DAF Speech disruptions in typical Kannada-English Bilinguals

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Abstract

The study examined the speech disruptions under the influence of Delayed Auditory Feedback in typical Kannada (L1)-English (L2) bilingual adults as a factor of language familiarity and L2 language proficiency. Nineteen typical Kannada (L1) – English (L2) bilingual adults in the age range of 18-30 years *(M =2, F = 17)* participated in the study. Speech disruptions under DAF was analysed for the stimuli tasks of reading passage and answering the questions across L1 and L2 of the bilinguals. Speech errors under DAF were analysed and categorized into three major subtypes which included articulatory, repetition and other errors. Results revealed greater speech disruptions for L1 which was the most familiar language of the participants. The predominance of a speech error subtype was contingenton the stimuli task of the study. Language proficiency in L2 influenced the articulatory errors of L1 wherein Low Proficient (LP) group showed higher frequency of speech disruptionscompared to the High Proficient (HP) category. Additionally, low proficient speakers showed insignificant differences between the speech error subtypes across the languages for the task of reading passage. Results are discussed in the light of semantic satiation and allocation of attentional resources for monitoring the ongoing speech under the influence of DAF along with a possible implication of the findings to the selected clinical population with speech disorders.

Key words: Delayed Auditory Feedback, Language proficiency, Language familiarity, Attention control.

Influence of Delayed Auditory Feedback on speech disruptions in typical Kannada (L1) - English (L2) Bilinguals

Background

Any dynamic motor acts, including speech production, require continuous feedback monitoring of the ongoing process. Particular to speech production, several such monitoring feedbacks are at work that complements each other to minimize the disruption in the process. Proprioceptive feedbacks from muscles and joints of speech apparatus, auditory feedback through bone conduction and air conduction mediums are the primary feedback mechanism that are relevant for the process of speech production. Among the several physiological processes that are thought to be involved in the continuous monitoring of speech, the feedback from the auditory domain is majorly studied as numerous speech production models of contemporary and past research emphasizes its unique role in subserving the production of speech (Guenther, 1995; Guenther, Ghosh&Tourville, 2006; Tourville, Reilly &Guenter, 2008). It was Lee (1950) who first demonstrated the effects of 'Delayed Auditory Feedback' (DAF) on the speech of typical speakers and provided a framework to understand the 'auditory-motor' integration and helped in detailing the consequences of its disruption on some of the speech disordered population like Stuttering.

Studies carried out on DAF in typical speakers have reported wide range of behavioral disturbances which either takes a form of slowed speaking rate, articulatory inaccuracy, increased vocal pitch and intensity, repetitions, blocks and prolongations (Bradshaw, Nettleton & Geffen, 1971; Harrington, 1988; Fairbanks &Guttman, 1958). After initial set of studies, several key factors that are thought to be determine the behavioral manifestations under the influence of DAF were focused. These factors include, but not limited to, auditory time delay (Howell & Powell, 1987; Mackay, 1968; Stuart,

Kalinowski, Rastatter, Lynch, 2002), age (Seigel, Fehst, Garber & Pick, 1980), gender (Buxton, 1969; Bacharch, 1964; Fukawa, Yoshioka, Ozawa & Yoshida, 1988; Timmons, 1971), stuttering (Borden, Dorman, Freeman, &Rapheal, 1977; Chase, 1958; Neelley, 1961; Neelley& Timmons, 1967) and language familiarity (Fabro& Darro, 1995; Van Borsel, Sunaert, Engelen, 2005). Among the factors outlined, language familiarity is thought to be influencing the behavioral manifestations of speech in bilinguals under the influence of DAF. The current study is one such attempt that addresses the language familiarity hypothesis on speech disruptions under DAF proposed by Mackay (1970) tested on Kannada-English typical bilingual speakers with varied proficiency attributes in their L2.

Language familiarity hypothesis was put forth by Mackay (1970) after observing the speech disruptions of German (L1)-English (L2) typical bilingual speakers under the influence of DAF. It was reported that the most familiar language viz., German, showed less speech disruptions and the utterances were produced at a faster speaking rate than English. These effects were found to be independent of the auditory time delay employed in the study. Higher motor practice was attributed as the underlying factor which made the participants to be more resistant for speech disruptions in the most familiar language. Contradicting to the findings of Mackay (1970), few of the earlier experiments and some of the follow up investigations that examined the disintegration of speech under auditory delay have failed to replicate the findings. For instance, Rouse and Tucker (1966) compared the speech disruptions under the influence of DAF on three groups of participants who either read their native language (English) or a foreign language prose (French). More errors were seen in the group that read the passage in their native language compared to the groups that read in their non-native languages. In contrast to the findings of Rouse and Tucker (1966), Kvavik, Katsuki-Nakamuri, Siegel, and Pick (1991) reported the speech disturbances for 38 native English speakers who were university students enrolled in learning Spanish/Japanese as a

second language. Participant groups were grouped into beginning and advanced learners' based on the years of exposure and experience to Spanish/Japanese languages. Results revealed an insignificant group difference for DAF based speech errors between beginners and advanced bilingual learners of Spanish/Japanese.

A recent study on the bilingual speech disruption under the influence of DAF was reported by Fabbro and Darro (1995). They compared the effect of DAF between 12 polyglot interpreters with 12 monolingual typical controls using a task of verbal fluency. Polyglot interpreters did not show any kind of disruption of speech but the participants of control group showed an opposite trends of increased disfluencies under DAF compared to non DAF conditions. Interestingly, the DAF effect did not influence any known languages of the polyglot interpreters. More recently, Van Borsel, Sunaert and Engelen (2005) supported the language familiarity effect on a group of native Dutch Speakers (17 males, 13 females) who were proficient in both French and English languages. Participants were increasingly disfluent in the later acquired languages compared to their mother tongue which was confirmed with two different tasks in which the first task included the participants to read meaningful texts across all the three languages and second task was to utter a nonsense text. The objective to delineate gender differences in the same study did not show any consistent trends.

To summarize, few of the of the above group of studies support the language familiarity hypothesis (Mackay, 1970; Van Borsel, Sunaert&Engelen, 2005), some have shown an opposite trend (Rouse & Tucker, 1966) whereas other group of studies have shown no differences in speech disruptions under DAF across the languages known by a bilingual (Fabbro & Darro, 1995, Kvavik, Katsuki-Nakamuri, Siegel, & Pick, 1991). Inherent methodological drawbacks among some of the studies reviewed also poses difficulty in clearly arriving at the conclusion. Majority of the studies reviewed did not outline the

language background of participants and did not provide any empirical evidences on the relative strengths of languages across participant groups (Mackay, 1970; Rouse & Tucker, 1966). Few studies have reported data on certain population who possess unique characteristics in language processing compared to other typical bilinguals (Fabbro & Darro, 1995). Understanding the speech disruptions under DAF may have significant influence on our understanding of some of the clinical conditions such as Stuttering as the DAF disruptions of speech provides an excellent means to understand the trade-offs between language and speech motor dynamics in these population. Paradigms geared on such a direction may help us to understand the already relevant theoretical knowledge on the influence of key language variables on fluency disruptions in bilinguals with stuttering. Although several studies have been undertaken in the recent past to identify such variables, clear conclusions are far from being reached due to methodological drawbacks and complex research paradigms which poses significant difficulty in replicating the findings of the previous work (see review on bilingualism and stuttering by Van Borsel et al., 2001).

Purpose of the study

Past research on DAF disruptions in bilinguals have led to mixed results due to methodological drawbacks which prompts to undertake further investigations to test the language familiarity hypothesis (Mackay, 1970) in the Indian context by exploring it on typical Kannada (L1)-English (L2) bilingualsby varying the language proficiency in L2. It is an interesting test case scenario to examine the DAF effects on Kannada-English bilinguals as these individuals reside in an L1 speaking environment whereas past research from the western context has studied bilinguals in an L2 speaking environment. In such an environment daily usage patterns of L1 and L2 for day today communication purposes highly differs. Therefore, it is interesting to study how bilingual participants would react to DAF disruptions when they have differential experiences across languages indexed by their

language proficiency in L2. Also, language structure of Kannada differs with English on the aspects of morphophonemics, word order and semantic expressions. Kannada being a Dravidian language is agglutinative in nature which follows free word order in oral and written expression whereas English belonging to the Indo-European family follows strict word order in both oral and written expression. Hence it is intriguing to understand how differences in language structure would alter the speech disruptions under DAF. We propose to carry out the experimental tasks across two different stimuli of reading passage and answering the questions, although we do not intend to address the speech error differences between the two in this study. Reading passage may not load the linguistic formulation process and execution of the words depends on the material given and hence they are relatively fixed. Whereas answering the questions require conscious formulation of responses which would tax the participants' cognitive-linguistics process and the word order of responses may vary with each participant. The current study analyses the speech disruptions under DAF with an auditory delay of 150 ms as delays around 0.2 ms is shown to interfere with the speech production process by few of the previous studies (Mackay, 1968; Stuart et al., 2002).

The study proposes to examine the following research questions:

a) Does DAF speech disruptions is less in Kannada which is the mother tongue of the Kannada-English typical bilingual adults compared to English across the tasks of reading passage and answering the questions?

b) Does language proficiency in English (L2) influences the DAF disruptions across the languages of Kannada-English typical bilingual adults for the tasks of reading passage and answering the questions?

Materials and Methods

Participants

A total of 19 Kannada (L1)-English (L2) bilingual adults (17F, 3M) in the age range of 18-30 years (*Mean age=21.6, SD=1.2*)were included in the study. Gender was not balanced as it was not considered as a variable for the study. Participants were undergraduate students of Speech and Hearing who were native speakers of Kannada, a Dravidian language spoken in the southern India. All the participants resided in the state of Karnataka for more than 10 years and agreed that they used Kannada as a predominant language for their day-to-day communication purposes. They were exposed to English in the school where it was learnt as a part of their curriculum. They were also exposed to English language through other modes such as reading books, TV advertisements and popular cinema to varied extents. Participants also learnt Hindi as a 3rd language from 5th grade onwards in the school. The characteristics of the participants included in the study are represented in table 1.

Insert Table 1 here

None of the participants had ever diagnosed with a speech, language or a hearing problem which was ascertained while taking the detailed language history of the participants. Furthermore, those participants with emotional, psychological and who are under medications for chronic illnesses were ruled out from the study group. Based on their performance in Cloze test and their self-rating on LEAP-Q, 10 participants was categorized into High Proficient (HP) group and the other 9 into Low Proficient categories. A written informed consent was obtained from all the participants before enrolling them into the study.

Materials

Language proficiency measurement

An adapted Indian version of Language Experience and Proficiency Questionnaire, LEAP-Q, (Maitreyee&Goswami, 2009; Marian, Blumenfeld, &Kaushanskaya, 2007) and Cloze test (Taylor,1953) was together used to categorize the participants into high and low English (L2) proficient groups. LEAP-Q being considered as one of the standard and reliable tools to assess the language proficiency in bi/multilingual population is a self-rated proficiency questionnaire which provides detailed information on language histories, age of exposure, proficiency and usage patterns. These variables were rated using a 4 point rating scale across 4 major domains that determines language proficiency such as Speaking, Understanding, Reading and Writing. The details of the LEAP-Q rating for all the participants of the study are provided in Table 1.

To reduce the subjective bias of the LEAP-Q, a performance measure to test the language proficiency in English called 'cloze test' (Taylor, 1953) (See Appendix I) was used. In cloze test key details of language such as words/letters are deleted and the participants are instructed to fill in the missing details depending on the context and the vocabulary of the passage. This is one of the commonly used tools to understand the second language abilities of bilinguals. In the current study, cloze test was used to analyze the language proficiency in English. The details of the participants' performance of the cloze test are provided in table 1.

Apparatus

Delayed Auditory Feedback was delivered to the participants using an Android smartphone application called 'Delayed auditory Feedback' developed by Boostlabz software development firm which could be freely downloaded from the Google Play Store.This application is currently used by individuals with stuttering as a treatment module to reduce the number of disfluencies in real life situations. When uploaded into the smartphone it works in the background without interrupting the other activities of the smartphone and hence

provides tremendous advantages to practice slowed rate of speech in persons with stuttering. Currently the application supports only DAF which has options to increase the delay from 0 to 500 milliseconds and the speech rate can be sampled from 8 kHz to 48 kHz. For the purpose of the current study, a speech rate of 44.1 kHz and an auditory delay of 150 milliseconds were used.

Stimuli

Two types of stimulus were used which included reading passages and questions across L1 and L2. A standard Kannada passage containing both voiced and unvoiced sounds was selected for the study (Savithri&Jayaram, 2004). This passage consisted of more than 300 words, however, for the purpose of present study first 256 syllables were chosen as it matched with the total number of words with the 'rainbow passage' chosen for English. For English, 'Rainbow passage' (Fairbanks, 1960) was used which tests almost all the phonemes of English except the phonemes /z/ and /h/ consisted of 256 syllables. Rainbow passage is a phonetically balanced passage where the ratios of the various phonemes reflect the ratios of those phonemes in normal unscripted speech.

Questions were developed as a second group of stimulus. A list of commonly encountered questions of day-today life was prepared in English and was given for rating for 10 individuals. Participants were asked to rate the questions on two parameters of 'commonality' and 'quality of responses' on a 3-point rating scale. In case of commonality parameter, '0' indicated the question as uncommon whereas '2' indicated the question as common. For quality of response parameter, '0' indicated 'poorly elaborated verbal response' whereas 2 indicated 'Evokes elaborated verbal response'. Only those questions which were rated as 2 across commonality and quality of response were chosen as final stimuli. A list of 10 questions formed the final set (Appendix II) which was translated from English to Kannada to maintain the homogeneity of stimuli across languages.

Procedure

All the participants filled the LEAP-Q form which collected their detailed language history across the languages (L1, L2 and L3). In LEAP-Q, Language proficiency in L2 was rated on a 4 point scale. Followed by which they were administered with Cloze test wherein they were instructed to fill the incomplete words (missed letters of a word) by understanding the context of the material. There were totally 30 incomplete words in the Cloze passage. Those participants who rated themselves as ≤ 2 in LEAP-Q with a score of ≤ 15 was categorized as Low Proficient (LP) and those with a rating of ≥ 3 in LEAP-Q with a score of ≥ 16 were categorized as High Proficient (HP) speakers of English (L2). Administration of both LEAP-Q and Cloze test approximately took around 30 minutes.

Followed by the language proficiency assessment participants were involved in the experimental tasks. All the participants had a comfortable seating position in a quiet room set up. The reading passages and the question stimuli were presented visually on the computer screen and they were instructed to read the passage in their habitual speaking rate and loudness as accurately as possible without any interruptions or attempts to correct their mistakes. Similar instructions were provided while answering the questions of the study. No practice trails were given before the recording of the experimental tasks. The order of presentation of reading passages and questions as well as the languages were counterbalanced across the participants. The instructions were provided to the participants in their most preferred language and it was observed that majority of the participants took their instructions for the tasks in Kannada (L1). Before they initiate the experimental tasks, a headphone was comfortably placed on their ears as well as a microphone at a distance of 10cm from their mouth which in turn was linked to the Delayed Auditory Feedback software (Boostlabz software development) loaded to Motorola G5 Plus Smartphone. A digital Olympus sound

recorder (WS-550M) was used to collect their responses in the experimental tasks which were later used to analyse their speech disruptions under the influence of DAF.

Analysis

The speech disruption errors under the influence of DAF was analysed by two co-investigators of this study. Both the investigators listened to the speech samples of all participants and analysed the errors jointly. Speech disruption error of the bilinguals was analysed according to the framework provided by Kvavik et al., (1991) wherein the errors were broadly categorized into Articulatory [Substitutions, Omissions, Distortions and Additions], Repetition Error [Repetition of sounds, syllables, words and phrases] and Other errors [Interjections, Prolongations, Pauses within and between the words]. Investigators counted the number of errors and categorized them according to the above classification only when both of them had a consensus on an error. If there were disagreements, the audio samples were repeated until they reached the consensus.

As the speech disruption analysed did not fall under the normal distribution, non-parametric tests were chosen analyse the results. The study had language as a within subject and L2 language proficiency as a between subject factor. To analyse the language differences, Wilcoxon Signed Rank test was used whereas Mann Whitney U test was used to compare the speech disruptions between the proficiency groups. Within language comparison of speech error subtypes was analysed using Friedman's test and if it showed statistical significance a post hoc analysis was conducted using Wilcoxon Signed Rank test.

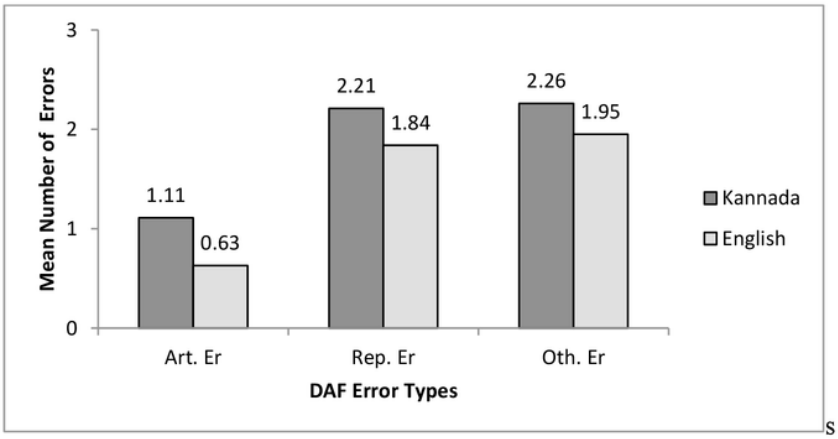
Results

The study examined the objectives of analysing the effect of DAF on typical Kannada English bilinguals across languages and proficiency groups. Non parametric tests were used to compare language and proficiency differences across DAF error types as the data wasnon-normally distributed [Shapiro-Wilks test, $p < 0.05$].

Language Differences

Language differences were computed for both passages as well as for the questions stimuli chosen for the study. To understand the between language differences, Wilcoxon signed rank test was used to compare the Speech error types under DAF across the stimuli. For reading passages, results showed significant differences for only Articulatory error condition [$Z = 2.31$, $p = 0.02$] and no differences were found for Repetition errors [$Z = 0.77$, $p = 0.43$] and Other errors [$Z = 0.63$, $p = 0.52$]. In the observed differences, the articulatory error was found to be higher in Kannada compared to English. Figure 1 represents the mean speech disruptions under DAF across Kannada and English language passages.

Figure 1. Representing the mean speech disruption errors under the influence of DAF in Kannada and English passages



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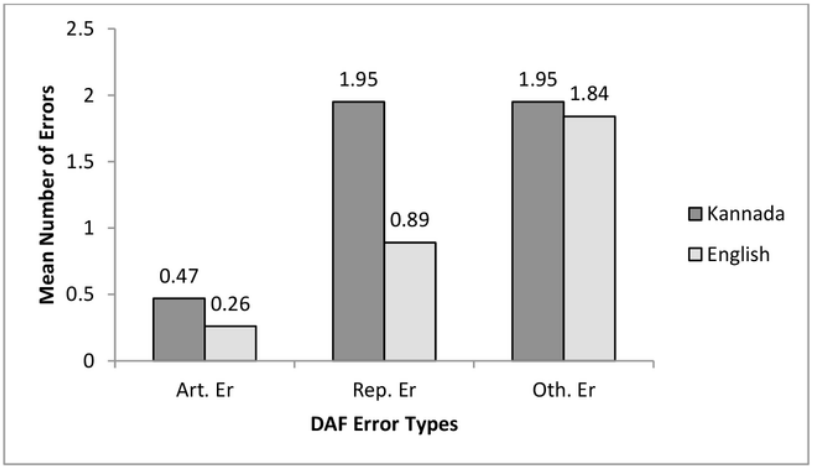
Within language differences of the DAF error conditions were examined using Friedman's Test. It revealed statistically highly significant differences across error types for both Kannada [$\chi^2 = 11.29$, $p < 0.01$] and English [$\chi^2 = 9.65$, $p < 0.01$] languages. Post hoc analysis for Kannada using Wilcoxon signed rank test revealed that the Articulatory error was significantly different when compared with Repetition [$Z = 2.68$, $p < 0.01$] and Other errors [$Z = 2.62$, $p < 0.01$] whereas differences were insignificant when Repetition error was compared with Other errors [$Z = 0.11$, $p = 0.90$]. In post hoc analysis of English, consistent differences were observed between a) Articulatory and Repetition [$Z = 2.46$, $p = 0.01$] b) Articulatory and Other errors [$Z = 3.23$, $p < 0.01$] but not for Repetition and Other error [$Z = 0.28$, $p = 0.77$] comparisons.

Analysis of questions revealed a significant difference for Repetition errors between the languages [$Z = 2.98$, $p < 0.01$] whereas the comparisons made for Articulatory [$Z = 0.92$, 0.35] and Other errors [$Z = 0.32$, $p = 0.74$] did not show any differences. Figure 2 represents the mean speech disruptions under DAF across Kannada and English language questions.

Figure 2.Mean speech disruption errors under the influence of DAF in typical Kannada and English bilinguals for stimulus questions.



Within language comparisons of DAF speech disruptions were significant for both L1 [$\chi^2 = 19.15$, $p < 0.01$] and L2 [$\chi^2 = 16.62$, $p < 0.01$]. Post hoc analysis of L1 revealed a consistent trend of Articulatory error being less frequent than Repetition [$Z = 3.23$, $p < 0.01$] and Other errors [$Z = 3.21$, $p < 0.01$] andanalysis made for L2 revealed differences across all the compared pairs ($p < 0.05$).

Proficiency Differences

a) Between group comparisons

Effect of proficiency was significant for Articulatory error of L1 between high (HP) and low (LP) L2 proficiency groups as revealed via Mann-Whitney U test ($Z = 2.11$, $p < 0.05$). In the observed difference, The LP group showed consistently more number of Articulatory errors compared to the HP group. None of the other comparisons showed any proficiency effect ($p > 0.05$). Table 2 represents the mean speech disruption errors across Articulatory, Repetition and Other errors across proficiency groups of typical Kannada (L1)-English (L2) bilinguals for reading passages.

Insert Table 2 here

Analysis of proficiency effect on questions revealed similar effect to that of passages. Here again the proficiency effect was significant for only the Articulatory Errors of L1 ($Z = 2.53$, $p < 0.05$) wherein articulatory errors were more evident in LP compared to HP group. None of other comparisons revealed any statistical significance. Table 3 represents the mean speech disruption errors across Articulatory, Repetition and Other errors across proficiency groups of typical Kannada (L1)-English (L2) bilinguals for answering the questions.

Insert Table 3 here

b) Within group differences

Friedman's test was used to compare various speech disruption errors under DAF for each proficiency category separately for reading passages and questions. In HP group, the error types differed with each other in Kannada [$\chi^2 = 7.93$, $p < 0.01$] whereas no such differences were revealed for English [$\chi^2 = 4.75$, $p > 0.05$]. Post hoc analysis of DAF error types in L1 revealed Articulatory errors to beless frequent compared to Repetition [$Z = 2.14$, $p = 0.01$] and Other error patterns [$Z = 2.26$, $p = 0.02$]. In LP group, DAF error types did not differ either for Kannada [$\chi^2 = 4.06$, $p = 0.13$] nor for English [$\chi^2 = 4.93$, $p > 0.05$].

Similar analysis was conducted for the stimulus questions within each proficiency categories. In HP group, results revealed that all the DAF error types differed significantly with each other in both L1 [$\chi^2 = 7.93$, $p < 0.01$]and L2 [$\chi^2 = 7.93$, $p < 0.01$]. Trends were similar when the error types were compared for LP category. Post hoc analysis of the HP group revealed that the frequency of articulatory error was less compared to repetition [$z = 2.85$, $p < 0.01$] and other errors [$Z = 2.20$, $p < 0.05$] in L1whereas articulatory error differed only with Other errors in L2 [$Z = 2.50$, $p < 0.05$]. In the post hoc analysis of LP group, articulatory error was found to be less frequent compared to the Other error types in both L1 [$Z = 2.41$, $p < 0.05$] and L2 [$Z = 2.40$, $p < 0.05$].

Discussion

Language Differences

First objective of the study addressed the effect of language as a whole on speech disruptions under DAF. In the case of reading passage, Articulatory error was found to be different between the languages whereas the Repetition error was higher while answering the questions. Interestingly, L1 showed higher frequency of errors compared to L2 in the above observed differences between the languages. It is intriguing to note such a high speech disruption error in L1 as this was the participants' native and most familiar language. Based on the language familiarity hypothesis L1 was expected to show fewer errors than L2 as there are high chances that L1 is motorically and linguistically the most used language among bilinguals. The findings are counterintuitive to some of the known studies of the literature which showed that the most familiar language is most resistant for speech disruptions under DAF (Mackay, 1970; Van Borsel et al., 2005). Additionally when we combined all the speech disruption errors for each language,L1 clearly outnumbered the L2 in the total frequency of errors [*Kannada=106; English=84*].With these findings we reject the language familiarity hypothesis which asserts lesser frequency of speech errors under DAF for the most familiar language spoken by a bilingual.However, a caution is exercised while rejecting the language familiarity hypotheses as higher errors in L1 was observed in only one among the three analysed speech disruptions and the other two classes of speech errors had comparable errors between the languages. Current findings are in agreement with the report of Rouse and Tucker (1966) who reported higher speech errors in L1 compared to L2. It was argued that the semantic satiation which is more common in a predominant language could be the reason for the increased errors in L1.

Interestingly the type of speech error which was higher in L1 varied with the stimuli chosen. For reading passage the differences were observed for Articulatory disruptions whereas for the questions Repetition errors were predominant. This is indicating of an interaction between the *type of stimuli chosen* and the *speech errors*analysed. It is hypothesized in a reading task that the overall load on the language formulation of the utterances is less and hence language independent articulatory errors such as substitution, omission, or distortions are more common. However, reformulation of the spoken utterances can be a well anticipated error while answering the questions as conscious formulation of propositional speech is encountered.

Within language analysis of the speech errors under DAF was consistent for both reading as well as for the task of answering the questions as articulatory errors was less frequent compared to repetition and other error types across languages. This indicates that repetition errors along with other errors (prolongations, interjections, pauses within and between the words) are language independent errors that remain same across the stimuli chosen. Together this indicates that fluency disruption under DAF is more common than articulatory disruptions.

Proficiency Differences

Less straightforward differences were observed when speech disruptions under DAF were compared for the variable of proficiency. As the linguistic experience in L2 was varied in terms of language proficiency it was expected that speech errors may differ between high and low L2 proficient speakers during the speech production of L2. However, no differences in the speech errors of L2 were observed between the groups. Surprisingly, L1 articulatory error was higher in low proficients' compared to the high proficient group across the stimuli.

With the above finding, we partly accept the influence of L2 language proficiency on speech errors of bilingual speakers, particularly on their speech errors of L1. We speculate that attention related variables might have been operative in less proficient group which made them to consciously monitor their native language which resulted in higher speech errors across the tasks. This is in line with the notion that speech errors under the influence of DAF are more when increased attention is paid to the auditory feedback (Mackay, 1970). It is speculated that the more proficient speakers of L2 may constantly redirect their attentional resources to shift their productions across languages whereas such opportunities are limited for a less proficient speaker and hence sharing of the attentional resources may become uneven across their languages. These situations are increasingly common in the Indian scenario as majority of the bilingual speakers live in their native speaking environment (L1) that reduces the opportunity to use their L2. Therefore, the language usage could be a more probabilistic factor on which the speech errors may possibly be dependent on rather than on the proficiency variations in the Indian context. Current finding may not go out of line with few of recent studies which have highlighted the influence of attentional control on monitoring speech and non-speech tasks (Lisman&Sadagopan, 2013; Freedman, Mass &Caligiuri,Wulf& Robin, 2007). Some of these investigations have clearly shown the detrimental effects of inward attention focus (focusing on the articulatory movements) on speech production (Lisman&Sadagopan, 2013).

When various speech error types were compared within each proficiency group (HP and LP) across stimuli, consistent differences were revealed only for the stimuli of answering the questions. All the speech error types differed within HP and LP groups across L1 and L2 and the articulatory error seemed to be less frequent compared to all other error types. The findings obtained here is not due to L2 language proficiency but rather to the characteristic speech error that was observed for languages cutting across the boundaries of proficiency.

But, in reading passage task, various speech error types were comparable for both L1 and L2 for the LP group which hinted for a possible interaction between *language proficiency, speech error type* and the *stimuli*. It can be speculated that LP participants may have reduced cognitive flexibility in selectively monitoring the auditory feedback across languages for a less taxing task of reading passage.

Current findings may have implications for the studies carried out on speech production in bilinguals with stuttering. Recent studies have shown that the variations in the stuttering symptoms across the languages of bilinguals with stuttering (BWS) may depend on several linguistic factors including language proficiency (see Van Borsel et al., 2001 for a review). The current study findings support a group of studies which reported higher stuttering frequenciesin a bilingual for a predominant/native language (Jayaram, 1983; Howell et al., 2004) as the current results also showed more speech errors in L1 compared to L2. Additionally, some of the recent studies which carried out physiological investigations have highlighted the influence of L2 language proficiency on speech movement variability of L1 in selected bilingual population and asserted that cross linguistic interference which is commonly seen in bilingual population could be the influencing factor (Chakraborty, Goffman& Smith, 2008; Mahesh & Manjula, 2016). It can be speculated that cross linguistic influence may have influenced in unknown ways in the current study design.However, we understand that the language familiarity hypothesis needs to be directly tested in BWS as the language processing and its interplay with speech production is complex in this population. From the current results it can be hypothesized that the DAF related treatment targets on selective clinical population (For instance BWS) needs to be primarily focussed on the language which is highly used by a bilingual rather than deciding on the factor of proficiency judgements.

Few drawbacks are observed in the current investigation. Although we used a combination of tests to analyse their L2 language proficiency, the differences between HP and LP groups may not have been large enough to bring changes on speech disruption patterns of our participants. Samples collected involved a high number of females who are known to be resistant for DAF related speech changes compared to males (Bacharch, 1964; Fukawa et al., 1988). Sample size was relatively less compared to some of the previous studies and hence this could be further enhanced in the future studies.

Conclusion

The current study examined the language familiarity hypothesis and the influence of L2 language proficiency in typical Kannada English bilinguals. Contradictory to the established reports, Kannada (L1) was observed to show higher speech disruptions than English and L2 proficiency influenced the speech disruptions of L1. The study findings did not provide support to the language familiarity hypothesis and the underlying reason for higher speech disruptions of L1 is not very clear although semantic satiation in the native language of the participants could be attributed to a certain degree. Higher speech errors in Kannada is paralleling some of the studies carried out in bilinguals with stuttering (BWS) who have shown higher variability in their native language. Though language proficiency showed some effect on the speech disruptions of L1, achieving a control on L2 language usage seemed to be more appropriate and this could be addressed in future studies.

DAF Speech disruptions in typical Kannada-English Bilinguals

ORIGINALITY REPORT

7%	2%	5%	1%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Mahesh, B. V. M., and Rajanna Manjula. "The effects of English (L2) language proficiency on speech motor indices for bisyllabic bilabial word utterances in typical Kannada (L1)–English (L2) bilinguals", Speech Language and Hearing, 2016. Publication	3%
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