INVESTIGATION OF STUTTERING IN BILINGUAL INDIVIDUALS: UNDERSTANDING ITS NATURE, ASSESSMENT, AND TREATMENT EFFICACY

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General Introduction

Although 50% of the world's population is bilingual and 1% of the world's population stutters (Bloodstein & Bernstein Ratner, 2008) studies on nature of stuttering in bilinguals who stutter (BWS) are few, and systematic studies investigating relation between stuttering and bilingualism are rare. Van Borsel, Maes, and Foulon (2001) reviewed literature on bilingualism and stuttering, and reported that BWS stutter commonly in both the languages, and there is some evidence that individuals stutter greater in one language than other. It has been reported that stuttering frequency may depend on language proficiency (Bernstein, Ratner & Benitez, 1985; Van Borsel et al., 2001; Van Borsel, Sunaert, & Engelen, 2005) and BWS stutter more severely in their less proficient language (Janelowitz & Bortz, 1996; Scott Trautmann, & Keller, 2000; Lim, Lincoln, Chan, & Onslow, 2008). However, there are also other studies (Howell, Ruffle, Fernandez-Zuniga, Gutierrez, Fernandez, O'Brian, Tarasco, Vallejo-Gomez, & Au-Yeung, 2004; Jayaram, 1983) that reported that stuttering participants stuttered more frequently in their primary or native language. Due to inconsistency in the available literature, the relationship between the language proficiency and distribution of the stuttering is inconclusive and further research is needed.

An investigation of assessment of stuttering behaviors is also of clinical importance. Bilingual stuttering assessment would require the evaluation of the perceptual measures like the percent dysfluency, rate of reading, naturalness rating in both the languages known by the client. As pointed by Von Borsel et al. (2001) assessment of stuttering in bilinguals is more challenging for the clinicians while providing services for such clients. For instance, Finn and Cordes (1997) reported that identification of stuttering in BWS may be more difficult if the clinician is not familiar with the language. Hence it is not known if clinicians underestimate or over estimate the overall severity of the disorder in an unfamiliar language.

In recent times, the interest in treatment of stuttering has also extended to BWS. Treatment of stuttering in bilinguals who stutter is challenging. Common practice in treatment of stuttering in bilingual children is to temporarily reduce or remove the child's exposure to his non-dominant language where possible (Shenker, 2004). When giving treatment to BWS, the clinician must make decisions about several issues like do clients need therapy in all languages they speak? Further, it is very time consuming and costly to recruit trainer and then conduct treatment working through interpreters. Thus, it becomes important to study if improvement in one language generalizes to the other language. To investigate this factor, many studies have provided treatment in only one language and measured the outcome in both the languages. But most of these studies are case reports. Humphrey, Al Natour and Amaryeh (2001) studied the aspect of stuttering modification and fluency shaping therapy in 11 year old twin girls. Language of treatment was Arabic. Fluency increased in Arabic language and generalized to English language in both the girls. Rousseau, Packman, and Onslow (2005) conducted a study to see the effect of Lidcombe treatment program on a 7-year old bilingual child. Language of treatment was French. Percentage of syllable stuttered was found to decrease in both the languages. Thus, literature on the treatment for BWS suggests that efficacy of the treatment generalizes to untreated language. However, systematic investigations are needed to quantify such findings.

In light of the reviewed findings and remaining gaps in the field's knowledge and understanding of the mechanisms underlying stuttering and bilingualism, in this project we investigated (1) whether there is any relationship between manifestation of stuttering and language proficiency, (2) whether the clinician's knowledge of the language possibly influences the assessment of stuttering in BWS, (3)whether prolongation therapy given in one language, brings in changes in fluency in the un-treated language, and, if it does, to compare the fluency in treated versus un-treated language.

Study 1: Dysfluency Characteristics of Kannada-English Bilingual Adults Who Stutter

Bilingualism was mentioned in the stuttering literature as early as 1937 (Travis, Johnson, & Shover, 1937). Initially, researchers investigated the role of second language as a risk factor for the development of stuttering. Prevalence studies conducted with the school children revealed that the prevalence was greater in bilingual children compared with monolingual children (Howell, Davis, & Williams, 2009; Stern, 1948; Travis, Johnson, & Shover, (1937). However, the UCL survey did not find bilingual speakers at greater risk of developing stuttering than monolingual speakers (Au-Yeung, Howell, Davis, Charles, & Sackin, 2000). Empirical studies have also tried to examine whether the nature of stuttering varies between two languages in bilingual persons who stutter (PWS). Such studies are relevant as it is reported that more than 50% of the world's population is bilingual (Grosjean, 2010). Information obtained from cross-linguistic comparisons in these individuals will add on to the existing literature on the role of linguistic factors on the nature of stuttering, and may further help in the assessment and management of stuttering.

Over the years, studies have reported three different patterns of stuttering manifestation in bilingual PWS (Nwokah, 1988). The first pattern is that bilingual PWS stutter only in one language. As per our knowledge, there is only one research support for this proposition. Dale (1977) reported that all four Spanish-English bilingual adults in his study exhibited stuttering only in Spanish. The second pattern is that bilingual PWS stutter in both the languages, and their stuttering frequency between two languages is not significantly different (same hypothesis) (Howell et al., 2004; Howell et al., 2009; Jayaram, 1977; Lebrun, Bijleveld, & Rousseau, 1990; Lee, Robb, Ormond, & Blomgren, 2014; Van Riper, 1971). The third pattern is that bilingual PWS stutter in both the languages, and their stuttering frequency is significantly different in both languages (different-hypothesis) (Ardila, Ramos,

& Barrocas, 2011; Bernstein Ratner & Benitez, 1985; Howell et al., 2009; Jankelowitz & Bortz ,1996; Jayaram, 1983; Lim, Lincoln, Chan, & Onlsow, 2008; Nwokah, 1988; Roberts, 2002; Schäfer & Robb, 2012; Taliancich-Klinger, Byrd, & Bedore, 2013). For the last pattern two different findings are reported in the literature. Few studies have reported that bilinguals stutter more in their 'native' or 'fluent' language (Howell et al., 2004; Jayaram, 1983; Lee, Robb, Ormond, & Blomgren, 2014; Taliancich-Klinger et al., 2013), whereas few other studies reported bilinguals stutter more in their 'less proficient' or 'non-dominant' language (Jankelowitz & Bortz , 1996; Lim, Lincoln, Chan, & Onslow, 2008; Nwokah, 1988; Roberts, 2002; Schäfer & Robb, 2012). This inconsistency in the findings may be mainly because the large majority of these studies are case studies (Ardila, Ramos, & Barrocas, 2011; Bernstein Ratner & Benitez, 1985; Dale, 1977; Jankelowitz & Bortz , 1996; Lee et al., 2014; Roberts, 2002; Taliancich-Klinger et al., 2013), and have not considered characteristics of the two languages, the type of bilingualism, and the mastery of the two languages using standard measures to check for the proficiency (Coalson, Peña, & Byrd, 2013; Lim et al., 2008).

Only two studies (Lim et al., 2008; Schäfer & Robb, 2012) have systematically considered the characteristics of languages, and mastery of two languages to check their effects on stuttering frequency. Lim et al. (2008) investigated the influence of language dominance on the stuttering severity in 30 Mandarin-English bilingual PWS. Using a self-reported classification tool, the participants were classified into 3 groups as English-dominant, Mandarin-dominant, and balanced bilinguals. The results revealed that balanced bilinguals had identical percentage of syllable stuttered in both the languages. The English-dominant group and the Mandarin-dominant group had greater stuttering in non-dominant language. However, the comparison of type of dysfluencies revealed no significant differences between the two languages. Further, it did not vary as a function of language dominance across the three bilingual groups. Schäfer and Robb (2012) examined the nature

of stuttering in 15 German-English bilingual adults who stutter. Results showed that stuttering severity was greater in the non-proficient language (English) compared to the proficient language (German).

The current study sought to examine the nature of stuttering frequency in Kannada-English bilingual adults who stutter (BAWS). It is relevant to do bilingual analysis of stuttering in these individuals as Kannada and English have different linguistic structure, and thus the role of linguistic factors on the nature of stuttering can be investigated. Kannada is a Dravidian language spoken predominantly in Karnataka, southern state in India. Around 45 million people speak this language. Unlike English, Kannada is an alpha-syllabary language, has simple (CVCV) syllabic structure, and always syllables end with a vowel. Further, Kannada has mora-timed rhythmic structure, and it has only emphatic stress (Savithri, Jayaram, Kedarnath, & Goswamy, 2005). Ononiwu (2010) reviewed few cross-linguistic studies done in French (Roberts, 2002), Spanish (Bernstein Ratner & Benitez, 1985), Afrikaan (Jankelowitz & Bortz, 1996), Igbo (Nwokah, 1988), Kannada (Jayaram, 1983), Mandarin (Lim et al., 2008) and English languages. Ononiwu illustrated these languages based on their phonological complexity. Phonological complexity across languages were assessed based on factors such as the total number of consonant phonemes in the languages, the number of syllable structures allowed, the maximum number of consecutive phonemes per syllable, and the tonal patterns in each language. The results showed that Kannada as being the least complex and English being the most phonologically complex languages. Because Kannada and English have a different phonological, phonetic, and prosodic structure, it is possible that the nature of stuttering across Kannada and English languages may be different. An earlier research by Jayaram (1983) studied stuttering in Kannada-English bilinguals, and reported more stuttering in the native language (Kannada) as compared to a second language (English). Another Indian study by Leah (2009) investigated

stuttering severity and pattern of dysfluencies in 12 Kannada-English PWS. The results revealed that there is no consistent pattern in both the languages with respect to the severity of stuttering. However, pattern of dysfluencies were more in L1 (Kannada, dominant language) than L2. Among pattern of dysfluencies, stuttering like dysfluencies of blocks were more in L1 than syllable repetition and prolongation. This inconsistency is seen may be because of language proficiency is not assessed objectively. However, both these studies have few methodological problems like the dysfluencies were calculated by the experimenter himself, and systematic documentation of language proficiency was not done (Coalson et al., 2013; Lim et al., 2008). Hence, further studies are necessary in Kannada-English bilingual PWS.

The second purpose of the study was to compare the effect of grammatical class (content-function word dichotomy) on the stuttering frequency between two languages. Multiple studies with monolingual adults who stutter (AWS) report that they stutter more on content words than on function words (Au-Yeung, Howell, & Pilgrim, 1998; Dayalu, Kalinowski, Stuart, Holbert, & Rastatter, 2002; Howell, Au-Yeung, & Sackin, 1999). In contrast, studies with young children who stutter (CWS) suggest that they stutter more on function words compared to content words (Bernstein Ratner, 1997; Bloodstein & Gantwerk, 1967; Bloodstein & Grossman, 1981; Dworzynski, Howell, Au-yeung, & Rommel, 2004; Howell & Au-Yeung 2007; Howell et al., 1999). However, Abdalla, Robb, and Al-Shatti, (2009) studied the effect of lexical category (content and function word) on stuttering frequency in adult Arabic PWS. Contradictorily, they found no significant difference between content and function words in the occurrence of dysfluency. Vahab, Zandiyan, Hadi falahi, and Howell (2013) also illustrated a high amount of stuttering on content words in CWS. The difference in the stuttering frequency between content and function words is suppose to be associated with difference in the phonetic complexity of content and function words (Howell

and his researchers), because content words carry lexical stress (Wingate, 2002), to improper acquisition of syntax of the language (Bernstein, 1981; Rispoli & Hadley, 2001; Rispoli, 2003), and difference in the frequency of usage of content and function words Dayalu, Kalinowski, Stuart, Holbert, & Rastatter, (2002).

Although the effect of the grammatical class on stuttering frequency is well-documented in monolingual speakers, there is limited research for the same in bilingual speakers. Howell et al. (2004) compared the percentage of dysfluency on content and function words in 11-year old Spanish-English bilingual PWS. Higher percentage of stuttering was observed on content words compared to function words in L1, whereas in L2, higher percentage of stuttering was observed on function words compared to content words. Schäfer and Robb (2012) examined the stuttering like dysfluency and distribution of stuttering on content and function words in 15 German-English BAWS. Results showed significantly higher percentage of dysfluency on content words than function words in L1, whereas no such difference was noticed in L2. Further, significantly greater content words were stuttered in L1 compared L2, whereas the reverse pattern was noticed for function words. Significantly greater function words were stuttered in L2 compared to L1. An investigation of stuttering behavior in Kannada-English bilingual PWS is relevant as we can compare the role of grammatical class on the stuttering frequency between two languages when the languages vary in their linguistic structure.

The third purpose of the study was to examine whether the type of dysfluency varies as a function of grammatical class in two languages in bilingual PWS. Previously, it has been suggested that in monolingual speakers, certain stuttering symptoms may be related to grammatical class (Howell, 2011). Some authors have reported that whole word repetitions on function words were more than content words in children who stutter (Au-Yeung et al., 1998; Bloodstein & Gantwerk, 1967; Bloodstein & Grossman, 1981; Vahab, et al., 2013).

Whereas AWS use more part-word repetitions, prolongations, and broken words on content words (Howell, 2007a). Studies on cross linguistic comparison of the type of dysfluencies in bilingual PWS are limited. Jankelowitiz and Bortz (1996) reported their English-Afrikaans bilingual had more 'typical (normal) disfluencies in Afrikaans than English. Howell et al. (2004) reported more 'stalling' type of dysfluencies on function words in their Spanish-English bilingual PWS. However, Lim et al. (2008) did not find any significant differences in the types of dysfluencies in their Mandarian-English bilingual PWS. As there is limited research in this aspect, it would be worthwhile to compare the types of dysfluencies between two grammatical categories in Kannada-English bilingual PWS. Thus, the objectives of the present study are multifold. First, to compare the stuttering frequency between L1 (Kannada) and L2 (English) in bilingual adults who stutter (BAWS). Second, to compare the stuttering frequency between content and function words within and between two languages. Third, to examine whether the type of disfluency varies between two grammatical classes and languages.

Method

Participants

Twenty five Kannada - English bilingual adults who stutter (23 males and 2 females) participated in the study. Their ages ranged from 16-28 years, with a mean age of 22.56 (standard deviation =3.03) years. As per the self-reported questionnaire, apart from developmental stuttering, none of the participants had any neurological, intellectual, hearing, vision, or other communicative disorders. Their stuttering severity was assessed in Kannada by a qualified speech-language pathologist using Stuttering Severity Instrument for Adults—third Edition (SSI-3) (Riley, 1994). Fifteen participants had mild, five had moderate, and another five had severe stuttering (table 1). None of the participants had taken any kind

speech therapy previously. All the participants had their native language as Kannada and their second language was English. They had a minimum of 6 years of exposure to English

Table 1: Details of the age, gender, and stuttering severity of bilingual adults who stutter (BAWS) who participated in study 1

BAWS	Age	Gender	Severity
S1	26	Male	Moderate
S2	21	Male	Mild
S3	26	Male	Mild
S4	20	Male	Moderate
S5	25	Male	Mild
S6	23	Male	Mild
S7	24	Male	Mild
S8	22	Male	Mild
S9	23	Male	Mild
S10	18	Male	Mild
S11	25	Male	Moderate
S12	18	Male	Severe
S13	20	Male	Mild
S14	20	Female	Mild
S15	23	Male	severe
S16	25	Male	Moderate
S17	24	Male	Mild
S18	20	Male	Moderate
S19	25	Male	Mild
S20	19	Male	severe
S21	28	Male	Mild
S22	23	Female	Severe
S23	25	Male	Mild
S24	25	Male	Mild
S25	16	Male	Severe

Language Proficiency Assessment

The Language Proficiency of the participants was evaluated in two ways. First, participants rated their proficiency of each language on Language Experience and Proficiency Questionnaire (LEAP-Q). LEAP-Q questionnaire is a self-rating scale, which was originally

developed by Marian, Blumenfeld, and Kaushanskaya (2007). This bilingualism assessment tool considers language history, function, proficiency, accent, and affect in each language. Participants rate their language proficiency in all the four language skills: understanding, speaking, reading, and writing. Each domain has zero to four rating, where '0' indicates zero proficiency and '4' indicates native like/perfect proficiency. This questionnaire was adapted and validated to Kannada language by Ramya (2009), which was used in the present study. Using this questionnaire all the participants' language history, language use, and language proficiency was documented.

Based on the questionnaire, all the participants had first exposure to Kannada (L1) from birth. They all had first exposure to English at school. Their mean age of first exposure to English (L2) was 7.32 years (SD = 3.09) and it ranged from 4 to 15years. The total number of years of exposure to each language was collected. The mean age of exposure to Kannada (L1) was 22.4 years (SD = 2.87) and mean age of exposure to English was 7.32 (SD = 6.91) years. Per week they were exposed to Kannada language for 6.92 (SD = 0.27) days, and to English for 5.24 (SD = 1.83) days. Per day, they were exposed to Kannada for 11.24 hours (SD = 2.89 hours) and to English 5.56, (SD= 2.26) hours.

Out of 25 BAWS, 23 participants rated their proficiency as native like/perfect in Kannada (L1) for understanding and speaking, and other two rated as 'good' in speaking, and native like/perfect in understanding domains. Whereas, LEAP-Q scores for English (L2) showed that 4 rated their proficiency as native like/perfect, 19 BAWS rated as having good proficiency and 2 rated as low proficiency for understanding and speaking in English language. All participants had their medium of instruction in English in school.

Second, to gain more information about participants' level of proficiency in English, each participant was given an objective, activity based, Cloze test (Taylor, 1953). Cloze test

has been widely used to measure second language proficiency (Oller, 1973). Cloze test includes a passage with thirty blank spaces of missing letters, and it is scored based on contextually acceptable word. The participant should have a good understanding of language context and vocabulary to accurately complete this test (Schäfer & Robb, 2012). Contextually acceptable word scoring method was followed for scoring the responses on Cloze test (Kobayashi, 2002; Oller, 1972). For every contextually correct word a score of 1 was given. While scoring spelling mistakes were taken into account. Percentage was calculated by dividing the number of correct answers by 30 and then multiplied by 100. Higher scores indicate better language proficiency. All BAWS had above 60 percentage score in cloze test, which indicated good L2-English proficiency. Cloze test scores, language proficiency description in BAWS for L1 (Kannada) and L2 (English) including maximally used language, age of first exposure and the total number of years exposed are provided in the table 2.

Table 2: Details of the maximally used language, age of first exposure to English, total number of years of exposure to two languages, cloze test score, and proficiency in understanding, speaking, reading, and writing in two languages of the BAWS.

Participants	Maximally used Language	Age of first exposure to English	Total number of years of exposure		Cloze test score	Proficiency	
			L1	L2		L1	L2
S1	K	8	26	12	100	U-4;S-4;R-4;W-4	U-4;S-3;R-4;W-4
S2	K	10	21	11	100	U-4;S-4;R-4;W-4	U-4;S-3;R-4;W-4
S3	K	10	23	15	96.6	U-4;S-4;R-4;W-4	U-3;S-3;R-2;W-2
S4	K	13	20	7	86.6	U-4;S-4;R-4;W-	U-3;S-3;R-3;W-

						4	3
S5	K	7	25	10	90	U-4;S-4;R-4;W-4	U-4;S-3;R-4;W-4
S6	K	8	23	13	93.3	U-4;S-4;R-4;W-4	U-4;S-3;R-3;W-3
S7	K	5	24	20	90	U-4;S-3;R-1;W-2	U-4;S-3;R-2;W-4
S8	K	5	23	7	73.3	U-4;S-4;R-4;W-4	U-3;S-3;R-3;W-3
S9	K	13	23	9	86.6	U-4;S-4;R-4;W-4	U-4;S-3;R-4;W-4
S10	K	4	18	14	93.3	U-4;S-4;R-4;W-4	U-4;S-3;R-3;W-4
S11	K	8	25	12	90	U-4;S-4;R-4;W-4	U-3;S-3;R-4;W-4
S12	K	5	18	10	96.6	U-4;S-4;R-4;W-4	U-4;S-3;R-3;W-3
S13	K	6	20	14	90	U-4;S-4;R-1;W-1	U-4;S-4;R-4;W-4
S14	K	5	20	15	96.6	U-4;S-4;R-4;W-4	U-4;S-4; R-4;W-4
S15	K	5	23	17	96.6	U-4;S-4;R-4;W-4	U-4;S-3;R-3;W-3
S16	K	5	25	19	93.3	U-4;S-4;R-3;W-3	U-3;S-3;R-3;W-3
S17	K	4	24	20	100	U-4;S-4;R-3;W-3	U-4;S-4;R-4;W-4
S18	K	4	20	20	96.6	U-4;S-4;R-2;W-2	U-4;S-4;R-3;W-3
S19	K	7	25	12	93.3	U-4;S-4;R-4;W-4	U-4;S-3;R-3;W-3
S20	K	7	19	13	100	U-4;S-4;R-4;W-4	U-4;S-3;R-4;W-4

S21	K	9	25	20	100	U-4;S-3;R-3;W-4	U-3;S-3;R-3;W-3
S22	K	4	23	17	96.6	U-4;S-4;R-4;W-4	U-4;S-3;R-4;W-3
S23	K	10	25	15	90	U-4;S-4;R-4;W-4	U-3;S-2;R-3;W-3
S24	K	15	27	9	73.3	U-4;S-4;R-4;W-4	U-2;S-2;R-3;W-3
S25	K	6	16	10	90	U-4;S-4;R-3;W-4	U-4;S-3;R-3;W-4

(1-Zero proficiency; 2-Low Proficiency; 3-Good Proficiency; 4-Native like/Perfect)

U-Understanding; S-Speaking; R-Reading; W-Writing, K-Kannada-L1; E-English-L2

Recording procedure

From each participant two 10-minute spontaneous speech samples, once in Kannada and once English, were audio-video recorded in a sound-treated room using a SONY Handycam recorder (HDR-CX 280). The tasks for spontaneous speech sample included speaking about topics such as hobbies, places, movies, and personal information. Spontaneous speech samples were recorded while the participants conversed with a Kannada-English bilingual clinician. The order of speech sample recording in each language was counterbalanced across participants. The participants were instructed to converse in only one language and not to use words from other language.

Dysfluency Analysis

A Kannada-English bilingual speech-language pathologist (SLP) did the dysfluency analysis. This judge was unaware of purpose of the study. The SLP had more than 10 years of training in the dysfluency analysis. First, the SLP orthographically transcribed the first 300 syllables of spontaneous speech sample, and then noted the loci of dysfluencies. Stuttering dysfluencies which included sound/syllable repetitions, monosyllable whole word repetitions,

prolongations, and blocks were counted (Conture, 1990). Then, the percentage of syllables stuttered (%SS) was calculated for each language by dividing the total number of dysfluencies by the total number of syllables and multiplied by 100. Similarly, the % SS was calculated separately under two grammatical classes (content and function words) for Kannada and English. Content words included noun, verbs, adverbs, adjectives, and function words included articles, prepositions, conjunctions, pronouns, auxiliaries. Further, the percentage of different types of stuttering dysfluencies was counted separately for each grammatical category in each language. This was done by dividing each type of dysfluency by the total number of dysfluencies separately for each type of grammatical category.

Reliability measures

Intra - and inter - judge reliability was established for the % SS. For intra-judge reliability, the first judge reanalyzed 20% of the samples. Pearson correlation coefficients were calculated between the first and second judgment separately for Kannada and English. The results showed a very high correlation between the first and the second judgment for Kannada (r=0.99) and English (r=0.99), showing that the measurements are reliable. To find the inter-rater reliability, another experienced Kannada-English bilingual, speech-language pathologist reanalyzed all the data. The intra-class correlation coefficients (single measures ICCs and average measures ICCs) were computed for the measurements done by two judges. Single measures ICCs which compared each measurement done by one judge to another judge showed high correlation for Kannada (r=0.94) and English (r=0.92). Average measures ICCs which represent the reliability of one judge to the mean measures by the other judge also proved to be highly reliable for Kannada (r=0.97) and English (r=0.96).

Results

Comparison of the percentage of syllables stuttered between L1 (Kannada) and L2 (English)

Before applying inferential statistics to the raw data, arcsine transformation was done to participants' proportional scores. This was done because the means and variances of proportional data are correlated, and hence are not suitable for inferential statistics (Schaivetti & Metz, 2006). Figure 1 illustrates comparison of the percentage of syllables stuttered between L1 and L2. In Kannada, the percentage of syllables stuttered ranged from 1.9% to 20.65% with a mean of 7.67% (*SD*= 4.11). In English, the percentage of syllables stuttered ranged from 2.6% to 21.39% with mean of 10.45 (*SD*=5.69). Paired t-test was done to compare the percentage of syllables stuttered between two languages, and results showed statistically significant difference between two languages [t (1, 24) = - 4.262, $p < 0.05$].

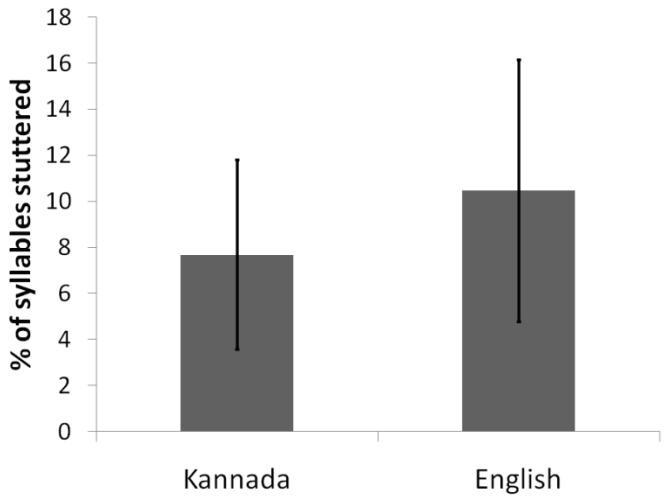

Figure 1: Mean % SS in L1 (Kannada) and L2 (English). The error bars indicate standard deviation scores

Content and function word analysis

The percentage syllables stuttered (%SS) for content and function words for Kannada (L1) and English (L2) are shown in figure 2. The % SS for content words in Kannada ranged from 50% to 100% with a mean of 79.51 (SD=14.58). The %SS for function words in Kannada ranged from 0% to 50% with a mean of 20.5 (SD=14.57). The % SS of content

words in English ranged from 50% to 89% with a mean of 69.55 (SD=11.15) for the group. The % SS of function words in English ranged from 10.9% to 50% with a mean of 30.45 (SD= 11.15) for the group. Two-way analysis of variance (ANOVA) was done to compare the dysfluencies between content and function words within each language and between two languages. Main interaction effects for language and grammatical classes were tested. The results showed no significant main effect for the language ($F(1, 24) = 1.740$, $p > 0.05$). However, a significant main effect for the grammatical class was noted ($F(1, 24) = 153.915$, $p < 0.05$). Further, significant interaction was observed between language and grammatical classes ($F(1, 24) = 8.769$, $p < 0.05$). Independent sampled t-test was done to find interaction of languages and grammatical classes. There was a significant difference in the % SS between two languages for both content ($t(24) = 2.962$, $p < 0.05$) and function words ($t(24) = -2.961$, $p < 0.05$). Further, there was a significant difference in the % SS between content and function words in both Kannada ($t(14) = 10.122$, $p < 0.05$) and English ($t(14) = 8.770$, $p < 0.05$) languages.

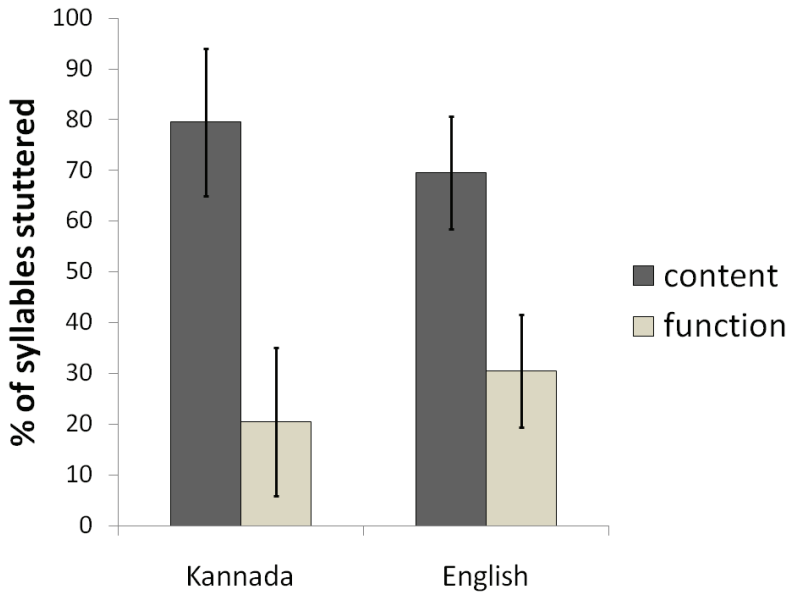

Figure 2: Mean % SS in L1 (Kannada) and L2 (English) with respect to content and function words. Error bars indicate standard deviation scores.

Types of disfluencies in each grammatical category

Table 3 shows the types of disfluencies with respect to each grammatical class (content and function word) in L1 and L2. The types of dysfluencies were separately calculated under content and function word categories for each language. The types of dysfluencies considered were sound/ Syllable repetitions, mono-syllable whole word repetitions, prolongations, and blocks. For both content and function words, in both the languages, most frequent type of dysfluency was blocks (49.6% to 65.2%) and the least frequent type was prolongations (2.88% to 5.57%). Relatively larger percentage of monosyllable syllable whole word repetitions (26.46%) were stuttered for function words in L2. Syllable repetitions showed a lower percentage of stuttering on function words in L2. As the data was found to be skewed, Wilcoxon signed ranked test was done comparing each type of dysfluency between content and function words within each language, and between two languages separately for content and function words. In Kannada, there was no statistically significant difference in the number of dysfluencies between content and function words for all types of dysfluencies: syllable repetition ($Z = -.341$, $p > 0.05$), monosyllable whole word repetitions ($Z = -.314$, $p > 0.05$), blocks ($Z = -1.531$, $p > 0.05$), prolongations ($Z = -1.214$, $p > 0.05$). In English, a statistically significant difference was found in the number of dysfluencies between content and function words only for sound/syllable repetitions and monosyllable whole word repetitions: sound/syllable repetitions ($Z = -3.003$, $p < 0.05$), monosyllable whole word repetition ($Z = -3.650$, $p < 0.05$), blocks ($Z = -1.629$, $p > 0.05$), prolongations ($Z = -0.534$, $p > 0.05$). The comparison of the number of dysfluencies between Kannada and English languages separately for content and function words suggested that, for content words, there was no significant difference between two languages in the mean

number of dysfluencies for all types of dysfluencies: syllable repetition ($Z = -1.343$, $p > 0.05$), monosyllable whole word repetition ($Z = -0.024$, $p > 0.05$), blocks ($Z = -.529$, $p > 0.05$), prolongations ($Z = -1.481$, $p > 0.05$). For function words, there was a significant difference in the mean number of dysfluencies between two languages only for sound/syllable repetitions and monosyllable whole-word repetitions: syllable repetitions ($Z = -2.433$, $p < 0.05$), monosyllable whole word repetitions ($Z = -2.782$, $p < 0.05$), blocks ($Z = -.487$, $p > 0.05$), prolongations ($Z = -.524$, $p > 0.05$).

Table 3: Details of the mean and standard deviation scores for each type of dysfluency between content and function words in two languages

Types of dysfluencies	**Content word**		**Function word**	
	Kannada	English	Kannada	English
SR	29.52 (SD=22.44)	24.36 (SD=21.91)	28.25(SD=26.21)	12.29(SD=22.57)
WWR	7.78(SD=18.35)	4.93(SD=5.43)	9.02(SD=22.32)	26.46(SD=40.64)
Blocks	59.82 (SD=26.63)	65.2(SD=23.36)	49.6(SD=31.02)	55.68(SD=43.43)
Prolongations	2.88(SD=9.4)	3.51(SD=6.99)	5.13(SD=15.51)	5.57(SD=1.54)

SR- Sound/syllable repetitions, WWR-monosyllable whole word repetitions, SD- standard deviation

Discussion

The first research question posed in this study was whether the stuttering frequency differed between two languages in Kannada - English BAWS. The results revealed that stuttering frequency varied between two languages. This supports the "different- hypothesis" (Nwokah, 1988), which states that stuttering is present in both languages but differently in two languages (Ardila et al., 2011; Bernstein Ratner & Benitez, 1985; Jankelowitz & Bortz, 1996; Jayaram, 1983; Lim et al., 2008; Lee et al., 2014; Nwokah, 1988; Schäfer & Robb,

2012). The current findings also suggested that the stuttering frequency was greater in L2 (English) compared to L1 (Kannada), which is in consonance with previous results (Jankelowitz & Bortz , 1996; Lim et al., 2008; Nwokah, 1988; Schäfer & Robb, 2012). Current results are in contrast to Jayaram (1983) and Leah (2009) findings in Kannada-English BAWS. Jayaram reported higher stuttering in L1 compared to L2. Leah reported no significant difference between L1 and L2. In our study, higher stuttering in L2 compared to L1may be because of two possible reasons. First, it strengthens the argument towards the role of language proficiency for the differences in the stuttering frequency in two languages. LEAP-Q Scores from our participants suggested that all BAWS had native like/perfect proficiency in Kannada language. Whereas, scoring in English suggested good, but lower proficiency than Kannada. Due to lower proficiency in L2 (English), our BAWS may experience more cognitive load while formulating the linguistic features of the L2 (Jankelowitz & Bortz, 1996; Lim et al., 2008). This may result in slower speech motor planning in L2 which increases the frequency of stuttering (Lim et al., 2008). Apart from language proficiency, the second possible reason could be differences in the phonological complexity between the two languages (Nwokah, 1988; Lim et al., 2008; Ardila et al., 2011). It has been suggested that Kannada has the least and English has the most complex phonological structure (Ononiwu, 2010). Complex languages may require a longer planning interval which may result in greater stuttering (Bernstein Ratner & Benitez, 1985).Thus, the phonological complexity of English language may also be a contributing factor for the higher frequency of stuttering than Kannada. Among the two possible reasons we speculate language proficiency may be a major factor for higher stuttering in L2 because our comparison of stuttering frequency for content and function words between two languages provided little evidence for the role of phonological complexity on the moments of stuttering.

The second purpose was to compare the relationship between grammatical class (content and function word dichotomy) and stuttering frequency in BAWS. The results showed that BAWS stuttered on both content and function words, and there was significantly more stuttering on content words than function words in both the languages. Current results are in consonance with Howell et al. (2004) report. Schäfer and Robb (2012) also reported significantly more stuttering on content words compared to function words in L1. However, in their study, even though the results were not statistically significant, higher stuttering was noticed on function words compared to content words in L2. Apart from this, many researchers with monolingual AWS have reported higher stuttering on content words compared to function words (Au-Yeung, et al., 1998; Brown, 1937, 1938, 1945; Howell, et al., 1999; Dayalu, et al., 2002).

When the comparison was done between two languages separately for each grammatical category, there was significantly more stuttering on content words in L1 compared to L2. In contrast, significantly more stuttering was noticed on function words in L2 compared to L1. Current findings are in consonance with Howell et al. (2004) and Schäfer and Robb (2012) findings. Schäfer and Robb (2012) attributed greater stuttering on content words in L1 (German) compared to L2 (English) to more complex phonological structure of German language over English. However, in our study, even though Kannada has more simple phonological structure compared to English (Ononiwu, 2010), greater stuttering on content words in Kannada compared to English suggests that phonological/phonetic structure may not be only factor for higher moments of stuttering on content words. Previously it has also been suggested that because content words carry lexical stress, they are more prone to stuttering compared to function words (Wingate, 2002). In our Kannada-English BAWS this explanation doesn't hold good as Kannada has only emphatic stress, whereas English has lexical stress. Hence, the role of lexical stress as one of possible factors for higher stuttering

on content words may also not be a valid justification. Two other possible explanations can be posited for the current findings. First, current results could be explained on the basis of generalized adaptation hypothesis (Dayalu et al., 2002). These authors explained the differences in frequency of stuttering on content and function words on the basis of differences in the word frequency of these two grammatical classes. Because function words occur more frequently compared to content words, CWS may have more difficulty with these words. However, over the years, because of repeated use of these function words (adaptation effect) AWS may have less stuttering on function words (Dayalu et al., 2002). In bilingual context, the differences in the frequency of words can be applied similarly. As all our participants were sequential bilinguals, and they used L2 less frequently, they may have more stuttering on function words in L2 compared to L1, and more stuttering on content words in L1 compared to L2 (Schäfer and Robb, 2012). Second, our BAWS may be exhibiting more mature form of stuttering in their L1 (more proficient language, Kannada) and less mature form of stuttering in L2 (less proficient language, English) (Howell et al., 2004; Schäfer & Robb, 2012). According to Howell et al. (1999), content words are difficult to plan as they are linguistically and motorically more complex for CWS. When the plan for executing content words are not available, children under the age of 8 years (beginning stutterers who do not yet have a full-blown chronic disorder) would, for the most part, repeat function words in their entirety (whole word repetitions) or pause before saying the content words that follow the function words. It has been suggested that function word are "easy" and their repetition and pausing before a content word would allow them extra time to plan the more "difficult" content words. This tactic of repetition of whole function words and pausing before content words was called “stalling." On the other hand, children over the age of 12 and adults who stutter, who presumably have a fully developed, chronic disorder, attempt to produce content words without stalling even though the words may not yet have fully completed motor plans

resulting in part-word repetitions, prolongations, and broken words. Howell (2007a) called these disfluencies "advancings." In bilingual context, it could be that our BAWS may be adopting a different kind of strategies for two different languages. Our comparison of different types of dysfluencies between the grammatical classes in both the languages provided more corroborative evidence for this proposition.

In Kannada, there was no significant difference in the number of dysfluencies between content and function words for all types of dysfluencies. In English, significantly more sound/syllable repetitions were observed on content words than function words. On the other hand, significantly more monosyllabic whole-word repetitions were observed on function words compared to content words. Across different types of dysfluencies, when the comparison was done between two languages separately for content and function words, results suggested that there was no significant difference between two languages in the number of dysfluencies for all types of dysfluencies for content words. However, for function words, significantly more sound/syllable repetitions occurred in Kannada compared to English, whereas, significantly more monosyllabic whole-word repetitions occurred in English compared to Kannada. This further supports the claim that our BAWS may be exhibiting more mature form of stuttering in their L1 (more proficient language, Kannada) and less mature form of stuttering in L2 (less proficient language, English) (Howell et al., 2004; Schäfer & Robb, 2012). Howell (2004a, 2007a, 2007b) reported that CWS use more pauses, whole-word and phrase repetitions as ‘stalling tactics’ on function words to delay the attempt of content words whose plan is not complete. Whereas, in their mature form AWS use more part-word repetitions, prolongations, and broken words as ‘advancing tactics’. Our BAWS may have more adult form of stuttering in Kannada. Hence, they exhibited more syllable repetitions and blocks. In contrast, the greater frequency of whole word repetitions

on function words in English might be the resultant of such self repair strategy employed in a less proficient language.

Collectively, results showed that our Kannada-English BAWS stutter in both the languages, and significantly more in their less proficient language. In both the languages, content words were stuttered more than function words. When the comparison was done between two languages, significantly more content words were stuttered in L1 (Kannada) compared to L2 (English). In contrast significantly more function words were stuttered in L2 compared to L1. Their types of dysfluencies also varied depending on the grammatical category and language. They had a more adult form of stuttering in their more proficient language and less mature form of stuttering in their less proficient language. Current results suggest that it is necessary to consider the language proficiency and language differences while assessing BAWS. As our study only included sequential bilinguals, further studies with simultaneous BAWS are necessary to verify current findings. Future studies can also be extended to the investigate nature of stuttering in bilingual/multi-lingual CWS. In addition, effect of fluency treatment in one language on the untreated languages can be investigated.

Study 2: Assessment of stuttering in native, non-native, and second language

Individuals with stuttering exhibit both overt and covert behaviors. The overt behaviors include sound/syllable repetitions, prolongations, blocks and monosyllable whole word repetitions. The covert behaviors include increase in anxiety, avoidance behaviors, and attitudinal changes (Conture & Curlee , 2007). For the precise diagnosis of stuttering, reliable judgment of above mentioned behaviors is necessary. One common method to measure stuttering is to count the stuttering events and document as frequency or percentage of stuttering as per total number of words or syllables (Wingate, 1977). Apart from these, another method is rating stuttering severity perceptually on rating scale (Cordes, 2000; Einarsdóttir and Ingham, 2005). Along with rating stuttering severity, clinicians also need to measure rate of reading and speech naturalness.

One among the various issues related to assessment of stuttering is clinical training and experience of the clinicians. Multiple studies have reported that inter-rater reliability for the identification and rating of severity is poor even among the highly trained judges (Curlee, 1981; Kully & Boberg, 1988; Ingham & Cordes, 1997; Cordes, 2000). Brundage, Bothe, Lengeling and Evans (2006) demonstrated the assessment of stuttering by highly experienced judges, practicing clinicians and students. The study showed similar analysis by practicing clinicians and students which varied from highly experienced judges. The assessment of stuttering also depends on judge's familiarity of the language being assessed. The task of stuttering analysis is more challenging for the clinicians who are unfamiliar with a language (Van Borsel, Maes, & Foulon, 2001). Clinicians require some knowledge about phonemic and prosodic features of a language for assessment in a language (Conture & Curlee, 2007). For instance, Finn and Cordes (1997) reported that identification of stuttering in BWS may be more difficult if the clinician is not familiar with the language because all languages have some rule based practices. Also, commented that reliability and validity of such judgments

are not well documented in the literature. Moreover, severity of stuttering can also manipulate the assessment in a non-native language, evidenced as stuttering can be easily identified in a foreign language for severe category (Watson & Kayser, 1994). During assessment of stuttering in an unfamiliar language, it is important to consider the language proficiency of Speech Language Pathologist as they may overestimate or underestimate the condition.

There is scarcity of studies addressing assessment of stuttering behaviors and language familiarity. Therefore little is known about the role of clinician's knowledge of language on the assessment of fluency in their native and nonnative languages. Lack of researches in this area has led to inadequate knowledge about the role of language familiarity in assessment of stuttering. Researches of this kind are of also clinical significance as it is not known if clinicians misjudge the overall severity of the disorder in an unfamiliar language. The efficacy of stuttering disfluency analysis by clinicians in a language they do not speak is still a query. Humphrey (2004) suggests that familiarity of language is not a significant factor in assessing stuttering and knowledge of Spanish language did not play role in precise measurement of stuttering for Spanish/English speakers. The study included six bilingual English–Spanish speaking judges and monolingual English-speaking judges who had taken a course in fluency disorders. Their task was to identify disfluencies from audiovisual speech samples recorded from an English–Spanish bilingual speaker. The judges were graduate students in speech-language pathology. The judges were instructed to press a switch to indicate disfluencies. Total percentages of judged disfluencies were measured for each group of judges and no significant difference was noticed. But the study included recorded sample from only one speaker. Moreover, the judges might have been familiar with some features of Spanish.

Van Borsel and Pereira (2005) compared stuttering assessment in a familiar and unfamiliar language. Recorded samples from 10 Dutch speakers (5 persons who stutter [PWS] and 5 persons who do not stutter [PWNS]) were judged by 14 native speakers of Brazilian Portuguese and Dutch. The judges were asked to identity PWNS and PWS as well as to rate stuttering severity on a 5-point scale in native and non-native languages. Dutch judges could accurately identify native-language PWS than non-native language PWS. Also, both groups of judges identified PWNS appropriately in their native language rather than in the other language. They proposed that accurate assessment was present for native language than the unfamiliar language and thus familiarity of language is an important factor in assessing stuttering. Further findings by Van Borsel, Leahy & Pereira (2008) suggest that judges speaking Dutch and/or English were better than Brazilian Portuguese speakers at identifying Dutch adults who stuttered. They concluded that language familiarity and closeness of the listener's native language are influencing factors for judging stuttering. If the language being assessed is closer to the clinician's native language, task of stuttering assessment requires lesser effort. The chance of false positive judgment is high from a judge whose language is remote from the language assessed.

Apart from the above mentioned studies which were done in adults with stuttering, few researches report the issue in children. Einarsdóttir and Ingham (2009) addressed the issue of language influence on judging stuttering in children. Ten experienced Icelandic speech-language pathologists (ICE-SLPs) and 10 experienced U.S. speech-language pathologists (US-SLPs) judged 5sec interval video samples of 9 children with stuttering (CWS). Severity of stuttering was rated as on a 9 point scale. The study suggested that language familiarity does not influence rating of stuttering. Experienced SLPs could well identify the stuttering and non-stuttering moments by CWS even for an unfamiliar language but variability was greater for identifying the stuttering moments.

The incidences for Speech Language Pathologists to assess and treat clients speaking a language that is different from one's own language are high. This may probably lead to misinterpretation of data which further lead to misdiagnosis of speech and language disorders (Finn &Cordes, 1997; Van Borsel, Maes, &Foulon 2001). Mackey, Finn and Ingham (1997) proved that speech naturalness is influenced by accent of native or another language. Later, Conture and Curlee (2007) recommended that replication of similar studies using speakers and judges of different languages are necessary. In a country like India, large numbers of Speech Language Pathologists are bilinguals and also often they will have to assess stuttering in an unfamiliar language.

Evidenced from the literature, the role of language knowledge for assessment of stuttering is still uncertain. Some authors reported that language knowledge influences stuttering assessment and opposing results were also found. Moreover, factors like experience and type of clinical training of judges might have brought about such conflicting results. In related researches, they have also not considered some aspects of stuttering assessment such as speech naturalness rating. The studies reviewed here have considered assessment of stuttering in a familiar and unfamiliar language but the judges were not necessarily bilinguals. More researches on different assessment facets of BAWS in native and non native languages is necessary. Moreover, in a country like India, bilingualism is common. The judges will be mostly exposed to two languages and will have to assess in a second language in addition to native and non-native language. Keeping these points, the present study aims to:

(1) To compare percentage of syllables stuttered, perceptual rating of stuttering severity, and speech naturalness between native and non native judges

(2) To compare intra- and inter-listener agreement for these measures between native and non native listeners

(3) To compare the variability of rating these measures in a native , non-native and a second language

Method

Speech sample

Speech sample from eight Kannada - English bilingual adults who stutter between age range of 20-28 years (mean age= 23.25 years; 7 males, & 1 female) were used as stimuli for the study (details shown in table 1). A self-reported questionnaire was used to obtain demographic information from these participants. All participants reported that, apart from stuttering, they did not have any neurological, intellectual, hearing, vision or other communicative disorders. The stuttering severity was assessed in Kannada using Stuttering Severity Instrument for Adults—third Edition (SSI-3) (Riley, 1994). The stuttering severity of the participants ranged from very mild to moderate.

Speech sample were recorded while the participants conversed with a Kannada-English bilingual speech-language pathologist. Speech samples were recorded in quiet room without any interference from background noise. The topics for speech sample included speaking spontaneously about hobbies, places and personal information . All the speech samples were recorded using a digital audio recorder. Speech samples were recorded in both Kannada and English languages. The order of recording was counter balanced across participants. The bilingual Kannada-English speech language pathologist orthographically transcribed the recorded speech samples. The transcripts consisted of first three hundred syllables.

Table 4: Details of the demographic data of bilingual adults who stutter (BAWS)

Participants	Age	Gender	Age of onset	SSI-3 score	Severity
S1	28	Male	5	18	Mild
S2	24	Male	<5	18.5	Mild
S3	25	Male	4	15	Very mild
S4	25	Male	6	25.5	Moderate
S5	20	Female	4	21.5	Mild
S6	20	Male	4	29	Moderate
S7	21	Male	3	15	Very mild
S8	23	Male	6	16.5	Very mild

Participants

Two groups of Speech Language Pathologists participated in this study. The first group consisted of ten Kannada- English bilingual adult speakers. The second group consisted of ten Malayalam-English bilingual adult speakers. Both the groups of SLPs had at least four years of training in the assessment and management of fluency disorders, were aware of diagnosis of developmental stuttering, and had provided treatment for individuals with stuttering in the past two years. Their language proficiency, language use, and language history was assessed through Language Experience and Proficiency Questionnaire (LEAP-Q) (Marian, Blumenfeld and Kaushanskaya, 2007). This questionnaire was adapted to Indian Context by Ramya (2009) which was used to in the present study. Both groups of listeners had perfect/ native like proficiency in their L1 (Kannada or Malayalam), whereas in L2 (English) they had good proficiency.

Procedure

The recorded samples were then presented to both the groups of listeners. Total of 16 recorded samples were presented to each listener of which included 8 Kannada and 8 English samples. For intra rater reliability testing four (2 Kannada and 2 English) samples were

replayed to each listener. An offline analysis of stuttering was then done by both listener groups. The recordings were played to SLPs individually through headphones at a comfortable intensity level and the listeners had to do the following tasks in Kannada and English languages: (1) identify stuttering like disfluencies on the transcribed manuscript of speech samples. Each listener was given the description of SLDs as per Conture (1990). Second judges were also asked to rate severity of stuttering, and speech naturalness.

Scoring

Calculation of percentage of syllables stuttered

Individuals of each listener group listened to the speech sample and marked stuttering like disfluencies (SLDs) which included syllable/ sound repetition, single syllable word repetitions, prolongations, and blocks on the transcript provided (Conture, 1990). Then the percentage of syllables stuttered was calculated for each language by dividing SLDs by total number of syllables and multiplied by 100.

Rating severity of stuttering

The judges had to then perceptually rate stuttering severity. After identifying the dysfluencies, the judges were to assign a numerical value that will represent the overall severity for the individuals with stuttering. For this purpose, a commonly used 9-point rating scale (O'Brian, Packman, & Onslow, 2004), was used. The rating scale showed an increase in severity from right to left side of the scale with "1" indicating no stuttering and "9" indicating severe stuttering. The measure was found to be reliable and consistent for measurement of stuttering severity (O'Brien et al., 2004).

Rating speech naturalness

Speech naturalness is a measure of how natural the speech of an individual sounds to another. Finally, the judges were to allot a numerical value that showed the overall naturalness for the

individuals with stuttering. The speech naturalness was rated by the listeners on a 9-point rating scale (Martin, Haroldson & Triden, 1984). The scale specified 'very natural' speech on left side and 'very unnatural' speech on right side.

Data analysis

The obtained raw data was analyzed using various statistical procedures. Descriptive statistics was computed for the measurements (percentage of syllables stuttered, severity, and naturalness) calculated for Kannada and Malayalam listeners for both Kannada and English samples. Paired t test was done to compare the percentage of syllables stuttered, perceptual rating of stuttering severity, and speech naturalness rating between two groups of listeners. Intrarater reliability was done using Pearson product moment correlation coefficient. For inter rater reliability, the data was subjected to single measures and average-measures intraclass correlation coefficient analysis. Variability for each measure as rated by two listener groups in a native language, non native language, and second language was done using variance measures.

Results

Comparison of percentage of syllables stuttered between two groups of listeners for Kannada and English samples

Table 5 shows the results of percentage of syllables stuttered for both groups of listeners in two languages. Both groups of listeners identified equal number of dysfluencies in Kannada and English languages. The results of paired t test showed statistically no significant difference between Kannada and English listeners ($t(1, 7) = -1.65$, $p > 0.05$) for Kannada samples, however, significant difference between two groups was found for English samples ($t(7) = -2.434$, $p < 0.05$),

Table 5: Comparison of percentage of syllables stuttered between Kannada and Malayalam listeners for Kannada and English samples

Subjects	*Kannada listeners*		*Malayalam Listeners*	
	Kannada samples	*English samples*	*Kannada samples*	*English samples*
Subject1	2.82	4.14	2.56	3.95
Subject2	1.03	2.18	0.73	1.66
Subject3	1.59	6.51	1.4	6.93
Subject4	4.08	3.6	5.29	5.19
Subject5	3.26	3.86	3.87	4.89
Subject6	5.67	6.75	6.66	8.24
Subject7	2.06	4.57	2.96	5.14
Subject8	5.42	4.7	5.39	5.43
Mean (SD)	3.24(1.71)	4.53(1.50)	3.60(2.07)	5.17(1.94)

Comparison of perceived severity between two groups of listeners for Kannada and English samples

Table 6 shows the results of perceived stuttering severity for both groups of listeners in two languages. The rating of stuttering severity in both groups of listeners was almost identical in Kannada and English languages. The results of paired t test showed statistically no significant difference between two groups of listeners for both Kannada ($t(7) = -1.78$, $p > 0.05$) and English samples ($t(7) = -1.737$, $p > 0.05$),

Table 6: Comparison of perceived stuttering severity between Kannada and Malayalam listeners for Kannada and English samples

	Kannada listeners		*Malayalam Listeners*	
Subjects	*Kannada samples*	*English samples*	*Kannada samples*	*English samples*
Subject1	2.1	2.4	2.6	3.2
Subject2	1.3	1.5	1.2	1.8
Subject3	1.8	4.2	2.4	4.4
Subject4	3.8	3.6	4.4	4.3
Subject5	3.0	3.2	3.2	3.4
Subject6	3.6	5.0	4.3	4.6
Subject7	2.0	3.0	2.1	2.8
Subject8	4.3	3.7	3.8	4.1
Mean (SD)	2.73(1.08)	3.32(1.07)	3.00(1.12)	3.57(0.96)

Comparison of perceived speech naturalness between two groups of listeners for Kannada and English samples

Table 7 shows the results of perceived speech naturalness for both groups of listeners in two languages. The rating of speech naturalness in both groups of listeners was almost identical in Kannada and English languages. The results of paired t test showed statistically no significant difference between two groups of listeners for both Kannada ($t(1, 7) = -1.64$, $p > 0.05$) and English samples ($t(7) = 1.963$, $p > 0.05$).

Table 7: Comparison of perceived speech naturalness between Kannada and Malayalam listeners for Kannada and English sample

	Kannada listeners		*Malayalam Listeners*	
Subjects	*Kannada samples*	*English samples*	*Kannada samples*	*English samples*
Subject1	2.1	2.6	2.6	2.9
Subject2	1.9	2.3	1.5	2.0
Subject3	2.3	4.4	2.7	4.1
Subject4	3.6	4.7	4.1	3.5
Subject5	3.1	3.0	3.1	3.1
Subject6	3.9	4.7	4.1	4.6
Subject7	2.0	3.1	2.1	2.7
Subject8	3.8	4.2	3.5	3.5
Mean (SD)	2.83(0.85)	3.62(0.97)	2.96(0.92)	3.30(0.81)

Intrarater agreement

Two ratings of 20% data from each listener for measurements percentage of syllable stuttered, perceived severity of stuttering and speech naturalness were taken for intrarater reliability. Pearson correlation coefficients analysis was done to find intrarater agreement in native language, non native language and second language for both groups of listeners. For all three measures (percentage of syllable stuttered, perceived severity of stuttering and speech naturalness) results revealed good correlation between two ratings for both groups of listeners while rating samples in native language, non native language as well as in second language (tables 8,9 and 10 respectively).

Table 8: Correlation values of intrarater agreement for percentage of syllable stuttered

	Kannada listeners		*Malayalam listeners*	
	Kannada (r)	English (r)	Kannada (r)	English (r)
Rater1	0.97	*0.95*	*0.92*	*0.98*
Rater2	*0.98*	*0.89*	*0.93*	*0.97*

Table 9: Correlation values of intrarater agreement for perceived severity of stuttering

	Native listeners		*Non native listeners*	
	Kannada (r)	English (r)	Kannada (r)	English (r)
Rater 1	*0.72*	*0.87*	*0.81*	*0.95*
Rater 2	*0.96*	*0.97*	*0.91*	*0.81*

Table 10: Correlation values of intrarater agreement for speech naturalness

	Native listeners		*Non native listeners*	
	Kannada (r)	English (r)	Kannada (r)	English (r)
Rater 1	*0.98*	*0.95*	*0.87*	*0.97*
Rater 2	*0.71*	*0.86*	*0.93*	*0.94*

Interrater reliability

Intraclass correlation coefficients (ICCs) including single measures and average measures were done to document interrater reliability for native language (Kannada listeners assessing stuttering in Kannada), non-native language (Malayalam listeners assessing stuttering in Kannada) and second language (both groups of listeners assessing stuttering in English). Single measures ICCs refer to evaluating the ratings by each listener to each other listener and average measures ICCs refer to comparing ratings of each listener to mean of each speaker. When average measures ICCs were computed, the findings showed high correlation for rating the three measures (percentage of syllable stuttered, perceived severity of stuttering and speech naturalness) in native language, non native language and second language. However, moderate correlation was noted between ratings (for percentage of syllable stuttered, perceived severity of stuttering and speech naturalness) in all languages

when single measures ICCs were calculated. Single measures ICCs and average measures ICCs for percentage of syllable stuttered, perceived severity of stuttering and speech naturalness are shown in table 11, 12, 13 respectively. Overall results suggested moderate to high interrater reliability for all measures for native language, non native language and second language.

Table 11: Details of the intraclass correlation coefficients (ICCs) values for percentage of syllable stuttered

	Native listeners		*Non native listeners*	
	Kannada (r)	English (r)	Kannada (r)	English (r)
Single measures ICCs	*0.61*	*0.44*	*0.56*	*0.43*
Average measures ICCs	*0.94*	*0.89*	*0.93*	*0.88*

Table 12: Details of the intraclass correlation coefficients (ICCs) for perceived severity of stuttering

	Native listeners		*Non native listeners*	
	Kannada (r)	English (r)	Kannada (r)	English (r)
Single measures ICCs	*0.5*	*0.39*	*0.67*	*0.53*
Average measures ICCs	*0.91*	*0.86*	*0.95*	*0.92*

Table 13: Details of the intraclass correlation coefficients (ICCs) values for speech naturalness

	Kannada listeners		*Non native listeners*	
	Kannada (r)	English (r)	Kannada (r)	English (r)
Single measures ICCs	*0.38*	*0.41*	*0.42*	*0.29*
Average measures ICCs	*0.86*	*0.88*	*0.88*	*0.8*

Variability for rating native language, non-native language and second language by native and non native listeners

Variability measures were done for tasks such as percentages of syllables stuttered, perceived severity and naturalness as rated by native and non native listeners in a native language, non native language and second language. Independent t test was done to understand the variability for all the measures by native and non native listener groups. No significant difference in variance for measuring percentages of syllables stuttered ($t(14) = -1.25$, $p > 0.05$), perceived severity ($t(14) = 0.52$, $p > 0.05$)and naturalness ($t(14) = -1.21$, $p > 0.05$) by native and non native listeners was seen. Also, no significant difference in variance for measure of percentages of syllables stuttered ($t(14) = -2.21$, $p > 0.05$), perceived severity ($t(14) = 0.9$, $p > 0.05$) and naturalness ($t(14) = -1.83$, $p > 0.05$) for a second language by two groups of listeners. However, slightly higher variance was noted in measuring percentage of syllables stuttered for two subjects (S4 & S6) when rated by non native listeners. Variance for percentages of syllables stuttered, perceived severity and naturalness as determined from two groups of listeners for native, non native and second language are shown in the table 14, 15, and 16 below.

Table 14: Details of the variance of percentage of syllable stuttered in native, non native language and in second language

Subjects	Kannada listeners		Malayalam listeners	
	Kannada language	English Language	Non native language (Kannada)	Second Language (English)
S1	0.81	1.98	1.15	4.56
S2	0.70	1.2	0.58	2.07
S3	1.16	3.03	1.16	8.25
S4	2.76	4.96	7.16	6.04
S5	1.49	0.73	2.97	5.68
S6	1.66	2.58	8.46	5.46
S7	1.94	5.3	1.41	2.90
S8	4.09	1.99	2.97	3.13

Table 15: Details of the variance of perceived severity of stuttering in native, non native language and in second language

Subjects	Native listeners		Non native listeners	
	Native language (Kannada)	Second Language (English)	Non native language (Kannada)	Second Language (English)
S1	0.32	0.71	0.49	2.4
S2	0.23	0.28	1.29	1.07
S3	1.73	4.4	0.71	0.49
S4	3.96	4.71	2.27	2.46
S5	1.56	2.18	0.84	0.49
S6	0.49	1.56	0.9	1.6
S7	0.67	0.44	0.77	0.62
S8	1.57	1.12	1.29	1.43

Table 16: Details of the variance of speech naturalness in native, non native language and in second language

Subjects	Native listeners		Non native listeners	
	Native language (Kannada)	Second Language (English)	Non native language (Kannada)	Second Language (English)
S1	0.1	0.93	1.156	2.989
S2	0.32	0.46	0.5	0.444
S3	0.46	1.16	0.9	2.1
S4	2.04	1.79	3.656	2.944
S5	2.1	1.33	3.433	3.211
S6	1.66	0.9	1.433	1.6
S7	0.44	1.88	0.544	0.9
S8	1.07	1.511	1.611	1.611

Discussion

The major finding of the study was that there was no significant difference in the frequency of stuttering, perceptual stuttering severity rating and speech naturalness rating by Kannada and Malayalam listeners. Similar findings were reported by Humphrey (2004) who found no differences in number of disfluencies identified by monolingual English and English Spanish bilingual students. Similarly, a study by Einarsdottir and Ingham (2009) found no significant difference between ICE SLPs and US SLPs for judging stuttering in children. Van Borsel and Pereira (2005) reported opposite results showing a better identification of stuttering in the native language as compared to an unfamiliar language. The authors suggested that familiarity of language is a factor to be considered for assessing

BAWS. An extended research in similar lines by Van Borsel, Leahy & Pereira (2008) stated that, along with language familiarity, closeness of the listener's native language influences judgment of stuttering in bilingual individuals. If the clinician's native language is closer to the language being assessed, requires lesser effort for stuttering assessment. However, the two languages (Kannada and Malayalam) considered for the current study are closely related and belonged to same language family. Previously, Conture & Curlee (2007) commended that some knowledge about phonemic and prosodic features of a language is necessary for assessment in a language. Our non native judges in the study might have acquired basic knowledge about the other language which had led to judgment similar to the native exposure. Additional rating of speech naturalness which was not included in other studies also showed no significant difference between judges. Measures of frequency of stuttering, perceptual stuttering severity and speech naturalness ratings were significantly reliable for judges in native, non native and second language. Interrater reliability for judges was also found in native, non native and second language. Comparison of ratings by each judge to average rating score suggested high correlation for all the measures. Whereas, reliability for measures as done by each judge to another judge showed only moderate correlation in all correlation. This suggests the need for a standard method for assessment of stuttering.

Overall variability for frequency of stuttering, perceptual stuttering severity and speech naturalness ratings was not significantly different between native and non native listeners. Though, the variability for rating all the measures within the listener group was not uniform. These findings support earlier researches (Cordes & Ingham, 1995 ; Kully & Boberg, 1988; Einarsdóttir and Ingham, 2005) who emphasized the lack of a standard. Current study supported the Einarsdóttir and Ingham (2005) who also found that variability for judging stuttering in children was independent of language familiarity. The severity of BAWS included in the present study was mild to moderate which might have contributed to

such findings. However, variability was relatively high for counting frequency of stuttering in a non native language for two participants with moderate stuttering. Earlier, Watson & Kayser (1994) proved identification of stuttering in a foreign language for individuals with severe stuttering is easy. In addition, the current study also suggests the role of severity in measuring stuttering in a non native language. Further studies can include detailed analysis of stuttering in a foreign language considering this factor.

Study 3: Generalization of fluency to untreated language in bilingual adults who stutter

It is reported that more than 50% of the world's population is bilingual (Grosjean, 2010). Further, it is also known that 1% of the world's population stutters (Bloodstein & Ratner, 2008). Hence, majority of persons who stutter in our clinics are bilinguals in nature. Treatment of these bilinguals who stutter (BWS) poses multiple challenges from both clinical as well as theoretical point of view. Clinically, the doubt may arise in the minds of treating clinicians as to whether the treatment should be given in one language or in both the languages? Although it is necessary that treatment should be given in both the languages, most of the time this is impractical. This may be mainly because providing treatment in both the languages takes more time, and costly, compared to treating only one language. Further, it is hard find qualified, multi-lingual clinicians who can offer their services for the needy clients. However, if the treatment is provided in only one language, clients may be using their other language daily and may have difficulty in coping with their stuttering in that language. Further, one another question which arises while treating only one language is which language to select for treatment? Hence, it is important to investigate whether there is any generalization of fluency to untreated language in BWS.

Apart from clinical significance, from theoretical point of view also investigating generalization of fluency to untreated languages may provide evidence for neural organization of fluency in two different languages. For instance, it will be interesting to compare relative amount of treatment generalization of fluency in simultaneous and sequential bilinguals. Further, the role of multiple variables like proficiency of language, role of language use, and the relatedness of the languages can be compared with respect to generalization of fluency.

The issue of generalization of acquired skills in one language to other language is not new. Supporting evidence is already available in other communicative disorders like aphasia (Edmonds & Kiran, 2006). Evidence from a review article on cross-language treatment generalization in bilinguals with aphasia suggests that out of 12 studies, 10 studies accounted for treatment generalization (Kohnert, 2009). The brain imaging studies also suggest that the regions activated in the brain for L1 and L2 are similar (Chee, Tan & Thiel, 1999) or partially different (Dehaene et al, 1997; Kim, Relkin, Lee & Hirsch, 1997). Some language specific gains were noticed in an earlier study were clarified in terms of dissociations, separate cross linguistic associations observed in typical bilingual individuals (Kohnert, 2009). Moreover, age of acquisition and proficiency for a second language is evidenced as an important factor using PET scan (Perani et al., 1998). Also, L1 and L2 are representation in brain differed for early bilinguals (simultaneous bilinguals) and late bilinguals (sequential bilinguals) (Kim, Relkin, Lee & Hirsch, 1997). Overall, the results from other communicative disorders suggest that generalization of treatment outcome can depend on multiple factors like type of bilingualism, proficiency of language, and relatedness of the two languages.

With respect to stuttering literature, currently, there is limited amount of evidence about the generalization of fluency to untreated language. Humphrey, Al Natour and Amaryeh (2001) studied the aspect of stuttering modification and fluency shaping therapy in 11 year old bilingual (Arabic-English) twin girls. Treatment was given in Arabic. Fluency increased in Arabic and it also generalized to English in both the girls. Rousseau, Packman, and Onslow (2005) conducted a study to see the effect of Lidcombe treatment program on a 7- year old bilingual (English-French) child. Treatment was provided in French. Percentage of syllable stuttered decreased in both the languages. Woods and Wright (1998) reported simplified regulated breathing treatment done on an adult male speaking in English and could generalize the technique to Russian, the untreated language. Lim (2007) (unpublished

doctoral dissertation) demonstrated generalization of smooth speech intensive program treated in English language for 14 BWS and progress was present in Mandarin language as well. Overall, the results from the available literature are not reliable as most these are not published reports and are based on the case reports. Further, no information is provided about the participants, and their proficiency of language. Therefore, the present study aims to systematically investigate whether prolonged speech therapy given in one language brings in changes in fluency in the un-treated language.

Prolonged speech technique is one of the most popular treatments for fluency inducing in persons who stutter (PWS). Here, PWS are taught to replace their dysfluent utterances by a novel speech pattern. This technique can be taught in programmed or non-programmed manner. In programmed approach of prolonged speech, clients are taught to reduce their rate to fixed syllables or words per minute, whereas in non-programmed prolonged speech approach there is no fixed rate of speech. Clients can reduce their rate to which they are comfortable. In the past, multiple studies have documented treatment effectiveness of prolonged speech therapy in adults who stutter (see Bloodstein and Ratner, 2008 for exhaustive review on this). However, large majority of these studies are done with group designs. One of the limitations of group designs is that individual performances of clients are masked when group averages are compared. When we use single-subject designs, each individual is described in detail and there is no need for control groups as same subject will act like control for himself. Further, there are also other control mechanisms like withdrawal, criterion-referenced change etc., to document the manipulation of independent variable (treatment) on the dependent variable (stuttering frequency). Present study aims to use single-subject ABAB research design wherein the independent variable (treatment) will be systematically manipulated to document effectiveness of the treatment. The current study aims to investigate effectiveness of prolonged speech therapy, and treatment generalization to

an untreated language in bilingual adults who stutter (BAWS). Also, any differences in treatment outcome of sequential and simultaneous bilinguals will be documented. Thus, the objectives of the study are

(1) To document effectiveness of prolonged speech therapy in bilingual adults who stutter (BAWS)
(2) To investigate the generalization of fluency to an untreated language in BAWS
(3) To compare the generalization of treatment outcomes between sequential and simultaneous bilinguals with stuttering.

Method

Participants

Six bilingual adults who stutter (BAWS) between age range of 17 to 29 years participated in the study. As per the self-reported questionnaire, apart from developmental stuttering, none of the participants had any history of neurological, intellectual, hearing, and other communicative disorders. Their stuttering severity was assessed using Stuttering Severity Instrument for Adults—third Edition (SSI-3) (Riley, 1994). For all the participants stuttering severity was assessed in their L1(first language). For participants 1, 4, and 5, the severity assessment was done the first author who is a qualified speech-language pathologist and a multilingual speaker (Kannada, English and Hindi). For participants 2, 3, and 6, the severity assessment was done by the second author who is also a qualified speech language pathologist and a multilingual speaker (Malayalam, Tamil and English). Participants' bilingual history, language use, and language proficiency was determined using LEAP-Q questionnaire (Marian, Blumenfeld, & Kaushanskaya, 2007). This bi/multilingualism assessment tool considers language history and evaluates language proficiency in four

language domains: understanding, speaking, reading and writing. Each domain has zero to four rating, where 0 indicates zero proficiency and 4 indicates native like/perfect proficiency. This questionnaire is adapted to Indian Context by Ramya (2009) which was used in the present study.

Participant1 (S1) was a 29 years old male. He had onset of stuttering at 4 years of age. He had positive family history of stuttering. His grandfather and brother had stuttering. Previously S1 had taken treatment for stuttering at age of 20 years and he had discontinued therapy after a week. He was a sequential bilingual whose native Language was Kannada and second language was Hindi. Age of first exposure to the second language (Hindi) was at 8 years. As reported, he learned to speak Hindi proficiently at 18 years. Total years of exposure to Hindi were 21 years. He rated his proficiency as native like for understanding, speaking, reading and writing domains for Kannada. For Hindi, except speaking for which he rated as good proficiency, for understanding, reading and writing domains he rated as native like proficiency. His SSI-3 score was 27 for Kannada and was rated as having moderate stuttering.

Participant 2 (S2) was a 18 years old male. As reported, he started stuttering at the age of 2 years, and had no previous history of treatment. He had no family history of stuttering. He was a sequential bilingual whose native language was Malayalam and second language was English. He was exposed English since 6 years of age. He learned to speak English proficiently at the age of 11 years. Total years of exposure to Malayalam and English were 18 and 12 years respectively. All domains he rated native like proficiency for Malayalam. Whereas for English, he rated as having good proficiency for speaking and understanding domains, with native like proficiency for reading and writing skills. His SSI-3 score was 31 and diagnosed as moderate stuttering in Malayalam.

Participant 3 (S3) was a 17 year old male. As reported his onset of stuttering was at about 2 years of age. He had no familial history of stuttering. As reported, no previous treatment was taken for stuttering. He was a sequential bilingual whose native language was Malayalam and second language was English. He was exposed to English since 6 years and he learned to speak proficiently at the age of 8 years. Number of years of exposure to Malayalam and English were 17 and 11years respectively. He showed native like proficiency for all the domains in Malayalam and good proficiency for speaking in English and perfect/ and native like proficiency for other domains. His SSI-3 score was 20 and diagnosed as mild stuttering in Malayam.

Participant 4 (S4) was a 22 years old male. He had onset of stuttering at 6 years, and had no positive family history. As reported he had not taken treatment previously for stuttering. He was a sequential bilingual whose native Language was Hindi and second language was English. His age of first exposure to English was 15 years and he learned to speak English proficiently at the age of 18 years. Total number of years of exposure to Hindi and English were 22 and 7 years respectively. He exhibited perfect/ native like proficiency for all the domains for Hindi. But, for English, he showed native like proficiency for reading and writing domains, and showed good proficiency for speaking and understanding. His SSI-3 score was 22 and was diagnosed as mild stuttering in Hindi.

Participant 5 (S5) was a 28 years old male. aged with onset of stuttering at 5 years and he had positive family history. His father had stuttering. He taken treatment previously at the age of 23 years for 3 months and improvement was noticed then. The client reported relapse of stuttering after 5 years. He was a sequential bilingual whose native Language was Kannada. He was first exposed to English when he was 15 years, and learned to speak English proficiently at the age of 18 years. Total number of years of exposure to Kannada and English were 28 and 13 years respectively. He reported perfect or native like proficiency for

all domains in Kannada. He had native like/ perfect proficiency for understanding English and good proficiency for speaking, reading and writing aspects. His SSI-3 score was 25 and was diagnosed as moderate stuttering in Kannada.

Participant 6 (S6) was a 26 years old male aged with the onset of stuttering at 7 years. He had no familial history of stuttering. He learned two languages, Tamil and Kannada simultaneously (simultaneous bilingual) which he could speak proficiently since the age of 2 years. Total number of years of exposure to both languages was 26 years. He demonstrated native like proficiency for understanding and speaking in both languages. Whereas, reading and writing for the languages showed zero proficiency. His SSI-3 score was 31 and was diagnosed as moderate stuttering.

Table 17: consolidated participant information

S. NO	Age /Gender	Language		Exposures (in year)	
		L1	L2	L1	L2
S1	29/M	K	H	29	21
S2	18/M	M	E	18	12
S3	17/M	M	E	17	11
S4	22/M	H	E	22	7
S5	28/M	K	E	28	13
S6	26/M	T	K	26	26

Study Design

To study the effect of non-programmed prolonged speech therapy in BAWS, single subject design was used. Single subject designs are often considered the design of choice when measuring behavioral change or when performing behavioral modification. Rather than comparing groups of subjects, this design relies on the comparison of treatment effects on a single subject or group of single subjects. Under single subject design in the present study, ABAB design was used (Hegde, 2003).

The A-B-A-B design represents an attempt to measure a baseline (the first A), a treatment measurement (the first B), the withdrawal of treatment (the second A), and the re-introduction of treatment (the second B). In other words, the A-B-A-B design involves two parts: (1) gathering of baseline information, the application of a treatment, and measurement of the effects of this treatment; and (2) measurement of a return to baseline or what happens when the treatment is removed and then again applying the treatment and measuring the change. In ABAB design, dysfluency analysis was carried out at four points

1) Baseline (A): baseline includes three base-ratings for percent dysfluency in native and second language.
2) During treatment (B): treatment program was introduced in one language and daily sessions were recorded and documented in both the languages. The treatment was withdrawn when at least 60% improvement was present.
3) After withdrawal (A): two baseline recordings in both languages after the withdrawal phase were done.
4) After re-installation of therapy (B): again treatment program was introduced and dysfluencies were noted for changes on daily bases in two languages.

Treatment

The participants were treated using non-programmed prolonged speech therapy program. This therapy program is an intensive therapy program, where clients visit the clinic daily for one hour. The program has six stages. In the first stage individuals learn to prolong the syllables. Clients learn the PS pattern by imitating a speech therapist. The clinician interrupted whenever disfluencies were present and reminded him to use the technique on the stuttered word. Here in non-programmed prolonged speech pattern, there no emphasis on prolongation at a fixed rate of speech. They can prolong at the rate at which they are

comfortable. Further there is no emphasis on exemplars like light articulatory contacts or gentle onsets. Only criterion is that their speech has to be fluent. This step is practiced initially while reading. Once they achieve 95% fluency, clients practice the technique in narration and spontaneous speech. Individuals may prolong all the syllables or prolong only the syllables of the first word depending on their severity of stuttering. For example, individuals with severe stuttering are required to prolonged all the syllables, whereas individuals with mild or moderate stuttering prolong only the initial word of the sentence. If the clients are not prolonging the syllable clinician gives corrective feedback. Once they achieve 95% fluency in this stage, clients move on to stage 2. Here in this stage, clients prolong only the initial syllable of the first word of the sentence. Again in this stage clients practice initially while reading, and later move on to narration and spontaneous speech tasks. Again in this stage clinician gives corrective feedback whenever clients don't prolong the initial syllable of each sentence. Once they achieve 95% fluency in this stage, clients move to stage 3. In this stage, prolongation of initial syllables is eliminated, and clients speak rate at which they are comfortable. They prolong only those syllables that they anticipate to stutter. Again in this stage clinician gives feedback whenever clients forget to use the PS pattern. At every stage group practice is done in the last ten minutes of therapy session. Typically group practice consists of 2-3 clinicians. Following this, the participants had to practice outside the clinical setting and report to the experimenter. Also, the individuals were advised to practice four sessions of 30 minutes per day. For all the clients treatment was given in their native language. No training was given in second language.

Generalization Probe

Each day, before the actual beginning of therapy, each client's spontaneous speech samples of 200-300 syllables were separately recorded from each language. Questions about the client's family, job, education, hobbies, and topics related to daily events were used for

eliciting conversation with the clients. The recordings were done using a portable digital audio recorder. From these recorded conversation samples, the percentage of syllables stuttered was calculated in both the languages.

Measurement of dependent variable (Dysfluency documentation)

Two independent speech-language pathologists, who were unaware of the purpose of the study served as judges for dysfluency analysis. The first judge was a Kannada-English-Hindi multilingual speaker. The second judge was a Malayalam-Tamil-English-Kannada multilingual speaker. Both the judges had more than ten years of experience in assessment and management of stuttering. Both the judges rated their proficiency as good to native like for all their languages. The first judge analyzed participants' P1, P4, and P5 data, and the second judge analyzed participants' P2, P3, and P6 data. These two judges were selected as they could make accurate measurements of the languages spoken by the participants. The dysfluency identification was carried using laptop. Judges listened to the recordings using a headphone connected to the laptop where the samples were stored with different codes. No information was provided about the identity of samples to the judges. Judges first opened the samples in Praat software and listened to the recordings multiple times till the accurate identification of the dysfluencies was confirmed. Both the judges first orthographically transcribed the samples and identified the dysfluencies. This procedure was extended to several days for each judge as they had to do the measurement for multiple recordings. The types of dysfluencies identified included sound/syllable repetitions, monosyllable whole word repetitions, prolongations, and blocks (Conture, 1990). The percentage of syllables stuttered was calculated by dividing the total number of dysfluent syllables with the total number of syllables and multiplying this value by 100. For reliability analysis, sixteen recordings were randomly selected (8 samples from L1 and 8 samples from L2) across participants. These recordings were played to judges after a gap of one month. The Cronbach's alpha between

the first analysis and second analysis for L1 was 0.956 and for L2 it was 0.871. In the present study, the occurrence of any trend in the progression of fluency for each session for each client was illustrated separately in each language.

Results

Participant 1 (S1):

Treatment was given in Kannada and the untreated language was Hindi. Before starting therapy, baseline (A) was measured. The baseline stuttering in L1 was 8.11% and in L2 was 9.53%. During initial phase of treatment (B), percentage of syllables stuttered scores decreased constantly across five sessions from 8.11% to 1.67% in Kannada and from 9.53% to 1.92% in Hindi. Therapy was withdrawn for 10 days and percentage of syllables stuttered was re-measured as the second baseline (A) in both languages. After withdrawal phase, individual showed increase in stuttering frequency for both the languages. However, second language showed greater increase in stuttering (8.44%) than the first language (4.62%). Treatment was then introduced (B) in Kannada and client demonstrated reduction of stuttering in both the languages after seven sessions. Measure of percentage of syllables stuttered after the first phase of treatment showed slightly higher in second language (2%) than the first language (0.57%). The participant could generalize the treatment given in one language to the untreated language, but with lesser extent.

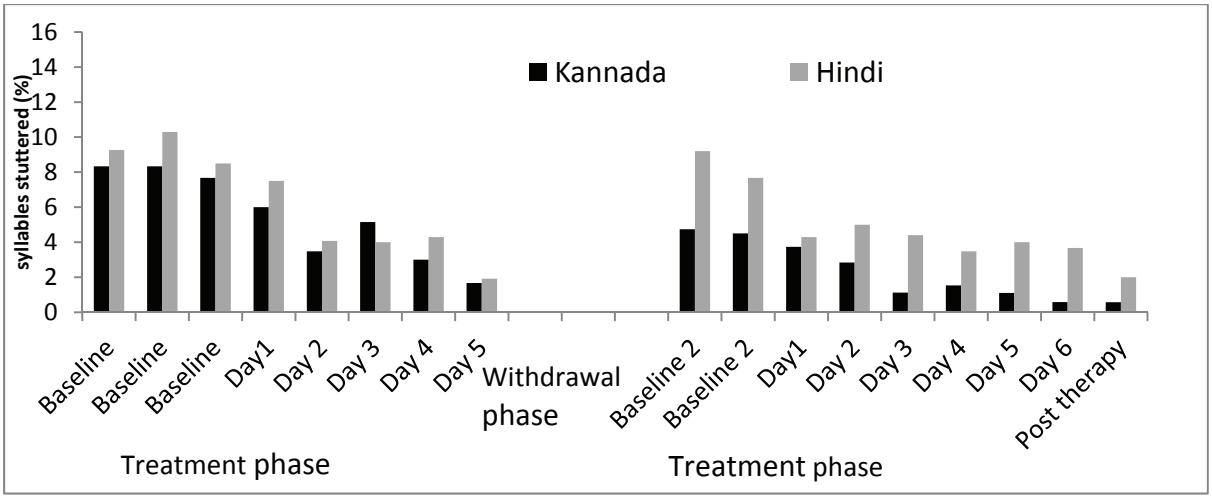

Figure3: Changes in frequency of dysfluencies with treatment in participant 1.

Participant 2 (S2):

Treatment given in Malayalam, his native language, and daily observation of percent of syllables stuttered was done for both the languages, i.e., in Malayalam and English. Baseline (A) done for both languages showed frequency of stuttering as 9.97% for Malayalam and 14.33% for English. After the initial phase of treatment (B), percentage of syllables stuttered scores decreased to 4.33% for Malayalam and 7.67% for English. Treatment was then withdrawn for 10 days and a second baseline (A) showed slight increase in stuttering frequency for both languages (6.57% for Malayalam; 8.67% for English). Reinstatement of treatment (B) demonstrated a reduction in stuttering in both languages. However the decrease in stuttering in untreated language was lesser than treated language. End of the treatment demonstrated percentage of syllables stuttered in Malayalam and English as 2% and 4.33% respectively. Whenever any increase or decrease in frequency of stuttering was seen, changes were present in both languages.

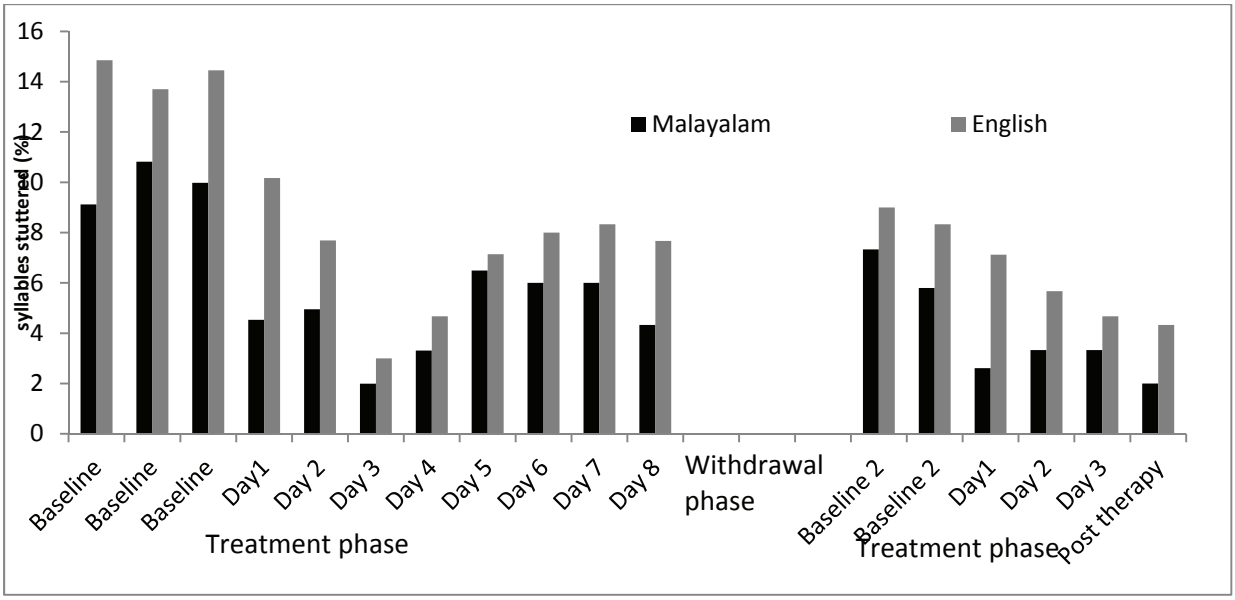

Figure 4: Changes in frequency of dysfluencies with treatment in participant 2.

Participant 3 (S3)*:*

The native language (L1) of the subject was Malayalam and the second language (L2) was English. Treatment was given in the native language. Baseline measurement (A) revealed percentage of stuttering in L1 (3.78%) was slightly higher than L2 (2.92%). Though, by the end of first phase of treatment (B), stuttering in the treated language disappeared completely but no significant change in stuttering frequency of L2 (2.5%) was present. No treatment was given for 10 days. However, second baseline (A) taken after the withdrawal phase demonstrated that the individual could maintain the progress brought in the initial phase of treatment for L1 (0.4%) and L2 (1.5%). The second phase of treatment (B) was thus initiated. Post therapy measures showed a significant reduction in L2 with reinstatement of treatment

(0.67%) and no stuttering in L1.

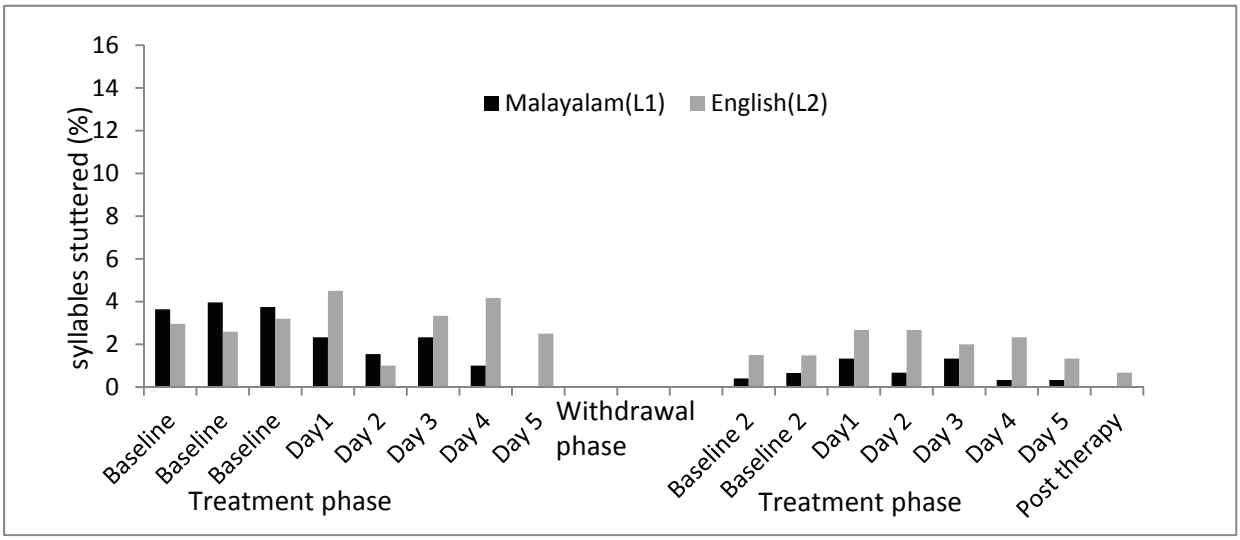

Figure 5: Changes in frequency of dysfluencies with treatment in participant 3.

Participant 4 (S4):

The individual's first language (L1) was Hindi and second language (L2) was English. He was given treatment in the first language. Baseline (A) measurements revealed relatively very high stuttering for L2 (13.36%) than L1 (3.67%). After initial phase of treatment (B), the stuttering lessened to 0.33% for L1 and 3.67% for L2. Therapy was then withdrawn for 10 days. Second baseline (A) showed no significant change for stuttering in the treated language (1%), whereas significant increase in stuttering frequency for L2 (7.5%) was present. Second phase of treatment (B) was then introduced and measurement was done at the end of 6 sessions revealed almost no stuttering (0% for L1; 0.67% for L2). In spite of greater difference in stuttering between the two languages, good generalization of treatment method to the untreated language was noticed.

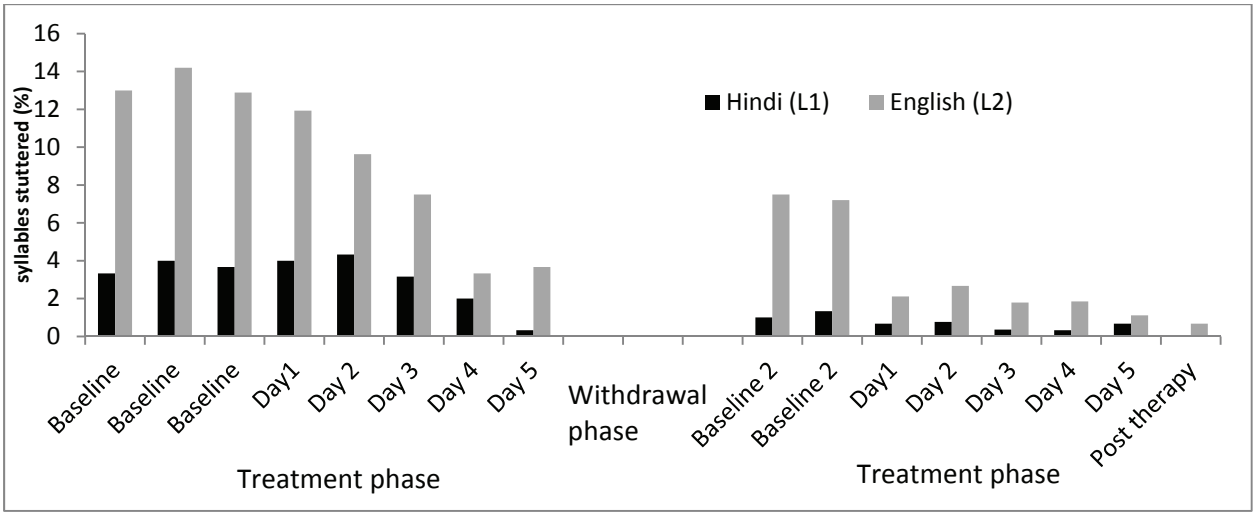

Figure 6: Changes in frequency of dysfluencies with treatment in participant 4.

Participant 5 (S5):

The individual was treated in Kannada, his native language (L1) and the second language (L2) was English. Baseline measurement (A) of stuttering was 3.87% for Kannada and 7.07% for English. After 7 sessions of therapy (B), frequency of stuttering has decreased to 0.33% for L1 and 1.53% for L2. Therapy was withdrawn for 10 days and baselines (A) were taken before initiation of second phase of therapy. The values showed that the individual sustained almost the same frequency of stuttering (L1; 0.33% & L2; 1.79%) as it was before the withdrawal phase. During the second phase of treatment (B) the individual continued to maintain the improvement. Post therapy measures showed percentage of syllables stuttered as 0.67% for Kannada and 1% for English. The individual could well generalize the treatment to an untreated language and the result was consistent.

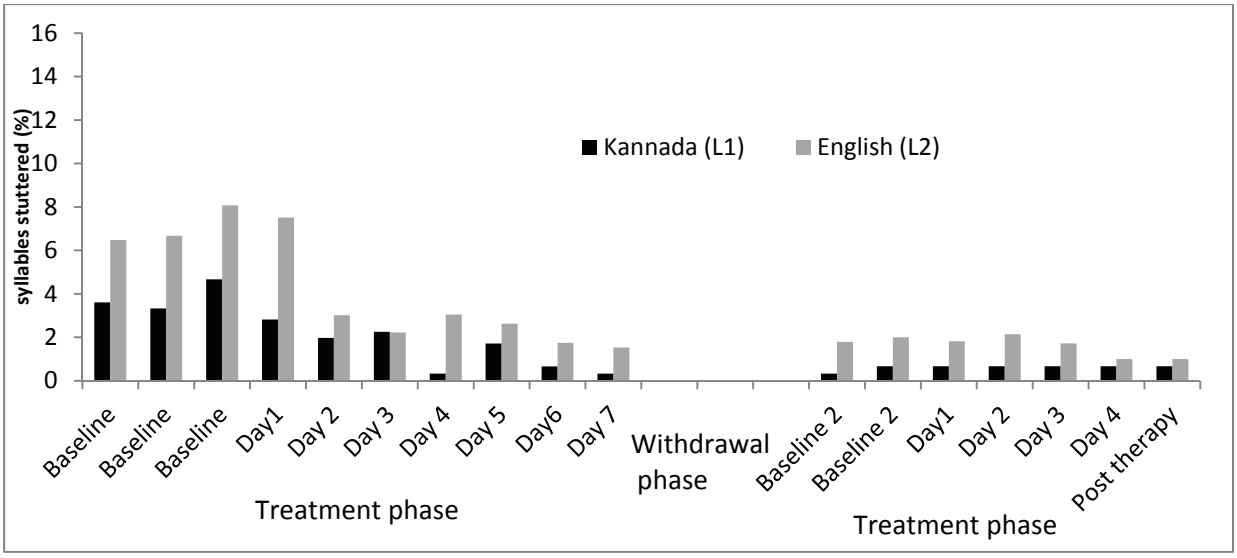

Figure 7: Changes in frequency of dysfluencies with treatment in participant 5.

Participant 6 (S6):

The first language (L1) of the subject was Tamil and his second language (L2) was Kannada. Baseline measurements (A) displayed same amount of stuttering in L1 (7.6%) and L2 (7.6%). The treatment was given in the first language. Throughout the initial phase of treatment (B), stuttering frequency has reduced across 8 sessions for both the languages with one complementing the other. Before the withdrawal phase, the percentage of syllables stuttered for L1 was 0.94% and for L2 was 2.65%. Therapy was then withdrawn for 14 days. Second baseline (A) was taken and showed that the individual was able to maintain the progress achieved earlier and had 1.33% of stuttering in both the languages. Subsequently, second phase of treatment (B) was introduced and he could maintain the progress all through the sessions except second session which showed unusually high stuttering frequency for both the languages. End of the session measures showed almost no stuttering in both the languages with 0 for L1 and 0.33 for L2.

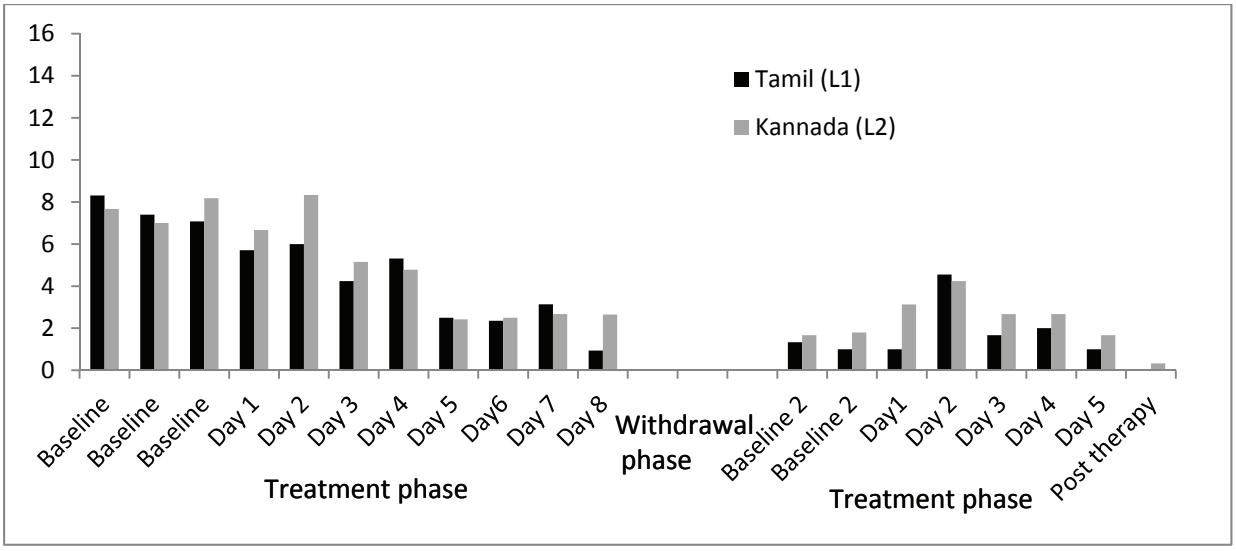

Figure 8: Changes in frequency of dysfluencies with treatment in participant 6.

Discussion

The objectives of present study were (a) to document effectiveness of non-programmed prolonged speech therapy in bilingual adults who stutter, (b) to study whether there is any generalization of fluency to untreated language, and (c) to explore possible relationship of type of bilingualism and amount of generalization to the untreated language. Six bilingual adults who stutter participated in the present study. Among them five were sequential bilinguals and one was a simultaneous bilingual. All six participants received non-programmed prolonged speech therapy in their native language. Using single-subject ABAB research design, changes in fluency were documented in both native and second languages. Results revealed several points of interest.

First, all six participants showed gradual reduction in number of syllables stuttered as the treatment progressed. By the end of treatment phase (B) there was significant reduction in number of syllables stuttered in all six clients. After the treatment was withdrawn, there was significant increase in number of syllables stuttered in four out of six clients. With the reintroduction of treatment again there was gradual decline in number of syllables stuttered.

Thus, the results of present study clearly suggest that non-programmed prolonged speech therapy was effective in reducing stuttering in all six participants. By using single-subject ABAB design, present study clearly documented that it is the treatment itself which brought changes in the achieved fluency, and changes in dysfluency rates not because of influence other extraneous factors such variability in stuttering. The results are in line with the findings of Onslow et al. (1996), Harrison et al. (1998), and O'Brian et al. (2003).These studies also found that non-programmed prolonged speech therapy was effective in reducing stuttering in adults who stutter. In non-programmed version of prolonged speech the strict criteria of fixed rate of speech at each step is not followed. Also, in this therapy, specific features of prolonged speech are not highlighted, and subjects are generally asked to reduce their rate of speech in a comfortable manner as long as they maintain 95% fluency in each step.

Second, present results highlight that in all six participants there was generalization of fluency to an untreated language. This is a significant finding as current results clearly highlight that in bilinguals who stutter, who exhibit similar characteristics as that of present group of subjects, there is clear generalization of fluency to untreated language. Thus, prolonged speech therapy proved to be an effective treatment for reducing stuttering not just in treated language but even in the untreated language as well. Results support the earlier researches on treatment of bilingual children (Humphrey, Al Natour and Amaryeh, 2001; Rousseau, Packman, & Onslow, 2005) and adults (Lim, 2007; Wood & Wright, 1998).

Third, the measurement of the percentage of syllables stuttered in L1 and L2 after the withdrawal phase revealed variability across six participants. This variability for maintaining the progress with withdrawal of treatment can be attributed to client motivation, language demand and practice (Conture & Curlee, 2007). According to these authors, for maintaining achieved fluency requires substantial effort and practice by the stuttering individuals.

Because of this, participants may vary in the maintenance of achieved fluency after the end of therapy.

Fourth, the comparison of dysfluencies between two languages in five sequential bilinguals showed that there was greater reduction of stuttering in treated language compared to untreated language. Further, when the treatment was withdrawn, there was greater increase in stuttering in untreated language compared to treated language. Unlike other five participants, one participant who was a simultaneous bilingual illustrated an identical amount of stuttering in both languages before treatment, throughout the therapy sessions, during the withdrawal phase, and after treatment was reintroduced. Current findings clearly suggest that generalization of fluency to untreated language may depend on the factors like type of bilingualism. In simultaneous bilinguals there is greater generalization of fluency compared to sequential bilinguals. According to Kim, Relkin, Lee and Hirsch (1997), L1 and L2 are represented in brain differed for simultaneous and sequential bilinguals. Thus, a difference in treatment generalization pattern was expected for these two types of bilinguals.

One another factor for difference in the generalization of fluency to untreated language may be relatedness of the native and second languages. The native languages spoken by our six clients included Kannada, Malayalam, Tamil and Hindi. English was the second language for 4 participants, and participants 1 and 6 had Hindi and Kannada as their second language respectively. The two languages spoken by the participant 6 belonged to same Dravidian language family and had similar language structure. As participant 6 showed identical amount of stuttering in both languages before treatment, throughout the therapy sessions, and after treatment one another possible explanation could be that the two languages belong to same language family (Dravidian languages) and have similar language structure.

Conclusion

Collectively, present results highlight that non-programmed prolonged speech therapy was an effective treatment for bilingual adults with stuttering. The results also showed that there is generalization of fluency to an untreated language in BAWS. Also, amount of generalization of achieved fluency may depend on factors like type of bilingualism and related of two languages. However, the current study looked into efficacy of treatment within the clinical setting only. Outside clinical setting measurements for L1 and L2 were not considered in the study and further research addressing these factors can give more information on treatment generalization. Further, in all our six clients treatment was given in their native language, which was their more proficient languages. Future studies need to explore whether there is any difference in the amount of treatment generalization when the treatment is given in the proficient and not -so -proficient languages.

Summary

Overall, results from our three different but related studiess suggest that

- Stuttering frequency is influenced by language proficiency, and greater stuttering is noticed in less proficient language.
- In both L1 and L2, greater stuttering was noticed on content words compared to function words
- Comparison between two languages suggested significantly greater stuttering on content words in L1 compared to L2, whereas significantly greater stuttering on function words in L2 compared toL1.
- Types of dysfluencies vary between two languages depending on the type of grammatical category.
- There was no influence of familiarity of language on the calculation of percentage of syllables stuttered, perceived stuttering severity rating, speech naturalness rating.
- Both intra- and inter-judge reliability was good for all the three measures in native, non-native and second languages
- Variability between judges was also not significant for all three measures between native and non-native languages
- Prolonged speech treatment provided in one language generalized to untreated language
- The amount of generalization may depend on type of bilingualism

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