

Does Syntactic Complexity Affect the Disfluency Frequency in School-Age Children?

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Introduction

- It is well established that syntactic complexity affects the speech fluency of preschool-aged children with typical fluency and children who stutter.
 - Preschoolers who stutter and preschoolers with typical fluency are more likely to produce stutter-like disfluencies on utterances containing relatively many grammatical constituents (Logan & Conture, 1997; Logan & LaSalle, 2003). The effect size is large, and independent of the number of syllables in an utterance.
 - Others have reported that children produce more stutter-like disfluency on late-developing sentence types (e.g., embedded relative clauses) vs. early-developing sentence types (e.g., Bernstein Ratner & Sih, 1987).
 - Such sentence types, however, inherently lead to increases in the numbers of syllables and words per utterance – variables which also affect preschooler's fluency as well (Logan & Conture, 1997).
- Studies with adolescents and adults suggest that the effect of syntactic complexity on fluency diminishes or is more subtle with age:
 - Silverman and Bernstein Ratner (1997) presented a sentence imitation task to adolescent speakers and found no effect for syntactic complexity on frequency of stutter-like disfluency for typical speakers or speakers who stutter. Logan (2001) reported similar results for a sentence reproduction task with adolescents and adults who stutter.
 - Tsiamtsiouris and Cairns (2009) reported that adults who stutter exhibited slower speech initiation times - but not more stutter-like disfluencies – than typical speakers when reproducing syntactically complex sentences. Exposure to syntactic primes improved the initiation times.
- Relatively few studies have examined syntactic complexity effects in elementary-school-aged children who stutter. Those that have, have mostly used "sentence-type" analyses, with mixed results.
 - It is unclear when (or if) syntactic complexity ceases to affect the frequency of stutter-like disfluency for children who do and do not stutter.
- This study compared the syntactic characteristics of fluent and "stutter-like" utterances of elementary-aged children who stutter and children with typical fluency. Syntactic complexity was measured quantitatively (# of syntactic constituents) rather than qualitatively (sentence types), and compared for sensitivity to lexical (# of words per utterance) and phonological (# of syllables per utterance) complexity measures.

Method

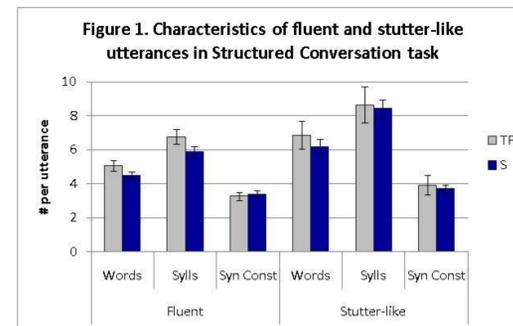
- Participants:**
 - 34 children who stutter, 34 with typical fluency
 - All spoke English with native competence.
 - 30 males, 4 females per group
 - Ages: $M = 8;2$ per group ($SD = 1;6$); Range: 5;6-10;7
 - Stutter severity: 16 mild; 11 moderate; 7 = severe.
- Data Collection**
 - Audio-recorded speech samples using experimental version of the *Test of Childhood Stuttering* (TOCS; Gillam et al., 2009).
 - TOCS *Structured Conversation* (child responded to standard requests about an 8-picture story sequence (19 responses analyzed per child).
 - TOCS *Modeled Sentences* (sentence generation task; 19 responses analyzed per child)
- Data Analysis**
 - Fluency analysis**
 - Responses transcribed; disfluent segments classified into two broad categories:
 - Repetitions/Prolongations/Blocks (RPBs)*: repeated sounds, syllables, parts of words, whole words; prolonged speech sounds; physically tense speech sounds;
 - Interjections/Revisions (IRs)*: semantically unproductive speech (e.g., "um") or speech that was subsequently revised, with no RPBs.
 - Utterances were coded as "fluent," "stutter-like" (i.e., those containing RPBs; or "disfluent" (i.e., those containing only IRs – *not used in present study*).
 - Utterance complexity analysis**
 - Number of syntactic constituents per utterance:
 - Noun phrases: word(s) that function as subjects or objects within utterance
 - Verb phrases: word(s) that function as predicate
 - Adverbials: words(s) that modify verb phrase
 - Complement: words(s) that follow copula verbs and modify subject noun phrase.
 - Number of words and syllables per utterance. (excluding repeated or revised speech, interjections).

Comparisons:

- Fluent utterances were compared to utterances that contained "stutter-like" disfluency for the number of words, syllables, and syntactic constituents they contained.
- Stutter-like utterances were limited to those containing repeating, prolonging, or blocking on the first three words of an utterance. (~70% of all SLDs occurred w/n 1st 3 words of utts.)
 - This was done to capture utterance contexts that are relatively likely to be associated with linguistic planning.

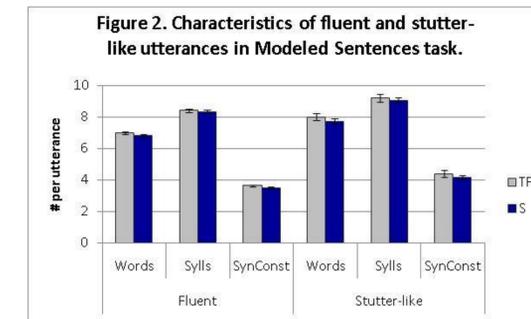
Structured Conversation Results

- Exploratory Data Analysis:**
 - 23/34 children with typical fluency & 32/34 children who stuttered produced stutter-like (St-L) utterances that met inclusion criteria. (All participants produced fluent utterances.) Thus, within-subjects comparisons of fluent and stutter-like utterances were performed using a subset of participants.
- # Syntactic constituents per utterance (see Figure 1)**
 - Within-subjects:** difference b/n F & St-L utterances approached significance, $F(1, 53) = 3.60, p = .06, \eta^2 = .064$.
 - Between-subjects & interaction terms:** ns ($p > .05$)
- # Syllables per utterance (see Figure 1)**
 - Within-subjects:** St-L utts contained more syllables than F utts, $F(1, 53) = 17.75, p < .001, \eta^2 = .247$
 - Between-subjects & interaction terms:** ns ($p > .05$)
- # Words per utterance (see Figure 1)**
 - Within-subjects:** St-L utts contained more words than F utts, $F(1, 53) = 17.40, p < .001, \eta^2 = .244$
 - Between-subjects & interaction terms:** ns ($p > .05$)



For both fluency groups, stutter-like utterances contained significantly more syllables and words than fluent utterances. The difference in number of syntactic constituents approached significance.

Modeled Sentences Results



For both fluency groups, stutter-like utterances contained significantly more syllables, words, and syntactic constituents than fluent utterances.

Exploratory Data Analysis:

- 29/34 children with typical fluency produced stutter-like (St-L) utterances that met inclusion criteria. 30/34 children who stuttered produced fluent utterances that met inclusion criteria. Thus, within-subjects comparisons of fluent and stutter-like utterances were performed using a subset of participants.
- # Syntactic constituents per utterance (see Figure 2)**
 - Within-subjects:** St-L utterances contained more syntactic constituents than fluent utterances, $F(1, 57) = 30.23, p < .001, \eta^2 = .347$.
 - Between-subjects & interaction terms:** ns ($p > .05$)
- # Syllables per utterance (see Figure 2)**
 - Within-subjects:** St-L utts contained more syllables than F utts, $F(1, 57) = 20.15, p < .001, \eta^2 = .261$
 - Between-subjects & interaction terms:** ns ($p > .05$)
- # Words per utterance (see Figure 2)**
 - Within-subjects:** St-L utterances contained more words than fluent utterances, $F(1, 57) = 46.178, p < .001, \eta^2 = .448$.
 - Between-subjects & interaction terms:** ns ($p > .05$)

Discussion

- Results provide support for the idea that stutter-like and fluent utterances are distinguishable on the basis of syntactic structure in school-aged children.
 - Stutter-like utterances contained significantly more syntactic constituents than fluent utterances in both fluency groups during a sentence production task (but only approached significance during a conversational task).
- Syllable and word measures distinguished between the utterance types also.
 - Additional research with larger samples is needed to contrast fluent and stutter-like utterances that are matched for the number of syllables/words within.

Selected References

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