ELSEVIER

Journal of Fluency Disorders
28 (2003) 115–142

Journal of
FLUENCY
DISORDERS

Childhood stuttering and speech disfluencies in relation to children's mean length of utterance: a preliminary study

Courtney T. Zackheim*, Edward G. Conture

Department of Hearing and Speech Sciences, Vanderbilt Bill Wilkerson Center for Otolaryngology and Communication Sciences and Disorders, Vanderbilt University Medical Center, 1114 19th Avenue South, Nashville, TN 37212, USA

Received 14 May 2002; received in revised form 28 February 2003; accepted 4 March 2003

Abstract

The purpose of this study was to examine the influence of utterance length and complexity relative to the children's mean length of utterance (MLU) on stuttering-like disfluencies (SLDs) for children who stutter (CWS) and nonstuttering-like disfluencies (nonSLDs) for children who do not stutter (CWNS). Participants were 12 (3;1–5;11, years;months) children: 6 CWS and 6 age-matched (±5 months) CWNS, with equal numbers in each talker group (CWS and CWNS) exhibiting MLU from the lower to the upper end of normal limits. Data were based on audio–video recordings of each child in two separate settings (i.e., home and laboratory) during loosely structured, 30-min parent–child conversational interactions and analyzed in terms of each participant's utterance length, MLU, frequency and type of speech disfluency. Results indicate that utterances above children's MLU are more apt to be stuttered or disfluent and that both stuttering-like as well as nonstuttering-like disfluencies are most apt to occur on utterances that are both long *and* complex. Findings were taken to support the hypothesis that the relative "match" or "mismatch" between linguistic components of an utterance (i.e., utterance length and complexity) and a child's language proficiency (i.e., MLU) influences the frequency of the child's stuttering/speech disfluency.

Educational objectives: The reader will learn about and be able to: (1) compare different procedures for assessing the relationship among stuttering, length and complexity of utterance, (2) describe the difference between relative and absolute measures of utterance

* Corresponding author. Tel.: +1-615-936-5126; fax: +1-615-936-5013.
E-mail address: courtney.t.zackheim@vanderbilt.edu (C.T. Zackheim).

doi:10.1016/S0094-730X(03)00007-X

length, (3) discuss the measurement and value of mean length of utterance and its possible contributions to childhood stuttering, and (4) describe how length and complexity influence nonstuttering-like disfluencies of children who stutter as well as the stuttering-like disfluencies of children who do not stutter.

Keywords: Stuttering; Children; Mean length of utterance

Recently, researchers have increasingly turned to linguistic variables, for example, length and complexity of utterance (e.g., Bernstein-Ratner & Sih, 1987; Logan & Conture, 1995; Yaruss, 1999), to explain the differences in speech disfluencies that exist between children who do and do not stutter. Specifically, the relationship between speech disfluencies and utterance length and complexity of utterances has been investigated with the following talker groups: (1) *children who stutter* (CWS) (e.g., Brundage & Bernstein-Ratner, 1989; Gaines, Runyan, & Myers, 1991; Logan & Conture, 1995; Melnick & Conture, 2000; Yaruss, 1999), (2) *children who do not stutter* (CWNS) (e.g., Gordon, Luper, & Peterson, 1986; McLaughlin & Cullinan, 1989; Yaruss, Newman, & Flora, 1999), (3) *both CWS and CWNS* (e.g., Bernstein-Ratner & Sih, 1987; Gordon, 1991; Howell & Au-Yeung, 1995; Kadi-Hanifi & Howell, 1992; Silverman & Bernstein-Ratner, 1997), and (4) *CWNS and CWS with language disorders* (e.g., Lees, Anderson, & Martin, 1999). In general, findings from most such research have indicated that increases in utterance length and complexity are associated with increases in speech disfluencies. While many researchers have interpreted these findings to suggest that the nature, frequency, and origin of stuttering relates to linguistic variables (e.g., Anderson & Conture, 2000; Bernstein-Ratner, 1997; Conture, 2001; Logan & Conture, 1997; Logan & LaSalle, 1999; Melnick & Conture, 2000; Postma & Kolk, 1993), motoric variables also appear to contribute to this relationship (e.g., Kleinow & Smith, 2000).

Further review of the aforementioned literature (see Tables 1–3) indicates that three means have been used to examine utterance length and complexity in relationship to speech disfluencies: (1) spontaneous speech and language samples (SSLS) (see Table 1) (e.g., Kadi-Hanifi & Howell, 1992; Melnick & Conture, 2000), (2) sentence imitation tasks (see Table 2) (e.g., Bernstein-Ratner & Sih, 1987; Pearl & Bernthal, 1980), and (3) a combination of spontaneous speech–language samples, sentence imitation and sentence modeling tasks (see Table 3) (e.g., Gordon, 1991; McLaughlin & Cullinan, 1989). Although sentence modeling would appear to be a more natural or ecologically valid sampling procedure than sentence imitation, it still does not directly assess the participant's speech and language production during conversation, the speaking situation where stuttering is most apt to occur. Consequently, spontaneous speech and language samples appear to have been the most widely used procedure to study the influence of utterance characteristics on stuttering/speech disfluencies.

Table 1
Selected empirical studies that use *spontaneous speech and language samples* (SSLS) to investigate the utterance length and complexity and loci of instances of stuttering for children who do (CWS) and do not stutter (CWNS) and children with language impairment (CWLI)

Authors	Participants	Age	Method	Results
Melnick and Conture (2000)	10 CWS (all males)	34–74 months; mean 50.6 months	30-min child/parent SSLS; analyzed 25 fluent/stuttered child utterances	Stuttered utterances were longer and more complex
Yaruss (1999)	12 CWS (all males)	40–66 months; mean 55.2 months	30-min child/parent SLSS; analyzed 75 child utterances	As a group, stuttered utterances were more likely to be longer and complex than fluent utterances
Yaruss et al. (1999)	12 CWNS	44–64 months; mean 54.7 months	30-min child/SLP SSLS; analyzed 50 child utterances	Stuttered utterances were higher in average length and complexity
Logan and LaSalle (1999)	14 CWS	Mean 52 months	Measured selected characteristics of disfluent conversational utterances with and without disfluency clusters from 30-min child/parent SSLS	CWS utterances containing clusters had significantly more syllables, clauses, and clausal constituents than fluent utterances. For both CWS and CWNS, disfluency clusters were significantly related to utterance clause onset. CWNS more apt to exhibit disfluency clusters with revisions than CWS
	14 CWNS	Mean 52 months		
Logan and Conture (1997)	14 CWS (all males)	36–66 months; mean 52 months	Selected aspects of speech fluency, clause and syllable structure, and response latency analyzed in 50 fluent and 50 disfluent utterances for CWS and 50 fluent utterances of CWNS during 30-min child/parent SSLS	Stuttered utterances of CWS contained significantly more clausal constituents than their length-matched fluent utterances
	14 CWNS (all males)	38–67 months; mean 52 months		

Table 1 (*Continued*)

Authors	Participants	Age	Method	Results
Hall (1996), follow-up of Hall et al. (1993)	9 CWLI	3:0–5:11 years	50 child utterances were selected from the middle of a 30-min child/SLP SSLS	Results from this follow-up study indicate that the speech rate for most participants were slower than normal
Howell and Au-Yeung (1995)	31 CWS	Groups divided by age	Analyzed child utterances from 10-min child/ interviewer SSLS	NSD on syntactic structures but stuttering tended to occur on complex syntactic structures. CWS initially produced more simple syntactic structures than CWNS but this difference decreased with age
	48 CWNS	young CWS; mean 4:2 years young CWNS; mean 4:4 years middle CWS; mean 7:3 years middle CWNS; mean 7:0 years old CWS; mean 11:4 years old CWNS; mean 10:11 years		
Logan and Conture (1995)	15 CWS (all males)	36–66 months; mean 51.2 months	Analyzed 25 fluent and 25 stuttered utterances from 30-min child/parent SSLS	Utterances that were of greater length and complexity were more often stuttered, whereas utterances that were of lower length and complexity were more often fluent
Hall et al. (1993)	60 CWLI	3:1–5:11 years; mean 4:5 years	50 child utterances were selected from middle of child/interviewer SSLS for analysis	From these utterances a “high disfluency” and “low disfluency” group was created; significant differences between two groups in disfluency and age with the “high disfluency” group being older

Kadi-Hanifi and Howell (1992)	17 CWS	Groups divided by age	20 child utterances were selected from 10-min child/interviewer SSLS for analysis	More stuttering occurred on more complex syntactic categories; this relationship varied with age with the younger group producing more stuttering on simpler syntactic categories
	17 CWNS	8 younger; mean 4:0 years 14 middle; mean 7:0 years 12 older; mean 11:6 years		
Weiss and Zebrowski (1992)	8 CWS	4:0–10:7 years	Analyzed child utterances from 20-min child/ parent SLSS; labeled these utterances as responsives or assertives	Responsive utterances were more fluent than assertives; assertives longer than responsives; overall, stuttering tended to occur on longer, more complex utterances regardless of classification
Gaines et al. (1991)	12 CWS	4:0–6:0 years; mean 4:1 years	13–48 utterances per child (total = 360 utterances for group) were analyzed from child/parent SSLS	Sentences containing stuttering within first three words were significantly longer and more complex than sentences without stutterings
Brundage and Bernstein-Ratner (1989)	8 CWS	3:11–7:6 years	Range of 30–200 child utterances selected from child/SSLS for analysis	Increases in length correlated with increases in complexity
Wall et al. (1981)	9 CWS (all males)	4:0–6:6 years	Range of 809–1780 words selected from 45-min child/parent interaction were analyzed	More stuttering occurred at clause boundaries; the conjunction “and” at the beginning of simple and complex utterances was associated with more stuttering

NSD: no significant differences.

Table 2
Selected empirical studies that use *sentence imitation tasks* to investigate the utterance length and complexity and loci of instances of stuttering for children who do (CWS) and do not stutter (CWNS)

Authors	Participants	Age	Method	Results
Silverman and Bernstein-Ratner (1997)	7 CWS	10–18 years	Measured fluency of utterances during sentence imitation task re three classes of grammatical complexity	For both CWS and CWNS, normal disfluencies and errors in response increased as syntactic complexity increased, but frequency of stuttering did not appear to be affected by changes in syntactic complexity
	7 CWNS	10–18 years		
Bernstein-Ratner and Sih (1987)	8 CWS	3:11–6:4 years	70 sentences used for imitation task that targeted nine clause structures	Significant increases in disfluencies were found for increases in length but not complexity
	8 CWNS	Matched ±3 months		
Pearl and Bernthal (1980)	30 CWNS	3:0–4:6 years; mean 3:11 years	30 sentences used for imitation task that targeted six clause structures	As errors on the imitation task increased, number of disfluencies increased; the passive structure resulted in more disfluencies than other five structures

Table 3
Selected empirical studies that use a *combination* of *spontaneous speech and language sampling, sentence imitation tasks*, and *sentence modeling tasks* to investigate the utterance length and complexity and loci of instances of stuttering for children who do (CWS) and do not stutter (CWNS)

Authors	Participants	Age	Method	Results
Logan (2001)	12 AWS	Mean 23:0 years	Analyzed an average of 15 fluent and 15 length-matched stuttered utterances. Also measured rate in a prepared simple/complex sentence task	NSD in number of clauses or syntactic constituents between stuttered and fluent utterances; less stuttering in prepared task than conversation; more rapid rate in prepared complex than prepared simple sentences
Gordon (1991)	7 CWS	3:7–7:11 years; mean 5:4 years	30 sentences used for sentence imitation task and 30 more sentences used for sentence modeling task	For both CWS and CWNS, more disfluencies occurred during sentence modeling than the sentence imitation task
	7 CWNS	3:5–7:10 years; mean 5:5 years		
Gordon and Luper (1989)	36 CWNS	Groups divided by age	30 sentences divided into three clause types used for imitation; 30 pictures used for sentence modeling also divided into three clause types	Significant differences for age, task, and complexity; 3-year-olds were the most disfluent and 7-year-olds were the least; sentence modeling resulted in more disfluencies than sentence imitation
		3:4–3:8 years; mean 3:6 years		
		5:4–5:9 years; mean 5:7 years		
		7:4–7:9 years; mean 7:7 years		
McLaughlin and Cullinan (1989)	20 CWNS	60–70 months; mean 65 months	60 utterances with subject–predicate relationships representing two levels of utterance length and complexity	Significantly more disfluencies in modeling tasks requiring more linguistically complex utterances; longer utterances also resulted in more disfluencies
Gordon et al. (1986)	16 CWNS	60–71 months	Sentence imitation task used with 30 sentences divided into six clause types; sentence modeling task used with 30 pictures designed to elicit same six clause	Significantly more disfluencies occurred during imitation than modeling task; more disfluencies in passive than other clause types

NSD: no significant differences.

Specifically, of the 22 empirical studies published in refereed journals that these authors are aware of, 14 (i.e., 64%) have used spontaneous speech and language samples. Typically, this procedure has involved using a specific number of utterances, often from the middle of the participant's corpus of utterances (Brundage & Bernstein-Ratner, 1989; Hall, 1996; Hall, Yamashita, & Aram, 1993; Howell & Au-Yeung, 1995; Kadi-Hanifi & Howell, 1992; Wall, Starkweather, & Cairns, 1981; Weiss & Zebrowski, 1992; Yaruss, 1999; Yaruss et al., 1999). However, in some of these studies, utterances within the SSLS have been used to match a specific number of fluent to stuttered/disfluent utterances for the purposes of within as well as between-group comparison (Gaines et al., 1991; Logan & Conture, 1995, 1997; Logan & LaSalle, 1999; Melnick & Conture, 2000). While the experimenter, when using SSLS, has minimal control of utterance frequency, length and complexity, use of the SSLS does allow the experimenter to naturalistically sample the participant's speech and language within the everyday context of play and/or conversational interactions.

Whatever the procedures used to elicit a participant's speech and language sample, all of the empirical studies reviewed above appear to have examined *absolute* rather than *relative* length of children's utterances. Indeed, based on reported procedures, these investigations neither studied nor controlled for children's mean length of utterance (MLU). Therefore, utterances considered to be long for the entire group of CWS or CWNS may have only been long for a few of the individuals in the study. Conversely, utterances labeled as short may have actually been long in relation to some of the children's average utterance length.

One possible solution to the above concern would be to use *relative* rather than *absolute* indices to determine which utterances are short or long based on each child's individual mean length of utterance. MLU is considered to be a measure of language proficiency (Miller, 1981) or rather linguistic maturity (Miller, 1981; Owens, 1992; Shipley & McAfee, 1992) that provides a developmental index of a child's average utterance length as measured in morphemes or words. Research has indicated that MLU is a valid developmental measure into the school years (e.g., Miller, Frieberg, Rolland, & Reves, 1992), with additional norms (Leadholm & Miller, 1992) providing reference data for children until 13 years of age.

Because MLU appears to be quite stable within individuals as they develop (Brown, 1973; Miller, 1981), it is not unreasonable to suggest that a child's MLU may have as much influence on a child's stuttering/disfluency as the length and/or complexity of the utterance. Specifically, since it has been suggested that speech disfluencies appear to increase when linguistic requirements for formulation exceed the child's typical developing linguistic and formulation skills (e.g., Gaines et al., 1991; Gordon, 1991; Gordon & Luper, 1989; Lees et al., 1999; Weiss & Zebrowski, 1992), it seems of interest to assess how the "match" or "mismatch" between the dynamically, rapidly changing linguistic requirements of an utterance and the relatively static, slowly changing linguistic skills (as assessed by MLU) of a speaker may influence the occurrence of speech disfluencies within groups of children who do and do not stutter.

If similar relationships exist for CWS and CWNS between speech disfluency, MLU and utterance length and complexity, this may suggest that the linguistic processes that underlie nonstuttering-like speech disfluencies (nonSLDs) in CWNS are similar to those that underlie stuttering in CWS; an argument similar to that made by Williams, Silverman, and Kools (1969) in their study of loci of stuttering/speech disfluencies in CWS/CWNS. To date, however, to these authors' knowledge, there have been no published studies examining the relationship of a child's MLU to the often-reported relationship between utterance length/complexity and speech disfluency (e.g., Bernstein-Ratner & Sih, 1987; Kadi-Hanifi & Howell, 1992; Logan & Conture, 1997). Instead, the apparently significant relationship between speech disfluencies (e.g., "stuttering-like" (SLDs) and/or "nonstuttering-like" disfluencies) and length of utterance has been, as mentioned above, typically based on the measurement of *absolute* utterance length rather than utterance length *relative* to the child's individual MLU.

Therefore, the general purpose of this study was to examine the relationship between childhood speech fluency and selected linguistic aspects of conversational utterances. In specific, the present investigators attempted to assess whether a child's MLU influenced the relationship between frequency of stuttering-like and nonstuttering-like disfluencies and utterance length and complexity in CWS and CWNS.

1. Method

1.1. Participants

Participants were two groups of six children ($N = 12$) between the ages of 3;1 and 5;11 (years;months) who do (CWS) and do not stutter (CWNS) stutter. Each CWS was matched in age (±5 months) to a CWNS participant and all participants were boys, with one exception (CWNS participant 4 was a girl). All participants were native speakers of American English with no history of hearing, neurological, psychological, or intellectual problems per parent report and examiner observation. All participants were tested in two settings: first, the child's home and then second, a laboratory setting. All participants were paid volunteer participants in an ongoing series of studies concerning the relationship between stuttering and phonology (e.g., Logan & Conture, 1997; Melnick & Conture, 2000).

1.2. Classification and inclusion criteria

1.2.1. Children who stutter

A child was considered a CWS if he/she met the following criteria: (a) exhibited *three or more* SLDs (%) (i.e., sound/syllable repetitions, sound prolongations, broken words and/or monosyllabic whole-word repetitions) per 100 words of conversational speech (Bloodstein, 1995; Conture, 1990); (b) received a total overall score of 11 or above (i.e., a severity equivalent of at least "mild") on the *Stuttering Severity Instrument-3* (SSI-3) (Riley, 1994); and (c) had people in his/her environment who were concerned about his/her speech fluency and/or believed that he/she is a child who stutters or is at a very high risk for becoming one.

1.2.2. Children who do not stutter

A child was considered a CWNS if he/she met the following criteria: (a) exhibited *two or fewer* SLDs (%) per 100 words of conversational speech (Conture & Kelly, 1991; Zebrowski, 1987) (typically 90% or more of CWNS exhibit less than 3% SLD; see Conture, 2001, Table 1), (b) received a total overall score of 8 or below (i.e., a severity equivalent of less than "mild") on the SSI-3, and (c) had no people in his/her environment who were concerned about his/her speech fluency and/or believed that he/she was a child who stutters or is at a very high risk of becoming one.

1.2.3. Speech, language, and hearing measures

All participants were required to score no less than 1 standard deviations (SD) below the mean for their age group on four standardized speech–language tests: the *Peabody Picture Vocabulary Test-III* (PPVT-III) (Dunn & Dunn, 1997), a measure of receptive vocabulary; the *Expressive Vocabulary Test* (EVT) (Williams, 1997), a measure of expressive vocabulary; the *Test of Early Language Development-2* (TELD-2) (Hresko, Reid, & Hamill, 1991), a measure of expressive/receptive language ability; and the "Sounds in Words" subtest of the *Goldman–Fristoe Test of Articulation* (Goldman & Fristoe, 1986), a measure of speech sound development. All participants passed a hearing screening test (bilateral pure tone testing at 25 dB SPL from 250 to 4000 Hz) and exhibited Type A tympanograms as a result of impedance audiometry (the latter resulting from 800 to 3000 Ω).

1.2.4. Mean length of utterance

Any participant whose MLU, in either the home or laboratory sample, was 2 SD (or more) above or below the mean for his/her chronological age was excluded from the final data corpus. Of the children whose MLU appeared to be within normal limits, any whose MLU varied more than 1 SD between the home and laboratory sample was also excluded from the final data corpus.

1.3. Procedures

1.3.1. Speaking/testing conditions

As previously mentioned, all 12 participants engaged in two informal parent–child conversational interactions (one in the *home* and one in the *laboratory*). In general, data obtained in the child's home were used to (1) insure that each child met the previously described inclusionary criteria and (2) establish the child's membership as either CWS or CWNS. In contrast, data obtained in the laboratory were used as the dependent measures (e.g., average utterance length) analyzed and reported on in the results.

1.3.2. Data collection/instrumentation

In the home, a certified speech–language pathologist and/or a graduate clinician trained in the assessment of stuttering administered all formal/informal tests and analyzed both parent–child interactions, with all such assessments beginning with administration of the aforementioned standardized tests followed by the parent–child interaction. During these assessments, all participants were audiotaped with a Bell & Howell Model 3191A audio tape recorder during data collection sessions lasting approximately 1–1.5 h. A pressure-zone microphone was placed within 61 cm of each participant's mouth to obtain the child and examiner's acoustic voice signal. Procedures for gathering spontaneous language sampling were those standard for the field (see Miller, 1981).

1.3.3. Parent–child interaction

In essence, spontaneous language sampling involves the recording and analysis of naturalistic conversations with children. For the present study, the general principles of natural conversation were adhered to within each parent–child interaction. For example, the parents were instructed and encouraged to avoid asking a preponderance of yes/no questions; provide ample opportunities for the child to select topics and to respond to adult productions; and provide a reasonably supportive conversational environment that served to enhance child participation. Thus, minimal constraints were placed on the child to insure that the sample was representative of true language competence. Materials and topics for conversation within the laboratory sample included age appropriate toys and books selected by the child, and the setting remained constant across all children.

The above procedures for parent–child interactions were followed in both the home and, approximately 1–2 weeks later, in the laboratory (further details pertaining to such laboratory setting and recording instrumentation are provided elsewhere (e.g., Anderson & Conture, 2000; Melnick & Conture, 2000)). In general, these parent–child interactions lasted 15–30 min and resulted in 110–130 utterances produced by each child.

1.4. Pre-analysis data preparation

1.4.1. Participants' mean length of utterance

Each child's MLU, for purposes of the final data corpus, was based on 80 intelligible utterances obtained during parent–child interactions in the laboratory setting and calculated in accordance with Brown's (1973) morpheme selection rules. To minimize the influence of "warm-up," the first 20 utterances of each parent–child interaction were omitted and the next or following 80 utterances

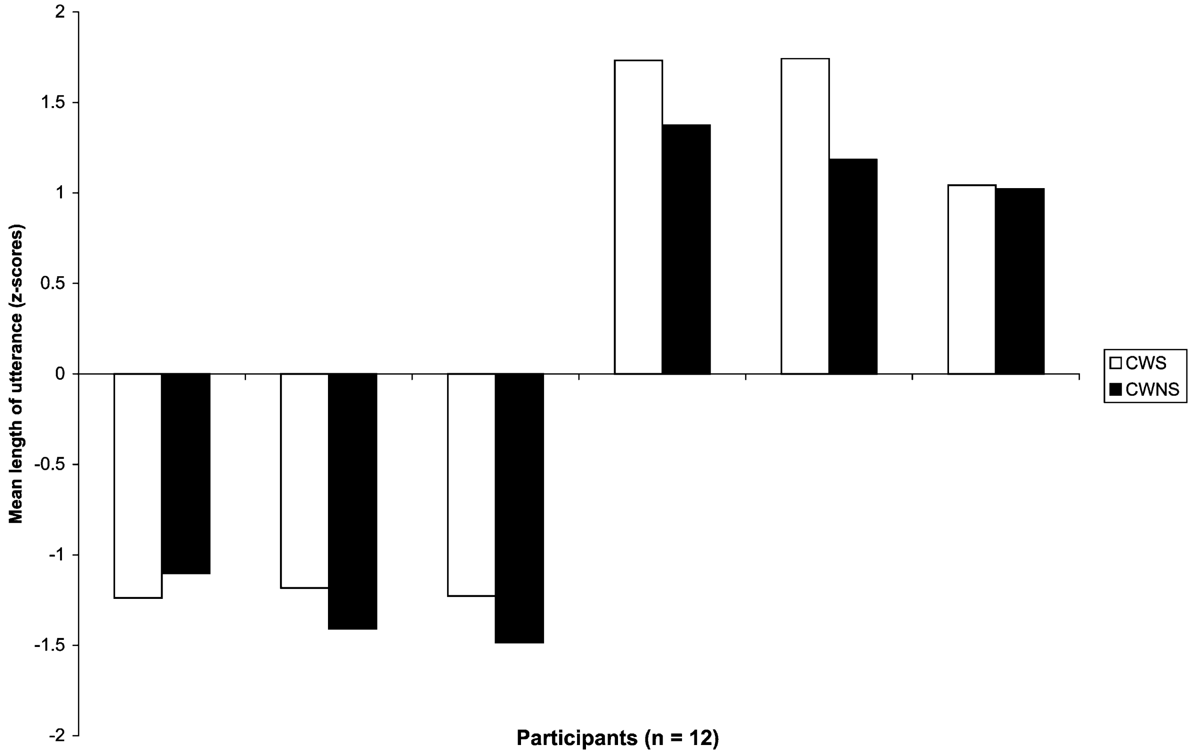

Fig. 1. Mean length of utterance z-scores for all 12 participants; CWS ($N = 6$) and CWNS ($N = 6$).

were used for establishment of MLU (with any utterances left over beyond the 80 also omitted from further analysis). Next, each child's MLU, in both the home and laboratory sample, was converted to a *z*-score [i.e., *z*-score = {child observed MLU − predicted mean MLU for the child's chronological age}/predicted MLU standard deviation]. Predicted means and standard deviations were obtained from Miller and Chapman (1979), as cited in Miller (1981) (similar criteria were applied to the home sample which was solely used, as mentioned above, to insure that no participant's MLU varied more than 1 SD between the home and laboratory setting).

Using these normed MLUs, the MLU of each CWS was matched within 0.5 SD or less, to a CWNS of comparable chronological age (±5 months). Using these matched CWS/CWNS pairs, the first author selected pairs that resulted in an equal distribution of MLUs between 1 and 2 SD above or below the mean for their chronological age (see Fig. 1). Thus, from an initial pool of 21 participants considered for inclusion in this study from a large, ongoing study of childhood stuttering (e.g., Pellowski & Conture, 2002), 6 CWNS and 3 CWS were excluded from the final data corpus, leaving 12 children (6 CWS and 6 CWNS) who served as participants in this study.

1.5. Measures of mean length of utterance, utterance complexity, stuttering and speech disfluency

The following measures were made, based on the aforementioned laboratory sample, for all 12 participants: (1) *utterance length* (MLU): utterance length measured in terms of mean length of utterance (in morphemes) based on 80 utterances from the laboratory conversational speech sample. To "normalize" utterance length for each of the 12 participants and to facilitate between participant comparisons, the experimenters determined the quartile rankings of each child's various utterance lengths across these 80 utterances, with these values serving the basis for all subsequent descriptive/statistical analyses. The selection of 80 utterances per child allowed for a reasonably comparable spread of utterance length across four quartiles and was greater than the typically used 50 utterances in attempts to achieve a more stable estimate of central tendency and dispersion of scores around the central tendency; (2) *utterance complexity*: each of the aforementioned 80 utterances was designated as either non-complex (i.e., the absence of a subordinate clause or presence of only one independent clause) or complex (i.e., presence of a subordinate clause or more than one independent clause); (3) *stuttering-like disfluencies*: mean percent of SLDs (%) (i.e., sound/syllable repetitions, sound prolongations, broken words and monosyllable whole-word repetitions) per 100 words; (4) *nonstuttering-like disfluencies*: mean percent of nonSLDs (%) (e.g., phrase repetitions, interjections, revisions) per 100 words; and (5) *number of SLDs or nonSLDs per utterance*: the number of SLDs and nonSLDs per utterance was calculated for each child and then converted to percentages to permit more direct comparisons between participants.

1.6. Intrajudge and interjudge measurement reliability

The conversational speech samples (i.e., 80 utterances) for four participants (i.e., two CWS and two CWNS in total) were randomly selected for purposes of measuring intrajudge/interjudge measurement reliability [i.e. (80 utterances $\times$ 4 participants $=$ 320 utterances)]. For these four participants intrajudge (author) and interjudge (author versus an independent judge) measurement reliability indexes were obtained for: (1) presence/absence of SLDs for the CWS; (2) presence/absence of nonSLDs for the CWNS; (3) presence/absence of utterance complexity; and (4) MLU. Based on analysis of these 320 utterances, intrajudge/interjudge measurement reliability using Cohen's Kappa was 94–78% for SLDs; 93–82% for nonSLDs, and 87–81% for utterance complexity. Due to the continuous nature of MLU, intrajudge/interjudge measurement reliability for the MLU calculated from the laboratory sample was determined through the use of Pearson product-moment correlations and mean differences resulting in $r = 0.95$ ($P < 0.05$) with a mean difference of 0.12 for intrajudge reliability and $r = 0.86$ ($P < 0.05$) with a mean difference of 0.22 for interjudge reliability.

1.7. Data analysis for both within-group and between sub-group comparisons

Central tendency (i.e., mean) and dispersion (i.e., standard deviation) of speech disfluency measures (SLDs for CWS and nonSLDs for CWNS), and utterance length ranks were assessed using a repeated measures ANOVA, a univariate ANOVA and planned comparisons, where appropriate.

2. Results

2.1. Descriptive/demographic data

Table 4 provides descriptive data for both talker groups, that is, children who stutter ($N = 6$) and children who do not stutter ($N = 6$). As would be expected based on talker group classification criteria, CWS participants exhibited an appreciably higher percentage of SLDs ($M = 12.0\%$; SD $= 2.17$) than the CWNS ($M = 0.43\%$; SD $= 0.29$). Conversely, CWNS produced an appreciably greater percentage of nonSLDs ($M = 4.9\%$; SD $= 0.59$) than the CWS ($M = 1.0\%$; SD $= 0.65$). Thus, because CWS produced so few nonSLDs, assessment of their speech disfluencies relative to utterance length and complexity was restricted to SLDs. Similarly, given the fact that CWNS had so few SLDs, assessment of their speech disfluencies was restricted to nonSLDs.

2.2. Children who do not stutter

2.2.1. Percent nonSLDs re utterance length

For the CWNS participants, a within groups repeated measures ANOVA was used to assess the percentage of nonSLDs across the four quartiles of the utterance

Table 4
Descriptive data pertaining to participants in this study

Participant number/gender	Age in mo.	Age at onset in mo.	Time since onset in mo.	SLDs/100 words	NonSLDs/100 words	MLU
CWS						
1/M	45	29	16	15.1	0.0	3.0
2/M	52	39	13	12.6	0.6	3.6
3/M	59	38	21	12.4	1.4	4.1
4/M	37	32	5	10.1	1.2	4.5
5/M	42	28	14	12.9	0.1	5.2
6/M	49	34	15	9.0	0.6	5.5
Overall mean	47.3	33.3	14.0	12.0	0.7	4.3
Standard deviation	7.8	4.6	5.2	2.2	0.5	1.0
CWNS						
7/M	46	n/a	n/a	0.0	4.8	3.2
8/M	47	n/a	n/a	0.0	3.9	3.0
9/M	59	n/a	n/a	0.8	5.4	3.8
10/F	42	n/a	n/a	0.6	4.9	4.9
11/M	44	n/a	n/a	0.6	5.3	5.0
12/M	54	n/a	n/a	1.2	5.5	6.1
Overall mean	48.7	n/a	n/a	0.5	4.9	4.3
Standard deviation	6.5	n/a	n/a	0.5	0.6	1.2

CWS: children who stutter; CWNS: children who do not stutter; MLU: mean length of utterance in morphemes; SLDs: stuttering-like disfluencies; nonSLDs: nonstuttering-like disfluencies; mo.: months; M: male; F: female; n/a: not applicable.

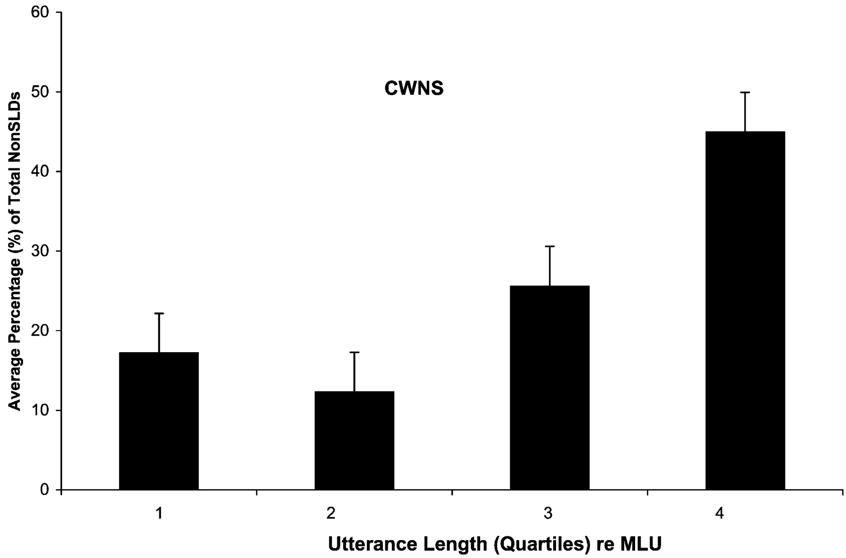

Fig. 2. Average percentage (%) of total "nonstuttering-like" disfluencies (nonSLDs) per utterance length (quartiles) relative to mean length of utterance (MLU) for CWNS ($N = 6$).

length re MLU. Results indicated there was a significant main effect for length of utterance re MLU [$F(3, 12) = 9.443$; $P = 0.002$], indicating that CWNS tend to produce a greater percentage of nonSLDs on those utterances above rather than below the child's MLU (see Fig. 2). Analysis of simple effects indicated a significantly greater percentage of nonSLDs in the fourth than the first quartile of utterance length re MLU [$F(1, 10) = 18.207$; $P = 0.002$], the third than the second quartile [$F(1, 10) = 13.976$; $P = 0.004$], the fourth than the second quartile [$F(1, 10) = 33.710$; $P = 0.001$], and the fourth than the third quartile of utterance length re MLU [$F(1, 10) = 12.905$; $P = 0.005$]. No significant difference was indicated in the percentage of nonSLDs between the first and the second quartile of utterance length re MLU [$F(1, 10) = 0.921$; $P = 0.360$], or between the first and third quartile [$F(1, 10) = 3.027$; $P = 0.113$] of utterance length re MLU.

2.3. Percent nonSLDs re utterance complexity

For the CWNS participants, mixed model repeated measures ANOVA was used with complexity as the between groups factor and length being the within groups factor. Results indicated that CWNS exhibited significantly more nonSLDs for *complex* (i.e., presence of a subordinate clause or more than one independent clause) than *non-complex* (i.e., the absence of a subordinate clause or presence of only one independent clause) utterances [$F(1, 16) = 110.134$; $P = 0.001$] and a significant two-way interaction between *length* relative to MLU and *complexity* of utterances [$F(1, 16) = 236.994$; $P = 0.001$] (see Fig. 3). Analysis of simple

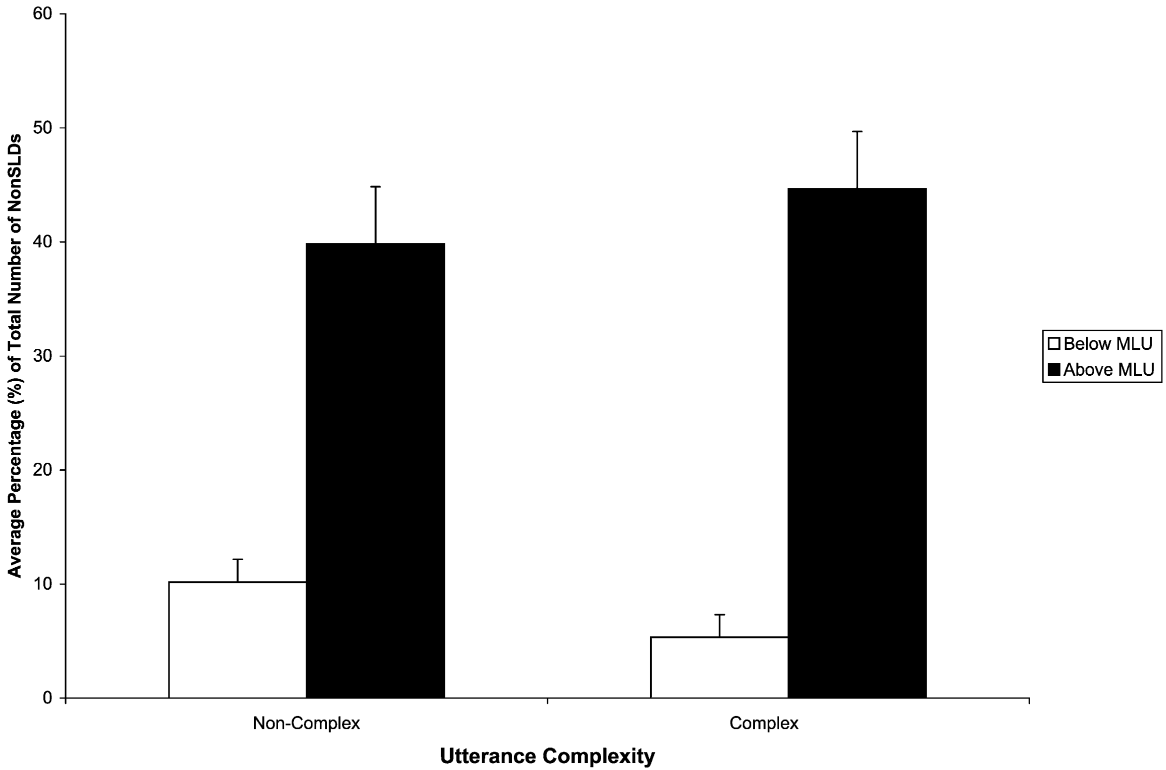

Fig. 3. Average percentage (%) of total “nonstuttering-like” disfluencies (nonSLDs) for complex and non-complex utterances below and above mean length of utterance (MLU) for CWNS ($N = 6$).

effects indicated a significantly greater percentage of nonSLDs on *non-complex* than *complex* utterances below MLU [$F(1, 8) = 25.427$; $P = 0.001$] as well as a significantly higher percentage of nonSLDs on *complex* than *non-complex* utterances above MLU [$F(1, 8) = 219.343$; $P = 0.001$]. Within *non-complex* utterances, there was a significantly greater percentage of nonSLDs on utterances above than below MLU [$F(1, 8) = 9.618$; $P = 0.015$] (see Fig. 3). Likewise for *complex* utterances, there was a significantly greater percentage of nonSLDs on utterances above than below MLU [$F(1, 8) = 915.633$; $P = 0.001$], indicating that CWNS produce a significantly greater percentage of their nonSLDs on utterances above their MLU, whether complex or not (see Fig. 3).

In summary, CWNS produced more nonSLDs on utterances above rather than below their MLU and on complex than non-complex utterances. There was, however, an interaction between length and complexity with more nonSLDs on complex utterances that were above rather than below the child's MLU. Similarly, for non-complex utterances, there were more nonSLDs on utterances above rather than below MLU.

2.4. Children who stutter

2.4.1. Percent SLDs relative to utterance length

For the CWS participants, within groups repeated measures ANOVA was used to assess the percentage of SLDs across the four quartiles of utterance length relative to MLU. Results indicated there was a significant main effect for the percentage of SLDs across utterance lengths relative to MLU [$F(3, 12) = 5.155$; $P = 0.016$], indicating that CWS, as a group, appear to produce more SLDs on those utterances that are longer than their MLU (see Fig. 4). Analysis of simple effects indicated that for CWS, there was a significantly greater percentage of SLDs in the third than the first quartile relative to MLU [$F(1, 10) = 8.975$; $P = 0.013$], the third than the second quartile [$F(1, 10) = 8.319$; $P = 0.016$], and the third than the fourth quartile relative to MLU [$F(1, 10) = 5.325$; $P = 0.044$]. No significant difference was indicated in percentage of SLDs between the first and second quartile of utterance length relative to MLU [$F(1, 10) = 0.006$; $P = 0.942$], the first and fourth quartile [$F(1, 10) = 1.007$; $P = 0.339$], or the second and fourth quartile of utterance length relative to MLU [$F(1, 10) = 0.792$; $P = 0.395$].

2.5. Percent SLDs relative to utterance complexity

For the CWS participants, a mixed model repeated measures ANOVA was used to assess complexity as the between groups factor and length being the within groups factor. Results indicated there was a significantly greater percentage of SLDs on *complex* than *non-complex* utterances across all utterance lengths relative to MLU [$F(1, 16) = 20.921$; $P = 0.001$] (see Fig. 5) and a significant two-way interaction between utterance length relative to MLU and utterance complexity [$F(1, 16) = 248.785$; $P = 0.001$]. Similar to findings for nonSLDs for CWNS,

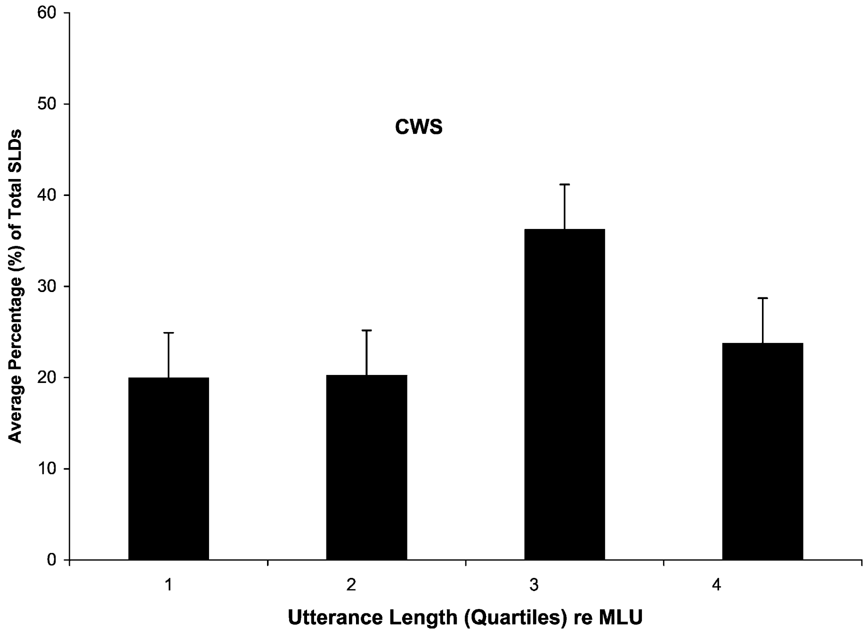

Fig. 4. Average percentage (%) of total "stuttering-like" disfluencies (SLDs) per utterance length (quartiles) relative to mean length of utterance (MLU) for CWS ($N = 6$).

analysis of simple effects indicated that for *low* length utterances relative to MLU (i.e., utterances shorter than children's MLU), there was a significantly greater percentage of SLDs for CWS on *non-complex* than *complex* utterances [$F(1, 8) = 130.068$; $P = 0.001$]. For *high* length utterances relative to MLU (i.e., utterances longer than children's MLU), there were a significantly greater percentage of SLDs for CWS on *complex* than *non-complex* utterances [$F(1, 8) = 136.373$; $P = 0.001$]. In addition, the non-complex utterances of CWS, unlike CWNS, contained a significantly higher percentage of SLDs on *low* than *high* utterance lengths relative to MLU [$F(1, 8) = 27.862$; $P = 0.001$]. Similar to CWNS, the complex utterances of CWS contained a significantly higher percentage of SLDs on *high* than *low* length relative to MLU [$F(1, 8) = 252.074$; $P = 0.001$] (see Fig. 5).

In summary, similar to the findings regarding nonSLDs for CWNS, CWS produced more SLDs on utterances above than below their MLU and on complex than non-complex utterances. There was, however, an interaction between length and complexity, which indicated that unlike nonSLDs for CWNS, CWS produced more SLDs on non-complex utterances below than above their MLU. Comparable to nonSLDs for CWNS, CWS had more SLDs on long, complex utterances than short, complex utterances.

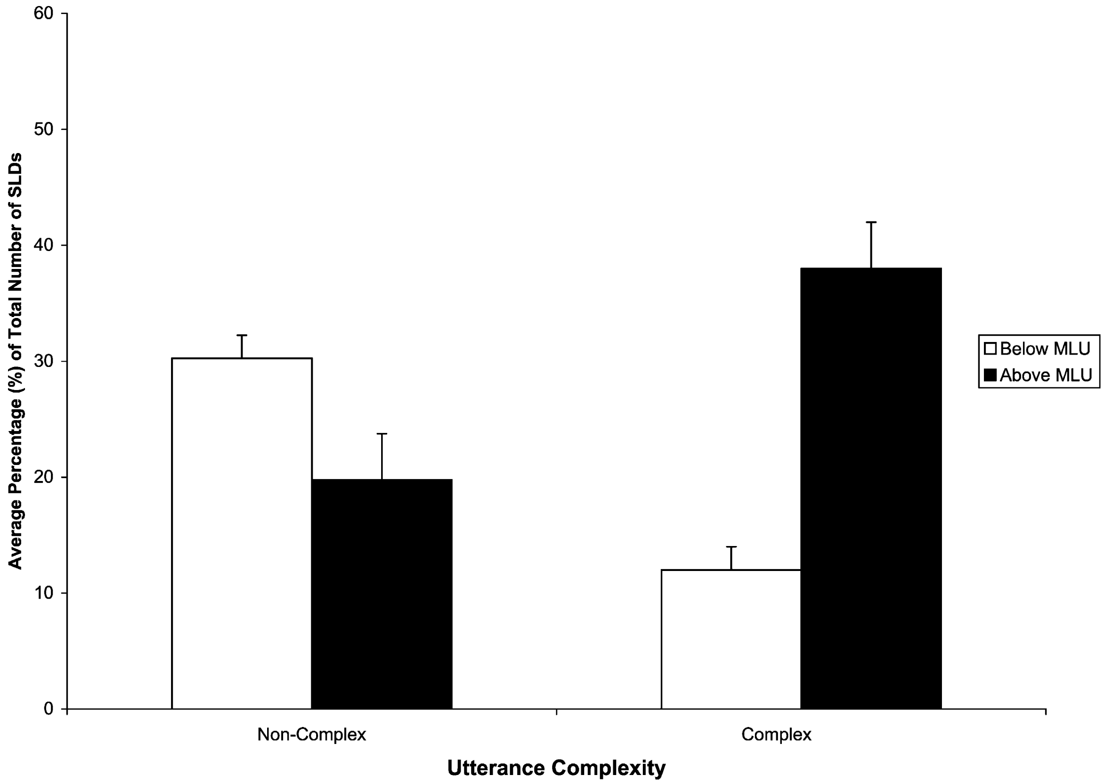

Fig. 5. Average percentage (%) of total "stuttering-like" disfluencies (SLDs) for complex and non-complex utterances below and above mean length of utterance (MLU) for CWS ($N = 6$).

3. Discussion

Overall, findings from this and most previous studies indicate that increases in either utterance length or complexity or both are associated with increases in stuttering and speech disfluencies for both CWS and CWNS, respectively. While most studies have found that utterance length and complexity interact in their influence on speech disfluencies, some studies have found that complexity has more impact on disfluency than length (Brundage & Bernstein-Ratner, 1989; Logan & Conture, 1995) whereas others have reported that length has a greater impact than complexity on disfluency (Yaruss, 1999). Results from the present study, however, suggest that such increases in disfluency may not solely relate to utterance characteristics but how these characteristics relate to participants' MLU.

3.1. Children who do not stutter

As a group, CWNS produced more nonSLDs on those utterances above rather than below their MLU indicating that the presence of nonSLDs within an utterance depends on the relationship the utterance has to the child's MLU. In addition, as has been reported in previous research, CWNS also produced more nonSLDs on *complex* than *non-complex* utterances, but significantly more nonSLDs for utterances above their MLU whether the utterance was complex or non-complex. Thus, while both utterance length and complexity appear to influence the presence of nonSLDs within an utterance, it appears reasonable to suggest CWNS produce a significantly greater percentage of their nonSLDs on utterances above their MLU, whether complex or not.

3.2. Children who stutter

Similar to CWNS, results indicated that CWS, as a group, produced more SLDs on utterances above their MLU, a finding that appears to lend additional support to the influence of utterance length on the presence of stuttering within the utterance. In addition, comparable to the nonSLDs produced by CWNS, CWS produced more SLDs on *complex* than *non-complex* utterances across all utterance lengths relative to MLU. Again as with the findings regarding nonSLDs for CWNS, CWS as a group produced significantly more SLDs on complex utterances above their MLU than on utterances below their MLU. However, unlike the findings regarding nonSLDs for CWNS, CWS produced significantly more SLDs on non-complex utterances below rather than above their MLU. Findings appear to indicate that while the impact of length on speech disfluency is apparent for CWNS, for CWS the combination of utterance length and complexity seems more likely to predict the presence of stuttering in an utterance than length alone.

3.3. CWS and CWNS

Previous research regarding the relationship between utterance length and complexity with adolescents who do (AWS) and do not stutter (AWNS) indicated that AWS produced more within-word disfluencies (i.e., speech disfluencies often perceived by listeners to be associated with stuttering) than AWNS (Silverman & Bernstein-Ratner, 1997), a finding consistent with present results. In the present study, however, the minimal overlap in the types of speech disfluencies produced by the CWS and CWNS meant that it was not feasible to make statistical comparisons between the two groups. Thus, although some between-group differences were noted and will be discussed, these speculations must be interpreted with caution to inherent differences observed between the two talker groups in terms of nonSLDs and SLDs.

In specific, when compared to CWNS, CWS had more "disfluencies" on non-complex utterances below rather than above their MLU, although both CWS and CWNS had a greater number of disfluencies on the non-complex short than non-complex long utterances. In addition, there was a disparity between the two groups at both the third and the fourth quartile for utterance length. Perhaps these differences are an indicator that length of utterance has more of a significant influence on "nonstuttering-like" disfluencies than "stuttering-like" disfluencies. In other words, as length of utterance increases, nonSLDs continually increase for CWNS, but not so for CWS; actually there appears to be a decrease for the very longest utterances (in fourth quartile) for CWS, a finding that seems to provide more support for CWNS than CWS for the hypothesis of "match"/"mismatch" between length of utterance and MLU.

However, present as well as past studies indicate that for both CWS and CWNS, a higher percentage of speech disfluencies occur on utterances that are both long *and* complex. Therefore, although length of utterance seemingly differs in its influence on "nonstuttering-like" and "stuttering-like" disfluencies, complexity of utterance appears to have a comparable influence on both types of speech disfluencies. This evidence appears to lend some support to Williams et al.'s (1969) finding that the loci of CWS/CWNS stuttering/speech disfluencies are influenced, in general, by similar word/utterance characteristics, a possibility that seems to warrant future empirical study.

As previously mentioned, the relationship between childhood stuttering/speech disfluencies and utterance characteristics appears, at first glance, to relate to *absolute* utterance length in, for example, number of syllables. However, present findings suggest that utterance length *relative* to the child's MLU is also very salient. In other words, the "match" between the dynamically, rapidly changing linguistic components of an utterance (e.g., both length and complexity) and the relatively static, slowly changing linguistic maturity (as indicated by the MLU) of a speaker appears to influence the fluency of the utterance. If children's linguistic maturity (i.e., mean length of utterance) interacts with utterance characteristics to influence occurrence of stuttering/speech disfluencies, it seems reasonable to suggest the need for further exploration of linguistic planning and production abilities of children who do and do not stutter.

Such exploration would seemingly require one to examine *relative* (i.e., utterance length relative to each child's MLU) as well as *absolute* (e.g., number of syllables) length of utterance. Thus, while it is certainly not inaccurate to say that children are disfluent on longer utterances, the statement does not appear to be sufficiently precise. Such imprecision of explication seems due to the fact that what is *relatively* long for one child may be *relatively* short for another, depending on their MLU. Furthermore, the relative impact of the length of a particular utterance on a child's stuttering/speech disfluency will vary depending on whether the child has a low or high MLU. Therefore, since the impact of length of utterance on speech disfluencies seems to vary with a child's linguistic maturity or MLU, future studies in this area may want to consider controlling for participants' linguistic maturity (i.e., mean length of utterance). Indeed, some of the differences in previously reported findings regarding the relative influence of utterance length on stuttering may also relate to differences between the MLUs of the participants.

3.4. Caveats

The most obvious limitation to the present study is the small sample size per talker group, limiting generalizability of findings even though trends do seem to be quite robust. Another, perhaps less obvious, limitation was the number of utterances obtained that were above the child's MLU. Although norming procedures were employed to minimize this concern, as is depicted in Fig. 6, more utterances, in absolute terms, were produced at or below the child's MLU, which resulted in an unequal distribution of utterances that were relatively short versus relatively long. This disparity, of course, should have biased findings in the opposite direction of what was actually found. Regardless, future studies should attempt to control for this difference to better examine the relationship between utterance length and complexity and speech disfluencies as related to both *relative* and *absolute* length of utterance.

As in all such studies based on conversational speech samples, length of conversational utterances cannot be entirely extricated from the issue of complexity; that is, in most cases, as the length of conversational utterances increase, they generally increase in complexity. Thus shorter utterances (i.e., those utterances within the first and second quartile) tended to be non-complex whereas longer utterances (i.e., those that fell within the third and fourth quartile) tended to be complex. Perhaps, future studies could minimize this particular confound by comparing, for example, speech disfluencies during an experimental task, whereby children imitate relatively long, non-complex versus relatively long, complex utterances. Although such an experimental study might allow individual examination of length and complexity of utterance, it may come at the expense of naturalness of conversation, limitation of the distribution of utterance length and complexity (utterances), or both.

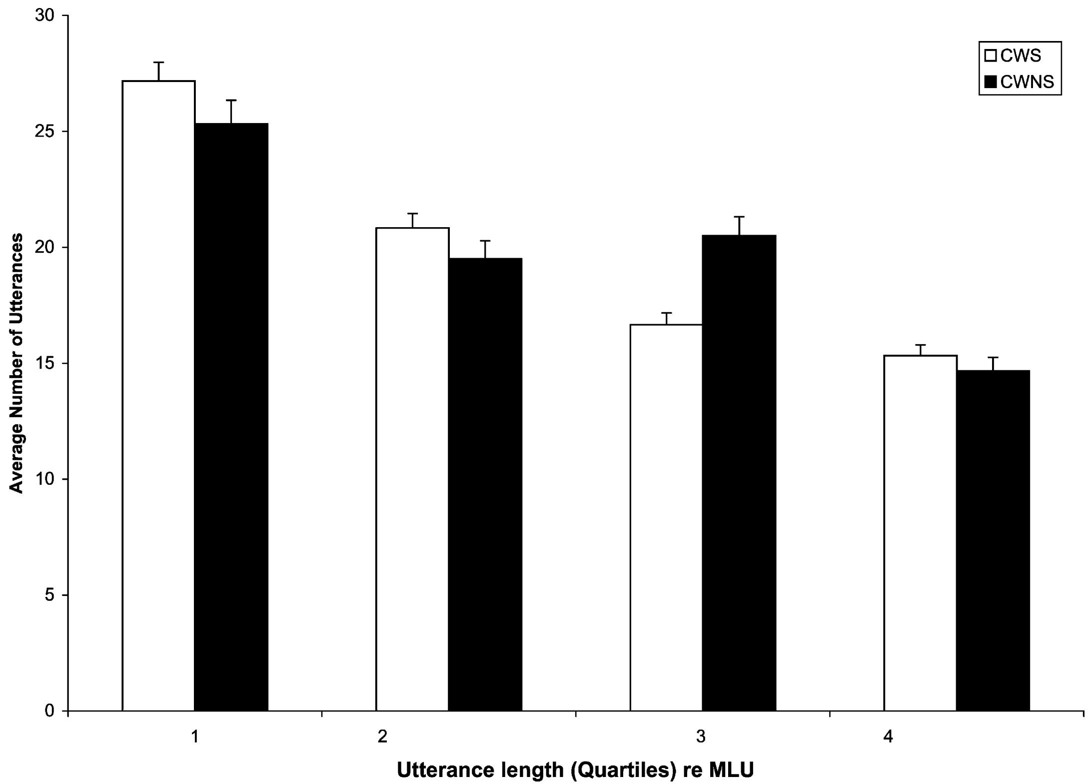

Fig. 6. Average number of utterances per quartile relative to MLU for CWS ($N = 6$) and CWNS ($N = 6$).

Finally, it is also important to note that utterance complexity can be defined and investigated in more than one way (Miller, 1981). Thus, the results from the present study should be interpreted with particular caution given to both the definition and method of investigation used for utterance complexity within this study.

4. Conclusions

Present findings indicate that utterances above children's MLU are more apt to contain instances of stuttering or speech disfluency which suggests that the presence of stuttering/speech disfluency within an utterance is not independent of the child's MLU. One might predict, therefore, that communicative situations that (in)directly encourage children to produce utterances above their MLU would be situations that are most apt to be disfluent, while situations that (in)directly encourage children to produce utterances similar to or even below their MLU would be situations that are most apt to be fluent. In other words, the confluence of the dynamically, rapidly changing linguistic components of a child's utterances (e.g., length of utterance) and the relatively static, slowly changing linguistic maturity of the child (i.e., MLU) seems to appreciably influence whether a child's utterance will be (dis)fluent. Thus, it seems reasonable to suggest that present results have meaningful implications for future study of conversational utterance characteristics and their influence on the stutterings and speech disfluencies of children who do and do not stutter.

Acknowledgments

The authors would like to thank Ralph N. Ohde and Stephen M. Camarata for their thoughtful suggestions regarding both the development of this project and revision of this manuscript. In addition, the authors would like to thank Julie Anderson and Mark Pellowski for their assistance in data collection. Finally, the authors would like to thank the participants and their families for their significant contribution to this study. Research supported by NIH grant (DC00523) to Vanderbilt University.

References

Anderson, J. D., & Conture, E. G. (2000). Language abilities of children who stutter. *Journal of Fluency Disorders*, *25*, 283–304.

Bernstein-Ratner, N. (1997). Stuttering: A psycholinguistic perspective. In R. Curlee & G. Siegel (Eds.), *Nature and treatment of stuttering: New directions* (2nd ed., pp. 99–127). Needham Heights, MA: Allyn & Bacon.

Bernstein-Ratner, N., & Sih, C. C. (1987). The effects of gradual increases in sentence length and complexity on children's disfluency. *Journal of Speech and Hearing Research*, *52*, 278–287.

Bloodstein, O. (1995). *A handbook on stuttering* (5th ed.). San Diego, CA: Singular Publishing Group, Inc.

Brown, R. (1973). *A first language/the early stages*. Cambridge, MA: Harvard University Press.

Brundage, S. B., & Bernstein-Ratner, N. (1989). Measurement of stuttering frequency in children's speech. *Journal of Fluency Disorders*, *14*, 351–358.

Conture, E. G. (1990). *Stuttering* (2nd ed.). Englewood Cliffs, NJ: Prentice Hall.

Conture, E. G. (2001). *Stuttering: Its nature, diagnosis, and treatment*. Needham Heights, MA: Allyn & Bacon.

Conture, E. G., & Kelly, E. M. (1991). Young stutterers' nonspeech behavior during stuttering. *Journal of Speech and Hearing Research*, *34*, 1041–1056.

Dunn, L., & Dunn, L. (1997). *Peabody picture vocabulary test-III* (PPVT-III) (3rd ed.). Circle Pines, MN: American Guidance Service, Inc.

Gaines, N. D., Runyan, C. M., & Myers, S. C. (1991). A comparison of young stutterers' fluent versus stuttering utterances on measures of length and complexity. *Journal of Speech and Hearing Research*, *34*, 37–42.

Goldman, R., & Fristoe, M. (1986). *Goldman–Fristoe test of articulation* (GFTA). Circle Pines, MN: American Guidance Service, Inc.

Gordon, P. A. (1991). Language task effects: A comparison of stuttering and nonstuttering children. *Journal of Fluency Disorders*, *16*, 275–287.

Gordon, P. A., & Luper, H. L. (1989). Speech disfluencies in nonstutterers: Syntactic complexity and production task effects. *Journal of Fluency Disorders*, *41*, 429–445.

Gordon, P. A., Luper, H. L., & Peterson, H. A. (1986). The effects of syntactic complexity on the occurrence of disfluencies in 5-year-old nonstutterers. *Journal of Fluency Disorders*, *11*, 151–164.

Hall, N. E. (1996). Language and fluency in child language disorders: Changes over time. *Journal of Fluency Disorders*, *21*, 1–32.

Hall, N. E., Yamashita, T. S., & Aram, D. M. (1993). Relationship between language and fluency in children with developmental language disorders. *Journal of Speech and Hearing Research*, *36*, 568–579.

Howell, P., & Au-Yeung, J. (1995). Syntactic determinants of stuttering in the spontaneous speech of normally fluent and stuttering children. *Journal of Fluency Disorders*, *20*, 317–330.

Hresko, W., Reid, D., & Hamill, D. (1991). *Test of early language development-2* (TELD-2). Austin, TX: PRO-ED.

Kadi-Hanifi, L., & Howell, P. (1992). Syntactic analysis of the spontaneous speech of normally fluent and stuttering children. *Journal of Fluency Disorders*, *17*, 151–170.

Kleinow, J., & Smith, A. (2000). Influences of length and syntactic complexity on the speech and motor stability of the fluent speech of adults who stutter. *Journal of Speech, Language, and Hearing Research*, *43*, 548–559.

Leadholm, B. J., & Miller, J. F. (1992). *Language sample analysis: The Wisconsin guide*. Madison, WI: Wisconsin Department of Public Instruction.

Lees, R., Anderson, H., & Martin, P. (1999). The influence of language disorder on fluency: A pilot study. *Journal of Fluency Disorders*, *24*, 227–238.

Logan, K. J. (2001). The effect of syntactic complexity upon speech fluency of adolescents and adults who stutter. *Journal of Fluency Disorders*, *26*, 85–106.

Logan, K. J., & Conture, E. G. (1995). Length, grammatical complexity, and rated differences in stuttering and fluent conversational utterances of children who stutter. *Journal of Fluency Disorders*, *17*, 35–62.

Logan, K. J., & Conture, E. G. (1997). Temporal, grammatical, and phonological characteristics of conversational utterances produced by children who stutter. *Journal of Speech and Hearing Research*, *40*, 107–210.

Logan, K. J., & LaSalle, L. (1999). Grammatical characteristics of children's conversational utterances that contain disfluency clusters. *Journal of Speech, Language, and Hearing Research*, *42*, 80–91.

McLaughlin, S. F., & Cullinan, W. L. (1989). Disfluencies, utterance length, and linguistic complexity in nonstuttering children. *Journal of Fluency Disorders*, *20*, 17–36.

Melnick, K. S., & Conture, E. G. (2000). Relationship of length and grammatical complexity to the (non)systematic speech errors and stuttering of children who stutter. *Journal of Fluency Disorders*, *25*, 21–45.

Miller, J. F. (1981). *Assessing language production in children: Experimental procedures*. Baltimore, MD: University Park Press.

Miller, J. F. (1981). *Assessing language production in children: Experimental proceedings*. Needham Heights, MA: Allyn & Bacon.

Miller, J. F., & Chapman, R. S. (1979). *The relation between age and mean length of utterance in morphemes*. Unpublished manuscript, University of Wisconsin at Madison.

Miller, J. F., Frieberg, C., Rolland, M. B., & Reves, M. A. (1992). Implementing computerized language sample analysis in the public school. *Topics in Language Disorders*, *12*, 69–82.

Owens, R. E. (1992). *Language development*. New York, NY: MacMillan Publishing Company.

Pearl, S. Z., & Bernthal, J. E. (1980). The effect of grammatical complexity upon disfluency behavior of nonstuttering preschool children. *Journal of Fluency Disorders*, *5*, 55–68.

Pellowski, M., & Conture, E. G. (2002). Characteristics of speech disfluency and stuttering behaviors in 3 and 4-year-old children. *Journal of Speech, Language, and Hearing Research*, *45*, 30–34.

Postma, A., & Kolk, H. (1993). The covert repair hypothesis: Prearticulatory repair processes in normal and stuttering disfluencies. *Journal of Speech and Hearing Research*, *36*, 472–487.

Riley, G. D. (1994). *Stuttering severity instrument for children and adults-3* (SSI-3) (3rd ed.). Austin, TX: Pro-Ed.

Shipley, K. G., & McAfee, J. G., 1992. *Assessment in speech–language pathology: A resource manual*. San Diego, CA: Singular Publishing.

Silverman, S. W., & Bernstein-Ratner, N. (1997). Syntactic complexity, fluency, and accuracy of sentence imitation in adolescents. *Journal of Speech, Language, and Hearing Research*, *40*, 95–106.

Wall, M. J., Starkweather, C. W., & Cairns, H. S. (1981). Syntactic influences on stuttering in young child stutterers. *Journal of Fluency Disorders*, *6*, 283–298.

Weiss, A. L., & Zebrowski, P. M. (1992). Disfluencies in the conversations of young children who stutter: Some answers about questions. *Journal of Speech and Hearing Research*, *35*, 1230–1238.

Williams, K. T. (1997). *Expressive vocabulary test* (EVT). Circle Pines, MN: American Guidance Service, Inc.

Williams, D. E., Silverman, F. H., & Kools, J. A. (1969). Disfluency behavior of elementary-school stutterers and non-stutterers: Loci of instances of disfluency. *Journal of Speech and Hearing Research*, *12*, 308–318.

Yaruss, J. S. (1999). Utterance length, syntactic complexity, and childhood stuttering. *Journal of Speech, Language, and Hearing Research*, *42*, 329–344.

Yaruss, J. S., Newman, R. M., & Flora, T. (1999). Language and disfluency in nonstuttering children's conversational speech. *Journal of Fluency Disorders*, *24*, 185–207.

Zebrowski, P. M. (1987). Disfluencies of preschool stutterers and their mothers' judgements of disfluencies (Doctoral dissertation, Syracuse University, 1987). *Dissertation Abstracts International*, *49*(07), 2599.

CONTINUING EDUCATION

Childhood stuttering and speech disfluencies in relation to children's mean length of utterance: a preliminary study

QUESTIONS

1. The following procedure has been most widely used when analyzing the conversational speech of children who stutter:
   a. picture-naming
   b. oral reading

c. silent reading
d. spontaneous speech and language samples
e. choral reading

2. The investigators measured the mean length of utterance of each child in this study to obtain:
   a. an absolute measure of utterance length
   b. a relative measure of utterance length
   c. a sentence complexity index
   d. the receptive versus expressive vocabulary ratio
   e. the average duration of each utterance
3. Speech (dis)fluency is influenced by which of the following utterance characteristics:
   a. utterance length
   b. utterance complexity
   c. measurement error
   d. reading skills
   e. a and b
4. Findings from this study support the hypothesis that the relative "match" or "mismatch" between linguistic components of an utterance (e.g., utterance length and complexity) and a child's language proficiency (i.e., mean length of utterance) influences the:
   a. frequency of the child's stuttering/speech disfluency
   b. child's reading comprehension
   c. child's auditory processing skills
   d. frequency of the child's echolalic responses
   e. size of the child's vocabulary
5. Findings from this study which indicate that utterances exceeding a child's mean length of utterance are likely to contain instances of stuttering or speech disfluency suggest that the:
   a. presence of stuttering/speech disfluency within an utterance is independent of the child's MLU
   b. child's speech disfluency/stuttering is randomly distributed across utterance length and complexity
   c. presence of stuttering/speech disfluency within an utterance is not independent of the child's MLU
   d. complexity and length of an utterance does not impact the fluency of the utterance
   e. a and b