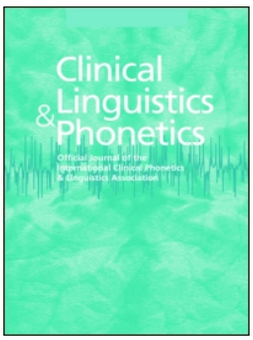

Clinical Linguistics & Phonetics

ISSN: 0269-9206 (Print) 1464-5076 (Online) Journal homepage: http://www.tandfonline.com/loi/iclp20

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To cite this article: Zoi Gkalitsiou, Courtney T. Byrd, Lisa M. Bedore & Casey L. Taliancich-Klinger (2017): Stuttering on function words in bilingual children who stutter: A preliminary study, Clinical Linguistics & Phonetics, DOI: 10.1080/02699206.2017.1324917

To link to this article: http://dx.doi.org/10.1080/02699206.2017.1324917

Published online: 30 Jun 2017.

CLINICAL LINGUISTICS & PHONETICS
https://doi.org/10.1080/02699206.2017.1324917

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Stuttering on function words in bilingual children who stutter: A preliminary study

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ABSTRACT

Evidence suggests young monolingual children who stutter (CWS) are more disfluent on function than content words, particularly when produced in the initial utterance position. The purpose of the present preliminary study was to investigate whether young bilingual CWS present with this same pattern. The narrative and conversational samples of four bilingual Spanish- and English-speaking CWS were analysed. All four bilingual participants produced significantly more stuttering on function words compared to content words, irrespective of their position in the utterance, in their Spanish narrative and conversational speech samples. Three of the four participants also demonstrated more stuttering on function compared to content words in their narrative speech samples in English, but only one participant produced more stuttering on function than content words in her English conversational sample. These preliminary findings are discussed relative to linguistic planning and language proficiency and their potential contribution to stuttered speech.

ARTICLE HISTORY
Received 5 May 2016
Revised 19 April 2017
Accepted 26 April 2017

KEYWORDS
Bilingual; content; function; loci; stuttering; young children

Introduction

Linguistic parameters that may influence the loci of stuttering have been the focus of several investigations. Brown (1945) was among the first researchers to identify potential determinants of stuttering loci. His data demonstrate that a) higher frequency of stuttering is related to specific speech sounds, particularly consonants at the initial position of a word, b) stuttering tends to occur more frequently on longer rather shorter words, c) distinct 'grammatical classes' of words are more likely to be stuttered and d) stuttering tends to occur more frequently on words in the first three positions of an utterance. Specific to the relationship between grammatical class and stuttered speech, Brown reported higher frequency of stuttering on nouns, verbs, adjectives and adverbs compared to articles, prepositions, pronouns or conjunctions. Brown's contribution is critical to our understanding of the loci of stuttering but it is exclusive to reading samples and also to adults.

To extend Brown's findings, researchers have since investigated the relationship between frequency of stuttering and grammatical word classes (i.e. function versus content) in narrative as well as conversational samples in both children (e.g. Au-Yeung, Howell, & Pilgrim, 1998; Bernstein, 1981; Bloodstein & Gantwerk, 1967; Bloodstein & Grossman, 1981;

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Buhr & Zebrowski, 2009; Howell, Au-Yeung, & Sackin, 1999; Richels, Buhr, Conture, & Ntourou, 2010) and adults who stutter (e.g. Au-Yeung et al., 1998; Howell et al., 1999). Results suggest unique developmental differences in the production of stuttered speech on function versus content words. In specific, individuals who stutter seem to stutter more on function compared to content words at a young age, but older persons who stutter present with more stuttering on content compared to function words (e.g. Howell et al., 1999). These developmental differences have been interpreted to suggest that linguistic planning (in addition to motoric planning) may uniquely contribute to stuttered speech.

Function words include articles, prepositions, pronouns, conjunctions, auxiliary verbs and interjections and constitute a 'closed word class' (i.e. new words are rarely added to this set of words). Although function words do not carry full lexical meaning, they do have a grammatical role. Content words include nouns, verbs, adjectives and adverbs. In contrast to function words, they belong to an 'open class' of words, with new words being added on this set, and they carry full lexical meaning (Corver & Van Riemsdijk, 2001). Content words are considered more 'difficult' to plan than function words (Howell, 2004). Factors that contribute to the 'planning difficulty' level of a word include phonetic complexity (e.g. number of syllables in a word and number of consonant strings), stress (i.e. whether the word carries stress or not) and word frequency (i.e. high versus low frequency) (Howell, 2004). These differences in lexicality, grammaticality and planning difficulty between function and content words translate into differences in the storage, retrieval and encoding of these words and their neurological representations (Bock & Levelt, 1994; Segalowitz & Lane, 2000). Thus, it is not surprising that researchers have explored differences in stuttering on function versus content words in an effort to better understand the potential influence of linguistic and motoric demands on stuttered speech.

The purpose of the present study is to investigate the loci of stuttering in young Spanish-English bilingual children who stutter (CWS) and whether their stuttering patterns differ compared to those that have been reported in monolingual young CWS. Exploration of the loci of stuttering in bilingual speakers will further inform our theoretical framework with regard to the onset and development of stuttering in monolinguals as well as speakers of more than one language.

Stuttering on function versus content words in monolingual English-speaking children who stutter

Bloodstein and colleagues (e.g. Bloodstein & Gantwerk, 1967; Bloodstein & Grossman, 1981) investigated the loci of stuttering in preschool CWS and concluded that young monolingual English-speaking children tend to stutter more frequently on function (i.e. conjunctions and pronouns) than content words, especially when initiating an utterance. They attributed the higher frequency of stuttering on function words to the fact that syntactic units are more likely to begin with a function word (e.g. pronouns and conjunctions) rather than with a content word (e.g. nouns and verbs). Therefore, it was the location of the word in the utterance *and* the syntactic unit that resulted in the production of stuttered speech. This interpretation is in accordance with Bernstein (1981), who stated that stuttering increases while planning and integrating syntactic units. That is, young CWS have difficulty planning an upcoming syntactic unit, which usually begins with a function word, and this difficulty manifests with stuttering on the first word of this unit.

A series of studies by Howell and colleagues (e.g. Au-Yeung et al., 1998; Howell et al., 1999) incorporated a wide age-range of monolingual English-speaking participants (e.g. Au-Yeung et al., 1998; n = 51 people who stutter, age range: 2–40 years; Howell et al., 1999; n = 51 people who stutter and 68 people who do not, age range: 2–40 years) and identified a higher percentage of stuttering on function compared to content words in their cohort of younger CWS. According to their interpretation, function words are more apt to be stuttered due to a 'delaying strategy' used by younger CWS when the motor speech plan for the subsequent content word is not yet available. The authors argue that content words are phonetically more complex, and thus, more taxing for these preschool CWS to plan and execute.

Other researchers have argued that the location of the utterance, not the phonetic complexity, contributes to the likelihood of stuttering on function words. Buhr and Zebrowski (2009) analysed the spontaneous speech samples from 12 preschool children who do and do not stutter (age range between 3 and 5 years). They reported that stuttering on function words was significantly more likely to occur when the function word was located in the utterance initial position only. In contrast, at utterance non-initial position, children were more likely to stutter on content words. Thus, they suggested that the likelihood of the word being stuttered is uniquely related to the position of the word in the utterance (i.e. initial vs. non-initial) rather than the word class itself (i.e. function vs. content). They further stated that sentence-planning demands and linguistic uncertainty are higher at the beginning of an utterance, which may explain the increased number of disfluencies at that location.

Similarly, Richels et al. (2010) investigated stuttering on function and content words and their relationship to utterance position and complexity in 30 preschool CWS (mean age 49.4 months, SD = 9.7 months). Their findings indicated that function words were more likely to be stuttered than content words at utterance initial position. No such trend was evident at utterance non-initial position (i.e. children tended to stutter equally frequently on function and content words). They attributed their results to the increased demands when planning sentences that begin with function words compared to those that begin with content words.

Stuttering on function versus content words in children who stutter who speak languages other than English

To investigate whether this pattern of more stuttering on function than content words is present in languages other than English, Howell and colleagues have examined the speech of monolingual Spanish speakers (Au-Yeung, Gomez, & Howell, 2003; n = 46 people who stutter, age range 3–68 years) and monolingual German speakers (Dworzynski, Howell, Au-Yeung, & Rommel, 2004; n = 50 people who stutter, age range 2–47 years). In both studies, results demonstrated a similar pattern to that observed in English monolingual speakers, that is, more stuttering on function words compared to content words in young CWS (e.g. Howell et al., 1999). According to the authors, repetition of function words provided additional time to the participants to complete the plan of the upcoming content words and, as a result, significantly reduced the likelihood of stuttering on content words.

Stuttering on function versus content words in bilingual speakers who stutter

To date, to these authors' knowledge, there has only been one published investigation of the loci of stuttering in bilingual individuals who stutter. Schäfer and Robb (2012) examined the frequency of stuttering on content and function words of 15 German-English bilingual adults who stutter (age range 16–59 years). The authors suggested that the frequency of stuttering was linked to language dominance, with stuttering occurring more on content words than function words in the dominant language (i.e. German); however, no differences were observed in the non-dominant language (i.e. English). This study is an important contribution to our understanding of the patterns of stuttering on function versus content words in bilinguals, but research in bilingual *children* is warranted to determine if the developmental patterns observed in monolingual speakers who stutter are also present in bilinguals.

In summary, the purpose of the present study is to investigate the potential word- and utterance-level parameters that may lead to stuttered speech in young Spanish-English bilingual CWS. If the pattern of more stuttering on function words than content words at utterance initial position that has been demonstrated in monolingual CWS is also evident in bilingual CWS, these data will lend further support to the contribution of linguistic planning to stuttered speech in bilingual CWS. The present study addressed the following questions:

(1) Do young bilingual CWS produce significantly more stuttering on function words than on content words in English and/or Spanish?
(2) Is stuttering on function words mediated by utterance location in English and/or Spanish in young bilingual CWS?

Method

Participants

Four participants were included in this study, two males and two females (age range 46–80 months). None of the participants had received any prior treatment services for stuttering. All participants' parents completed a detailed language history questionnaire in order to determine bilingual status (Gutiérrez-Clellen & Kreiter, 2003). The questionnaire included questions regarding the child's language use on a year-by-year basis as well as a detailed account of the child's language use at the time of the study (e.g. day-by-day and hour-by-hour language use). To assess their language abilities, each participant completed the experimental version of the Bilingual English Spanish Assessment (BESA) (Peña, Gutiérrez-Clellen, Iglesias, Goldstein, & Bedore, 2014), with scaled scores being reported. Participants also completed a narrative and a play-based conversational sample in both English and Spanish. The Mean Length of Utterance (MLU_w) and the Number of Different Words (NDW) were calculated from each speech sample for all participants in both languages. The reference databases that are included in the Systematic Analysis of Language Transcript (SALT) software (Miller & Iglesias, 2012) as well as information from Gutiérrez-Clellen, Restrepo, Bedore, Peña, and Anderson (2000) and from Miller (1992) were used in order to compare the participants' narrative and conversational skills with the average expected scores for their age. See Tables 1 and 2 for demographic information and scores related to the measurements administered.

Table 1. Participants' demographic information and their language measures.

ID	Age	G	Lang	ENG-acq	% use	MLU_w Nar	NDW Nar	NTW Nar	MLU_w Con	NDW Con	NTW Con
CWS1	71	F	ENG	0–1	68.0	5.77	168	957	3.04	91	216
			SPN	N/A	32.0	5.71	290	1113	2.64	69	124
CWS2	62	M	ENG	4	50	3.34	100	284	1.90	49	80
			SPN	N/A	50	3.46	117	270	2.31	105	192
CWS3	46	M	ENG	2	53	4.65	84	242	3.15	60	107
			SPN	N/A	47	4.76	143	400	3.62	121	228
CWS4	80	F	ENG	0	74.2	6.20	116	304	5.75	51	92
			SPN	N/A	25.8	7.67	116	353	4.21	113	257

CWS = Child who stutters, Age = age in months, G = gender, Lang = Language, ENG = English, SPN = Spanish, ENG acq = age of first English exposure in years, % use = % of current use of English or Spanish, MLU_w = Mean Length of Utterance in words, NDW = Number of Different Words, NTW = number of total words, Nar = Narrative, Con = Conversation.

Table 2. Participants' BESA scaled scores for each subtest across languages.

ID	Age	Gender	Lang	BESA-SEM-R	BESA-SEM-E	BESA-MS-C	BESA-MS-SR
CWS1	71	F	ENG	9	8	3	13
			SPN	14	12	11	11
CWS2	62	M	ENG	5	6	5	2
			SPN	6	7	3	6
CWS3	46	M	ENG	4	6	3	5
			SPN	11	9	9	10
CWS4	80	F	ENG	13	11	12	13
			SPN	8	9	6	8

CWS = Child who stutters, Age = age in months, Lang = Language, ENG = English, SPN = Spanish, BESA-SEM-R = BESA semantic-receptive, BESA-SEM-E = BESA semantic-expressive, BESA-MS-C = BESA morphosyntax-cloze, BESA-MS-SR = BESA morphosyntax-sentence repetition.

Stuttering identification

For stuttering identification, narrative and play-based conversational samples in both English and Spanish were analysed by the first and last authors, who are both licensed speech-language pathologists specializing in stuttering and bilingualism. Stuttering frequency measures were obtained for both speech tasks across languages. In addition, a 9-point severity scale similar to the one used by O'Brian, Packman, Onslow, and O'Brian (2004) (1 = no stuttering, 3 = mild stuttering …9 = extremely severe stuttering) was used to determine stuttering severity. The first author along with a second licensed Spanish-English speaking bilingual speech language pathologist specializing in stuttering analysed the participants' speech samples in English and in Spanish using frequency of stuttering, duration and presence of tension in their analysis of stuttering severity (for details, see Taliancich-Klinger, Byrd, & Bedore, 2013). See Table 3 for detailed information regarding each participant's stuttered speech in his/her narrative and conversation samples as well as his/her stuttering severity ratings.

Data collection

Both a narrative and a play-based conversational sample were collected for each participant in English and Spanish by a trained student clinician with native proficiency in Spanish. For the narrative task, participants were asked to retell a story based on a script provided by the examiner (Miller & Iglesias, 2012) using a wordless picture book (e.g. Mayer, 1967, 1969, 1973, 1974). In addition, participants were given a

Table 3. Percentages of the three different types of disfluencies in English and Spanish and stuttering severity ratings for each language.

			Narrative			Conversation		
ID	Language	Rating	%Total	%TD	%S	%Total	%TD	%S
CSW	ENG	4.5	39.8	25.8	14.0	9.2	9.2	0
1	SPN	5.5	37.5	32.0	5.5	12.1	5.1	7.0
CWS2	ENG	5	24.2	13.3	10.9	12.7	3.7	9.0
	SPN	5	31.3	10.3	21.0	14.5	8.8	5.7
CWS3	ENG	2	6.9	4.9	2.0	10.2	3.7	6.5
	SPN	2	7.0	4.0	3.0	9.2	5.2	4.0
CWS4	ENG	4	30.4	16.9	13.5	30.4	16.3	14.1
	SPN	5	45.0	21.0	24.0	27.2	17.1	10.1

CWS = Child who stutters, ENG = English, SPN = Spanish, %Total = percentage of total disfluencies per total words, % TD = percentage of typical disfluencies per total words, %S = percentage of stuttering instances per total words.

second wordless picture book and were asked to tell an original story based on the pictures of the book. The same procedure was followed in both English and Spanish resulting in a total of four different stories. For the Spanish sample, each participant completed a narrative retell and a narrative tell task. The two samples were combined to allow for a more representative sample in complexity and length for analysis. Similarly, for the English sample, the narrative retell and tell tasks were combined resulting in one narrative sample in English. The order of the language was counter-balanced across participants with some completing their English narratives first and others producing their Spanish narratives first. The conversational samples were obtained via a 10-minute play activity between the clinician and the child. As with the narrative samples, the production of English versus Spanish first was counter-balanced. The narrative and conversation speech samples were transcribed in both languages.

The Systematic Analysis of Language Transcripts (Miller & Iglesias, 2012) was used to analyse the samples. The produced utterances were segmented into Communication units (C-units), including one main clause and any subordinate clauses related to it, following the guidelines by Miller and Iglesias (2012). Pauses and intonation were used to segment utterances (e.g. 'The froggy was crying [2 second pause] because he was really sad'). When segmenting the narrative samples, connector words (e.g. 'and then', 'then', 'y luego') were used as additional markers to indicate a separate utterance. Words and morphemes were coded according to SALT guidelines, and unintelligible productions were marked with an 'X' on the transcript and were excluded from analysis.

Each disfluent word was coded as either an instance of stuttering or a typical disfluency (TD). Additionally, the type of disfluency (e.g. monosyllabic word repetition and interjection), number of clusters (i.e. multiple disfluencies on the same word), the number of iterations, whether the word that included the disfluency was function or content and whether the disfluent word was at the beginning of the utterance or not was also marked. The classification of stuttering instances included tension as a consideration as recent research (Byrd, Bedore, & Ramos, 2015) has demonstrated that Spanish-English bilingual children who do not stutter produce high rates of syllable repetitions, sound repetitions and monosyllabic word repetitions, but they produce these without tension, whereas bilingual Spanish-English CWS produce these repetitions with tension (Taliancich-Klinger et al., 2013). Thus, we considered

the following as instances of stuttering when they were produced with atypical tension: a) monosyllabic word repetitions, b) sound repetitions, c) syllable repetitions, d) audible sound prolongations, e) inaudible sound prolongations and f) multisyllabic word repetitions. The TDs were not produced with atypical tension and consisted of: a) revisions (lexical, phonological, and/or grammatical), b) interjections, c) unfinished words, d) multisyllabic word repetitions and e) phrase repetitions, as described by Ambrose and Yairi (1999), Byrd et al. (2015) and Taliancich-Klinger et al. (2013). Each disfluency within a cluster was coded for type, iteration, function/content nature and utterance position. Stuttering instances were included as separate counts in the following analyses. In our participants' samples, the only type of TD that was presented with atypical tension was multisyllabic word repetitions, and no sound/syllable/word repetitions occurred without atypical tension.

Based on the classification method developed by Au-Yeung et al. (1998), function words included pronouns, articles, prepositions, conjunctions, copula and auxiliary verbs, whereas content words included nouns, verbs, adverbs and adjectives. For the narrative samples, connector words that were repeated at the beginning of each utterance, such as 'and' or 'and then', were not counted towards the calculation of the total number of words and the MLU_w. However, since these words were at the initial position of the utterances and included words that were produced disfluently, they were included in the total word counts when determining the participants' percentages of disfluencies.

Reliability

Reliability was obtained for transcription, utterance segmentation, disfluency coding, including the identification of tension in the disfluent productions, and function/content word coding. Four Spanish-English trained bilingual research assistants transcribed and coded the samples and re-listened to each transcript to determine whether changes were required in the transcription and coding processes. Twenty five percent of the narrative and conversational samples in English and Spanish were transcribed again by two of the trained bilingual research assistants who were not familiar with the samples. The inter-rater reliability for transcription in English was 96% and in Spanish 94%, for utterance segmentation 98% in English and 95% in Spanish, for disfluency coding 86% in English and 83% in Spanish, and for function/content word coding 92% in English and 89% in Spanish; all met the criteria for at least 80% agreement. All speech samples were reviewed again by the first author, with the second and third author providing input as needed, and any discrepancies were resolved in order to achieve 100% agreement.

Results

To review, the present study examined whether bilingual Spanish-English CWS produce more stuttering on function than content words and whether the production of stuttering on these words is mediated by their position in the utterance. Table 4 includes participants' individual percentages of function, content, stuttered function and stuttered content words for utterance initial and utterance non-initial position for each speech sample in Spanish and English.

Do young bilingual children who stutter produce significantly more stuttering on function words than on content words in English and/or Spanish?

To address our first research question, the percentages of all function words that were stuttered (see 'F_stut' in Table 4) and the percentages of all content words that were stuttered (see 'C_stut' in Table 4) were compared across languages. A 2×2 contingency table analysis, with Pearson's chi square and Yate's correction, indicated that all four participants presented with more stuttering on function compared to content words in their Spanish *narrative* (CWS1 χ^2 (1) = 81.87, $p \leq .0001$; CWS2 χ^2 (1) = 73.45, $p \leq .0001$; CWS3 χ^2 (1) = 11.80, $p = .0006$; CWS4 χ^2 (1) = 124.01, $p \leq .0001$) and *conversational* (CWS1 χ^2 (1) = 7.31, $p = .007$; CWS2 χ^2 (1) = 4.029, $p = .045$; CWS3 χ^2 (1) = 7.20, $p = .007$; CWS4 χ^2 (1) = 28.89, $p \leq .0001$) samples.

In their English *narrative* samples, three participants were more likely to stutter on function compared to content words (CWS1 χ^2 (1) = 118.17, $p \leq .0001$; CWS2 χ^2 (1) = 20.29, $p \leq .0001$; CWS4 χ^2 (1) = 8.03, $p = .005$), with the exception of CWS3, who

Table 4. Participants' percentages of function, content, stuttered function and stuttered content words per utterance position for each speech sample across languages.

		Participants' percentages							
		Narrative				Conversation			
Language	Measures	CWS1 (%)	CWS2 (%)	CWS3 (%)	CWS4 (%)	CWS1 (%)	CWS2 (%)	CWS3 (%)	CWS4 (%)
ENG	F	50	54	55	49	56	63	38	51
	C	50	46	45	51	44	37	62	49
	F_In	99	96	94	82	87	83	50	94%
	C_In	1	4	6	18	13	17	50	6
	F_nonIn	40	36	44	43	41	39	33	42
	C_nonIn	60	64	56	57	59	61	67	58
	F_stut	26	19	3	17	0	12	12	28
	C_stut	1	2	0.9	6	0	3	3	0
	F_stut_In	100	100	100	100	0	100	100	100
	C_stut_In	0	0	0	0	0	0	0	0
	F_stut_nonIn	92	90	50	66	0	80	50	100
	C_stut_nonIn	8	10	50	34	0	20	50	0
SPN	F	46	36	42	33	50	48	36	35
	C	54	64	58	67	50	52	64	65
	F_In	96	87	94	87	94	90	86	93
	C_In	4	13	6	13	6	10	14	7
	F_nonIn	35	16	28	25	31	16	21	17
	C_nonIn	65	84	72	75	69	84	79	83
	F_stut	19	51	7	55	14	10	8	24
	C_stut	2	5	.04	3	0	2	0.7	2
	F_stut_In	93	95	0	100	100	83	67	83
	C_stut_In	6	5	0	0	0	17	33	17
	F_stut_nonIn	85	79	92	87	100	80	100	85
	C_stut_nonIn	15	21	8	13	0	20	0	15

ENG = English, SPN = Spanish, CWS = child who stutters, F = percentage of function words per total words, C = percentage of content words per total words, F_In = percentage of function words at initial position per total words at initial position, C_In = percentage of content words at initial position per total words at initial position, F_nonIn = percentage of function words at utterance non-initial position per total words at utterance non-initial position, C_nonIn = percentage of content words at utterance non-initial position per total words at utterance non-initial position, F_stut = percentage of stuttered function words per total function words, C_stut = percentage of stuttered content words per total content words, F_stut_In = percentage of stuttered function words at utterance initial position per total stuttered words at utterance initial position, C_stut_In = percentage of stuttered content words at utterance initial position per total stuttered words at utterance initial position, F_stut_nonIn = percentage of stuttered function words at utterance non-initial position per total stuttered words at utterance non-initial position, C_stut_nonIn = percentage of stuttered content words at utterance non-initial position per total stuttered words at utterance non-initial position.

did not demonstrate significantly more stuttered function words compared to content words. In their English *conversational* samples, only CWS4 stuttered significantly more on function compared to content words (χ^2 (1) = 12.31, p = .0005), with the remaining participants presenting a similar percentage of stuttering on function and content words (see Table 4 for details regarding participants' individual percentages).

Is stuttering on function words mediated by utterance position in English and/or Spanish in bilingual children who stutter?

To address our second question, a 2×2 contingency table was performed to determine whether function words and stuttered function words were more likely to occur at utterance initial (see 'F_In' and 'F_stut_In', respectively, on Table 4) than at utterance non-initial position (see 'F_nonIn' and 'F_stut_nonIn', respectively, on Table 4).

Results showed that function words were significantly more likely to occur at utterance initial compared to utterance non-initial position for all participants' *narrative* samples in both English (CWS1 χ^2 (1) = 187.70, $p \leq .0001$; CWS2 χ^2 (1) = 86.15, $p \leq .0001$; CWS3 χ^2 (1) = 69.90, $p \leq .0001$; CWS4 χ^2 (1) = 47.81, $p \leq .0001$) and Spanish (CWS1 χ^2 (1) = 239.39, $p \leq .0001$; CWS2 χ^2 (1) = 110.01 $p \leq .0001$; CWS3 χ^2 (1) = 158.14, $p \leq .0001$; CWS4 χ^2 (1) = 65.37, $p \leq .0001$). Similarly, function words in the participants' *conversational* samples were more likely to occur at utterance initial than non-initial position in English (CWS1 χ^2 (1) = 40.20, $p \leq .0001$; CWS2 χ^2 (1) = 14.56, p = .0001; CWS3 χ^2 (1) = 7.68, p = .0056; CWS4 χ^2 (1) = 12.18, p = .0005) and Spanish (CWS1 χ^2 (1) = 48.12, $p \leq .0001$; CWS2 χ^2 (1) = 102.57 $p \leq .0001$; CWS3 χ^2 (1) = 88.51, $p \leq .0001$; CWS4 χ^2 (1) = 116.63, $p \leq .0001$).

However, stuttered function words were *not* more likely to occur at utterance initial versus non-initial utterance position for all participants in either their *narrative* or their *conversational* samples across languages.

To further determine whether stuttered function words were more likely to occur than their overall frequency in the sample at utterance initial versus at utterance non-initial position, a z-approximation test based on binomial distribution was used. The proportion of all words that were function words and the proportion of all stuttered words that were function were separately compared at utterance initial and utterance non-initial positions across languages. At utterance initial position, the proportion of stuttered words that were function was not found to be significantly different than the proportion of total function words in the *narrative* and *conversational* samples for all participants in both English and Spanish. In contrast, at utterance non-initial position in Spanish, stuttered function words were more likely to occur than the occurrence of function words in the sample for all participants in their *narrative* (CWS1 z = 8.81, $p < .0001$; CWS2 z = 8.01, $p < .0001$; CWS3 z = 4.95, $p < .0001$; CWS4 z = 8.78, $p < .0001$) as well as their *conversational* samples (CWS1 z = 4.10, $p < .0001$; CWS2 z = 3.63, p = .0003; CWS3 z = 4.54, $p < .0001$; CWS4 z = 6.88, $p < .0001$). At utterance non-initial position in the English *narrative* samples, function words were more likely to be stuttered that their overall frequency in the sample for CWS1 (z = 9.50, $p < .0001$), CWS2 (z = 4.86, $p < .0001$) and CWS4 (z = 2.34, p = .019), but not for CWS3. In the English *conversational* samples, stuttered function words were more likely to occur than the overall proportion of function words in the sample only for CWS4 (z = 3.12 p = .002).

Discussion

The purpose of the present study is to investigate the potential word- and utterance-level parameters that may lead to stuttered speech in young Spanish-English bilingual CWS. Our preliminary results suggest these children present with more stuttering on function words compared to content words in their *narrative* and *conversational* samples in Spanish, and three out of four participants demonstrated the same pattern in their *narrative* sample in English. These results are in accordance with previous studies in monolingual English-speaking CWS at this age range (e.g. Au-Yeung et al., 1998; Bloodstein & Gantwerk, 1967; Bloodstein & Grossman, 1981; Buhr & Zebrowski, 2009; Howell et al., 1999; Richels et al., 2010) as well monolingual German-speaking (Dworzynski et al., 2004) and monolingual Spanish-speaking CWS (Au-Yeung et al., 2003).

All four participants in the present study stuttered more frequently on function compared to content words in their *narrative* samples in Spanish and three out of four participants in their *narrative* sample in English. The only participant who did not follow this pattern in his English narrative sample was CWS3, most likely due to his low number of stuttering instances in that sample (only 2% of stuttered words per total words were present in his narrative sample in English). In addition, participants' *conversational* samples in Spanish followed the pattern observed in the narrative samples, with more stuttering occurring on function compared to content words. However, with the exception of one participant, a different pattern was observed in their English *conversational* samples. Only participant CWS4, who was the only participant who had stronger language skills in English compared to Spanish, had significantly more stuttering on function compared to content words. The remaining participants did not show a difference in their stuttering on function compared to content words in their English conversational samples.

The observation of more stuttering on function than content words in the participants' *narrative* samples in both languages (with the exception of CWS3 in English narrative) and their *conversational* samples in Spanish (all four participants) indicates that the loci of stuttering may be uniquely affected by how demanding a task is (i.e. narrative vs. conversational) and by the language being spoken by young bilingual CWS. Narrative samples have been demonstrated to yield more stuttering-like disfluencies than conversational samples in monolingual children who stutter (Byrd, Logan, & Gillam, 2012). Narratives are cognitively demanding tasks that require knowledge of temporal and cause-effect relationships, connecting and sequencing events as well as planning/developing plots and problem solving abilities (Stadler & Ward, 2005). In addition, they usually include more adverbial clauses and noun phrases than conversation samples. Narrative samples are more demanding to plan syntactically as they typically include more syntactical units within the same utterance. Syntactic units tend to begin with function words. Thus, bilingual CWS may stutter more on these function words as they hold the location in the utterance where CWS are attempting to prepare the rest of the syntactic unit within the utterance (Bernstein, 1981; Bloodstein & Gantwerk, 1967; Bloodstein & Grossman, 1981).

More stuttering on function compared to content words was also observed in Spanish compared to English *conversational* samples. Spanish is morphosyntactically more

complex than English (e.g. number and person agreement must be marked on verbs and pronouns can often be omitted within a verb phrase). Additionally, even though Spanish syllables are phonetically less complex than English (Goldstein & Iglesias, 2006), most Spanish function words are two or three syllables long (e.g. nuestro 'ours', otro 'another'). Therefore, Spanish function words may be more likely to be produced disfluently because of their linguistic and motoric complexity (e.g. Ardila, Ramos & Barrocas, 2011; Byrd et al., 2015). Alternatively, the increased stuttering on function words may relate to the delaying strategy used by younger speakers when the speech plan of a more complex (i.e. content word), subsequent word is not yet available (Au-Yeung et al., 2003, 1998; Howell et al., 1999).

Regarding the lack of differences between stuttered function and stuttered content words in the English *conversational* samples, our results indicate that language ability may play a role in the loci of stuttering in the conversational samples in young bilingual CWS and strong language abilities may be required in order for disfluency patterns as the ones seen in monolingual CWS (i.e. more stuttering on function words) to emerge. Based on prior evidence in bilingual CWS (e.g. Carias & Ingram, 2006), increased disfluency frequency is linked to language ability, as measured by the participants' MLU. In our study, only participant CWS4 demonstrated increased MLU and stronger language skills, based on her BESA scores, in English compared to Spanish, contrary to the remaining participants, whose BESA scaled scores were higher in Spanish compared to English. Therefore, the speaker's language abilities may significantly influence whether the pattern (i.e. more stuttering on function words) similar to the one observed in monolingual CWS is present in bilingual CWS in that language.

Utterance position considerations and stuttering on function words in bilingual children who stutter

The majority of the utterances produced by our bilingual participants commenced with function words. This trend was consistent across languages and speech samples. The majority of the utterance initial function words were connector words (e.g. 'and' and 'and then') in their narrative samples and prepositions or articles in their conversational samples (e.g. 'I', 'he' and 'the'). As has been observed in prior studies with monolingual CWS, younger children are more likely to begin their utterances with function words (e.g. Au-Yeung et al., 1998; Bernstein, 1981; Bloodstein & Gantwerk, 1967; Bloodstein & Grossman, 1981; Buhr & Zebrowski, 2009; Richels et al., 2010). Our preliminary data suggest bilingual CWS initiate their utterances in a similar manner. Therefore, it was not surprising that stuttered function words at the initial position of an utterance were more likely to be stuttered than content words.

Present findings are limited in terms of the number of participants, but it is still important to note that our preliminary data differs from prior studies of monolingual English-speaking young CWS in two critical ways. First, in contrast to previous studies, there was no significant difference between stuttered function words at utterance initial versus non-initial position. Second, there was a significant difference between the proportion of stuttered function words and the proportion of function words in the sample at utterance non-initial position. In other words, even though function words were *not* more likely to occur at utterance non-initial position compared to content words, they were still

more likely to be stuttered. That is, in our bilingual CWS, stuttering was more likely to occur on function compared to content words irrespective of their position in the utterance. These results applied to the participants' *narrative* samples in both English and Spanish (except CWS3's English narrative sample possibly due to the small number of stuttering instances) and the participants' *conversational* samples in Spanish. These preliminary data are not in agreement with previous studies that either reported more stuttering on content words at utterance non-initial position (Buhr & Zebrowski, 2009) or no differences between stuttering on function and content words at utterance non-initial position (Richels et al., 2010).

Although the stuttering on function words demonstrated by our participants was not exclusive to the utterance initial position, present findings may still indicate that stuttering on function words occurred at a position in the utterance for which there were higher linguistic demands (i.e. beginning of a syntactic unit) (Bernstein, 1981; Bloodstein & Gantwerk, 1967; Bloodstein & Grossman, 1981). As previously discussed, narrative samples are more structured in nature and are more likely to include a higher number of subordinate clauses. Function words are produced more frequently immediately prior to the subordinate clause. Additionally, the increased planning demands attributed to the beginning of the utterance are also thought to be present at the beginning of subordinate clauses (Bernstein, 1981). Therefore, the higher number of subordinate clauses in the sample may have led to the increased number of stuttering instances on function words, even at utterance non-initial position but still at the beginning of a syntactic unit. These results confirm Bernstein's (1981) interpretation, wherein 'children may take advantage of midsentential stopping points to contemplate the rest of the utterance as a whole' (p. 349), in those cases where planning and/or integrating syntactic units break down.

Another potential explanation for the consistent higher number of stuttering on function words irrespective of their position in the utterance might be explained by the EXPLAN model (Howell, 2004). According to this model, planning and execution of speech are two independent processes, where a segment of a subsequent plan can be generated during the execution of the current speech plan. However, when the plan for the upcoming word is not ready when the execution of the current plan ends, a disfluency will occur. Howell and colleagues have argued that stuttering on function words provides additional time for young CWS to plan an upcoming and more 'difficult' content word preventing it from being disfluent. This 'delaying strategy' has been observed in young monolingual English-speaking (e.g. Au-Yeung et al., 1998) and Spanish-speaking (Au-Yeung et al., 2003) CWS and may also explain more stuttering on function words in our bilingual participants.

Finally, our participants, unlike the young CWS in previous studies, were bilingual. Unlike monolingual speakers, bilingual speakers have to navigate two languages. Bilingual speakers have more options to select from when engaged in planning their language output, contributing to higher levels of linguistic uncertainty (Bedore, Fiestas, Peña, & Nagy, 2006). Utterances that are more linguistically uncertain are more likely to begin with function than content words (Buhr & Zebrowski, 2009) and are more likely to be disfluent (Byrd et al., 2015). All participants showed similar patterns in their *narrative* samples in English and Spanish (except CWS3's English narrative sample) indicating that the syntactic demands in connected discourse may have the most impact in young bilingual children's fluency breakdowns, irrespective of the language being used.

Furthermore, the lack of more stuttering on function compared to content words in the participants' English *conversational* samples, where participants' language abilities were not as advanced (except CWS4), suggests that language ability may uniquely influence the loci of stuttering. Additional data are needed, but present preliminary findings suggest bilingual children may have to present with sufficient linguistic ability in that language to demonstrate the grammatical class loci patterns observed in monolingual English-speaking (e.g. Au-Yeung et al., 1998) and/or Spanish-speaking (Au-Yeung et al., 2003) CWS.

Limitations

The present study is a first attempt to investigate the loci of stuttering in young bilingual CWS. These results are preliminary, and findings should be interpreted with caution given the number of participants and the limitations with regard to the samples collected. In specific, our study was limited to four participants, and their language profiles as well as the amount of their speech output and their stuttering frequency were highly variable. In addition, we only collected one (as opposed to multiple) conversational sample in each language. Nevertheless, the recruitment of bilingual participants who stutter is not trivial, and these data do provide interesting patterns for future investigations of the manifestation of stuttering in speakers of more than one language.

Conclusion

Our preliminary data indicate that young bilingual Spanish-English speaking CWS present with more stuttering on function as opposed to content words, irrespective of the position of the stuttered word in the utterance in the *narrative* samples of both languages (except CWS3's English narrative sample) and the *conversational* samples in Spanish. Additional research is needed, but these findings suggest that young bilingual CWS may have distinct difficulties planning and integrating syntactic units in discourse, as indicated by the patterns observed in the participants' narrative samples. Navigating two languages places higher demands and increased linguistic uncertainty in bilingual speakers' speech output, demands that may uniquely contribute to the higher frequency of stuttering on function words. Linguistic uncertainty is manifested not only at the beginning of utterances but also at the beginning of a syntactic unit. Thus, stuttering on functions words may not be exclusive at utterance initial position but may also include the function words that are produced immediately prior to subordinate clauses. Our preliminary data also suggest that language ability may mediate the word- and utterance-level parameters that lead to stuttered speech when analysing *conversational* speech samples. Additional research with additional samples across languages as well as an extended range of language abilities across participants is needed in order to further elucidate the loci of stuttering in bilingual CWS.

Acknowledgements

We would like to thank our undergraduate research assistants, Blanca Esperanza, Cristina Rincon, Carmen Garcia, and Christi Prado who assisted with the transcription and data coding process. We would also like to thank Dr. Michael Mahometa for his assistance with the statistical analyses. Most

of all, we would like to thank the bilingual children who stutter and their families who were willing to give their time to participate in this study and help us to further our knowledge of the underlying nature of stuttering.

Declaration of interest

The authors report no conflicts of interest.

Funding

We would like to acknowledge the Michael and Tami Lang Stuttering Institute endowment and the ASHA Multicultural Affairs grant awarded to the second author.

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