

Cross-Linguistic Generalization of Fluency to Untreated Language in Bilingual Adults Who Stutter

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Abstract

Introduction: Majority of the studies in bilingual persons who stutter have reported that stuttering frequency is greater in nondominant or less proficient language. However, there is limited research concerning the efficacy of speech therapy in bilingual adults who stutter (BAWS). The current study aimed at investigating whether there is a generalization of fluency to a nontreated language in BAWS. **Materials and Methods:** Five BAWS participated in the study. The efficacy of prolonged-speech therapy was evaluated using a modified single-subject ABA withdrawal design. In all the five participants, nonprogrammed prolonged-speech therapy was provided in their first language, and fluency was monitored in both the first and second languages. Mean and standard deviation were derived for a percentage of syllables stuttered. Relative mean differences and effect sizes (Cohen's *d*) were derived for each participant and language. **Results:** All the five participants showed a significant reduction in %SS in the withdrawal condition when compared to the pretreatment baseline condition. Most importantly, there was a significant generalization of achieved fluency to untreated language in all the five participants. However, the amount of treatment generalization to nontreated language varied across participants. **Conclusions:** The present results highlight that there was a significant cross-linguistic generalization of achieved fluency to the nontreated language in all the five bilingual individuals using the nonprogrammed prolonged-speech therapy.

Keywords: Generalization of treatment, bilingual adults who stutter, bilingualism, fluency, prolonged-speech treatment, single-subject design, stuttering

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INTRODUCTION

One long-standing question which researchers have investigated is the nature of stuttering in bilingual persons. The most consistent finding from the past research is that bilingual individuals stutter in both their first (L1) and second language (L2) and their stuttering frequency is greater in L2 when compared to L1 language.^[1-3] The manifestation of stuttering in both languages may give rise to the clinical question as to whether the treatment should be given in one language or both the languages. Furthermore, from the theoretical point of view, it would be interesting to compare the relative amount of treatment generalization in simultaneous and sequential bilingual persons. Further, the role of multiple variables such as proficiency of language, language use, and relatedness of the languages can be compared concerning the amount of generalized fluency.

Supportive evidence for generalization of acquired skills is already available in such other disorders as aphasia,^[4] speech

sound disorders,^[5-8] and dysarthria.^[9] In stuttering literature, there are only two published studies on the effect of speech therapy in bilingual persons who stutter (PWS). Bakhtiar and Packman^[10] reported a case study where an 8 years 11 months old bilingual boy (Baluchi-Persian) was provided Lidcombe Program in both the languages. The results indicated that the Lidcombe program was effective in reducing stuttering in both languages. Lim *et al.*^[11] investigated the effectiveness of the *speech restructuring intensive program* in reducing dysfluencies when delivered in English to a group of English-Mandarin bilingual Singaporean adults who stutter. The results were that speech restructuring treatment reduced stuttering in both English (treated language) as well as

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Mandarin (nontreated language). However, the stuttering reduction was slightly lower in the nontreated language. In the present study, we investigated whether nonprogrammed prolonged-speech therapy provided in one language affects fluency of nontreated second language in bilingual adults who stutter (BAWS).

Prolonged-speech technique is one of the most popular speech restructuring treatments for inducing fluency in PWS.^[12] In this treatment technique, PWS are taught to replace their dysfluent utterances by a novel speech pattern. In the past, multiple studies have documented the treatment effectiveness of prolonged-speech therapy in adults who stutter. However, the large majority of these studies are done with monolinguals who stutter. At present, it is not known whether prolonged-speech technique used in one language has a significant effect on the fluency of the untreated language in BAWS. To investigate that question, we used a modified single-subject ABA withdrawal design in which the baselines are compared against the treatment condition and the withdrawal condition. The objectives of this study were: (a) to document the effect of nonprogrammed prolonged speech therapy offered in one language in BAWS and (b) to investigate the generalization of fluency to the untreated language.

MATERIALS AND METHODS

Participants

Five BAWS between the age group of 18–29 years participated in the study. These participants were recruited from a speech diagnostic clinic.

Each participant's stuttering severity was assessed using Stuttering Severity Instrument Version 3 (SSI-3).^[13] For all participants, stuttering severity was assessed in both their languages by the first author who is a qualified speech-language pathologist and a multilingual speaker (Kannada, English, Malayalam, Tamil, and Hindi languages) and had more than 5 years of experience in the assessment and management of fluency disorders. As per the self-reported questionnaire, none of the participants had any history of neurological diseases, intellectual disabilities, hearing problems, or disorders of communication other than stuttering. Further, participants' language proficiency was determined using LEAP-Q.^[14] Individual participant information in BAWS is displayed in Table 1. The individual participant results of LEAP-Q are depicted in Table 2. The detailed characteristics of each participant are given below.

- Participant 1 (P1) was 29-year-old male. He was a sequential bilingual person whose first (native) language was Kannada and the second language was Hindi. Age of first exposure to Hindi was at 8 years. As reported, he spoke Hindi proficiently by the age of 18 years. The total number of years of exposure to Hindi was 21 years. Based on the SSI-3 score, he was diagnosed with having moderate stuttering in both the languages
- Participant 2 (P2) was an 18-year-old male. He was a sequential bilingual individual whose first language was Malayalam and the second language was English. He was exposed to English since he was 6 years of age. He learned to speak English proficiently at the age of 11 years. His SSI-3 score suggested moderate stuttering in both the languages

Table 1: Individual participant information for bilingual adults who stutter

Participant number	Age	Onset of stuttering (years)	The family history of stuttering	Treatment history	First language	Second language	Age of second language exposure	SSI score in L1	The severity of stuttering in L1	SSI score in L2	The severity of stuttering in L2
1	29	4	Yes	Yes	Kannada	Hindi	8 years	27	Moderate	29	Moderate
2	18	2	No	No	Malayalam	English	6 years	31	Moderate	31	Moderate
3	22	6	No	No	Hindi	English	15 years	32	Severe	22	Mild
4	28	5	Yes	Yes	Kannada	English	15 years	25	Moderate	22	Mild
5	26	7	No	No	Kannada	Tamil	Birth	31	Moderate	27	Moderate

SSI score: Stuttering severity instrument 3rd Eds. overall score. L1: Native language; L2: Nonnative language

Table 2: Individual participant information for language proficiency in native language and nonnative language across four domains

Language proficiency parameters	Understanding		Speaking		Reading		Writing	
	L1	L2	L1	L2	L1	L2	L1	L2
P1 (SLB)	Native like	Good	Native like	Good	Native like	Good	Native like	Native like
P2 (SLB)	Native-like	Good	Native-like	Good	Native-like	Native-like	Native-like	Native-like
P3 (SLB)	Native-like	Good	Native-like	Good	Native-like	Native-like	Native-like	Native-like
P4 (SLB)	Native-like	Native-like	Native-like	Good	Native-like	Good	Native-like	Good
P5 (SMB)	Native-like	Native-like	Native-like	Native-like	Couldn't read and write	Couldn't read and write	Couldn't read and write	Couldn't read and write

The language proficiency was assessed by LEAP-Q, Marian, Blumenfeld, and Kaushanskaya, 2007. L1: Native language; L2: Nonnative language; P: Participant; L: Language; SLB: Sequential bilingual person; SMB: Simultaneous bilingual person; LEAP-Q: Language Experience and Proficiency Questionnaire

- Participant 3 (P3) was a 22-year-old male. He was a sequential bilingual individual whose first language was Hindi and the second language was English. His age of first exposure to English was at 15 years, and he learned to speak English proficiently by the age of 18 years. The total number of years of exposure to Hindi and English were 22 and 7 years, respectively. Based on his SSI-3 score, he was diagnosed with severe stuttering in Hindi and mild stuttering in English languages
- Participant 4 (P4) was a 28-year-old male who was a sequential bilingual person whose first language was Kannada and the second language was English. He was first exposed to English when he was 15 years and learned to speak English proficiently by the age of 18 years. The total number of years of exposure to Kannada and English were 28 and 13 years, respectively. He was diagnosed with having moderate stuttering in Kannada and mild stuttering in English based on SSI-3 scores
- Participant 5 (P5) was a 26-year-old male and a simultaneous bilingual. He learned two languages, Kannada and Tamil simultaneously which he could speak since the age of 2 years. The total number of years of exposure to both languages was 26 years. His SSI-3 score depicted moderate stuttering in both the languages.

Study design

The study was approved by the Institutional Ethical Clearance Committee. To study the effect of nonprogrammed prolonged-speech therapy in BAWS, modified single-subject ABA withdrawal design was used.^[15] In the more traditional ABA treatment withdrawal design, first the pretreatment baseline is established (the first A), then the treatment is introduced (B), once a treatment effect is evident, the treatment is withdrawn, and the dependent variables are measured under the withdrawal condition to return the target behavior to the baseline level. In the present study, however, we did not attempt to recover the baseline in the withdrawal condition. Instead, we did the following:

1. Pretreatment Baseline (A): We established baselines in three sessions (the first A) of dysfluencies for three successive days in both languages
2. Treatment phase (B): We introduced the treatment program in one language, took daily recordings, and documented dysfluency rate in both the languages
3. The withdrawal phase (A): We withdrew the treatment when at least 95% improvement was present and measured the stuttering frequency in three withdrawal sessions (the second A).

Therapy setting and schedule

None of the BAWS had attended therapy previously for their stuttering condition. For the current study procedures, participants' written consent was obtained before the initiation of therapy. All the recordings and therapy sessions were carried out in a quiet therapy room without any interference of background noise in an institutional clinical setup. Before recording the baseline, participants were instructed to introduce

themselves in their first and second languages which were recorded. Furthermore, they were instructed not to use words from another language as far as possible and to converse only in the language that is being recorded. They were informed that therapy would begin after recording the third baseline.

All the BAWS were treated using the nonprogrammed prolonged-speech therapy program. This is an individualized, intensive treatment program. The BAWS visited the clinic daily for 1 h for 5 days a week. In the nonprogrammed prolonged-speech therapy program, BAWS were instructed to prolong syllables by imitating the speech therapist. BAWS were taught to prolong syllables at the rate at which they were comfortable without emphasizing on a fixed rate of speech. The only criterion was that their speech had to be devoid of stuttering. In stage I, individuals were instructed to prolong all the syllables or prolong only the syllables of the first word of each sentence depending on the severity of their stuttering. Individuals with severe stuttering were instructed to prolong all the syllables of the sentence, whereas individuals with mild or moderate stuttering were instructed to prolong only the syllables of the initial word of the sentence. If the BAWS were not able to prolong the syllables, the clinician interrupted and provided corrective feedback. In all stages, initially, prolongation was taught in the reading task, and then they were instructed to transfer the same skills to narration and conversation tasks.

Once they achieved 95% fluency in stage I in the conversation task, BAWS went on to stage II where they were instructed to prolong only the initial syllable of the first word of the sentence. Once they achieved 95% fluency at this stage, the BAWS moved to stage III. In this stage, prolongation of initial syllables was eliminated, and BAWS spoke at a comfortable speech rate. They were instructed to prolong only those syllables that they anticipated to stutter. In stage IV, BAWS were instructed to use the technique in everyday situations (generalization). In stage V, BAWS were instructed to maintain achieved fluency using different problem-solving skills.

For all the five BAWS, treatment was given in their first language which was also their preferred language for therapy. No training was given in the second language. All the participants were provided with therapy by a single speech therapist, and all the treatment sessions were individual therapy sessions. During all the recording sessions of baseline, therapy, and withdrawal phases, the participants were instructed to speak on familiar topics such as family, work/college, and social interests or activities with least emotive load. They were informed that after the third withdrawal point, there would be no continuation of treatment. Each day, before the commencement of therapy, each participant's spontaneous speech samples of 200–300 syllables were separately recorded from each language. All the recordings were done with a high-quality SONY Handycam recorder (HDR-CX 280) which was mounted on a tripod.

Measurement of dysfluencies

Two independent speech-language pathologists, who were unaware of the purpose of the study served as

judges for the 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 10 years of experience in the 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 and P4 data, and the second judge analyzed participants' P2, P3, and P5 data. 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. Both the judges first orthographically transcribed the samples and identified the dysfluencies. The types of dysfluencies identified included part-word repetitions, monosyllable whole-word repetitions, prolongations, and broken words.^[16] The percentage of syllables stuttered (%SS) was calculated by dividing the total number of dysfluent syllables with the total number of syllables spoken. For reliability analysis, 16 recordings were randomly selected (8 samples from L1 and eight samples from L2) across participants. These recordings were played to judges after a gap of 1 month. The Cronbach's alpha between the first analysis and second analysis for L1 was 0.956, and for L2 it was 0.871. Furthermore, 10% of the recordings were subjected to inter-rater reliability by another rater, and the Cronbach's alpha value was found to be 0.977 for L1 and 0.978 for L2.

Analysis

In the present study, the occurrence of any trend in the progression of fluency was separately illustrated in each participant in each language. Analysis of single-participant data was performed through visual inspection of the data points between conditions (e.g., baseline vs. treatment) for recognizing unambiguous changes in the performance of a participant due to treatment.^[17,18] In this study, to determine changes in the performance of a participant between conditions, calculation of 95% confidence interval was done for the baseline condition.

The 95% confidence interval is the difference between the three baseline test scores (i.e., 95% baseline critical difference [CD]). The treatment effect was considered significant whenever two or more successive treatment data points fell below the lower limit of the 95% baseline (CD).^[19,20] For quantifying the extent of the significance of the treatment effect, effect sizes were computed. In the current study, Cohen's *d* was calculated using the standardized mean difference method.^[21] Cohen's *d* effect sizes range from 0.01 to >2 with 0.01 indicating very small, 0.20 indicating small, 0.5 indicating medium, 0.8 indicating large, 1.2 indicating very large, and 2 or >2 indicating huge effect sizes.^[22]

RESULTS

Table 3 shows mean (pretreatment baseline and treatment withdrawal), standard deviation (pretreatment baseline and treatment withdrawal), relative mean differences, and effect sizes (represented as Cohen's *d* value) for each participant in each language. Each participant's performance on fluency regarding the percentage of syllables stuttered (%SS) has been given below in detail.

Participant 1 (P1) – Treatment was given in Kannada (L1), and the untreated language was Hindi (L2). The average of three pretreatment baseline stuttering points was 8.11%SS in L1 and was 9.35%SS in L2. P1 showed significant treatment effects by reducing to 6.0%SS after the very first treatment session in Kannada (L1). P1 showed improvement with the percentage of stuttering reducing to 7.5%SS after the first session of treatment in Hindi (L2), but it did not meet the criterion to be considered as a significant difference. However, a significant effect was noted after the second treatment session. After 11 sessions of treatment, %SS reduced to 0.75%SS in L1 and 3.22%SS in L2. The relative mean difference (pretreatment baseline versus withdrawal condition) was 7.36%SS in L1 and 6.13% SS in L2 [Table 3]. There was a greater reduction in stuttering in L1 compared to L2.

Table 3: Relative difference in performance level in terms of percentage of syllables stuttered from pretreatment baseline to treatment withdrawal for each participant for both first and second languages (native language and nonnative language)

Participants	Number of treatment sessions attended	Language	Mean		SD		Relative mean difference	Cohen's d value
			Pretreatment baseline	Treatment withdrawal	Pretreatment baseline	Treatment withdrawal		
P1	11	L1	8.11	0.75	0.38	0.30	7.36 *	21.37
		L2	9.35	3.22	0.90	1.07	6.13*	6.18
P2	12	L1	9.97	2.31	0.85	0.90	7.66 *	8.72
		L2	14.33	4.11	0.58	0.69	10.22 *	15.90
P3	10	L1	3.67	0.33	0.33	0.33	3.33 *	9.95
		L2	13.36	1.21	0.72	0.59	12.15*	18.28
P4	11	L1	3.87	0.67	0.70	0.00	3.20*	6.40
		L2	7.07	1.24	0.86	0.41	5.83*	8.56
P5	14	L1	7.59	0.66	0.63	0.57	6.93 *	11.38
		L2	7.61	0.77	0.59	0.77	6.84 *	9.93

*Significant difference at $P < 0.05$. L1: Native language; L2: Nonnative language; SD: Standard deviation

The treatment was highly effective in reducing stuttering in both the languages, as the effect sizes were 21.37 and 6.18 in L1 and L2, respectively. In P1, fluency treatment given in one language generalized to the untreated language. Figure 1a and b shows the %SS during the pretreatment baseline, treatment, and the treatment withdrawal phases for each of the two languages for P1.

Participant 2 (P2) – Treatment was given in Malayalam (L1), and daily observation of %SS was done for both Malayalam and English. The average of three pretreatment baseline (A) stuttering measurements taken in both languages showed the frequency of stuttering as 9.97% SS for L1 and as 14.33% SS for L2. Significant treatment effects were evidenced after the very first treatment session of using the treatment technique for this participant for both the languages; 4.53%SS for L1 and 10.17%SS for L2. After providing 12 sessions of treatment, the %SS scores decreased to 2.31% SS for Malayalam, and 4.11% SS for English. The relative mean difference (pretreatment baseline versus treatment withdrawal) was 7.66% SS in L1 and 10.22% SS in L2 [Table 3].

Effect sizes indicated that the treatment was highly effective in reducing stuttering, with effect sizes of 8.7 and 15.9, respectively, in L1 and L2 languages. P2 showed evidence of significant reduction of %SS in both the languages with treatment. However, there was a greater reduction of stuttering in L1 compared to L2. Figure 2a and b shows the %SS during the pretreatment baseline, treatment, and withdrawal baseline phases for each of the two languages for P2.

Participant 3 (P3) – His first language (L1) was Hindi, second language (L2) was English, and he was given treatment in L1. The average of three pretreatment baseline (A) stuttering measurements revealed relatively very high stuttering for L2 (13.36% SS) than L1 (3.67% SS). P3 results showed there was a delay in the treatment effect for L1 but not for L2. However, P3 showed significant evidence of improved fluency with treatment across ten treatment sessions. After the treatment phase (B), the stuttering decreased drastically in L1 (0.33%SS) and reduced to 1.21% SS in L2. The relative

mean difference (average pretreatment baseline versus average treatment withdrawal) was 3.33% in L1 and 12.1% in L2 [Table 3].

Effect sizes were large for the participant in L1 (effect size = 10) in L2 (effect size = 18.3) indicating highly effective treatment effects in L1 and L2 languages. In spite of the greater difference in stuttering frequency between the two languages at the pretreatment baseline, a good generalization of treatment to the untreated language was noticed. Figure 3a and b shows the %SS during the pretreatment baseline, treatment, and treatment withdrawal phases for each of the two languages for P3.

Participant 4 (P4) – Treatment was given in Kannada, his first language (L1), and measurement of stuttering was done in both the languages (Kannada [L1] and English [L2]). The average of three pretreatment baseline stuttering measurements (A) of stuttering was 3.87% SS for Kannada and 7.07% SS for English. After 11 sessions of therapy (B), the frequency of stuttering decreased to 0.67% SS in L1 and 1.24% SS in L2. The relative mean difference (pretreatment baseline versus treatment withdrawal) was 3.20% in L1 and 5.83% in L2 [Table 3].

Effect sizes for the treatment indicated highly effective treatment for the participant in both the languages with effect sizes of 6.4 and 8.6 in L1 and L2, respectively. Thus, the participant (P4) showed significant evidence of improved fluency with treatment in both the languages. This individual could generalize the treatment effects to an untreated L2 language. Figure 4a and b shows the %SS during the pretreatment baseline, treatment, and treatment withdrawal phases for each of the two languages for P4.

Participant 5 (P5) – The average of three pretreatment baseline stuttering measurements (A) displayed the almost same amount of stuttering in L1 (7.59% SS) and L2 (7.61% SS). The treatment was given in the Kannada language, Tamil language being the other. Participant (P5) showed significant evidence of improved fluency performance in both languages with treatment. Throughout the treatment phase (B), across 14

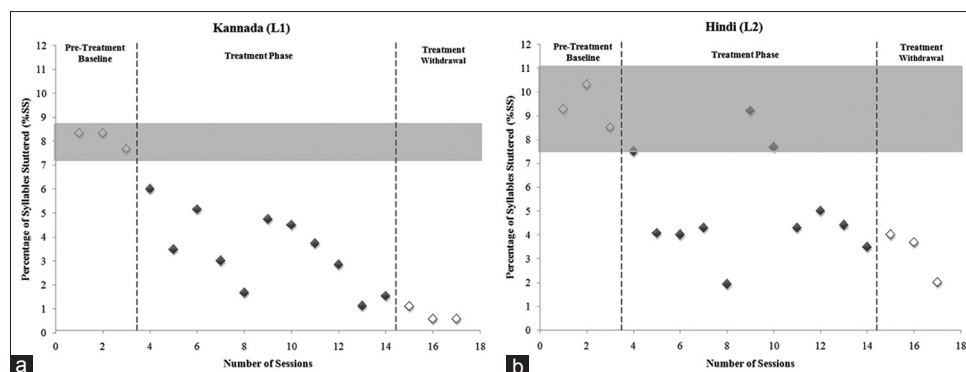


Figure 1: Percentage of syllables stuttered (%SS) for participant 1 in both the languages: (a) Kannada (L1) and (b) Tamil (L2) through nonprogrammed prolonged-speech treatment technique. Represented are: pretreatment baseline percentages (three white diamonds), during treatment percentages (black diamonds) and treatment withdrawal percentages (three white diamonds). Gray-shaded regions display the 95% critical difference of the three baseline scores (baseline critical difference)

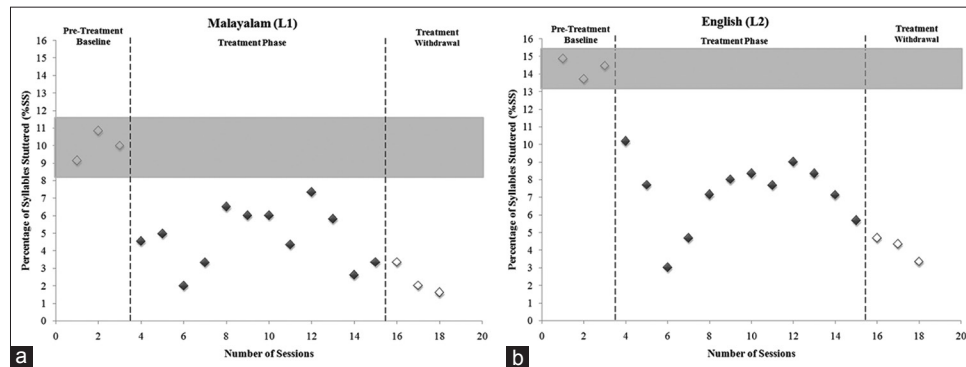


Figure 2: Percentage of syllables stuttered (%SS) for participant 2 in both the languages: (a) Kannada (L1) and (b) Tamil (L2) through nonprogrammed prolonged-speech treatment technique. Represented are: pretreatment baseline percentages (three white diamonds), during treatment percentages (black diamonds) and treatment withdrawal percentages (three white diamonds). Gray-shaded regions display the 95% critical difference of the three baseline scores (baseline critical difference)

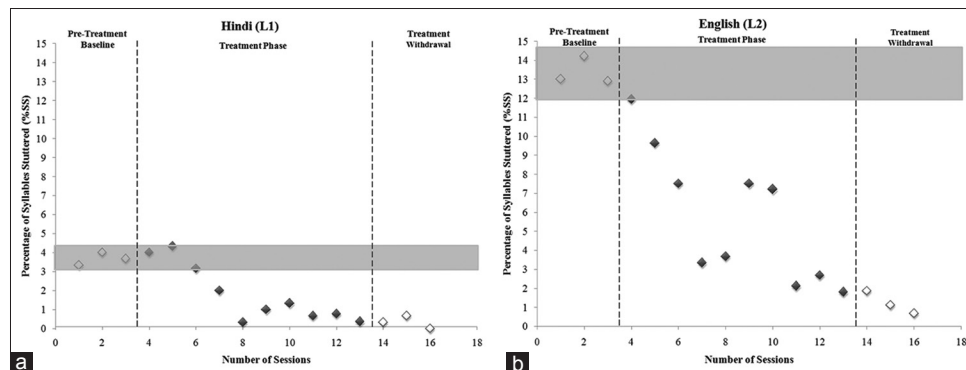


Figure 3: Percentage of syllables stuttered (%SS) for participant 3 in both the languages: (a) Kannada (L1) and (b) Tamil (L2) through nonprogrammed prolonged-speech treatment technique. Represented are: pretreatment baseline percentages (three white diamonds), during treatment percentages (black diamonds) and treatment withdrawal percentages (three white diamonds). Gray-shaded regions display the 95% critical difference of the three baseline scores (baseline critical difference)

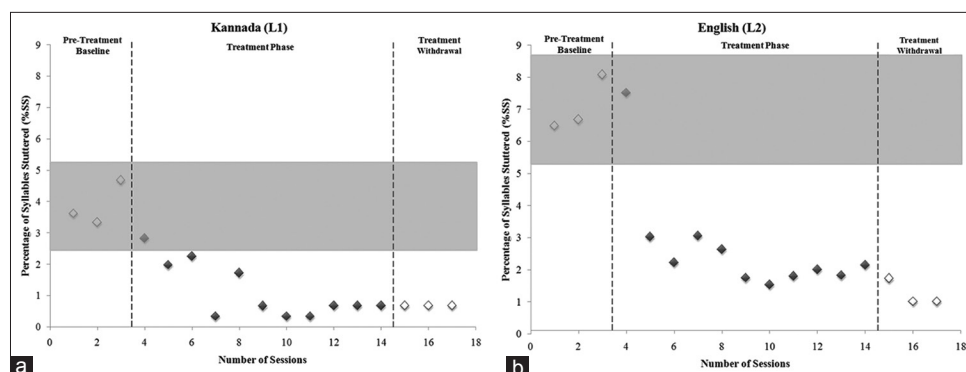


Figure 4: Percentage of syllables stuttered (%SS) for participant 4 in both the languages: (a) Kannada (L1) and (b) Tamil (L2) through nonprogrammed prolonged-speech treatment technique. Represented are: pretreatment baseline percentages (three white diamonds), during treatment percentages (black diamonds) and treatment withdrawal percentages (three white diamonds). Gray-shaded regions display the 95% critical difference of the three baseline scores (baseline critical difference)

sessions, stuttering frequency reduced for both the languages with one complementing the other. He could maintain the progress generally all through the sessions. After 14 sessions of therapy, the participant had reduced stuttering in both the languages (0.66% SS for L1 and 0.77% SS for L2). The relative

mean difference (pretreatment baseline versus treatment withdrawal) was 6.93% for L1 and 6.84% in L2 [Table 3].

Effect sizes for the treatment indicated highly effective treatment for L1 and L2 in this participant with effect size

values of 11.4 and 9.9, respectively. Figure 5a and b shows the %SS during the pretreatment baseline, treatment, and treatment withdrawal phases for each of the two languages for P5.

DISCUSSION

First, in their treated languages, all five participants showed a gradual reduction in %SS as the treatment progressed. When the treatment withdrawal (A) was obtained, in all five participants, there was a significant reduction in the number of syllables stuttered. The current results are in line with the findings of some of the studies in the literature.^[23-25] The present results suggest that in all five participants there was a significant generalization of fluency to an untreated language. Thus, in all five participants, prolonged-speech therapy proved to be an effective treatment method for reducing stuttering not just in treated language, but in the untreated language as well. This was consistent across all five participants even though their L1 and L2 differed. Current results support the earlier findings on the treatment of bilingual adults.^[11]

One possible explanation for a reduction in stuttering in untreated language is that these participants may have started using the prolonged-speech technique in untreated language.^[11] It appears that improved fluency in one language was observed to have generalized to the other language.^[11]

Second, across the participants, the difference in the generalization of fluency to untreated language may be explained based on the relatedness of the first and second languages, language proficiency as well as the amount of language usage. As shown in the results section, the generalization of fluency from treated to untreated language was significant for the participants. While interpreting these results with respect to the degree of generalization to the untreated languages, some interesting findings were noticed. Although the effect sizes for both the languages were huge for all the participants in both their languages, indicative of significant generalization of fluency to untreated language, we attempted further to compare the extent of generalization

by comparing the effect sizes for these participants across the two languages. The first language of P4 and P5 was Kannada and the second languages for these two participants were English and Tamil, respectively. It was noticed that the degree of generalization for these two participants was similar as compared to the other three participants. Both the languages spoken by participant 5 belonged to the Indo-Dravidian language family, and have a similar language structure. This relatedness of the linguistic structure of two languages could be one of the factors for near equal generalization in P5 for both the languages. L2 was English for both P2 and P3 and their respective second languages were Malayalam and Hindi. For these two participants, their second language, i.e., English was observed to have shown greater decrease in disfluencies as compared to their L1. This finding might have resulted due to the fact that most of the formal setups in India demand individuals to make use of English more than their native languages. Due to this, P2 and P3 may have made use of the English language more extensively in their day-to-day life while incorporating the technique taught to them. P1 had Kannada as L1 and Hindi as L2. This participant was observed to have reduced disfluencies to a greater extent in L1 as compared to L2. Hence, the extent of generalization was greater for L1, i.e., Kannada compared to L2, i.e., Hindi. Considering the bilingual proficiency of each of the languages of this participant, "native-like" proficiency was reported in the domains of understanding, speaking, reading, and writing in his first language. "Good" proficiency was however reported by the participant in understanding, speaking and reading domains in his second language. This could have led to a greater generalization in L1 compared to L2 due to overall greater language proficiency in L1. On the whole, results highlight that variability in nature of stuttering in our BAWS could be because of a combination of factors such as differences in the linguistic structure, language proficiency as well as the extent of language use.

Third, in four sequential bilingual participants, greater reduction in stuttering was noticed in treated language when

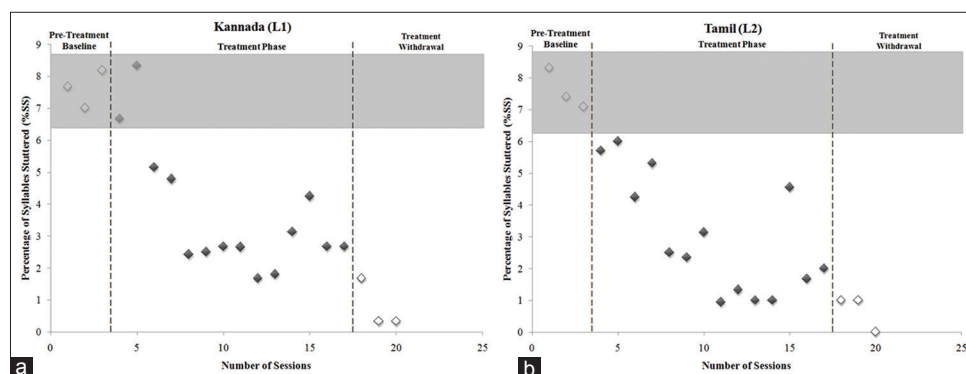


Figure 5: Percentage of syllables stuttered (%SS) for participant 5 in both the languages: (a) Kannada (L1) and (b) Tamil (L2) through nonprogrammed prolonged-speech treatment technique. Represented are: pretreatment baseline percentages (three white diamonds), during treatment percentages (black diamonds) and treatment withdrawal percentages (three white diamonds). Gray-shaded regions display the 95% critical difference of the three baseline scores (baseline critical difference)

compared to untreated language [Table 3]. Participants may be practicing prolonged-speech therapy technique more in the treated language when compared to untreated language, and there may be the better observed and recorded fluency and stuttering measures in treated language when compared to untreated language. Unlike other four participants, fifth participant (P5), who was a simultaneous bilingual individual illustrated an identical amount of stuttering in both languages before treatment, throughout the therapy sessions, and after treatment was withdrawn. This participant's native language was Kannada and the second language was Tamil. As this participant was a simultaneous bilingual individual, there may be a greater generalization of fluency compared to other four sequential bilingual individuals. Previous research has shown that L1 and L2 representations in brain differed for simultaneous and sequential bilingual persons.^[26] Thus, a difference in the treatment generalization pattern may be expected for these two types of bilingual persons.

In addition, some observations were that syllable prolongations were noted while analyzing the speech samples after the treatment. These were, however, a part of the prolongation technique which was taught to the BAWS. The syllable prolongations which were noticed before the treatment were observed to be dysrhythmic and involved effort and hence were considered dysfluent. The BAWS were observed to be prolonging the syllables in their untreated language as well (which was a part of the technique) even after treatment, but these were not as frequent as was in their treated languages. All BAWS prolonged their speech in the three withdrawal sessions. The participants were instructed to maintain their fluency in all the situations by using the prolongation technique only when they anticipated stuttering or when they stuttered. This instruction was given to them soon after the completion of stage V of therapy. After providing these instructions, there were no new or ongoing instructions given, and during the consecutive days, the speech samples were recorded during the treatment withdrawal sessions. It was noticed that all the participants made attempts to prolong the syllables even during withdrawal sessions despite the withdrawal of treatment. One another observation was that a perceptual reduction in the speech rate was noticed from the pretreatment till after the completion of stage V as well as during the withdrawal sessions, i.e., the speech rate was higher in the pretreatment sessions as compared to withdrawal sessions in all the participants. All the above-given details were observations which were not objectively documented but perceptually noticed. Since our main aim of this study was to document the amount of generalization of fluency in the untreated language regarding the percentage of syllables stuttered (%SS), we did not report these results objectively. However, our future attempts will consider reporting the same.

In summary, present results highlight that nonprogrammed prolonged-speech technique was an effective treatment method for all five BAWS. The results also showed that there is a significant generalization of fluency to an untreated language

in all five participants. Further, the amount of generalization of achieved fluency may depend on factors such as type of bilingualism, relatedness of two languages, language proficiency, and the extent of language use. We recognize that in the current study only five BAWS participated. Therefore, the current study needs to be replicated with a more typical ABA withdrawal or ABAB withdrawal and reinstatement designs. Group-design studies with a larger sample size may also be considered.

Further, the current study looked into the efficacy of treatment within the clinical setting only. Outside clinical setting measurements for L1 and L2 were not made, and further research addressing these factors will shed light on an extra-clinical generalization of fluency. Further, in all our five participants, treatment was given in their first language, which was also their more proficient language. Further studies may compare the degree of generalization from treatment in L2 to L1. Studies also may compare treatment offered to both the languages in an alternative fashion to see the effects and the degree of generalization. How the achieved fluency in L1 and L2 languages is maintained in long-term also needs to be investigated.

For practical reasons, we limited the withdrawal condition to just three sessions. Generally, however, the withdrawal condition is extended until a convincing reduction in the treated behavior is observed. Additional studies are needed to examine the effects of typical withdrawal of treatment of nonprogrammed prolonged speech technique while treatment is provided in either L1 or L2. Furthermore, whether or not the application of a programmed variant of prolonged-speech technique will provide outcomes similar to those of the present study is a matter for empirical demonstration and is of interest to compare with the present data. Furthermore, details regarding the duration of longest blocks, types of dysfluencies, physical concomitants, etc., could be incorporated and compared in future studies. Finally, whether other stuttering treatment procedures, such as time-out from speaking, offered in one language, would produce generalized fluency in a second language, is also worthy of investigation.

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Conflicts of interest

There are no conflicts of interest.

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