The Lidcombe Program (Onslow, Andrews, & Lincoln, 1994; Onslow, Costa, & Rue, 1990; Onslow, Packman, & Harrison, 2003) for treatment of stuttering in young children has received considerable clinical and research interest in recent years. The Lidcombe Program is an operant, parent-conducted method whose objectives are to increase stutter-free speech based on parental verbal contingencies for stutter-free speech and stuttering. Therapy is conducted by the parent in out-of-clinic, everyday environments, in consultation with the clinician. Parents are trained by the speech pathologist to call the child’s attention directly to his or her stutter-free speech and occasionally to stuttering. Parents learn to provide praise for stutter-free speech and to acknowledge number of different words (NDW), and percentage of syllables stuttered. Analysis revealed that all participants presented with language skills in the average and above average range. The children achieved an increase in stutter-free speech accompanied by increases in MLU, percentage of complex sentences, and NDW. For these preschool children who stutter, improved stutter-free speech during treatment with the program appeared to be achieved without a decrease in linguistic complexity. Theoretical and clinical implications are discussed.

**Key Words:** Lidcombe Program, linguistic complexity, utterance length, lexical diversity, fluency development

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The Lidcombe Program is an operant treatment for early stuttering. Outcomes indicate that the program is effective; however, the underlying mechanisms leading to a successful reduction of stuttering remain unknown. The purpose of this study was to determine whether fluency achieved with the Lidcombe Program was accompanied by concomitant reduction of utterance length and decreases in linguistic complexity. Standardized language tests were administered pretreatment to 4 male preschool children. Spontaneous language samples were taken 2 weeks prior to treatment, at Weeks 1, 4, 8, and 12 during treatment, and 6 months after the onset of treatment. Samples were analyzed for mean length of utterance (MLU), percentage of simple and complex sentences, and number of different words (NDW), and percentage of syllables stuttered. Analysis revealed that all participants presented with language skills in the average and above average range. The children achieved an increase in stutter-free speech accompanied by increases in MLU, percentage of complex sentences, and NDW. For these preschool children who stutter, improved stutter-free speech during treatment with the program appeared to be achieved without a decrease in linguistic complexity. Theoretical and clinical implications are discussed.

**Key Words:** Lidcombe Program, linguistic complexity, utterance length, lexical diversity, fluency development
operate techniques on stuttering. Andrews, Howie, Dozza, and Guitar (1982) and Onslow et al. (1997) investigated this issue, but their data produced little evidence to suggest that operant methods induce subtle changes in the acoustic characteristics of speech, thereby reducing stuttered speech. Another factor that has been suggested as a contributor to the achievement of increased fluency in operant programs is related to linguistic competence or linguistic complexity. Several authors (Bernstein, 1981; Colburn & Mysak, 1982a, 1982b; Tetnowski, 1998; Wijnen, 1990) have hypothesized that effects of utterance length and function as well as language complexity could stress the language operating system, resulting in increased stuttering. In this line of reasoning, it can be speculated that reducing language complexity as well as sentence length might result in increased fluent speech production. Thus, a treatment that reduces linguistic complexity and/or utterance length, or that approximates the linguistic demands to the linguistic abilities of the child, should increase fluency. This explanation would be consistent with the demands and capacities model (Adams, 1990), which hypothesizes that stuttering will increase when the child’s capacity for fluency is exceeded by internal and/or environmental demands. These demands include a variety of potential “stressors” such as parental speaking rate, frequent interruptions, insufficient turn taking, and the complexity of language input to the child.

The relationship among stuttering, sentence length, and grammatical language complexity has been studied by a number of researchers. Wall, Starkweather, and Cairns (1981) analyzed spontaneous speech samples of 9 boys who stuttered, age 4.0–6.6 (years;months), to investigate whether they stuttered more on complex than on simple sentences, when complex sentence types involved various types of coordinated and subordinated clauses. Results showed that there was no significant difference between the rate of stuttering on complex and simple sentences.

In contrast, several researchers have reported an increased length and grammatical complexity of utterances associated with increased stuttering (Bernstein Ratner & Sih, 1987; Logan & Conture, 1995, 1997; Weiss & Zebrowski, 1992). Bernstein Ratner and Sih (1987) showed that for imitated utterances 6 to 12 syllables in length, the positive correlation between the percentage of stuttered utterances and utterance length was statistically significant. However, it must be considered that children’s speech and language can differ substantially between imitative and conversational tasks. Therefore, the relevance of these findings for stuttering in spontaneous conversation may be questioned. This relationship between utterance length and increased stuttering in conversational speech was shown more clearly, however, by Gaines, Runyan, and Meyers (1991) and Weiss and Zebrowski (1992). These authors found that stuttered utterances were significantly longer than fluent utterances. Weiss and Zebrowski assessed conversational speech for 8 parent–child pairs to determine the relative amounts of disfluency in the child’s responses to questions versus assertions. In addition, length and complexity of the child’s utterances and the frequency of the parent’s request by level of demand were analyzed. Results showed that fluent responses to questions were significantly shorter and somewhat less complex in structure than were the children’s assertive contributions to the conversation. Logan and Conture (1995) investigated the relationship among length, grammatical complexity, and rate differences in the stuttered and fluent conversational utterances of children who stutter. Participants were 15 boys (mean age 51.2 months) who stuttered. Twenty-five stuttered and 25 fluent utterances were collected from spontaneous speech samples and measured in terms of length in syllables, grammatical complexity, and articulatory speaking rate. Utterances were categorized as “high” or “low” in length, grammatical complexity, and articulatory speaking rate relative to each participant’s median for each of these three variables. Results showed that syllabic length was significantly greater for stuttered than for fluent utterances. In addition, significantly more stuttered utterances were categorized as high in length/grammatical complexity, and significantly more fluent utterances were categorized as low in these categories. However, results did not lend support to the hypothesis that stuttered or fluent utterances differed in articulatory speaking rate. The authors suggested that encoding grammatically complex utterances may place greater demands on the child’s capacity for grammatical encoding, thereby exceeding the child’s capacity in this linguistic domain, resulting in increased stuttering.

Research by Melnick and Conture (2000) further supports the idea that increased utterance length or grammatical complexity influences the frequency of stuttering. Participants were 10 boys (mean age 50.6 months) who exhibited both a fluency and phonological disorder. The authors analyzed 25 stuttered and 25 fluent utterances from spontaneous speech samples. Each utterance’s syntactic complexity was analyzed for the number of clausal constituents (i.e., subject, verb, and object) as an assessment of grammatical complexity. Utterances were categorized as high or low in length and grammatical complexity depending on each participant’s median for each of the two variables. Length of utterance was measured by counting the number of syllables containing no within- or between-word disfluencies. Results revealed that stuttered utterances were significantly more complex and longer than nonstuttered utterances. The authors presented their results as support for the notion that stuttering is related to grammatical complexity and utterance length.

Although there are some discrepancies in the findings of the individual studies in this area, the overall trend suggests that stuttering is influenced by grammatical complexity and/or utterance length. This possible relationship has influenced clinical practice with children who stutter. Indeed, several speech-language pathologists (Kelly & Conture, 1991; Ryan, 1979; Starkweather, Gottwald, & Halfond, 1990) discuss the importance of modifying length or complexity of utterance as part of their treatment programs for young children who stutter. Many treatments for early stuttering manipulate utterance length and/or complexity in order to achieve fluent speech production. These include Ryan’s Gradual Increase
in Length and Complexity of Utterance program (Ryan, 1979), Costello’s Extended Length of Utterance program (Costello, 1983), and programs described by Culp (1984), Riley and Riley (1984), and Wall and Myers (1984).

In addition to the effects of modifying linguistic complexity, other explanations for the effectiveness of operant methods on early stuttering include alterations in the quantity of conversations produced under treatment conditions and changes in the pragmatic context of conversation that are modified by parameters of operant treatment of stuttering. There are several reasons for speculating that changes in communicative parameters between child and parent might be related to the effects of the Lidcombe Program. Some authors have suggested that environmental stressors, in the form of the parent’s linguistic patterns, may be involved in the development of early stuttering (for an overview, see Onslow & Packman, 1999). The demands and capacities model (Starkweather, 1987; Starkweather & Gottwald, 1990) suggests that stuttering increases when the child’s capacity for language is exceeded by environmental demands on expressive language. These linguistic demands include a variety of potential stressors such as increased parental speaking rate, frequent interruptions, insufficient turn taking, and the complexity of language input to the child. Some other demands exceeding the child’s capacity for fluency are related to internal factors such as increasingly complex thoughts to be expressed, which, in turn, require an increased use of syntactic, semantic, and pragmatic structure.

In addressing this model, some studies have investigated whether changes in parental speech behavior influence the stuttering of preschool children. A study by Stephenson-Opal and Bernstein Ratner (1988) found that parental reduction of speaking rate during conversation with their children resulted in a reduction in the frequency of the child’s stuttering, with no corresponding decrease in the child’s speech rate. A subsequent study by Bernstein Ratner (1992) asked mothers of normally fluent children to talk more slowly to their child or to talk more slowly and use short, simple sentences. Results demonstrated that the mothers who had been instructed only to slow down also decreased the length and complexity of their own utterances. Additionally, an increase in inter-speaker latencies was observed, although no instructions to make these changes had been given. Ratner concluded that the “simple” instruction that parents “slow down” was sufficient to cause various changes in maternal speech parameters.

Although previous studies have suggested that the Lidcombe Program is effective in significantly reducing stuttering (Jones, Onslow, Harrison, & Packman, 2000; Lincoln & Onslow, 1997), it is not clear exactly how stutter-free speech is achieved in this program, or what strategies children employ in response to parental feedback that results in greater fluency. In order to pursue the interaction between linguistic complexity and stuttering, Bonelli, Dixon, Bernstein Ratner, and Onslow (2000) investigated the effects of linguistic complexity on fluency as well as some aspects of speech characteristics of parents using the Lidcombe Program. Spontaneous language samples of 9 children were collected 1 week to 1 month before treatment onset and at 1 week to 1 month after maintenance was initiated. These samples were analyzed for mean length of utterance (MLU; Brown, 1973), developmental sentence score (DSS; Lee, 1974), and number of different words (NDW; Leadholm & Miller, 1992; Miller, 1981; Templin, 1957). Results showed that all the children’s language measures fell within or above normal limits for their chronological age at the end of treatment. However, the authors suggested that some participants did not meet developmental expectations for these measures (MLU, DSS, and NDW) over the period of the study, stating that, for these children, language scores obtained at the conclusion of treatment were lower than would have been predicted by modeling growth curves based on their intake measures over the time elapsed. This suggested that the treatment might have influenced the linguistic complexity employed by these children.

In light of these findings, the goals of the present study were twofold. The first goal of the study was to further investigate whether increased fluency achieved through treatment with the Lidcombe Program is accompanied by a concomitant reduction of utterance length and decrease in linguistic complexity. A second objective was to further investigate the efficacy of the Lidcombe method in increasing stutter-free speech. To this end, 4 preschoolers who stutter were provided treatment using the Lidcombe Program. This study goes beyond previous studies by employing a prospective single-subject design, with assessment of fluency as well as utterance length and syntactic complexity before treatment as well as at several points during treatment. This design allows a close inspection of the relationship between fluency and linguistic complexity for individual children at multiple times during the intervention.

Method

Participants

Four male preschool children with a history of stuttering persisting for more than 18 months prior to treatment participated in this study. The participants’ ages at onset of treatment were 4;1, 5;1, 5;4, and 5;11, respectively. All children were residents of Montreal, with English being the first language spoken at home. The parents completed a background history questionnaire regarding developmental and disfluency milestones for their child, the family’s cultural background, and the child’s birth order. Parents also provided information about their educational
background and were asked to bring a video- or audiotaped language sample of their child taken at home to the first treatment session. This 10-min sample of the child’s language in out-of-clinic settings included conversation with a parent or caregiver. For those families who were unable to produce this tape because of a lack of recording equipment, the pretreatment sample was taken at the Montreal Fluency Centre. There was no positive family history of chronic stuttering for any of the 4 children. All participants were firstborn 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. Three children were in the process of acquiring French; 1 child was additionally exposed to Italian. It is unclear from the literature whether stuttering is more prevalent in bilingual speakers or those who acquire a second language during early childhood. Van Borsel, Maes, and Foulon (2001) cite the early studies of Travis, Johnson, and Shover (1937) and Stern (1948), suggesting that stuttering was more prevalent among bilinguals. However, a recent study based on an ongoing Internet survey by Au-Yeung, Howell, Davis, Charles, and Sackin (2000) does not corroborate these early findings; this study shows that the percentage of bilingual speakers self-reporting stuttering is almost identical to the prevalence in monolingual speakers (for an overview, see Shenker, 2004).

The participants in our study met the following selection criteria: (a) age between 4:0 and 5:11; (b) stuttering of at least 18 months duration, to control for natural recovery; (c) no previous direct treatment for stuttering; (d) English as first language for both parents and child; (e) stuttering at a rate of 3.0% (percentage of syllables stuttered) or greater pretreatment during conversation at the clinic with the investigator or parent; (f) no language disorder identified or suspected; and (g) no history of neurological disorder and no regular medication intake. Stuttering severity was determined using the Iowa Scale for Rating Severity of Stuttering (Johnson, Darley, & Spriesterbach, 1963). Participant characteristics are outlined in Table 1. Language proficiency was evaluated before treatment by the following standardized tests: (a) the Clinical Evaluation of Language Fundamentals—Preschool (CELF–Preschool; Wiig, Secord, & Semel, 1998), (b) the Peabody Picture Vocabulary Test—III (PPVT–III; Dunn & Dunn, 1997), (c) the Expressive One-Word Picture Vocabulary Test—Revised (EOWPVT–R; Gardner, 2000), and (d) the Goldman Fristoe Test of Articulation—Revised (GFTA–R; Goldman & Fristoe, 1999). Test results for all 4 participants additionally exposed to Italian. It is unclear from the literature whether stuttering is more prevalent among bilinguals. However, a recent study based on an ongoing Internet survey by Au-Yeung, Howell, Davis, Charles, and Sackin (2000) does not corroborate these early findings; this study shows that the percentage of bilingual speakers self-reporting stuttering is almost identical to the prevalence in monolingual speakers (for an overview, see Shenker, 2004).

Table 1. Participant description.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age (months)</th>
<th>Gender</th>
<th>Stuttering severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>49</td>
<td>Male</td>
<td>Severe</td>
</tr>
<tr>
<td>P2</td>
<td>61</td>
<td>Male</td>
<td>Moderate</td>
</tr>
<tr>
<td>P3</td>
<td>71</td>
<td>Male</td>
<td>Moderate-severe</td>
</tr>
<tr>
<td>P4</td>
<td>64</td>
<td>Male</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

Procedures

Following the initial assessment, each of the children was enrolled in treatment, using the Lidcombe Program. The children were seen in the clinic weekly, with each session lasting 60 min. A speech-language pathologist who had completed a 4-day training workshop and who had extensive experience using the Lidcombe Program conducted the treatment. The study employed a single-subject design in which repeated measures of linguistic complexity and fluency were made for each participant at predetermined points during the treatment phase. Measures were taken 2 weeks prior to the start of treatment and at Weeks 1, 4, 8, and 12 of the treatment phase, as well as 6 months after the onset of treatment. Each of the assessment points included the following measures:

Language measures. Spontaneous language samples of 100 utterances were recorded at the beginning of each treatment session in conversation and play with an experienced clinician (the first author) using a standard set of toys. The language samples were transcribed and coded orthographically from the videotapes using the Systematic Analysis of Language Transcripts (SALT) computer program (Miller & Chapman, 1983). The linguistic analysis of the spontaneous language samples included MLU, NDW, and proportion of sentences that contained complex syntax. For this analysis, all sentences occurring in the transcripts were classified as either simple sentences (containing a main clause only) or complex sentences (including conjoined and/or embedded sentences), following Paul (1981): simple infinitive clauses with equivalent subjects, full propositional complements, simple noninfinitive wh-clauses, infinitive clauses with different subjects, relative clauses, gerund clauses, unmarked infinitive clauses, wh-infinitive clauses, double

Table 2. Participants’ speech and language status at treatment onset.

<table>
<thead>
<tr>
<th>Test procedure</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPVT–III</td>
<td>113</td>
<td>98</td>
<td>115</td>
<td>109</td>
</tr>
<tr>
<td>EOWPVT–R</td>
<td>&gt;145</td>
<td>106</td>
<td>106</td>
<td>117</td>
</tr>
<tr>
<td>GFTA–R</td>
<td>112</td>
<td>101</td>
<td>94</td>
<td>114</td>
</tr>
<tr>
<td>CELF–Preschool</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receptive language score</td>
<td>112</td>
<td>108</td>
<td>106</td>
<td>120</td>
</tr>
<tr>
<td>Linguistic Concepts</td>
<td>15</td>
<td>9</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Basic Concepts</td>
<td>12</td>
<td>14</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>Sentence Structure</td>
<td>9</td>
<td>11</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Expressive language score</td>
<td>92</td>
<td>110</td>
<td>110</td>
<td>110</td>
</tr>
<tr>
<td>Recalling Sentences</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>Formulating Labels</td>
<td>14</td>
<td>14</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>Word Structure 3</td>
<td>3</td>
<td>11</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Total language score</td>
<td>102</td>
<td>109</td>
<td>105</td>
<td>115</td>
</tr>
</tbody>
</table>

embeddings, and the clause introducer “let’s.” Thus, the language use of the children was examined both in terms of utterance length and in terms of syntactic complexity. In addition, NDW provides an indication of the vocabulary diversity employed in the samples.

Fluency measures. Stuttering was measured as percentage of syllables stuttered in the same language samples that were used for the linguistic analyses. This measure of stuttering frequency records the number of unambiguous moments of stuttering (Jones, Onslow, Harrison, & Packman, 2001). Percentage of syllables stuttered did not include normal disfluencies, such as interjections, one effortless whole-word repetition, revisions, and phrase repetitions. Measures of percentage of syllables stuttered were calculated by the treating clinician and verified by a second clinician who was experienced in treating and measuring stuttering and who had no prior knowledge of the participants. Further analyses assessed types of speech disfluencies (Conture, 2001): syllable repetition, whole-word repetition, and audible and inaudible (so-called “blocks”) sound prolongations.

Reliability. All language tests were administered and scored by the first author. The scores of the CELF–Preschool, PPVT–III, EOWPVT–R, and GFTA–R were verified for accuracy by the author and a second, experienced clinician.

In order to ensure consistency of coding, reliability measures were obtained for all of the fluency variables requiring identification and coding. To obtain interjudge reliability, three randomly selected samples (15% of the samples employed) were rescored by independent scorers. An experienced speech-language pathologist with expertise in the area of fluency disorders identified and coded the speech disfluencies. Another clinician with expertise in the field of developmental language disorders and ample experience with the SALT analysis rescored the samples for morphology and syntax. Percentage of agreement between the original and the rechecked analyses was tallied to determine interjudge agreement (Sackett, 1978). Reliability was calculated as a percentage on a point-by-point basis using the following formula: (number of agreements/number of agreements + number of disagreements) × 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 disfluencies was 95.5% and for frequency of stuttering was 100%. Calculation of interjudge reliability for linguistic coding revealed 93% agreement.

Results

Results for MLU and fluency are provided separately for each child, showing progress on two key variables over time, starting with the pretreatment measure (2 weeks before treatment) and including the four measurements taken during treatment (Weeks 1, 4, 8, and 12) and the measure taken at 6 months after treatment onset (Figures 1–4). Figure 5 depicts the level of syntactic complexity of the language samples (percentage of sentences that contain complex syntax) at each measurement time for each of the children, and Figure 6 displays the NDW for each child at each measurement time. Each of these variables is discussed below.

Fluency Level and MLU

As is evident from Figures 1–4, the participating children presented with somewhat different levels of severity of stuttering at the beginning of the study. Participant 1 (P1) presented with the most severe stuttering. His stuttering was characterized by sound, syllable, and whole-word repetitions, prolongations, blockages, and pitch rises at the end of utterances. Participants 2 and 3 (P2 and P3) presented initially with moderate stuttering. Their speech disfluencies were similarly characterized by syllable and whole-word repetitions,
prolongations, and blockages of speech production. P3’s performance was additionally characterized by considerable variability of stuttering severity during the first four sessions in the clinic ranging from 6% to 14% syllables stuttered. His mother reported that this variability was representative of his fluency over the 18 months preceding the intervention. Participant 4 (P4) showed moderate stuttering during the initial assessment. His stuttering symptoms included sound, syllable, and whole-word repetitions.

Overall, each of the children achieved an improvement in stuttering severity over the course of the 12-week treatment as demonstrated by a decrease in percentage of syllables stuttered. For 3 of the children (P1, P2, and P3), the gains in fluency were maintained at the 6-month measurement point; P4’s level of stuttering had decreased by the 12-week point, but he did not complete the treatment, because the child’s mother terminated treatment prematurely, against the clinician’s advice. As the children’s stutter-free speech increased over the course of treatment, their MLU increased as well. Thus, there was no indication that the children achieved stutter-free speech by shortening their utterances.

Compared to the normative reference database for MLU in conversational language samples of Leadholm and Miller (1992), each of these children’s MLU was within the normal range for their age. The MLU for P1’s age group was 4.22 (SD = 1.02). For the other 3 participants, the MLU was 5.71 (SD = 0.91), which places the performance range of each of these participants in the high normal range for their age.

**Syntactic Complexity**

The fact that MLU did not decrease as the children’s stutter-free speech increased suggests that fluency was not
achieved by means of simplification of linguistic complexity. However, although longer utterances tend to be more complex, this is not always the case. Therefore, syntactic complexity was analyzed. Results are shown in Figure 5 in terms of the proportion of sentences in each child’s language sample that contain complex sentences. As this figure reveals, the proportion of sentences containing complex syntax consistently increased over the course of treatment for P1, P2, and P3. For P4, an increase was seen up to Session 8 with a subsequent decline at Week 12. However, the level of syntactic complexity for this participant at the 6-month point is slightly higher than at pretreatment. Thus, the trend across participants is generally in the direction of increased syntactic complexity, and none of the participants evidenced a decrease in syntactic complexity over time. These results, therefore, offer no support for the hypothesis that syntactic simplification was among the factors that contributed to the increased fluency of these children.

**NDW**

The NDW used in each of the samples offers a measure of vocabulary diversity. Results for this measure for each of the children are displayed in Figure 6. As this figure reveals, NDW tended to change little over the course of the study, showing only very slight increases over time for P1 and P3, and somewhat fluctuating levels for P4. In contrast, a clear increase in NDW is seen over time for P2. As discussed above, a comparison with normative data was of less interest in this study than within-child comparisons of the different variables. However, comparison of the NDW data with the language sample norms of Leadholm and Miller (1992) reveals that each of the 4 children’s NDW levels were below age expectations at all points during the study. This result stands in sharp contrast to the children’s MLU levels. P1’s NDW was between 71 and 93 in the five samples, which was approximately 56% of the expected mean for the age group (144, SD = 26). The NDW in P2’s samples ranged between 96 and 149 words up to Session 12, which was approximately 68% of the expected mean (181, SD = 25) for his age group. However, his NDW was 178 words at 6 months after treatment onset, thereby nearly meeting the expected norm. P3 produced an NDW between 104 and 139 words in the five samples, which was approximately 67% of the expected mean (181, SD = 25), when compared with other children of this age group. Finally, P4 presented with a production of different words ranging from 93 to 129 words, which was nearly 61% of the expected age norm of 181 (SD = 25) words.

**Discussion**

The purpose of the present study was to investigate whether an increase in stutter-free speech production is accompanied by a decrease in language complexity during treatment with the Lidcombe Program of Early Stuttering Intervention. The results showed that the achievement of stutter-free speech or near-stutter-free speech was not accompanied by a decrease in linguistic complexity. Conversely, all participants presented with an increase in MLU as well as an increase in the proportion of complex sentences. Initial language testing revealed receptive and expressive language abilities firmly within or above the average range; however, all 4 children presented consistently with vocabulary diversity (as measured by NDW) in their language samples that ranged significantly below average for their age. While NDW showed little change for most of the participants, a trend toward a slight increase for all participants over time was noted as fluency concurrently increased. Stutter-free speech increased for all participants over the 12 weeks of treatment and was maintained for 3 children at 6 months after initiation of treatment, indicating that the Lidcombe Program is an effective treatment for early stuttering intervention. P4’s mother discontinued verbal contingencies after 12 weeks, satisfied with the treatment success. The measurement 6 months after treatment onset revealed that his percentage of syllables stuttered had increased again compared with his performance in the 12th week of treatment, suggesting the importance of completing the treatment process. Data reported in this study confirm anecdotal observations suggesting that withdrawing parental verbal contingencies before Stage 2 (Maintenance) of the Lidcombe Program may result in an increase in stuttering. P1 reached Stage 2 in 23 weeks, P2 in 14 weeks, and P3 in 15 weeks. These children are currently being followed in Stage 2. Treatment will be terminated when the children have maintained the program criteria for Stage 2 (<1.0% syllables stuttered and stuttering severity between 1 and 2) for 12 months. None of the children reached Stage 2 criteria during the first 12 weeks of the program, all exceeding the reported median treatment time of 11 sessions (Jones et al., 2000).

The suggestion of several authors that linguistic complexity and sentence length stress the language operating system resulting in fluency breakdown (Bernstein, 1981; Colburn & Mysak, 1982a, 1982b; Tetnowski, 1998; Wijnen, 1990) was not supported by this study. All participants showed a substantial increase in MLU over the course of treatment. Moreover, all the children increased their production of complex sentences over time: P2 doubled, and P1 and P3 nearly tripled the proportion of complex sentences within their language samples, while at the same time all increased their fluent speech production. P4 had doubled the percentage of complex sentences by Session 12. However, after terminating treatment he presented with a relatively small increase in this area. These data clearly show that these children increased stutter-free speech without a decrease in language complexity during treatment with the Lidcombe Program. Moreover, the data suggest that the children who continued in treatment were able to maintain their fluency despite an increase in linguistic complexity 6 months after initiation of treatment. Bonelli et al. (2000), who predicted language outcomes using intake values of each child and treatment time and then compared observed versus predicted values, suggested that 4 out of their 9 children may have reset their expressive language attempts to be more congruent with
their overall language abilities until they were able to be more fluent. They speculated that stutter-free speech production in these children was facilitated by reductions in expressive language to age-appropriate levels during treatment with the Lidcombe Program. Results of the current study do not support this hypothesis. The children in this study all showed an increase in linguistic complexity and utterance length over the course of treatment. Further, Bonelli et al. suggested that the pretreatment language levels of some of their participants exceeded age norms, but subsequently moved closer to the normal range. In the present study, both the standardized language tests administered before treatment and the MLU levels recorded during treatment suggest that the participants performed within or above the normal range for their age and that their linguistic performance did not decrease as fluency improved.

An interesting and surprising result in this context is the finding that while all 4 participants’ expressive vocabulary scores were in the high average and above average range on standardized language tests (PPVT–III and EOWPVT–R), the NDW used within the language samples ranged below, and in some cases far below, the expected norms when compared with other children their age (Leadholm & Miller, 1992). However, over the course of treatment, NDW showed an upward trend for all children, thereby again supporting the hypothesis that the linguistic complexity did not decrease during treatment with the Lidcombe Program.

In this context, the findings of Watkins and Yairi (1997), who compared language production abilities of children whose stuttering persisted or recovered, are of interest. They found that several children in the persistent group displayed an unexpected pattern of decline or limited change in the areas of language production (NDW, number of total words, and MLU) across a 1-year period. These plateaus or declines occurred during a developmental period when typical language learners continue to show steady growth in language production capabilities (Leadholm & Miller, 1992). The authors stated that considering the available literature on NDW (as well as MLU and number of total words), such decline or limited change is notably aberrant. They suggested that some of the children with these patterns might ultimately shift to below average range performance on measures of language production. Another research group (Watson et al., 1991, 1994) has identified a cluster of discourse and language problems in subsets of adults who stutter and suggested that subtle language deficits can concomitantly occur with stuttering in adults. In this context, Watkins and Yairi concluded that this profile may become a component of persistent adult stuttering. They stressed the need for longitudinal tracking and detailed syntactic analysis to identify possible patterns of change in language production over time in subgroups of children who stutter.

One explanation for the low vocabulary diversity, based on the Child Talk model of language acquisition (Chapman et al., 1992), may be that the finding of reduced lexical diversity reflects underlying processes of word retrieval. The Child Talk model assumes an interactive relation between motor speech processes and language formulation. The model suggests that simultaneous, parallel interactive systems of syntactic, phonological, semantic, and phonetic processes exist. In addition, motor programs and systems of rhythm or temporal programs are simultaneously activated. It is assumed that the development of increased automaticity in language formulation as well as in speech motor control allows for continued interactive development of complex motor speech and linguistic processes (Strand, 1992). Therefore, growth in speech motor and linguistic performance is facilitated by gradual increases in automatic processing. It must be stressed that critical to this issue of increased automaticity in processing is the assumption that motor programming develops interactively with language formulation. It may be speculated that for the children in this study, the processes of lexical retrieval were operating such that fluency was preserved or gained by relying on well-established retrieval processes, that is, retrieval processes that showed a higher level of automaticity. These better established or more automatized retrieval processes may have been reinforced through familiarization and greater use, leading to the reduced lexical diversity in the spontaneous samples of the 4 participants. The participants’ competence in the area of word retrieval was not part of the test battery used in this study. This hypothesis suggests an explanation as to why the NDW deployed in the language samples might be reduced despite well-established receptive and expressive vocabulary knowledge as demonstrated by scores on standardized vocabulary tests. Future research should further investigate this hypothesis using test methods that allow for a more sensitive analysis of the linguistic skills, in particular word retrieval competence of preschool children who stutter. In addition, it would be of interest to compare the results with a matched control group of nonstuttering children. Such a comparison might assist in the interpretation of the gap between expressive language skills and the NDW used, providing further insight into this area.

Given previous findings that treatment with the Lidcombe Program may result in children simplifying their language use, it is interesting that this study documents an increase in utterance length over the course of treatment for all of the children. Judging from the average 1-year increase in MLU reported in normative data for conversational language samples collected under similar circumstances (Leadholm & Miller, 1992), the MLU increases seen in the present study over a 6-month span far exceeded developmental expectancies. One possible explanation for the increase in language production might be that the children adapted to the examiner and the initially unfamiliar situation over time. In addition, it is likely that the increase in stutter-free speech led to increased verbal self-confidence in the 4 participants. The parents of P1, P3, and P4 reported that their children were aware of their stuttering and showed signs of frustration and anger when stuttering occurred. P4 had even begun to withdraw from conversations. It can be hypothesized that these children had adopted strategies that
reduced their linguistic complexity and verbal output in an effort to avoid stuttering and/or as an attempt to increase stutter-free speech. Three of the 4 children made considerable progress during treatment. It is possible that this improvement resulted in an increase in self-confidence in verbal communication that may have led to increased verbal output, reflected in an increased MLU and a higher number of complex sentences compared with the beginning of the therapy. This would support 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 improvement in these areas. These improvements may be reflected in increased verbal output, linguistic complexity, and increased stutter-free speech. However, another possibility might be that the increases in MLU were the continuation of an upward trend that began prior to treatment. In future studies, this could be evaluated more directly by the inclusion of a control group. Current norms on language sample measures (e.g., Leadholm & Miller, 1992) involve a single sampling of each participating child. Less is known about how a child’s MLU and other language sample measures typically change over time in repeated interactions with the same examiner.

The results of this study are not consistent with findings by several authors which suggested that preschool children who stutter present with lower linguistic performance levels compared with their fluent peers. These studies have found that, compared with their fluent peers, nonfluent preschoolers produce a lower MLU (e.g., Kline & Starkweather, 1979; Silverman & Williams, 1967), lower PPVT–III performances (e.g., Meyers & Freeman, 1985), and lower scores on tests of language comprehension (Murray & Reed, 1977; Ryan, 1992; Westby, 1979), and are less advanced when tested with a large language battery (Bernstein Ratner & Silverman, 2000). In contrast, the present study showed scores falling in the average-to-above-average range on all language tests for all participants. The 4 children in this study presented with advanced language skills. They were extremely talkative and frequently tried to express highly complex thoughts. In contrast, many previous studies reporting lower levels of linguistic performance involved larger sample sizes and, as a consequence, reported group mean data. It is possible that some participants of these studies did perform at a higher linguistic level, similar to the children of this study, but these individual performances were masked by group means. Several researchers have raised the issue that subgroups of preschool children who stutter may present with different developmental linguistic pathways (Cordes & Ingham, 1998; Häge, 2001; Hall, 1996; Ryan, 1992; Schwarz & Conture, 1988; Scott, Healey, & Norris, 1995; Watkins & Yairi, 1997; Yairi, Ambrose, Paden, & Throneburg, 1996). Further studies should investigate the existence of possible subgroups with such distinct linguistic profiles, who may in part require different treatment objectives or respond differently to different treatment protocols.

The present study involved a detailed and time-consuming analysis of language and stuttering behaviors at multiple points in time, providing a rich set of data for the participating children and a depth of analysis that is frequently not possible in large-sample studies employing a group design. A further strength is that the participants were observed continuously over 12 weeks of treatment and at 6 months after treatment onset. This design, however, limited the number of participants who could be included. The findings of the present study are, therefore, based on a small sample size and included only male children. This inevitably limits the generalizability of the results. The findings of this study should, therefore, be considered preliminary, offering insights to be verified in further studies. Future research should involve larger sample sizes, analyzing the linguistic profiles of the children and tracking the progression of language development during the therapy process. Finally, all spontaneous language samples were elicited by one conversational partner in a clinic setting. While this ensures consistency between measurement points, it does not allow evaluation of whether the children would have presented with differences in language samples gathered by a familiar conversational partner at home.

In summary, the findings of this study suggest that, at least for these 4 preschool children who stutter, improved stutter-free speech during treatment with the Lidcombe Program was not achieved at the cost of a decrease in linguistic complexity. On the contrary, it appears that the children increased their linguistic complexity over the course of treatment. However, the question as to why the 4 participants presented consistently with an NDW below the average range when compared with other children their age remains unanswered and may represent a form of linguistic simplification strategy or be indicative of the children’s reliance on highly rehearsed and automatized retrieval strategies. Continued research should include extended, longitudinal data collection; in-clinic as well as beyond-clinic samples; larger sample sizes; and evaluation of both the linguistic complexity of the conversational partner and the interaction style pertaining to the verbal contingencies used by parents. Furthermore, additional procedures to test word retrieval abilities and language formulation skills should be included. The analysis of larger sample sizes may identify subgroups presenting with different developmental linguistic pathways. Hopefully, results of the current study will motivate continued research in this area.

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Appendix

Lidcombe Program Treatment Summary

As described by Onslow, Packman, and Harrison (2003), treatment with the Lidcombe Program is divided into two parts. Stage 1 involves parent training to provide treatment during structured conversation (in the form of verbal contingencies) and unstructured conversation, in order to facilitate generalization of fluency to all activities of daily life. In Stage 2, treatment is gradually withdrawn, provided that fluency is maintained. In Stage 1, parents are taught by the clinician to initially praise their child’s stutter-free speech during a short structured conversation. Treatment starts at a linguistic level where the child can achieve sufficient stutter-free speech to enable the parents to provide verbal reinforcement within the structured setting. The linguistic level is increased naturally during the therapy process until spontaneous, fluent speech production is reached and the parents are comfortable in using the verbal contingencies. When the parents are providing verbal contingencies accurately, the parents start to administer one short treatment session at home daily, reinforcing their child’s fluent speech. Reinforcement involves acknowledgment and request for self-assessment of stutter-free speech, verbal praise for stutter-free speech, and acknowledgment and request for self-correction of stuttering. At this stage, the treatment setting expands to include more unstructured conversations and exchanges with the child. However, parents are never explicitly instructed to change any dimension of their interactions with their child, such as reduction of utterance length or speech rate, or simplification of language style in a systematic way. 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 requested in a natural and supportive manner, and the child is praised for all attempts. The child and the parents visit the clinic once per week for a 45–60-min session during Stage 1 treatment. As stutter-free speech increases, more treatment is conducted in spontaneous speaking situations outside of the clinic, and the frequency of structured sessions is decreased. Toward the end of Stage 1, all treatment is provided by parents during natural conversations throughout the day. The median number of clinic sessions needed to reach Stage 2 is 11 (Jones et al., 2000).

Stage 1 ends when the child’s stuttering reaches near-zero levels for a period of 3–4 weeks according to percentage of syllables stuttered and perceptual severity ratings for both in- and beyond-clinic measurements made by parents and clinician. A criterion-based maintenance program (Stage 2) is then implemented. Maintenance implies the systematic and gradual fading of 30-min clinic visits over a period of 8 to 12 months. Medium- and long-term outcome data show that the Lidcombe Program is able to establish and generalize stutter-free speech. In addition, the data indicate that these benefits are maintained for up to 7 years after treatment (Lincoln & Onslow, 1997; Onslow, Andrews, & Lincoln, 1994; Onslow, Costa, & Rue, 1990).