this study showed that the achievement of stutter- free speech or near-stutter-free speech was not accompanied by a decrease in linguistic complexity. On the contrary, all participants presented with an increase in mean length of utterance and also an increase in the number complex sentences. However, although initial language testing revealed receptive and expressive language abilities firmly within or above the average range, all four children presented consistently with vocabulary diversity (as measured by number of different words) in their language samples which ranged below the average test norms, when compared to other children their age. Nevertheless, the number of different words did not decrease but increased for three participants accompanied by an improvement of speech fluency. The number of different words for one boy remained nearly stable.

Stutter-free speech production increased for all participants over the course of the 12 week treatment, indicating that the Lidcombe Program is an effective treatment for early stuttering intervention. However, the gains in fluent speech production varied across the participants with P1 demonstrating a considerable decrease in stuttering and P2, P3, and P4 demonstrating smaller decreases of percent syllables stuttered. None of the

children were able to reach near-zero-levels of stuttering during the 12 weeks of the program, thereby exceeding the suggested median treatment time of 11 sessions (Jones, Onslow, Harrison & Packman, 2000). All four boys showed the highest distribution of speech dysfluencies at the beginning of their syntactic utterances, with only a few dysfluencies being located at the middle and hardly any at the final position of an syntactic utterance.

**Mean Length of Utterance/Number of Complex Sentences**

All four participants showed a substantial increase of mean length of utterance over the course of treatment with the Lidcombe Program. P1 presented with an age appropriate MLU. Moreover P2, P3 and P4 achieved MLUs during the 12 week treatment, which would have been expected in older children, thereby exceeding the expected age norms (Leadholm & Miller, 1992). Additionally, all participants increased their production of complex sentences over time. P1 produced four times more complex sentences in session 12 compared to the baseline measure, P2 produced three times more, and P3 and P4 doubled the number of their complex sentences while at the same time increasing their fluent speech production. These data clearly indicate that, at least for some children, improved stutter-free speech can be achieved without a decrease in language complexity during treatment with the Lidcombe Progam. On the contrary, treatment with the Lidcombe Program appeared to facilitate an increase in language complexity in these children. Moreover, the data suggest that some children who stutter are able to increase their fluency despite an increase in linguistic complexity. In turn, the suggestion of several authors that language complexity stresses the language operating system resulting in fluency breakdown (e.g., Bernstein, 1981; Colburn & Mysak, 1982a, 1982b; Tetnowski, 1998; Wijnen, 1990) may not account for all preschool children who stutter.

**Number of Different Words**

It is important to note that although all four participants revealed expressive vocabulary scores in the high average and above average range on standardized language tests, the analyses of all spontaneous language samples displayed that the number of their

different words ranged below, and in some cases, far below the expected norms when compared to other children their age (Miller & Leadholm, 1992 ). P1 produced between 71 and 80 different words in the five samples, using nearly 50% fewer words than expected. The norm for his age group is 144 (26) words. The number of different words in each sample for P2 ranged between 96 and 149 words, which is approximately 33 % less than the expected 181 (25) different words for his age group. P3 produced between 104 and 129 different words in the five samples, thereby ranging approximately about one third below the norms as did P2. Finally, P4 presented with a production of different words ranging from 93 to 129 words, thus scoring nearly 40% below the expected age norms of 181 (26) words. None-the-less, the numbers of different words remained stable for P1 and displayed an upward trend for P2, P3 and P4, thereby again supporting the hypothesis that the linguistic complexity does not decrease during treatment with the Lidcombe Program.

One possible explanation for this phenomenon may be that the toys and the play activities within the analyzed play-situations did not allow for a broader variety of expressive vocabulary. However, it is remarkable that all four children scored consistently below the expected age range, although they frequently chose different sets of toys from the available selection during the five measurement settings. The unfamiliarity of the new situation, the distraction caused by the videotaping and the examiner being an unknown person could have also contributed to the reduced expressive vocabulary production. Yet, all boys appeared to feel comfortable with the initially unfamiliar situation and the examiner. In turn, they did not present any signs of shyness, inhibition or withdrawal, when the language samples were taken. The parents confirmed that the videotaped samples were representative for the verbal behavior which their children demonstrated at home and during the day. (The only exception is P1's language sample taken in week 8. During this day the boy appeared to be tired and very quiet compared to the other days.)

A second hypothesis may be that the finding of reduced lexical diversity reflects underlying processes of word retrieval. One may speculate that in these children the processes of lexical retrieval were operating such that fluency was preserved or gained by relying on well established retrieval processes. These better established retrieval

processes have been reinforced through familiarization and greater use, leading to the reduced lexical diversity in the four participants. The participant's competence in the area of word retrieval has not been tested, since this linguistic component was not part of the test battery used in this study. In addition, it can be speculated that word retrieval problems may be more difficult to detect in standardized tests, which are frequently based on the retrieval of single words, but become more apparent in spontaneous speech. This hypothesis provides an interesting explanation why the number of different words was reduced in spite of well established receptive and expressive vocabulary skills. Future research should further investigate this hypothesis using test methods which allow for a sensitive analysis of the word retrieval competence of preschool children who stutter.

A third speculation involves the idea that the children presented with numbers of different words ranging below the average range because they avoided certain difficult words to achieve stutter-free speech. However, as Bloodstein (1960; 1995) reported, it is extremely rare that preschool children who stutter regard certain sounds or words as difficult. Most of them seem to have no awareness of any words or sounds as especially difficult. As a consequence, word avoidance is rarely seen in a preschool child.

A fourth hypothesis may be that the children reduced their expressive vocabulary in order to achieve a more balanced linguistic system. It may be speculated that during treatment with the Lidcombe Program, the boys produced primarily words which were familiar and more redundant than others, and, therefore, provided for easier access. A theory by Tetnowski's holds that when one or more language skill/s is/are below the level of other language components, "the production of language is then thrown out of balance as different components arrive at a central language integrator at different times and thus have a mistimed impact on the motor production of speech – which may result in stuttering" (Tetnowski, 1998). Based on this theory, the participant's highly developed expressive vocabulary might have been above the level of other language components, thereby resulting in an imbalance of the linguistic system and a breakdown of the fluent speech production. Reducing the expressive vocabulary might have been used to lower the expressive language component to the level of the other linguistic skills, and thus regaining a more balanced language system leading to improved fluency. It is suggested that a mechanism like this is used unconsciously in a preschooler, since it is unlikely that

children this age possess the necessary meta-linguistic and cognitive skills to control such a complex process voluntarily. However, this hypothesis raises the question why, if every component of the language falls within normal limits, would a child who stutters be regressed to reduce word use to a level well below these other components? Future research including more pre-treatment and treatment data will be necessary to verify this speculation.

Finally, it has to be taken into consideration that the by Leadholm and Miller (1992) established norms for the number of different words are based on relatively small sample sizes (N = 30 in the group of 4-year-old and N= 28 in the group of 5-year-old children). In addition, these norms were obtained in another geographical area, and there may have been some differences in the sampling context which may have produced differences between this study and these norms.

**Loci of stuttering moments**

The analysis of the loci of stuttering moments yielded results which indicate that there are certain regularities that govern the distribution of early stuttering. Between 79.4% and 95.2 % of all cases speech dysfluencies were found at the beginning of syntactic utterances. A high percentage of these dysfluencies were whole-word repetitions. Part-word repetitions, prolongations, blockages and pitch increases also showed a strong tendency to occur at the beginnings of syntactic units, but they appeared more often at other loci compared to whole-word repetitions. Stuttering appeared from 3.1 % to 17.8 % in the middle and from 1.6 % to 6.09 % at the end of a syntactic utterance. These results lend support to the suggestion of several authors ( e.g., Bloodstein & Grossman, 1981; Silverman, 1974) that whole-word repetitions appear to occur at the beginnings of syntactic structures. The idea underlying this suggestion is that children repeat the initial word of a syntactic unit because they feel that to attempt the unit as a whole is too difficult at the moment. Bloodstein (1995) states that one possible explanation for the fragmentation of syntactic structures may be a sense of inadequacy in the complex execution of speech as a speech motor task. By contrast, he also suggests that the underlying problem might be more closely related to grammatical uncertainty. This would be in agreement with the fact that many stutterers experience some early

difficulty with language acquisition. However, future research is required to confidently answer this question.

**An increase in fluency achieved in combination with an increase in linguistic complexity – questioning the Demands and Capacity Model**

The results of the current study raise some questions regarding the underlying rationale of the Demands and Capacity Model (Adams, 1990), which suggests that a breakdown in fluency is the result of speaking demands exceeding the speech-production capacities. This model proposes that some of the demands exceeding the child's capacity for fluency are internal factors like increasingly complex thoughts to be expressed, which, in turn, require increasingly developed use of syntactic, semantic and pragmatic skills. Other demands are external factors such as the complexity of environmental language input to child. As a result parents are taught to modify aspects of the verbal interactions with their child by modeling linguistically less complex sentences in order to decrease the linguistic demands that are thought to increase dysfluencies.

The results of this preliminary study contradict the appropriateness of this treatment advice at least for the children in this study. The data of the four children indicated that fluent speech production was clearly improved despite an increase in linguistic complexity. In addition, none of the parents had been taught to model reduced levels of language complexity during verbal interaction with the child. It would be of interest to analyze the development of parental language complexity during the treatment process in future studies.

These results suggest that reducing linguistic complexity may not be necessary for all preschool children who stutter in order to increase fluency. Many of the children who stutter may be able to increase their fluency without targeting the linguistic level of their verbal input and output during early stuttering intervention. If future research including a larger group of participants and children of both genders supports this hypothesis, this finding may have important clinical consequences. The treatment of early stuttering may not most appropriately include a focus on the parental modeling of linguistically less complex sentences to decrease the language demands that have been thought to increase dysfluencies. In turn, the conversational style in the child's daily environment will not be

artificially altered. Intervention without such a decrease in linguistic complexity is likely to lead to better functional fluency in real, everyday settings. It is likely that treatment goals, like the transfer and maintenance of the improved fluent speech production during daily interaction and communication, will be achieved easier and faster.

On the other hand, if the speculation that the four children in this study lowered their number of different words based on an attempt to avoid difficult words is correct, this would lend some support to the Demands and Capacity Model, indicating that the linguistic demands in this area were too high. However, as mentioned earlier most preschool children who stutter seem to have no awareness of any words as especially difficult. Consequently, word avoidance is a rarely observed secondary behavior in this age group.

**Variables that may have impacted on changes in the linguistic complexity**

The increase in linguistic complexity measured by means of MLU and production of complex sentences far exceeded the developmental expectancies. A developmental growth of the rate all participants showed in mean length of utterance would not be expected over the course of 12 weeks (Miller & Leadholm, 1992). Three possible explanations of causes for these increases are suggested in the following section.

**a) Familiarity with the examiner**

One possible explanation of the increase in language production may be that the children became more comfortable with the examiner and the initially unfamiliar situation over time. However, none of the boys showed extreme signs of discomfort and displayed, for example, shy or inhibited behavior, when the measurements were taken. All parents reported that their children's communication and interactions were representative of their behavior during the day. None-the-less, the children may have developed an increased level of comfort with the examiner and the situation during the five measures taken, which is reflected in an increase in their linguistic complexity.

**b) Increased comfort and confidence-level**

In addition, it is likely that the treatment with the Lidcombe Program led to an improved level of self-confidence in the four participants. The parents of P1, P3 and P4 reported that their children had presented with signs of frustration and anger, when stuttering occurred. P4 had even started to withdraw from conversations. It can be hypothesized that stuttering caused these children to reduce their linguistic complexity and their verbal output in an effort to avoid dysfluent speech production and/or to improve their fluency.

Three of the four children made considerable progress during the 12 week treatment. P1 decreased his percent syllables stuttered from 22.9 % to 4.8%, P3 from 6.5 to 3.8% and P4 from 6.5% to 3.3%. The parents reported that the children were aware and proud of the improvements in their speech production. There is a possibility that this improvement resulted in an increase in self-confidence and in an increased comfort level when the boys communicated with their environment. In turn, this may have led to increased verbal output, which is reflected in an increased MLU and a higher number of complex sentences compared to the beginning of the therapy.

This supports findings by Woods, Shearsby, Onslow and Burnham (2002), which indicated that the Lidcombe Program is not associated with negative systematic effects such as anxiety, aggression, withdrawal or depression, but on the contrary, appears to lead to an improvement in these areas. These improvements may be reflected in an increase in verbal output and linguistic complexity. Future research is necessary to further investigate the psychological impact of the Lidcombe Program on preschool children and on their social interactions.

**c) Collection of the language samples**

Analysis of the transcripts of all four participants revealed that the initial language sample taken required more prompting of verbal responses and thereby yielded more one and two-word utterances, this leading to a lower MLU compared to the other samples taken. This data suggests that familiarity with the examiner accompanied by an increase in comfort and confidence level may in part support a progressive increase in MLU as it has been proposed above. In addition, some toys may have been less attractive to the

individual kids and thereby less motivating for communicating. Finally, some of the toys may have limited the possibilities for elicitation of verbal output compared to other toys.

**Previous studies, which are supported by the current results**

The results of this study support the conclusion of Bonelli and colleagues (2000) that the Lidcombe Program does not induce curtailment of language function, but facilitates expressive language production and increase in complexity. This accounts at least for the nonfluent children who participated in the above mentioned and the current study. In addition, this study lends support to findings that preschoolers who stutter show language abilities at or above the expected norms (Rommel, Haege, Kahlene & Johannsen, 1999; Haege, 2001) (see however discussion of productive vocabulary).

**Persistence and recovery rates in relation to average and above average linguistic abilities**

In their longitudinal study a group of German researchers found that preschool children who stuttered with linguistic skills in the average or above average range, especially in the area of expressive and receptive vocabulary, had a poorer prognosis of stutter free speech when compared to children with a delay in this area (Rommel, Haege, Kahlene & Johannsen, 1999; Haege 2001). The initial language testing revealed receptive and expressive language skills within and above average for all participants of this study. Although their fluent speech production improved, none of them reached near- zero-levels during the 12 weeks of treatment. All children exceeded the suggested medium treatment time of 11 sessions (Jones, Onslow, Harrison & Packman, 2000).

There are two possible explanations why these children may be more prone to a later recovery or persistent stuttering compared to other children who stutter:

a) Stuttering in these children may be unrelated to their linguistic competence. Therefore linguistic development and maturation will not positively influence speech production as may be the case in children with a language delay.

b) Although the language skills of the four children appear to be rather precocious, one or more language areas may be below the level of other language components. As Tetnowski (1998) suggested, this may lead to an imbalance of language production

caused by different components arriving at a central language integrator at different times, which in turn, may result in stuttering. The persistence of such a dissynchrony between language components may slow down or prevent the process of recovery in these children.

Future research aimed at investigating the relationship language development and stuttering should include sub-grouping of participants. This may help to identify different developmental pathways and may support the idea that children who require a longer treatment time and show a tendency to more persistent stuttering are more likely to manifest unbalanced linguistic profiles.

**Previous findings which are not consistent with current results**

On the one hand, the results of this study appear not to be consistent with findings by several authors, which suggested that preschool children who stutter present with a lower linguistic performance level compared to their fluent peers. Some authors suggested that nonfluent preschoolers produce a lower MLU (e.g., Kline & Starkweather, 1979; Silverman & Williams, 1967). By contrast, P1 used an age appropriate mean length of utterance compared to other children his age (Leadholm & Miller, 1992). Moreover P2, P3 and P4 achieved MLUs which would have been expected in nine year-old children, thereby exceeding the expected age norms by far. Other authors presented findings which suggested that preschoolers who stutter score significantly lower on the PPVT compared to their fluent peers (e.g.., Meyers & Freeman, 1985). Westby (1979), Murray and Reed (1977) and Ryan (1992) reported scores ranging significantly below those of the fluent controls on tests of language comprehension, however, still falling within the average range in relation to test norms. The four children of this study presented with scores ranging in the high average and above average range. Findings by Ratner and Silverman (2000) indicated that the preschoolers, while ranging firmly within normal limits, were not found to be as advanced as their fluent controls, when tested with a large language battery. On the contrary, the findings of this study indicate scores falling in the average to above average range on all language tests for all participants.

It has to be considered, however, that the findings of the present study are based on a small sample size. The above mentioned studies involved larger sample sizes and, as

a consequence, reported group mean data. Therefore, it is possible that some participants of these studies did perform on a higher linguistic competence level, like the children of this study did, but these individual performances were masked by group means. The four children participating in the present study appear to form a sub-group with a different linguistic competence level compared to other non-fluent children. This observation raises the necessity of identifying sub-groups of preschoolers who stutter in future research.

**A sub-group of preschool children who stutter**

Several researchers have raised the issue of sub-groups in preschool children who stutter presenting with different developmental linguistic pathways (e.g., Häge, 2001; Ryan, 1992; Schwarz & Conture, 1988; Scott, Healey, & Norris, 1995; Yairi, Ambrose, Paden & Throneburg, 1996). The preliminary results of this study suggest the existence of such a sub-group of children who stutter, with all boys in this study displaying certain similarities in the area of their linguistic abilities. The following section provides an overview of the characteristics of the children in this study.

**Characteristics of the children in this study**

Although the initial language testing revealed receptive and expressive language abilities firmly within and above average, all four children presented consistently with numbers of different words that ranged far below the average test norms, when compared to other children their age. The latter finding appeared not to be consistent with the results of the standardized expressive and receptive vocabulary tests, which indicated well-developed skills for all children in these areas. The parents of P1, P2 and P3 reported a close relationship between the occurrence of speech dysfluencies and formulation difficulties. These connections were also observed by clinicians and by the author during therapy. It appeared that these formulation difficulties caused plateauing of the treatment success in some cases.

The above mentioned linguistic difficulties may imply the existence of a language impairment in these children. However, it has to be stressed again that the participants

performed in the average to above average range on a test battery of standardized language tests. In addition, from the author's point of view based on observation, the severity of the described formulation difficulties ranged between mild and moderate. Since language formulation skills had not been tested no definite statement can be made about the competence in this linguistic area. Yet, it appeared that formulation on a higher language level did take these three participants more effort. During therapy the children showed more difficulties using language online, when describing events or explaining ideas. The observed formulation difficulties were characterized by difficulties in sequencing, structuring ideas, organizing content, and word-finding. The children showed a tendency to stray from topic or use circumlocutions. All boys were extremely talkative and showed difficulties in conversational turn-taking. As a consequence, they disliked limiting their verbal output during initial treatment in the clinic and during initial sessions at home. Although the online production of higher level language appeared to be more effortful compared to other children their age, test results and the overall linguistic performance during therapy did not imply the notion that these boys could be considered language impaired.

**An underlying theoretical model for the fluency breakdown in the children in this study**

As Tetnowski (1998) suggested, unevenly developed linguistic skills may lead to an imbalance of language production caused by different components arriving at a central language integrator at different times, which in turn, may result in stuttering. The hypothesis stated above can also be related to findings by Anderson and Conture (2000), who examined 20 children who stuttered and suggested that their semantic development might lag behind their syntactic development. They hypothesized that this imbalance among components of the speech-language systems of children who stutter might contribute to the difficulties they have establishing fluent speech production. However, it has to be stressed that many children presenting with an unevenly balanced linguistic profile produce perfectly fluent speech. A dissynchrony between the development of individual language components may contribute to a fluency disorder, but is unlikely to be the sole cause.

The analysis of the Expressive One-Word Picture Vocabulary Test – R, the Peabody Picture Vocabulary Test, and the Clinical Evaluation of Language Fundamentals-P (see subtest Formulating Labels) results of the four children revealed that all children showed well- and above average developed expressive and receptive vocabulary skills. However three of them presented with moderate to severe formulation difficulties which became evident during therapy and where supported by observations of their parents. These children showed language formulation difficulties when confronted with tasks like story telling, expression of ideas, and describing and sequencing of daily events. As a consequence, the children presented with an unbalanced linguistic profile with one or more language skills being above the level of other language components. Their fluency breakdowns may in part be caused by less-developed formulation skills in the context of well-developed vocabulary skills.

P1 and P3 reached a plateau during treatment, but improved their fluent speech production after their formulation difficulties had been targeted. It can be speculated that their formulation skills improved during treatment, thereby reaching the level of the other well-developed language components and regaining a balance in the linguistic system.

Decreasing linguistic complexity and modelling structured, short and simple verbal output may not be key to achieving sustained fluent speech production in these children. The reduced linguistic level is likely to merely mask the underlying poor formulation skills. As a consequence this may lead to short term success during treatment or in structured situations, but transfer into more functional language and maintenance is likely to fail. In sum, it appears to be necessary to improve the poor formulation abilities in these children, resulting in increased stutter-free speech, which is likely to be maintained during daily interaction.

## Clinical implications for assessment and treatment

### Assessment of different language components

If the above mentioned theories, indicating dissynchronies between language components, are correct, this would implicate the need to examine the linguistic proficiency of each child to detect differences between the developmental level of specific language components. If children whose language skills become more balanced

will, in turn, develop fluent speech production more easily, then stuttering therapy should combine language and fluency treatment. In some cases, stuttering treatment might even be preceded by treatment of these language skills, which are below the level of the other linguistic abilities. It would be predicted that, as a consequence, these children respond more successfully and faster to stuttering treatment.

**Assessment of higher level language abilities: formulation skills**

In case the level of formulation skills and formulation difficulties has an impact on the progress of early stuttering treatment, it would be desirable to develop a standardized test procedure to detect these difficulties in preschool children. With the exception of measures of MLU, story grammar competency and level of mazing, there is no other objective way to identify the level of formulation abilities and determine, if the children are presenting with age-appropriate skills when compared to other children of their age group. Treatment of this important area is therefore frequently based on observations and parental reports, which causes difficulties in developing an adequate treatment program and in determining therapy progress.

Initial identification of formulation difficulties would influence treatment plans and the responsiveness to stuttering treatment. Early stuttering intervention for children with identified formulation problems may start by targeting these problems or may incorporate the improvement of these skills during the treatment. An overview of possible treatment goals to increase formulation abilities in these preschoolers is provided in the following section.

**Treatment**

Suggested treatment goals for preschool children who stutter and present with formulation difficulties include practising to organise ideas, and to sequence stories and daily events. In order to support formulation skills, picture description, narration and story retell should be facilitated with mapping strategies and prompted by wh-questions. Additionally, word finding abilities should be trained and access-strategies provided. Therapy should target verbal turn-taking skills, and encourage the children to take some time and think before starting to talk. Parents should be advised to provide cues and

appropriate questions to chunk the child's verbal output and prompt for an improved structure.

## Parental compliance

### Parental compliance in relation to more severe forms of stuttering

Finally, the current study raises the issue of how parental compliance impacts on a parent-conducted treatment like the Lidcombe Program for Early Stuttering Intervention. The parents of P1 and P3 demonstrated a constant participation in treatment. They attended the therapy sessions regularly, rated their children's speech fluency and practiced at home on a consistent basis. One may hypothesize that there is a direct proportional relation between the degree of the child's stuttering severity and the degree of parental motivation. P1 showed the most severe stuttering with 22.9% stuttered syllables during the initial assessment. P3 presented with moderate to severe stuttering, producing initially 6.5% stuttered syllables. However, his fluency disorder was characterized by a high variability of severity. His mother reported that the measurements taken during the first month of treatment displaying up to 12.2% stuttered syllables were more representative of his speech production during the day. P1's stuttering was significantly marked by an increase of pitch, blockages and frequent whole word repetitions. P3's fluency disorder was characterized by extremely frequent whole- and part-word repetitions. Both boys obviously struggled when trying to communicate and their symptoms had increased over time before treatment was initiated. It can be speculated then, that the parents were more highly motivated, firstly because of the severity degree of their children's fluency disorders, but secondly also because the marked characterization of the stuttering symptoms led to higher parental sensitivity for the dysfluent speech production. The distinct and severe symptoms resulted in greater awareness of their boys' stuttering, which may have supported the parental cooperation and their effectiveness during treatment. Since the Lidcombe Program requires the parents to quickly identify stutter-free speech and stuttering, and, in turn, react appropriately, increased parental sensitivity may be a supporting and facilitating prerequisite for treatment success.

**Parental compliance in relation to less severe forms of stuttering**

By contrast, P2 and P4 presented with moderate forms of stuttering. P2 produced 5.9 % stuttered syllables and P4 6.5 % stuttered syllables during the initial assessment. Their stuttering symptoms were less distinct compared to P1 and P3. Both of them presented with short moments of stuttering, frequently presenting with only two repetitions of a word or a syllable. In addition, P2 showed extremely short blockages, which were difficult to identify.

P4 had been starting to withdraw from communication before treatment began. During the course of the program he regained confidence and engaged increasingly in conversations at school and at home. Although his stuttering was still at approximately 5% ( compared to being below 1% as required for starting Stage 2) stuttered syllables at this point in time, his mother was satisfied with the progress and was not sure about continuing treatment and the daily sessions at home. From her point of view, the boy had made good progress and the stuttering was hardly noticeable at all any more. As a result, her compliance to the treatment decreased and therapy progress slowed down.

P2 presented with symptoms which were frequently difficult to detect, caused by their short duration but also by the mumbling articulation of the child. His mother was not highly concerned about the fluency disorder and had problems identifying his moments of stuttering. Although initially attending the therapy sessions on a regular base, she did not engage consistently in the treatment process, canceled appointments and did not work at home with the boy on a consistent basis. Several trouble-shooting and counseling sessions failed to increase her compliance. She frequently explained that she noticed progress in the fluent speech production of her son. During week 8 to 12 she reported that the child would not present any stuttering symptoms at all at home. Measurements and the language sample analysis revealed that his fluency was not significantly altered over the course of the 12 weeks.

In sum, when analyzing the different patterns of parental interaction and compliance, it can be speculated that a possible positive relation exists between the severity of stuttering symptoms and parental motivation to engage in the therapy process during treatment with the Lidcombe Program. An improved awareness of their child's dysfluent speech production may result in an increase of motivation, and in turn, in better

compliance and cooperation during the treatment process. This is likely to result in a faster and more successful treatment progress.

**Limitations of the current study**

There are several limitations of this study that should be considered when interpreting its results. The first is the small sample size and the fact that only male children participated, which limited the generalizibility of the results. A larger sample size would have been beneficial, because it would have allowed for examination of a broader range of participants and for statistical analyses of the data. In addition to the inclusion of female participants this would have contributed to a higher generalizibility and validity of the results. Furthermore, the four children were examined during a limited period of 12 weeks. More insight into a possible relation between an increase in fluent speech production and changes in linguistic competence might have been provided by using an extended longitudinal design up to the end and beyond treatment with the Lidcombe Program. During the 12 week period of this study none of the participants had been able to achieve nearly or completely fluent speech production. It appears to be of interest, if and what kind of changes in the linguistic performance would become apparent, when a non-fluent child achieves and maintains normal fluent speech production. Another important limitation that has to be considered is the factor, that the chosen standardized language test procedures have been limited. The areas of word retrieval and language formulation were not included in the standardized test battery. Pre-treatment data regarding the boy's linguistic competence in these areas would have been critical to better analyze the results of this study. In this context, the examination of story retell and analysis of story grammar competency may have been a useful tool to collect important data and provide more insight into these children's higher language level skills. Finally, all spontaneous language samples were elicited by one conversational partner in a clinic setting. It remains unclear whether the children would have presented with differences in language samples gathered by a familiar conversational partner at home in contrast to those gathered by an unfamiliar partner in the clinic.

**Directions for Future Research**

Continued research is necessary before more definitive statements can be made regarding the relationship between the development of fluent speech production and linguistic competence in preschool children who stutter during treatment with the Lidcombe Program.

Future research should analyze extended longitudinal data on the children's speech and language development until the completion and beyond treatment with the Lidcombe Program. This would further add to the understanding of a possible relationship between changes in fluency and linguistic competence. In this context, it appears of major importance to further analyze the issue of reduced lexical diversity in children treated with the Lidcombe Program. Future studies should incorporate standardized test procedures and story-retell tasks to examine vocabulary, word retrieval and language formulation competency of the participants. Maybe more sensitive pre-and intra-treatment measurement methods will be necessary to detect differences and/or changes in these areas. In addition, studies analyzing the linguistic complexity of the parents conducting the stuttering treatment would be beneficial to gather more insight into underlying mechanisms of the Lidcombe Program. Investigating a larger sample size, including female preschool children who stutter, may provide information on whether more sub-groups presenting with different developmental linguistic pathways exist. In this context, research should focus more on the investigation of children who stutter presenting with advanced language skills. As Cordes and Ingham (1998) pointed out there is a strong need to study how treatment for stuttering is influenced by concomitant expressive and receptive language abilities which are superior. Unfortunately, this line of research has not been pursued yet. Additionally, it appears to be of interest to investigate a group of preschool children who stutter, and who additionally present with a language delay. Currently it is unknown whether these children will present differently during treatment with the Lidcombe Program when compared to non-fluent peers, who have no identified or suspected language delay. Finally, future studies should focus on the question whether children with persistent stuttering show a more unevenly balanced language profile compared to children who have recovered. Results may provide some

insight into the relationship between individual language abilities and recovery or persistency of a fluency disorder.

## Conclusion

The goal of this thesis was to investigate whether an increase in stutter-free speech was accompanied by a decrease in linguistic complexity in four, male preschool children during treatment with the Lidcombe Program for Early Stuttering Intervention. All participants showed an increase in MLU, three of them achieved levels which far exceeded the expected norms for their age group. During the course of the 12 weeks of treatment, the four boys clearly increased the number of complex sentences. The number of different words produced remained stable in one participant and displayed slight increases in the other three. Fluent speech production improved in all children.

These findings suggest that at least for a sub-group of preschool children who stutter, improved stutter-free speech during treatment with the Lidcombe Program is not achieved at cost of a decrease in linguistic complexity. On the contrary, it appears that the Lidcombe Program facilitated an increase in linguistic complexity in the language production of these children.

Furthermore, findings of this study indicate the existence of four subjects of preschoolers who stutter presenting with a distinct linguistic profile. Analysis of the data revealed that the four participants performed in the average and above average range on a battery of standardized language tests. Additionally, these children were extremely talkative and showed difficulties in verbal turn-taking. Three of the participants presented with moderate to severe formulation difficulties at higher language levels. These findings suggest that sub-groups of children who stutter may present with different developmental language pathways and may in turn require assessment and treatment, which is tailored to improve their individual linguistic difficulties. In the case of the sub-group identified in this study it is recommended that treatment should not only focus on an increase of stutter-free speech, but also on the improvement of formulation abilities. This finding also indicates the need for the inclusion of more descriptive measures of language in future studies.

The question why the four participants presented consistently with number of different words below the average range when compared to other children their age remains unanswered. Future research is necessary to provide an explanation for this striking phenomenon.

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## Appendix

**Table 1**
**P1: Number of present morphemes**

| | Pre-Tx | Session 1 | Session 4 | Session 8 | Session 12 |
|---|---|---|---|---|---|
| ARTP | 17 | 22 | 18 | 17 | 23 |
| CAUXP | 6 | 0 | 5 | 4 | 1 |
| CCOPP | 4 | 4 | 9 | 8 | 9 |
| ONP | 4 | 2 | 0 | 0 | 3 |
| INP | 2 | 7 | 1 | 1 | 1 |
| INGP | 6 | 1 | 5 | 2 | 3 |
| RPTP | 1 | 0 | 0 | 1 | 1 |
| PLUP | 8 | 16 | 5 | 3 | 10 |
| R3SP | 2 | 1 | 4 | 4 | 4 |
| UCOPP | 0 | 1 | 0 | 0 | 0 |
| IPTP | 0 | 0 | 0 | 4 | 3 |
| I3SP | 1 | 0 | 0 | 0 | 7 |

**Table 2**
**P1: Number of absent morphemes**

| | Pre-Tx | Session 1 | Session 4 | Session 8 | Session 12 |
|---|---|---|---|---|---|
| UCAXA | 1 | 0 | 0 | 0 | 0 |
| CCOPA | 0 | 1 | 0 | 0 | 0 |
| ARTA | 0 | 0 | 0 | 2 | 0 |
| R3SA | 0 | 0 | 0 | 3 | 0 |

**Table 3**

**P2: Number of present morphemes**

| | Pre-Tx | Session 1 | Session 4 | Session 8 | Session 12 |
|---|---|---|---|---|---|
| ARTP | 17 | 19 | 24 | 17 | 46 |
| CAUXP | 2 | 2 | 1 | 7 | 10 |
| CCOPP | 7 | 10 | 20 | 21 | 10 |
| ONP | 2 | 3 | 9 | 7 | 12 |
| INP | 2 | 6 | 5 | 9 | 8 |
| INGP | 5 | 3 | 5 | 9 | 14 |
| IPTP | 4 | 15 | 13 | 15 | 26 |
| PLUP | 4 | 5 | 15 | 15 | 25 |
| R3SP | 3 | 1 | 6 | 2 | 17 |
| UCOPP | 1 | 0 | 0 | 0 | 0 |
| UAUXP | 0 | 1 | 0 | 0 | 0 |
| RPTP | 0 | 0 | 4 | 10 | 3 |
| I3SP | 0 | 1 | 1 | 0 | 4 |

**Table 4**

**P2: Number of absent morphemes**

| | Pre-Tx | Session 1 | Session 4 | Session 8 | Session 12 |
|---|---|---|---|---|---|
| UCAXA | 1 | 0 | 1 | 0 | 0 |

**Table 5**
**P3: Number of present morphemes**

| | Pre-Tx | Session 1 | Session 4 | Session 8 | Session 12 |
|---|---|---|---|---|---|
| ARTP | 38 | 43 | 24 | 42 | 44 |
| CAUXP | 5 | 6 | 13 | 7 | 10 |
| CCOPP | 15 | 20 | 21 | 17 | 26 |
| ONP | 7 | 1 | 0 | 14 | 7 |
| INP | 11 | 9 | 9 | 8 | 7 |
| INGP | 6 | 5 | 10 | 5 | 21 |
| IPTP | 4 | 3 | 5 | 12 | 4 |
| PLUP | 8 | 14 | 21 | 7 | 6 |
| R3SP | 6 | 3 | 5 | 3 | 3 |
| UAUXP | 4 | 0 | 1 | 0 | 0 |
| UCOPP | 1 | 4 | 2 | 0 | 0 |
| POSO | 0 | 1 | 0 | 1 | 1 |
| RPTP | 0 | 0 | 2 | 0 | 2 |
| IRSP | 5 | 2 | 8 | 3 | 0 |

**Table 6**
**P3: Number of absent morphemes**

| | Pre-Tx | Session 1 | Session 4 | Session 8 | Session 12 |
|---|---|---|---|---|---|
| R3SA | 2 | 0 | 0 | 0 | 0 |
| VA | 0 | 1 | 0 | 0 | 0 |
| CCOPP-WF | 0 | 1 | 0 | 0 | 0 |
| IPTA | 0 | 0 | 0 | 1 | 0 |
| I3SA | 1 | 0 | 0 | 0 | 0 |

**Table 7**
**P4: Number of present morphemes**

| | Pre-Tx | Session 1 | Session 4 | Session 8 | Session 12 |
|---|---|---|---|---|---|
| ARTP | 15 | 18 | 32 | 36 | 40 |
| CAUXP | 3 | 5 | 7 | 12 | 10 |
| CCOPP | 12 | 31 | 24 | 29 | 23 |
| ONP | 4 | 3 | 1 | 5 | 6 |
| INP | 4 | 3 | 8 | 7 | 5 |
| INGP | 6 | 5 | 15 | 14 | 9 |
| IPTP | 1 | 1 | 11 | 9 | 8 |
| PLUP | 3 | 5 | 4 | 3 | 7 |
| R3SP | 2 | 2 | 5 | 3 | 2 |
| I3SP | 1 | 1 | 0 | 0 | 3 |
| RPTP | 0 | 0 | 0 | 3 | 0 |

**Table 8**
**P4: Number of absent morphemes**

| | Pre-Tx | Session 1 | Session 4 | Session 8 | Session 12 |
|---|---|---|---|---|---|
| R3SA | 0 | 0 | 0 | 0 | 1 |
| IRPA | 0 | 0 | 0 | 0 | 1 |

**Table 9**
**Percentage of correct bound mophemes for all participants:**

| | Pre-Tx | Session 1 | Session 4 | Session 8 | Session 12 |
|---|---|---|---|---|---|
| % Bound Morphemes | 100 | 100 | 100 | 100 | 100 |

## Morpheme Analysis Code List

| | *Present* | *Absent* |
|---|---|---|
| Present Progressive | INGP | INGPA |
| Plural | PLUP | PLUA |
| Preposition In | INP | INPA |
| Preposition On | ONP | ONA |
| Possessive | POSP | POSA |
| Regular Past Tense | RPTP | RPTA |
| Irregular Past Tense | IPTP | IPTA |
| Articles | ARTP | ARTP |
| Regular 3rd Person Singular | R3SP | R3SA |
| Irregular 3rd Person Singular | I3SP | I3SA |
| Contractible Copula | CCOPP | CCOPA |
| Uncontractible Copula | UCOPP | UCCOPA |
| Contractible Auxiliary | CAUXP | UCAXA |
| Uncontractible Auxiliary | UAUXP | UAUXA |
| Verb | VP | VA |
| Uncontractible Copulala- Wrong Form | UCOPP-WF | |

McGill

Faculty of Medicine
3655 Promenade Sir William Osler
Montreal, QC H3G 1Y6

Faculté de médecine
3655, Promenade Sir William Osler
Montréal, QC, H3G 1Y6

Fax/Télécopieur: (514) 398-3595

# CERTIFICATION OF ETHICAL ACCEPTABILITY FOR RESEARCH INVOLVING HUMAN SUBJECTS

The Faculty of Medicine Institutional Review Board consisting of:

HARVEY SIGMAN, MD
GEOFFREY BLAKE, MD
VINCENT GRACCO, PHD
MARIGOLD HYDE, BSC
ABBY LIPPMAN, PHD
MICHAEL THIRLWELL, MD

has examined the research project **A08-B28-02B** entitled **"Fluency Disorders and Language Abilities: Language Development During Treatment with the Lidcombe Program"**

as proposed by: Elin Thordardottir (Applicant) to _____ (Granting Agency, if any)

and consider the experimental procedures to be acceptable on ethical grounds for research involving human subjects.

November 15, 2002
Date

Chair, IRB

Dean of Faculty

**Institutional Review Board Assurance Number: M-1458**