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Stuttering, cluttering, and phonological complexity: Case studies

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ABSTRACT

The phonological complexity of dysfluencies in those who clutter and/or stutter may help us better understand phonetic factors in these two types of fluency disorders. In this preliminary investigation, cases were three 14-year-old males, diagnosed as a Stutterer, a Clutterer, and a Stutterer–Clutterer. Spontaneous speech samples were transcribed, coded for dysfluent words which were then matched to fluent words on grammatical class (i.e., function vs. content), number of syllables and word familiarity. An Index of Phonological Complexity was determined per word, and word frequency, density and phonological neighborhood frequency were derived from an online database. Results showed that compared to fluent words, dysfluent words were more phonologically complex and 'sparser', implying that they have fewer phonological neighbors or words in which a single phoneme is added, deleted or substituted. Interpretations and future directions for research regarding phonological complexity in stuttering and cluttering are offered.

Educational objectives: 1. The reader can list three key symptoms of cluttering. 2. The reader will define phonological neighborhood density and neighborhood frequency. 3. The reader can calculate the Index of Phonological Complexity (IPC) for a given word. 4. The reader can state two findings from the current study and how each relates to other studies of phonological complexity and fluency disorders.

1. Introduction

Researchers and clinicians continue to grapple with the disorders of stuttering and cluttering and how they may be influenced by phonetic and phonological variations. Cluttering is a fluency disorder characterized by three features – higher than average frequency of both types of disfluencies, between-word types and within-word types (i.e., "dysfluencies"), a rapid and/or irregular articulatory rate, and low intelligibility or imprecise articulation. The articulatory difficulties in clutterers manifest as weak syllable deletion, sibilant difficulty and consonant deletion, to name a few (St. Louis, Myers, Bakker & Raphael, 2007; Van Zaalen, Wijnen & DeJonckere, 2009).

The relationship of stuttering to the properties of words has been of interest for many decades (e.g., Brown, 1945). For example, articulatory errors and dysfluencies are more likely to occur on low frequency words, as determined by the word frequency databases of Thorndike and Lorge (1944) and Kucera and Francis (1967) (see Bloodstein & Bernstein Ratner, 2008, p. 257 for a review). Johnson and Brown (1935) were the first to posit that the more difficult a phonological or suprasegmental

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unit, the more likely a word will be dysfluent. Since then, many authors have offered versions of this speculation (e.g., Gregg & Yairi, 2007; Howell, 2004; Wingate, 1988). When deciding if findings support or refute the “phonetic factor” in stuttering, one challenge has been the individual variability across those who present with fluency disorders. Some suggest that stuttering may be influenced by the phonological component of segments and/or words (Dworzynski & Howell, 2004; Huinck, van Lieshout, Peters & Hulstjin, 2004; Howell, Au-Yeung & Sackin, 2000). By contrast, other studies question the relationship (Anderson, 2007; Nippold, 2002) or suggest little or no relationship (Logan, 2001; Marshall, 2005). The specific notion of phonological complexity may relate to aspects of the symptom complex of stuttering, and possibly in cluttering as well.

Anderson (2007) investigated the phonological complexity of dysfluencies of preschool-aged children who stutter. She measured: (a) Phonological neighborhood density, or “density,” which is the number of words that differ from the target word by adding, deleting or substituting a single phoneme (e.g., the word “cat” is in a relatively dense neighborhood with words like “at,” “bat,” “cab,” etc.); and (b) Neighborhood frequency, or the average word frequency of all of the phonological neighbors of a word (e.g., the neighbor words of “cat” average about 540 per million, whereas a word like “dog” has neighbor words like “hog”, averaging only about 11 per million). Anderson (2007) found that children’s stuttered words were lower in both word frequency and neighborhood frequency than matched fluent words, but that density did not differ between stuttered and fluent words. She offered several explanations for this finding, one of which was that these 3- to 5-year-old children used relatively high frequency words in their play-based samples, and since 71% of the sampled words were function words and thus higher in word frequency, the effects of density were reduced.

To date, there are little to no published studies of density and neighborhood frequency in older children and adolescents who stutter, and yet this is a population who stutters more on content words than function words (e.g., Howell et al., 2000). Thus, the purpose of the present study was to investigate the interaction between phonological complexity and dysfluencies in three adolescent speakers, one who cluttered, one who stuttered, and one who was diagnosed with both cluttering and stuttering.

2. Methods

2.1. Procedures

Three 14-year-old participants conversed with a clinician, from which a 300- to 400-word spontaneous sample was collected. Orthographic and phonetic transcriptions of the spontaneous speech samples were obtained from the audio recordings. Within-word disfluencies or “dysfluencies” (i.e., single-syllable word repetitions, sound-syllable repetitions, audible prolongations, and blocks) and between-word disfluencies (i.e., phrase repetitions, revisions, interjections) were identified. As per methods of Anderson (2007), only within-word disfluencies were included (i.e., $N = 42$ in the spontaneous sample).

The grammatical class of Dysfluent words was also coded: “Function” words were pronouns, articles, prepositions, conjunctions and auxiliary verbs, whereas “Content” words were nouns, main verbs, adverbs, and adjectives (Howell, 2004). Again following the methods of Anderson (2007), “fluent words” or control words were perceptibly fluent words paired with each of the disfluent words. Fluent words of same grammatical class (function vs. content), with the same number of syllables and the same word familiarity as the Dysfluent words were numbered and randomly selected as matches. Twenty of the 42 word pairs were content words (48%); 22/42 were function words (52%). Syllable length ranged from 1 to 3 and averaged 1.4 and word familiarity ranged from 6.4 to 7 and averaged 6.9 for the word pairs.

The Index of Phonological Complexity (*IPC score*) (Jakielski, Maytasse, & Doyle, 2006) (scores = 0–10) was determined for each Dysfluent and Fluent word. As per Jakielski et al.’s (2006) methods, one point was assigned for each: (a) Velar, fricative, affricate and liquid; (b) /r/-colored vowels; (c) Consonant coda (max of 1 point); (d) Syllable length > 3 (max of 1 point); (e) Singleton consonants that are place variegated (e.g., “sun” = 0; “bun” = 1) (max of 1 point); (f) Contiguous consonants (including consonant clusters, but also abutting C’s, e.g., “drops” = 2 vs. “rainbow” = 1); (g) Contiguous consonants that are place variegated, so/sn/ = 0; but/bl/ = 1.

Word frequency, density and neighborhood frequency, and word familiarity for matching purposes, were derived from the Washington University Speech & Hearing Lab Neighborhood Database, http://128.252.27.56/Neighborhood/SearchHome.asp (“Method B” was used). “Word Frequency” is the frequency of word usage during conversational speech in a given language. The phonological neighborhood density, or “Density,” is the number of words that can be generated from the target word due to a single phoneme being added, deleted or substituted “Neighborhood Frequency” is the mean of the word frequencies of all the targets’ phonemic neighbors.

2.2. Cases

The participants were three 14-year-olds whose parents sought out speech fluency evaluations in two separate clinics. Cases 1 and 2 came from the second author’s clinic; Case 3 came from the first author’s clinic. They were selected due to their diagnoses and same ages. *Case 1* was a 14-year-old male who presented with moderate to severe stuttering. He evidenced a high frequency of sound-syllable repetitions and a predominant use of sound prolongations, and he described a loss of control over stuttered moments and physical concomitants were evident. Furthermore, he did not evidence either of the two more salient diagnostic features of cluttering, imprecise articulation and an excessively rapid speech rate. Case 1 averaged 6