# LEXICAL ACCESS IN BILINGUAL ADULTS WHO STUTTER

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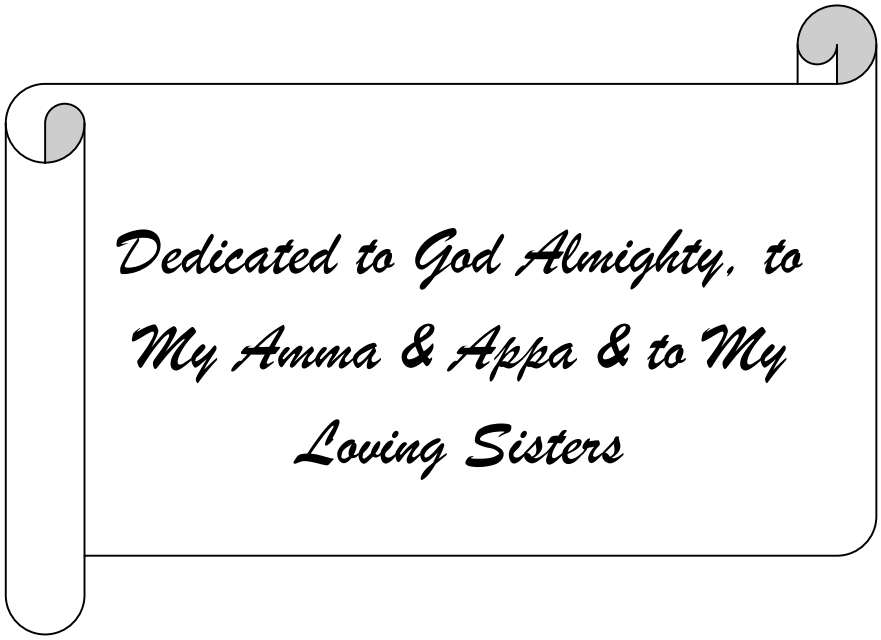
Dedicated to God Almighty, to
My Amma & Appa & to My
Loving Sisters

# Acknowledgements

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# CHAPTER 1

## INTRODUCTION

Stuttering is a developmental disorder of speech typically characterized by repetitions, prolongations and silent blocks. It is estimated that 1% of the world's population stutters. Stuttering usually starts between 2 and 4 years of age and in 50% of the children, the condition persists. Although stuttering is one of the extensively researched topics in the field of speech pathology, till today, its cause remains unknown. Previously, several attempts have been made to understand the underlying mechanisms behind stuttering. Researchers have investigated stuttering from both linguistic and motoric deficits point of view, and speculate that stuttering occurs due to imbalance between linguistic and motoric development (Peters & Starkweather, 1990). However, Cheverkeva (1967) and Bloodstein (2002) propose that stuttering is basically a disorder of language development. Keeping this point of view, several attempts have been made to investigate the relation between stuttering frequency and different linguistic variables.

A vast number of studies have investigated the effect of different linguistic variables on stuttering frequency. These linguistic variables include: syntactic complexity (Bernstein Ratner & Sih, 1987; Brundage & Ratner, 1989; Hannah and Gardner, 1968; Wells, 1979; Weiss & Zebrowski, 1992;), phonetic complexity (Brown, 1938, 1945; Geetha, 1978; Hahn, 1942; Hejna, 1955; Quarrington, Conway & Siegel, 1962), morphological structure of words (Marshall, 2005), lexical factors (Bloodstein & Gantwerk, 1967; Helmreich & Bloodstein, 1973; Howell, Au-Yeung & Sackin, 1999; Jayaram, 1983; Dayalu, Kalinowski, Stuart, Holbert, & Rastatter, 2002). The results

from all these studies indicate that linguistic factors have a strong influence on moments of stuttering.

Stuttering has also been viewed as disorder of lexical retrieval (Perkins, Kent, & Curlee, 1991; Scripture & Kittredge, 1923; Wingate, 1988). Research relates stuttering as deficit in retrieving linguistic frames. There are specific stages in speech production, which involve processing of linguistic factors like lexical retrieval, syntactic encoding, and phonological encoding that might be disrupted in stuttering. These stages of processing can be indirectly examined through priming studies by measuring the reaction time. Research on lexical retrieval (Arunkumar & Yeshoda, 2006; Hartfield & Conture, 2006; Hennessey, Nang, & Beilby, 2008; Packman, Onslow, Coombes & Goodwin, 2001; Pellowski & Conture, 2005; Newman & Ratner, 2007; Santosh & Arunkumar, 2006), syntactic encoding (Anderson & Conture, 2004; Tsiamtsiouris & Cairns, 2009), and phonological encoding (Melnick, Conture & Ohde, 2003; Vincent, Grela & Gilbert, 2012) report that children and adults with stuttering have longer reaction time for these processes compared to controlled normal population. However, the majority of these investigations in the linguistic factors/process in stuttering are done in monolingual context. Limited attention has been paid to investigating relationship between stuttering and linguistic variables in bilingual context.

Around 50% of the world's population is bilingual (De Howuer, 1998). Hence, a large majority of individuals who stutter are also bilinguals. Previously, few studies have analyzed the stuttering patterns in bilinguals considering the type of bilingualism and language proficiency in each language (Ardila, Ramos & Barrocas, 2011; Jankelowitz & Bortz, 1996; Lim, Lincoln, Chan, & Onslow, 2008; Leah, 2008; Schafer & Robb, 2012).

The results from these studies indicate that stuttering characteristics may vary across languages because the structure of the language would be different, and frequency of stuttering might also depend on the proficiency of each language.

**Need for the study**

In a country like India bilingualism is more prevalent. Many individuals learn English as a Second language. The effect of bilingualism on lexical access may occur in these individuals. Studies related to lexical access in bilingual individuals are few, and whatever studies are done are in other communication disorders, namely Aphasia and Dyslexia. In individuals who stutter, the comparison of different cross linguistic factors across languages are done, but no study has documented differences in lexical access across languages. As mentioned earlier, studies report stuttering is caused by disruption in the linguistic process such as lexical retrieval, syntactic encoding and, phonological encoding. But the majority of these studies are conducted in monolinguals with stuttering. It is said that bilingual's process linguistic factors differently compared to monolinguals. Therefore, it is necessary to examine whether bilinguals with stuttering also exhibit difficulties in processing of linguistic factors. Hence, the present study aims to investigate lexical access in bilingual adults who stutter.

Such a study will add information regarding differences in lexical access in bilinguals who stutter. Further, such a study can also highlight the effect of language proficiency on the lexical access and its relationship with the severity of stuttering. Thus, the aim of the present study is to compare the lexical access in Kannada-English bilingual adults who stutter and compare them with bilinguals who do not stutter using semantic and cross-linguistic priming paradigm.

**Objectives of the study**:

1. To compare the frequency of stuttering between L1 (Kannada) and L2 (English) in bilinguals who stutter
2. To compare lexical access using semantic and cross-linguistic priming in bilingual adults who stutter with bilingual who do not stutter. For this objective, Lexical access was evaluated in two conditions:
    i. Lexical access within each language using semantic priming paradigm
    ii. Lexical access using cross-linguistic priming paradigm, to know whether there will be any interaction between L1 and L2 and also to understand the direction of the interaction if any
3. To investigate the relationship between percentages of syllables stuttered and lexical access scores.

# CHAPTER 2

# REVIEW OF LITERATURE

Stuttering is a developmental disorder of speech typically characterized by repetitions, prolongations and silent blocks. It is estimated that 1% of the world's population stutters. Stuttering usually starts between 2 and 4 years of age and in 50% of the children, the condition persists. Although stuttering is one of the extensively researched topics in the field of speech pathology, till today, its cause remains unknown. Previously, several attempts have been made to understand the underlying mechanisms behind stuttering. Researchers have investigated stuttering from both linguistic and motoric deficits point of view, and speculate that stuttering occurs due to imbalance between linguistic and motoric development (Peters & Starkweather, 1990). However, Cheverkeva (1967) and Bloodstein (2002) propose that stuttering is basically a disorder of language development. Keeping this point of view, several attempts have been made to investigate the relationship between stuttering frequency and different linguistic variables.

## Studies on Linguistic variables that influence Stuttering frequency

Linguistic variables associated with specific locations of stuttering have been studied since Brown (1938). These linguistic factors include syntactic, lexical, phonological and morphological structure of words. Brown (1945) found the occurrence of stuttering due to four main linguistic factors: word length i.e., number of syllables in the word, word type: grammatical class of the word i.e., content or function words, word position i.e., initial position of sentence or clause and the phoneme from which the word starts i.e., word starting with consonant or vowel. Hannah and Gardner (1968) and Wells

(1979) analyzed the spontaneous speech samples of adults who stuttered on sentences and they reported that syntactic position as well as syntactic complexity had an effect on stuttering. The results of these studies highlight the influence of syntactic factors on the frequency of stuttering. There are number of studies which report that syntactic complexity increases the dysfluencies in children's speech (Bernstein Ratner & Sih, 1987; Weiss & Zebrowski, 1992). Marshall (2005), to study the effect of morphology on stuttering in English, analyzed the spontaneous speech samples of 16 males with stuttering in the age group of 16 to 47 years. From the analyzed speech samples the words were classified as having simple phonology, complex phonology and words with uninflected and inflected morphology. The results revealed that stuttering rates were not associated with phonological complexity as well as morphology. There are no other studies to provide information whether morphology effects stuttering or not.

Other authors also studied the effect of additional linguistic factors which demonstrate their strong influence on the occurrence of stuttering events. Some of them are utterance length and syntactic complexity (Brundage & Ratner, 1989), phonetic complexity (Geetha, 1978) and word type (Bloodstein & Gantwerk, 1967; Helmreich & Bloodstein, 1973). Stuttering is more likely to occur on longer words or multisyllabic words compared to short ones (Brown, 1945; Williams, Silverman & Kools, 1969). Also many authors have found that the occurrence of dysfluency is generally on consonants than vowels (Brown, 1938, 1945; Hahn, 1942; Hejna, 1955; Quarrington et al., 1962; Geetha, 1978).

Many authors studied the effect of word position on stuttering. It was found that the frequency of stuttering is more at the beginning of the sentence or a clause compared

to other positions (Conway & Quarrington, 1963; Brown, 1938; Griggs & Still, 1979; Bernstein, 1981; Wingate, 1979; Soderberg, 1967). Jayaram (1984) studied the distribution of stuttering in sentence with respect to sentence length and clause position, and results showed that the occurrence of stuttering was always at the beginning of the clause irrespective of sentence length and clause position. The results suggested that breakdown in the speech occurs due to demands on motor planning of speech, which occurs particularly at the beginning of sentences. Another study by Koopmans, Slis and Rietveld (1992), also found that stuttering occurrence was high at the initiation of the clause and dysfluency occurred on function word in the first and second word position than on lexical words, whereas lexical words were stuttered at the third word position, this was attributed to speech planning process where function words required decision making.

Lexical factors that influence stuttering are word frequency, word class/word type. Previous research evidences reveal that the occurrence of stuttering is high on low frequency words compared to high frequency words (Hejna, 1955; Newman & Ratner, 2007; Soderberg, 1966). Many authors studied the word class which is another major factor and the results of this are conflicting. Some authors found that stuttering occurs mainly on content words (Jayaram, 1981; Dayalu, 2002) and other authors found that stuttering occurs on function words rather than content words (Griggs & Still, 1979). Howell, Au-Yeung and Sackin (1999), analyzed the spontaneous speech of people who stutter and people who do not stutter in the age group from 2 to 40years to find the relationship between dysfluency of function and content words. The results revealed that people without stuttering had a higher occurrence of disfluency on function words,

whereas in people with stuttering the occurrence of dysfluency on content & function words changed over age groups. There was a higher percentage of dysfluency on function words in the younger age group with stuttering and as their age increased the dysfluencies on function words gradually decreased. This study concludes that due to incomplete planning of content words, adults with stuttering have high percentage of dysfluency on these words. Apart from these linguistic factors, few researchers also consider bilingualism as a factor which influences stuttering.

**Bilingualism** is considered one of the cultural factors in the development of stuttering. Bilingualism is defined as "knowing" two languages (Valdez & Figueora, 1994). People around the world speak more than one language and around 50% of the world's population is bilingual (De Howuer, 1998). The two important factors to be considered in bilinguals are the age of second language acquisition and proficiency in the second language. Bilingualism is gaining much attention in the area of research but clinical implications are yet to be applied.

**Bilingualism and Stuttering**

Many questions arise when bilingualism is considered in stuttering. Does exposure to a second language increase the dysfluency? Does the severity of stuttering vary across languages in bilinguals? Is it an important factor to be considered during treatment, which language has to be treated or targeted? Hence research in stuttering should focus on the multicultural population of those people speaking languages with the same linguistic structure versus different structures. There is no exact prevalence of stuttering established in multilingual population. Previous research has revealed that stuttering is more prevalent in bilingual speakers than monolinguals (Au-Yeung, 2000).

The prevalence of stuttering in school children were studied by Travis, Johnson and Shover, (1937) and Stern, (1948); and the results revealed that prevalence was higher in bilingual school children compared to monolingual school children.

Studies on cross linguistic analysis on bilingual speakers who stutter have indicated varying results, and there are two different hypotheses that have been proposed with respect to stuttering frequency in bilingual speakers. According to the "Same-hypothesis" there is no significant difference in stuttering frequency between two languages and only few studies support this hypothesis (Van Riper, 1971; Lebrun, Biijleveld, & Rousseau, 1990). According to "different-hypothesis" dysfluency may vary in two languages in bilinguals who stutter (Dale, 1977; Jayaram, 1984; Nwokah, 1988).

Each language has its own linguistic structure and hence the influence of linguistic factors on stuttering may vary from one language to the other (Dworzynski, Howell, & Natke, 2003; Dworzynski & Howell, 2004). Few cross linguistic studies are done in German, Spanish, Arabic, Afrikaan, Igbo, Kannada, Mandarin; languages. Abdalla, Robb and Al-Shatti, (2009) studied the effect of lexical category (content & function word) on stuttering frequency in adult Arabic speakers with stuttering and results revealed that there were no significant differences between content and function words in the occurrence of dysfluency. Dworzynski and Howell (2004) investigated the phonetic complexity affecting German speakers comparing it with English speakers. Subjects included both children and adults in English and German with stuttering in the age range of 6 to 29yrs. Samples were transcribed to calculate IPC (Index Phonetic complexity) scores to compare between the two languages. The results indicated that IPC scores were higher for content words than function words which indicated a more

complex phonetic structure. IPC scores also indicated that phonetic complexity was higher in German language compared to English. Function words stuttering decreased and content words stuttering increased with age in both languages, hence the word length, and phonetic complexity was the factor in German language. Loci of stuttering in German language showed similar trend as that of English.

There are other cross linguistic studies which included bilingual speakers for analyzing the linguistic influence of stuttering in other languages. In bilingual speakers, researchers have also investigated the relationship between language proficiency and stuttering frequency. Bernstein Ratner and Benitez (1985), structurally analyzed the spontaneous speech of a 50 year-old Spanish-English bilingual adult stutterer and results revealed that there were similarities and differences in dysfluency between the two languages. The dysfluency was not equal in both languages even though the participant was simultaneous bilingual. Both languages were structurally analyzed to find the relation between the phonological and syntactic structure on frequency and loci of stuttering and results indicated dysfluency occurred at the beginning of sentence or clause, vowel-initiated words in both languages, dysfluency at the verb initiation in English. Hence these authors concluded that syntactic and phonological analysis is required to assess the loci of dysfluency across different languages.

Another study by Jayaram (1983), analyzed the reading and spontaneous speech of 10 Kannada monolingual stutterers and 10 Kannada-English bilingual stutterers. The bilingual stutterers were further sub-grouped into Kannada bilingual stutterers and English bilingual stutterers, based on the dominant language. The results revealed that stuttering was more in the monolingual group compared to bilingual group. In bilingual

group results indicated that there was no significant difference between two languages in pattern or distribution of stuttering, but there was a significant difference with respect total severity of stuttering. Bilinguals stuttered more in L1 (Kannada) compared to L2 (English). Nowak (1988) compared stuttering behavior in 16 Igbo-English balanced bilingual adults with stuttering. The results confirmed the stutterers belief that, stuttering was more in one language compared to the other. The imbalance of stuttering behavior in two languages was explained in terms of selection and processing of lexical and syntactic features of the languages. All these studies had methodological issues, did not consider proficiency of the second language.

Recent studies have considered: characteristics of the two languages, the type of bilingualism and the mastery of the two languages using standard measures to check the proficiency. Ardila, Ramos and Barrocas (2011) studied the pattern of stuttering in a Spanish-English bilingual adult. Speech and language abilities were tested in both languages and found that English was his dominant language. The results revealed that stuttering was more evident in Spanish than in English, but the dysfluency types were similar in both languages and stuttering occurred more at the function and vowel-initiated words in both languages. Stuttering was more frequent on verbs and content words in Spanish compared to English. Jankelowitz and Bortz (1996) studied the relation between bilingualism and stuttering in a 63 year-old English-Afrikaans, a compound bilingual (simultaneous exposure and mastery of both languages) with stuttering. The language ability was assessed in both the languages, and anticipation, adaptation, consistency, frequency, distribution and nature of dysfluencies were analyzed. The results revealed that anticipation and adaptation were more in Afrikaan than English whereas consistency

was more in English compared to Afrikaan. Stuttering was more in an Afrikaan language which was non dominant language. Hence, the authors concluded that there is a relation between the frequency and stuttering and proficiency of language.

Lim, Lincoln, Chan, and Onslow (2008) investigated the influence of language dominance on the stuttering severity in 30 English-Mandarin Bilingual speakers with stuttering in the age group of 12 to 44yrs. The participants were classified into 3 groups using a self-report classification tool as- English dominant, Mandarin dominant, and balanced bilingual. The conversation speech sample was recorded in both English and Mandarin language. The percentage of syllable stuttered, severity rating and type of stuttering were measured in both languages. The results revealed that balanced bilinguals had identical scores in percentage of syllable stuttered and severity rating for both languages. The English dominant group had higher percentage of syllable stuttered and severity rating for Mandarin than in English language. The Mandarin dominant group also had a similar pattern that stuttering was greater in non dominant language i.e., English. The type of stuttering across the two languages revealed no significant difference and also it did not vary as a function of language dominance across the three bilingual groups.

Schafer and Robb, (2012) examined the stuttering like dysfluency and distribution of stuttering on content and function words in 15 German-English bilingual adults with stuttering. Results showed that the severity of stuttering was high in non dominant language English. Comparison of languages to find the distribution of stuttering on content and function words revealed that a higher percentage of dysfluency on function

words in English than German, whereas within German language high percentage stuttering were on content words.

Howell, et al., (2003) compared monolingual Spanish speakers with stuttering in the age range 3 to 68 years and bilingual Spanish-English speakers with stuttering to find the developmental changes in the loci of stuttering. Results showed that monolingual young Spanish stutterers had high percentage of dysfluency on function words than content words, and the content word stuttering increased with age. Bilingual speakers with stuttering showed more stuttering on function words in non dominant language English which was similar to the pattern observed in young monolingual speakers. The content words were more stuttered in dominant language Spanish which was similar to the pattern observed in adult monolingual speakers. But the stuttering was high in dominant language Spanish which is conflicting to the above studies.

These studies have shown contradicting results about the relationship between language proficiency and severity of stuttering. On the one hand, studies showed that persons with stuttering stutter less in their dominant language than in the non-dominant language. On the other hand, few studies report that the frequency of stuttering was less in their non- dominant language. However, Leah (2008) revealed no significant difference in the severity of stuttering between L1 and L2. An overall majority of recent studies indicate that language dominance influences the severity of stuttering, but there is no clear consensus in the literature with respect to whether language proficiency influences severity of stuttering. Hence, further studies are required in bilinguals who stutter across different languages for proper assessment and management in these individuals.

**Stuttering and Lexical Retrieval**

Researchers have also viewed stuttering as impairment in planning specific stages in speech production. The planning stages may involve processing of linguistic factors-lexical retrieval, syntactic encoding, and phonological encoding. Researchers opine that these stages of linguistic encoding might be disrupted in individuals with stuttering. In the present study, lexical access in bilingual adults who stutter was investigated. Hence relevant research related to lexical access in individual with stuttering are discussed below.

Lexical access or lexical retrieval refers to accessing the lexical information or retrieving the lexical information from the lexicon. According to Levelt's (1999) model, lexical access includes 4 stages:

1) Conceptual preparation-concepts will be associated with target stimulus (word/picture).
2) Lemma retrieval- target word will be associated to its meaning.
3) Word-form encoding- meaning/semantics of the target (word/picture) will associate to its phonological properties.
4) Motor plan- motor planning of articulators will take to produce the target word.

Disruption in planning and processing of these stages may cause breakdown in the fluency of speech (Garret, 1982; Rispoli & Hadely, 2001). Wingate (1988) suggested that persons with stuttering exhibit problem in retrieving words, which occurs in the third stage in Levelt's model of lexical retrieval, hence they have difficulty maintaining fluent speech.

Limited research has been conducted on children and adults with stuttering to investigate whether these individuals have difficulty in lexical retrieval. Either, lexical decision task or lexical naming tasks with different priming paradigm were used to investigate the lexical retrieval.

Arunkumar and Yeshoda (2006) compared individuals with stuttering and individuals with no stuttering using lexical decision task and results revealed that they had longer reaction time compared to individuals with no stuttering and also reaction time increased as the word length increased in individuals with stuttering. Another study by Santosh and Arunkumar (2006), investigated the lexical access using the semantic priming task in persons with stuttering and persons with no stuttering. Auditory primes were of 3 type- neutral, related and unrelated prime and speech reaction time was measured when participants read the target word. Results revealed stutterers had longer speech reaction time across all 3 priming condition compared to persons without stuttering. Both groups had shorter speech reaction time for the related priming condition compared to other two primes. Newman and Bernstein Ratner (2007), studied the role of lexical factors-word frequency, neighborhood density and neighborhood frequency in confrontation naming accuracy, reaction time and stuttering episodes in 25 adults who stutter and 25 adults who do not stutter who were matched for age, gender and education level. The results revealed that adults who stutter had slower reaction time and less naming accuracy compared to adults who do not stutter. There was a effect of word frequency on stuttering rate, but the other two lexical factors- neighborhood density and neighborhood frequency did not have any effect on stuttering rate in adults who stutter.

Hence the authors concluded that adults who stutter had impairment in lexical retrieval which is at the level of phonological representation.

Hennessey, Nang, and Beilby (2008), studied linguistic encoding deficits in adults who stutter and adults who do not stutter. Auditory priming was used in picture naming which included four priming conditions-semantically related, phonologically related, unrelated and no prime. Also word versus non word comparison in simple reaction time and choice reaction time was done. The results of picture naming revealed that, there was no significant difference in mean reaction time between the two groups. Both groups had slower naming reaction time, when auditory prime was semantically related to target picture compared to other three priming conditions. This was supported by semantic inhibition effect which has caused slower reaction when prime was semantically related. Results for simple verbal reaction time also revealed no significant difference between the two groups for word verses non words, where in choice reaction time persons with stuttering were slower compared to persons with no stuttering. Packman, Onslow, Coombes and Goodwin (2001), tested the prediction that for stuttering to occur, lexical retrieval is one of the factors. They investigated this in reading task which does not require any lexical retrieval; the task was reading aloud a Standard English passage and also a passage with non words, in three adults who stutter. The results showed that stuttering was present even in non-words in all 3 subjects and hence the authors conclude that stuttering can occur even in the absence of lexical retrieval. This study contradicts the above studies suggesting that lexical retrieval is not a major factor. A recent study by Furness and Ward (2012) investigated lexical access, story re-telling and sequencing skills in eight adults who clutter in comparison with adults who do not clutter. Lexical

access was assessed through three subtests: naming on description, category naming and the semantic and phonological word generation and response time was measured. Sequencing skill and story recall was used to analyze maze behaviors. The results revealed that adults who clutter were slower in lexical access tasks and also there were more maze behaviors in sequencing skills compared to control group, but there was no difference between the groups in story retelling task.

Few researchers have also investigated lexical access in children who stutter. Pellowski and Conture (2005) compared *lexical priming* between children who stutter and children who do not stutter. The results showed that children who do not stutter had faster and shorter speech reaction time in semantically related prime condition followed by no-prime condition, whereas children who stutter had slow and longer reaction in both priming conditions. Hence, this study suggests that children who stutter have difficulties with lexical encoding, which may influence stuttering. Hartfield and Conture (2006) investigated the effect of perceptual and conceptual properties of words in children who stutter and children who do not stutter in the age range of 3-5 years. This was investigated in the picture naming task which was associated with 4 auditory lexical priming conditions-neutral, physical, functional, and categorically related speech reaction time and accuracy scores were measured. The results indicated that children who stutter took more speech reaction time in all priming conditions compared to children who do not stutter. The children who stutter had faster naming latencies in functional related prime condition compared to physical related prime condition. The results indicated that conceptual/functional than perceptual aspects influenced lexical retrieval in children who stutter. Savage and Howell (2008), investigated the lexical priming on content and

function words in children who stutter and children who do not stutter in the age group of 3 to 9 years. Children were asked to repeat the auditory prime presented followed by the description of action or naming. Speech initiation time, the effect of priming on content and function words and dysfluency on prime type were analyzed. Also comparison was done between the two groups (CWS and CWNS) between these parameters. The results revealed that the effect of priming was greater in children who stutter compared children who do not stutter. There was no significant difference between the two groups for speech initiation time and prime type. Children who stutter had fewer dysfluency on function words after content word primes than after function word primes.

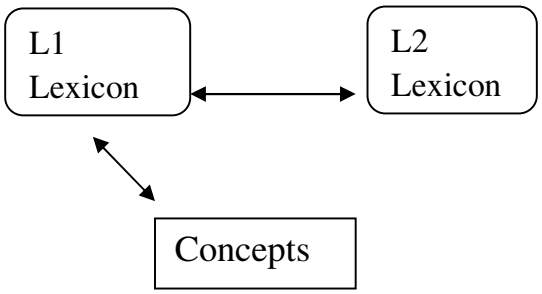
Further, studies have been carried out using ERP and FMRI to compare the lexical access between adults who stutter and adults who do not stutter using priming tasks. Weber-Fox (2001) investigated the role of the neurolinguistic factor in stuttering using Event-related potentials in nine adults who stutter and control group in the age range of 17 to 34 years. Participants were asked to read sentences silently which were presented on the computer screen and had to respond by pressing the button to judge whether sentence made any sense or not. ERP's elicited for closed-class, open-class and semantic anomalies were characterized by reduced negative amplitude in adults who stutter compared to the control group. Results showed that there were alterations in linguistic processing for adults who stutter were related to neural functions that are common to word classes and perhaps involve shared, underlying processes for lexical access. Blomgren, Srikantan, Lee, Alvord and Li (2003), did a preliminary study on lexical access during the word description task and activation patterns were analyzed in FMRI. Results revealed that non stuttering control speakers activated primarily left

hemisphere cortical speech and language areas while the stuttering speakers appeared to produce more bilateral activation. All these studies show that individuals who stutter are slower in lexical access compared to fluent speakers.

The common question which arises in bilingual research is that whether bilinguals have same lexicon or 2 different lexicons for his/her 2 languages spoken. There are many hypothesis and models to explain the bilingual lexical representation. The lexical access in bilinguals is explained by 3 main models: Word association model, Concept mediation model, Revised hierarchical model and Mixed Model. All these models explain the cross language process in terms of lexical links and concepts of word forms.

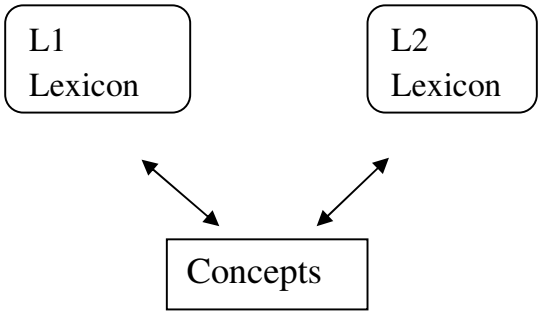
1) **Word association model** (Potter, So, Von Eckardt & Feldman, 1984)

   This model assumes that "L2 gain access to concept through L1 mediation". Here the translation of L2 relies on Lexical links of L1 and then L1 will mediate the concept of the word. For example when a Kannada-English Bilingual is asked to name the picture of an apple in English; he relies on the translation of lexical links of L1 and then conceptual access happens, which is mediated by L1 (Kannada).



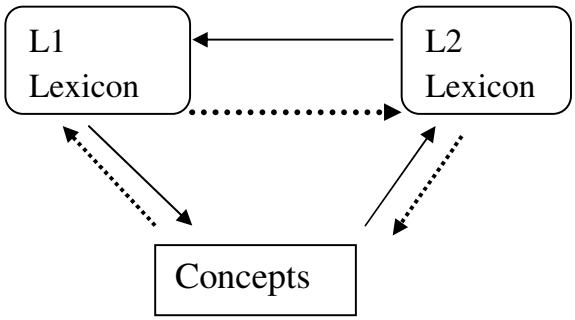
2) **Concept mediation model** (Potter et al., 1984)

This model assumes that "L1 and L2 are both connected to their corresponding concept". Here L2 words are accessed directly from their concepts. For an example when a Kannada-English Bilingual is asked to name the picture of an apple in English; conceptual access takes place prior to retrieval of the L2 word.



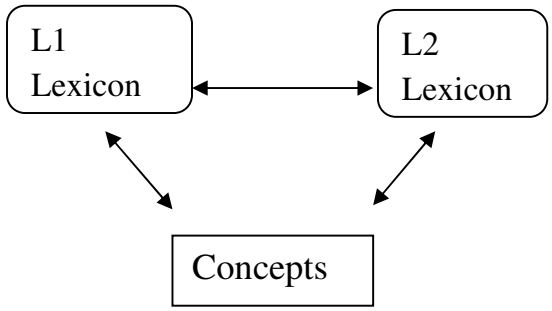

3) **Revised hierarchical model** (Kroll & Stewart, 1994)

This model assumes that "L1 & L2 have separate representation of word forms but they share their conceptual representation". It assumes that there are 2 routes through which the L2 word forms access the concepts: a) word association route, where the concepts are accessed through the L1 lexical link which mediates the concept. b) concept mediation route, where the concepts are directly accessed from L2 conceptual link.



4) **Mixed Model** (De Groot, 1992)

This model assumes that "the lexicon of bilingual are directly connected to each other as well as indirectly connected by way of shared semantic representation". This model is a combination of word association and concept mediation model.




**Studies on Lexical access in Bilinguals**

Recent research has focused to find out processing of lexical factors in bilingual speech production. Costa, Miozzo and Caramazza (1999) conducted study on Catalan–Spanish bilinguals using picture-word interference experiment, where naming of the picture was facilitated by distractors in same and different- language pairs. Results revealed that facilitation was larger for the same and semantically related distractors in the same language compared to different-language pairs. Lee and Williams (2001) studied the lexical access in picture naming task using in cross language semantic priming paradigm in unbalanced English-French bilinguals and results revealed that the reaction time was slower for non dominant language French and more errors were found in non dominant language when cross-language priming was present. Hence, this study concludes the cross-language priming facilitated a faster reaction response for the dominant language.

A study by Deema (2005) conducted on normal bilingual adults to find the cross language priming in high proficient versus low proficient language revealed that high proficient bilinguals were faster and quicker in lexical decision task compared to low proficient bilinguals. Finkbeiner, Almeida, Janssen, and Caramazza (2006), report that hard problem of lexical access in bilinguals arises due to lexical representation gets activated in both languages and hence competes in the lexical selection which leads to slower reaction time in the speech tasks. This hard problem of lexical access in bilinguals is solved by suppression of lexical representation in non target language which is explained by Green, 1998 through language suppression hypothesis. Hence, these authors tested this prediction by conducting a study on bilinguals through picture naming task in their dominant language and digit naming in dominant as well as non dominant- English to check the language switching. The results revealed that participants took no longer to name pictures in their dominant language on language switch trials than they did on nonswitch trials. Hence authors conclude that language suppression hypothesis was not valid. Studies have also been conducted using priming paradigms to find whether the cross-language priming facilitates the selection of lexical representation in bilinguals. Ivanovo and Costa (2007) compared the performance in lexical access through a picture naming task in Spanish monolinguals and Spanish-Catalan bilinguals and results showed that monolinguals were faster in naming the pictures compared to bilinguals who were slower even naming in their dominant language. Hence authors concluded that bilinguals have linguistic disadvantage due to slow lexical access.

Studies have also been done using Event Related Potentials (ERP). A study by Geyer, Halcomb, Midgley and Grainger (2011), conducted on Russian-English Bilinguals

who were proficient in both languages, revealed a symmetrical pattern of within-language repetition and between-language translation ERP priming effects. Martin, Costa, Dering, Hoshino, Wu and Thierry (2012) to find speed of processing of words in bilinguals and monolinguals, results revealed that bilinguals were slower in discriminating between pseudowords and words compared to monolinguals.

From the above studies it is evident that adults and children who stutter have difficulty in lexical retrieval and this difficulty with speech-language planning may be one variable that contributes to stuttering. However, most of these studies have been done in individuals who are monolinguals and as per our knowledge; no studies are done in bilinguals who stutter. The lexical encoding in bilinguals would be different from monolinguals as there are many models proposed based on their lexical organization. The above mentioned studies on lexical access in bilinguals reveal that the lexical retrieval is faster in the dominant language compared to non dominant language. This shows in bilinguals lexical retrieval depends on proficiency of the language. Research in stuttering bilinguals have revealed that language dominance influences stuttering severity. Hence, to find whether even bilinguals adults who stutter have any difficulty in lexical access and also to find if there is any interaction effect between two languages. Hence, the present study aims to investigate lexical access in bilingual adults who stutter.

# CHAPTER 3

# METHOD

## Participants

Fifteen Kannada- English bilingual adults who stutter (BAWS) (mean age 22.2 years, SD 2.68 years) participated in the study. Among them 14 were males and one was a female participant. Apart from stuttering, they did not have any other history of neurological, intellectual, sensory (hearing & vision) or other communicative disorders. All the participants were native speakers of Kannada, and English was their second language. They had a minimum of 6 years of exposure to English. To determine their stuttering severity, the Stuttering Severity Instrument for Children and Adults—Third Edition (SSI-3) (Riley, 1994), was administered. Stuttering severity was assessed in both the Kannada and English languages. Speech samples were video-audio recorded for both the languages in two different speaking tasks: spontaneous speech and reading standard passages. Spontaneous speech was recorded while the participants talked about their hobbies, places and personal information. In reading task, participants read two standard passages: the Rainbow passage in English & 300-word passage in Kannada (Santosh, 2007). Table 1 shows demographic detail of individual bilingual adults who stutter including their age, gender, reported time of stuttering onset and severity of stuttering in Kannada and English. For comparison purposes, fifteen age, gender, and language proficiency matched bilingual adults who do not stutter (BAWNS) were recruited.

The dysfluency analyses were done by orthographically transcribing the speech sample and following analysis were done:

1. Percentage of syllable stuttered for each task.
2. Severity of stuttering in each language as per SSI.

**Inter - and intra-judge reliability**

Inter- and Intra - judge reliability was established for measurement of severity of stuttering by calculating the percentage of agreement for identifying moments of stuttering in both languages and also for severity rating in both languages. The reliability was established for 20% of the samples.

For intra-judge reliability, the researcher reanalyzed the samples. A point to point method was used to assess the stuttering moments and severity rating, which resulted in a reliability index of 90% for inter-judge reliability. Three randomly selected samples of bilingual adults who stutter were given to two Post-Graduate students in Speech-Language Pathology who were Kannada-English bilinguals. A point to point agreement between judges and the investigator was obtained which resulted in a reliability index of 87%.

Table 1

*Demographic details of bilingual adults who stutter (BAWS)*

| **Bilingual Adults who stutter** | **Age** | **Gender** | **Severity of Stuttering in Kannada** | **Severity of Stuttering in English** |
|---|---|---|---|---|
| S1 | 21 | Male | Mild | Mild |
| S2 | 20 | Male | Severe | Very severe |
| S3 | 23 | Male | Severe | Very severe |
| S4 | 25 | Male | Moderate | Moderate |
| S5 | 26 | Male | Moderate | Moderate |
| S6 | 18 | Male | Very severe | Very severe |
| S7 | 24 | Male | Moderate | Moderate |
| S8 | 23 | Male | Mild | Moderate |
| S9 | 20 | Male | Mild | Moderate |
| S10 | 26 | Male | Moderate | Moderate |
| S11 | 22 | Male | Mild | Mild |
| S12 | 23 | Male | Moderate | Moderate |
| S13 | 18 | Male | Moderate | Moderate |
| S14 | 25 | Male | Very severe | Very severe |
| S15 | 20 | Female | Moderate | Moderate |

**Assessment of Language Proficiency**

The Language Proficiency of each participant was evaluated in two ways. Firstly, each participant rated their proficiency on each language on LEAP-Q Questionnaire. 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 and evaluates language proficiency in all the four language skills: Understanding, Speaking, Reading and Writing. Each domain has zero to four rating score, where 0 indicates zero proficiency and 4 indicates native like/perfect proficiency. This questionnaire was adapted to Indian Context by Ramya, (2009), which was used for the present study.

Out of 15 BAWS, 12 participants rated their proficiency as native like/perfect in Kannada (L1) for all the four domains and other three rated as native like/perfect in understanding and speaking domains whereas good proficiency in reading and writing. LEAP-Q scores for English (L2) showed that nine BAWS rated as having good proficiency in English for all the four domains and the other six participants rated their proficiency as good in understanding of L2 domain, but low proficiency in speaking, reading and writing.

In control participants group, all 15 BAWNS rated LEAP-Q scores for their proficiency as native like/perfect in Kannada (L1) for all the four domains. LEAP-Q scores for English (L2) showed that, nine BAWNS rated their proficiency as good proficiency in English for all the four domains and the other six participants rated their proficiency as good in understanding of L2 domain, but low proficiency in speaking, reading and writing.

Secondly, each participant was given an activity based cloze test to check for the language proficiency in the second language. Cloze test is a performance test developed by Taylor (1953). It is language ability test which assesses L2 English language proficiency. This test taps low-level lexical, grammatical and higher level discourse competence (Alderson, 1979; Markham, 1985; Shanahan, Kamil, & Tobin, 1982). Previous investigations have shown that cloze tests are internally consistent and scores have high correlation with standardized language proficiency scores (Trembly and Garrison, 2010). Cloze test includes a passage with 30 'blanks' spaces of missing letters, the participants were asked to fill the blank spaces to make the passage comprehendible. In order to successfully complete the task and make the passage comprehendible the participant should have "good understanding of language and large vocabulary" (Kobayashi, 2002).

For scoring responses on Cloze test, contextually acceptable word scoring method as given by Oller (1972) and Kobayashi (2002) was followed. A score of 1 was given for each correct word if the sentence remained comprehendible with correct syntax and grammar. Spelling errors were not considered for scoring. Percentage of language proficiency in L2 was calculated by number of correct answers divided by 30 and then multiplied by 100. All Bilingual adults who stutter had above 60 percentage score in cloze test, which indicated good L2-English proficiency. In the present study, the language proficiency of control participants are matched with the experimental group only on Cloze test scores. Table 2 shows the description of language proficiency in BAWS. In the table, information regarding the age of exposure of second language, cloze test scores, and LEAP-Q scores are provided for L1 (Kannada) and L2 (English).Table 3

shows the description of language proficiency in BAWNS. In table 3 information regarding the age of exposure of second language, cloze test scores, and LEAP-Q scores are provided for L1 (Kannada) and L2 (English).

Table 2

*Description of Language proficiency of BAWS including their age of exposure to L2-second language- English, Cloze test scores for L2, and LEAP-Q scores in L1 (Kannada) and L2 (English)*

| BAWS | Age of Exposure to L2 | Cloze test score in % | LEAP-Q scores for L1 | LEAP-Q scores for L2 |
|---|---|---|---|---|
| **S1** | 10yrs | 96.6 | U-4; S-4; R-4; W-4 | U-3; S-3; R-3; W-3 |
| **S2** | 5yrs | 90 | U-4; S-4; R-4; W-4 | U-3; S-3; R-3; W-3 |
| **S3** | 13yrs | 76.6 | U-4; S-4; R-4; W-4 | U-3; S-2; R-3; W-2 |
| **S4** | 4yrs | 86.6 | U-4; S-4; R-3; W-3 | U-3; S-3; R-3; W-3 |
| **S5** | 16yrs | 83.3 | U-4; S-4; R-3; W-3 | U-3; S-3; R-3; W-3 |
| **S6** | 15yrs | 76.6 | U-4; S-4; R-4; W-4 | U-3; S-2; R-2; W-2 |
| **S7** | 13yrs | 96.6 | U-4; S-4; R-4; W-4 | U-3; S-3; R-3; W-3 |
| **S8** | 16yrs | 80 | U-4; S-4; R-4; W-4 | U-3; S-2; R-3; W-2 |
| **S9** | 5yrs | 90 | U-4; S-4; R-3; W-3 | U-3; S-3; R-3; W-3 |
| **S10** | 6yrs | 90 | U-4; S-4; R-4; W-4 | U-3; S-3; R-3; W-3 |
| **S11** | 16yrs | 60 | U-4; S-4; R-4; W-4 | U-3; S-2; R-2; W-2 |
| **S12** | 10yrs | 93.3 | U-4; S-4; R-4; W-4 | U-3; S-3; R-3; W-3 |
| **S13** | 4yrs | 83.3 | U-4; S-4; R-4; W-4 | U-3; S-2; R-3; W-2 |
| **S14** | 16yrs | 76.6 | U-4; S-4; R-4; W-4 | U-3; S-2; R-3; W-2 |
| **S15** | 6yrs | 100 | U-4; S-4; R-4; W-4 | U-3; S-3; R-3; W-3 |

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

Table 3

*A description of Bilingual Adults Who do not Stutter including their age, gender, age of exposure to L2-second language-English, Cloze test score in L2 and LEAP-Q scores in L1 (Kannada) & L2 (English)*

| **BAWNS** | **Age/ Gender** | **Age of Exposure to L2** | **Cloze test score in %** | **LEAP-Q scores for L1** | **LEAP-Q scores for L2** |
|---|---|---|---|---|---|
| N1 | 21/Male | 4yrs | 96.6 | U-4; S-4; R-4; W-4 | U-3; S-3; R-3; W-3 |
| N2 | 20/Male | 4yrs | 90 | U-4; S-4; R-4; W-4 | U-3; S-3; R-3; W-3 |
| N3 | 23/Male | 18yrs | 90 | U-4; S-4; R-4; W-4 | U-3; S-2; R-3; W-2 |
| N4 | 25/Male | 4yrs | 96.6 | U-4; S-4; R-4; W-4 | U-3; S-3; R-3; W-3 |
| N5 | 26/Male | 4yrs | 96.6 | U-4; S-4; R-4; W-4 | U-3; S-3; R-3; W-3 |
| N6 | 18/Male | 13yrs | 76.6 | U-4; S-4; R-4; W-4 | U-3; S-2; R-2; W-2 |
| N7 | 24/Male | 6yrs | 100 | U-4; S-4; R-4; W-4 | U-3; S-3; R-3; W-3 |
| N8 | 23/Male | 16yrs | 86.6 | U-4; S-4; R-4; W-4 | U-3; S-2; R-3; W-2 |
| N9 | 20/Male | 6yrs | 90 | U-4; S-4; R-4; W-4 | U-3; S-3; R-3; W-3 |
| N10 | 26/Male | 10yrs | 100 | U-4; S-4; R-4; W-4 | U-3; S-3; R-3; W-3 |
| N11 | 22/Male | 18yrs | 60 | U-4; S-4; R-4; W-4 | U-3; S-2; R-2; W-2 |
| N12 | 23/Male | 6yrs | 93.3 | U-4; S-4; R-4; W-4 | U-3; S-3; R-3; W-3 |
| N13 | 18/Male | 10yrs | 90 | U-4; S-4; R-4; W-4 | U-3; S-2; R-3; W-2 |
| N14 | 25/Male | 15yrs | 73.3 | U-4; S-4; R-4; W-4 | U-3; S-2; R-3; W-2 |
| N15 | 20/Female | 10yrs | 96.6 | U-4; S-4; R-4; W-4 | U-3; S-3; R-3; W-3 |

(1-Zero proficiency; 2-Low Proficiency; 3-Good Proficiency; 4-Native like/Perfect) U-Understanding; S-Speaking; R-Reading; W-Writing

**Procedure**

In the present study cross modal priming paradigm was used. In the cross modal priming task the target pictures are visually displayed on the laptop screen and prime stimuli are presented in the auditory mode through headphones. Two experiments using cross modal priming paradigm was conducted. In the first experiment, lexical access was investigated within each language. In the second experiment effect of cross-linguistic priming on lexical access was investigated.

**Experiment 1**: Lexical access within each language

Here, lexical access was investigated within each language separately for L1 and L2. That is, the auditorily presented prime word as well as the expected target response was in the same language. For instance, prime word was presented auditorily in Kannada and participants were asked name the pictures in Kannada. Three priming conditions were included under this experiment. They are neutral-prime condition, related-prime condition and unrelated-prime condition.

a) Neutral-prime condition: In this condition, there will be no prime word, instead a tone was presented.
b) Related-prime condition: In this condition a semantically related prime word was presented auditorily in Kannada. Example: For the target picture- /magu/ (baby) the semantically related prime would be /thottilu/ (cradle).
c) Unrelated-prime condition: In this condition a semantically unrelated word was presented auditorily in Kannada. Example: For the target picture- /sebu/ (apple) the semantically unrelated prime would be /mancha/ (cot).

For all the three conditions, the participants were asked to name the pictures in Kannada. The same procedure was repeated in English, i.e., the same three priming conditions were included. However, the participants were asked to name the target pictures in English instead of Kannada.

**Experiment 2**: Lexical access using cross-linguistic priming

Here lexical access was investigated using cross linguistic priming paradigm which included two language order conditions i.e., Kannada to English and English to Kannada. In the first condition, the prime presentation was in L1-Kannada, the target response expected was in L2-English and vice-versa. Three priming conditions were included: translation equivalent, related and unrelated.

a) Translation equivalent: Here, a translation equivalent word was presented auditorily in Kannada and the response expected was to name the target picture in English. Example: For the target picture-baby, translation equivalent prime would be /magu/ and the expected response is 'baby'.
b) Related-prime condition: Here a semantically related prime word was presented auditorily in Kannada, and the response expected was to name the target picture in English. Example: For the target picture- egg, related prime would be /koli/ and the expected response is 'egg'.
c) Unrelated-prime condition: Here, a semantically unrelated word was presented auditorily in Kannada and the response expected was to name the target picture in English. Example: For the target picture- house, unrelated prime would be /jebu/ and the expected response is 'house'.

The same procedure was repeated for Kannada to English cross-linguistic priming paradigm. Only difference here is that the prime was presented in Kannada and participants were to name pictures in English.

**Stimulus preparation**

Two separate prime-target word pair lists developed by Deema, (2005) were used for this study. These two lists included 100-word pairs separately for translation equivalent, semantically related, and semantically unrelated prime-target conditions. From these two lists, 107 target words that can be represented as pictures were selected. For each target word, the pictures were selected from the internet, based on the appropriate size, naturalness and pictures which exactly represented the real item.

These 107 target pictures were then given to five post graduates and five under graduate speech and hearing students for checking the validity of those pictures. They were asked to name those target pictures in Kannada as well as in English. Also they were asked rate the naturalness and comment whether the picture represented the real object. Out of 107 target pictures, 100 pictures were named correctly which matched target word list. Out of these 100 pictures, 75 pictures were rated as natural and represented the real objects. These 75 target pictures were included in the stimulus. Among them 60 target pictures were used in the final stimulus and 15 target pictures were used for practice trials.

**Recording of stimuli**

Both prime and target stimuli were recorded in a sound-proof room. A native Kannada –English bilingual adult male recorded the words. The prime stimuli were

recorded in PRAAT software using i-ball microphone. For Neutral prime condition, a pure tone of 1 KHz with the duration of 10ms was generated using Adobe Audition software (Version 3.0). The Noise reduction process was done for all prerecorded prime words using the same software. Each prime word which was saved as wave file was analyzed through restoration option in Adobe Audition and later noise reduction process was performed. To maintain the same intensity of all prime stimuli including pure tone, normalization process was done using the amplitude and compression option in Adobe Audition software.

For DMDX programming, the entire target pictures were saved in bmp format, and each prime word and pure tone were saved as wave file in each folder for each language condition. The DMDX programming included four set of programs for each language condition. The first experiment (Lexical access within each language) included two programs of 60 prime words-target picture pairs. The first program included 20 filler, 20 semantically related and 20 semantically unrelated prime words in Kannada and corresponding target pictures. The second program included 20 filler, 20 semantically related and 20 semantically unrelated prime words in English and corresponding target picture. The second experiment (Lexical access using cross-linguistic priming) also included two programs (Kannada to English & English to Kannada) of 60 word-target picture pairs. The first program included 20 translation equivalents, 20 semantically related and 20 semantically unrelated prime words in Kannada and corresponding target picture. The second program included 20 filler, 20 semantically related and 20 semantically unrelated prime words in English and corresponding target pictures.

DMDX software controlled the presentation of the auditory prime, target picture and recorded the speech reaction time in milliseconds i.e., from the target picture onset to the subject's verbal response. For both the experiments, in each task, the order of stimulus presentation was randomized in DMDX programming to avoid adaptation effect/practice effect. Further, the order of conditions was counterbalanced across participants.

*Task*

Each prime was presented auditorily through headphones. Then after the prime presentation, 250ms gap was given and then target word appeared on centre of the computer screen and remained for 4000ms. A gap of 60ms was given as inter stimulus interval after which the next auditory prime word was presented. In order to familiarize participants to the task, a set practice trails were given.

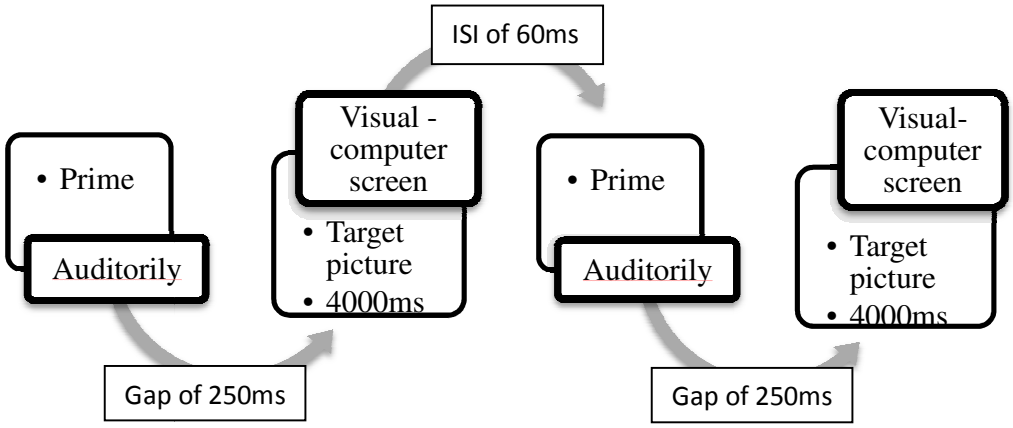



Figure 1, *Pictorial representation of stimulus presentation.*

**Instructions**

Participants were tested individually in a quiet room. Familiarization of the target pictures were done before the task began. Participants were instructed to sit facing the desktop screen and listen carefully to the words presented through headphones and later

name the target picture appearing on the screen as quickly as possible. For each language condition participants were instructed, about in which language he or she had to name the target pictures.

**Data analysis**

Analyses of target word responses were done using Check vocal software. Check vocal software is Windows application software which helps the experimenter/researcher to manually calculate the speech reaction time and label the accuracy of response as 'correct', 'wrong', 'no response' for vocally recorded responses of naming. Check vocal software displays the waveform, spectrogram and also plays the audio of each recorded vocal response that are corresponding to the response duration which are registered in DMDX programming. The experimenter can manually calculate the speech reaction time by placing the cursor on the spectrogram to verify the beginning of spoken utterance and Check vocal software automatically gives the SRT in ask.file. Figure.2 shows the calculation of the SRT using check vocal software.

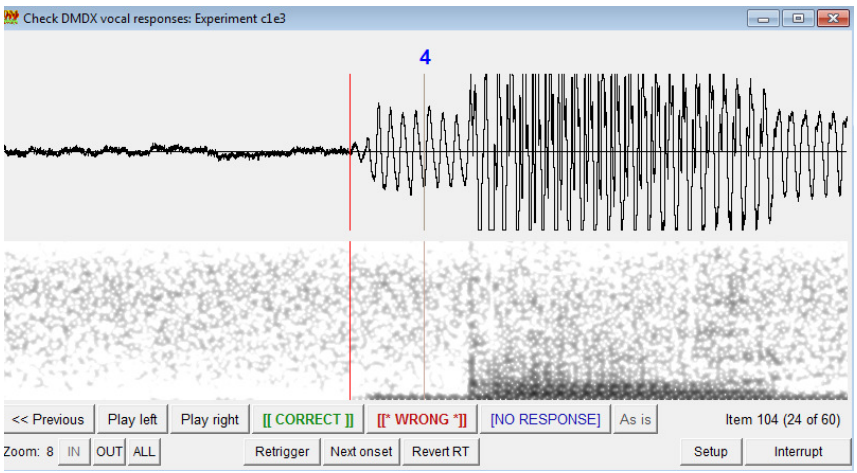



Figure2, *Check vocal software displaying the waveform and spectrogram of participant's vocal response.*

From the recorded responses of the target words, three variables were measured using this Check vocal software

1. Response errors
2. Speech Reaction Time
3. Stuttering frequency

1. ***Response errors:*** Four types of responses were considered as errors (Burger & Wijnen, 1999; Byrd, Conture, & Ohde, 2007; McFarlane & Shipley, 1981; Melnick, Conture, Ohde, 2003) and these errors were excluded from Speech Reaction Time analysis.
   - Incorrect response (if the subject verbal response is deviated from the target word or intended language)
   - Absent response (if the subject does not respond within 4000ms)
   - Stuttering moments (if the target response is preceded by any dysfluency)
   - Other response (if the target response is preceded by any noise, cough, yawn etc.,)
2. ***Speech Reaction Time*:** Speech reaction time was extracted using Check Vocal software which was recorded by DMDX software during related, unrelated, translation equivalent and neutral prime-target conditions. Speech reaction time is the time interval between the onset of the target stimulus on the screen and the onset of the participant's verbal response.
3. ***Stuttering frequency:*** For all priming conditions, stuttering frequency was obtained only for bilingual adults who stutter, by calculating the frequency of stuttering moments in each priming condition. Stuttering like dysfluencies: sound/ syllable/ part word repetitions, blocks and prolongations were considered as stuttering moments.

Statistical analysis:

The data analyzed were entered in SPSS (17.0 version) software and quantitative analysis was done. The following statistical analyses were used:

1) Paired t-test was done to compare the percentage of syllable stuttered between two languages i.e., L1-Kannada and L2-English in spontaneous speech and reading.
2) Mixed ANOVA was performed to each experiment (1 & 2) to compare the two groups (BWAS & BWANS) between two languages and across the priming conditions as dependent variables.
3) Paired t-test was performed to find whether there is a significant difference between two language orders in each priming condition.
4) One way MANOVA was performed to compare each priming conditions between two language orders.
5) Pearson correlation analysis was performed to find the relation between percentages of syllables stuttered and mean SRT in L1 and L2.
6) Repeated measure ANOVA was performed to find relation between the frequency of stuttering moments and mean SRT.

# CHAPTER 4

# RESULTS

Results are discussed under five sections.

1) Comparison of the percentage of syllables stuttered between Kannada (L1) and (L2) English for spontaneous speech and reading tasks.
2) Results of lexical access within each language (Experiment 1) and lexical access in cross linguistic priming tasks (Experiment 2) for the dependent variable speech reaction time (SRT).
3) Results of lexical access within each language (Experiment 1) and lexical access in cross linguistic priming tasks (Experiment 2) for the dependent variable frequency of stuttering moments.
4) Relationship between the percentage of syllable stuttered and lexical access in Kannada (L1) and English (L2) languages in BAWS.
5) Comparison of error responses between two groups across the priming conditions in experiment 1 and experiment 2.

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

Results for mean percentage of syllable stuttered for spontaneous speech and reading in (L1) Kannada and (L2) English are displayed in Figure.3. From the figure it is clear that BAWS stuttered more in English (L2) compared to Kannada (L1) in both spontaneous and reading tasks. For (L1) Kannada, the percentage of syllable stuttered in spontaneous speech ranged from 2.58% to 11.37% with a mean of 5.71 and SD of 2.60;

in reading the percentage of syllable stuttered ranged from 1.22% to 7.33% with a mean of 4.24 and SD of 1.92. For English (L2), the percentage of syllable stuttered in spontaneous speech ranged from 4.29% to 17.07% with a mean of 10.93 and SD of 4.30; in reading the percentage of syllable stuttered ranged from 0.88% to 13.82% with a mean of 5.43 and SD of 3.45. A paired *t*-test was done to determine whether there was any statistically significant difference in the percentage of syllable stuttered differed in (L1) Kannada and (L2) English. The *t*-test results showed statistically significant difference between two languages only in spontaneous speech task [$t$ (1, 14) = -6.55, $p$<0.0001]. There was no significant difference [$t$ (1, 14) = -1.36, $p$<0.193] between L1 and L2 in reading task.

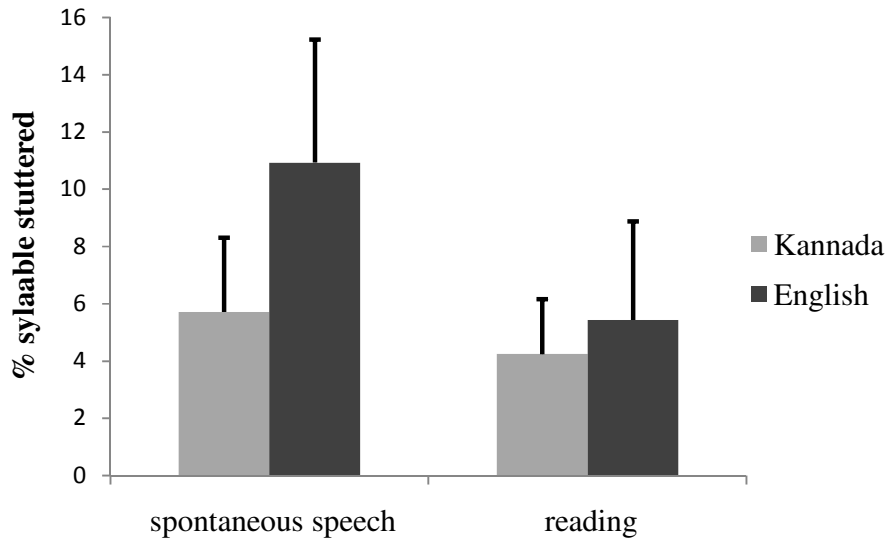



Figure 3, *Mean % of syllable stuttered for spontaneous speech and reading in (L1) Kannada and (L2) English. In the figure error bars indicate standard deviation values.*

### *4.2 Results of lexical access within each language (Experiment 1) and lexical access in cross linguistic priming tasks (Experiment 2) for the dependent variable speech reaction time (SRT)*

#### 4.2.1 *Experiment 1: Lexical access within each language*

Speech reaction time (SRT) analyses were done for bilingual adults who stutter and bilingual adults who do not stutter separately in priming condition for both the languages. In both the languages, SRT values were slightly slower in BAWS compared to BAWNS for all the three priming conditions. Comparison of SRT between two languages across three priming conditions showed no significant difference in both the groups. Table 4 shows comparison of mean, SD for SRT in BAWS and BAWNS in each language in three priming conditions.

Table 4

*Comparison of SRT in BAWS and BAWNS in each language for three priming conditions.*

| | **Priming conditions** | | | | | |
|---|---|---|---|---|---|---|
| **Languages/ Participants** | **Neutral (Filler)** | | **Related** | | **Unrelated** | |
| | Mean | SD | Mean | SD | Mean | SD |
| Kannada | | | | | | |
| BAWS | 1183.62 | 249.31 | 1146.17 | 296.92 | 1178.18 | 251.20 |
| BAWNS | 1033.45 | 193.88 | 1004.51 | 239.20 | 982.92 | 193.62 |
| English | | | | | | |
| BAWS | 1133.03 | 228.45 | 1095.35 | 240.36 | 1076.22 | 164.23 |
| BAWNS | 1063.47 | 174.17 | 1033.19 | 174.72 | 1050.53 | 230.14 |

(BAWS- Bilingual Adults who stutter; BAWNS- Bilingual Adults who do not stutter)

A 2 language (Kannada and English) * 3 priming conditions (Neutral, Related & Unrelated) Mixed ANOVA was performed on the SRT data for both the groups (bilingual adults who stutter and bilingual adults who do not stutter). The results showed statistically no significant main effect for language [F (1, 28) = 0.137, p=0.714], for priming conditions [F (2, 56) = 2.116, p = 0.130] and for groups [F (1, 28) = 2.57, p = 0.12]. Also, the interaction effect for languages*group [F (1, 28) = 2.514, p = 0.124]; languages*priming conditions [F (2, 56) =0.019, p = 0.981]; priming conditions*group [F (2, 56) = 0.034, p = 0.966] as well as languages*priming conditions*groups [F (2, 56) = 0.892, p = 0.416] was not statically significant.

### *4.2.2 Experiment 2: Lexical access using cross-linguistic priming task*

Mean speech reaction times (SRT) in BAWS were significantly slower compared to BAWNS for all the three priming conditions. Table 5 shows comparison mean and SD for SRT in two groups in each language order (Kannada-English and English-Kannada) and in three priming conditions (Translation equivalent, related and unrelated primes).

Table 5

*Comparison of SRT in BAWS and BAWNS in each language order for three priming conditions.*

| | **Priming conditions** | | | | | |
|---|---|---|---|---|---|---|
| **Language** | **Translation equivalent** | | **Related** | | **Unrelated** | |
| **order/ Participants** | Mean | SD | Mean | SD | Mean | SD |
| Kannada to English | | | | | | |
| BAWS | 970.50 | 224.35 | 1244.65 | 273.00 | 1139.23 | 197.35 |
| BAWNS | 845.10 | 188.97 | 1048.36 | 219.43 | 1013.13 | 147.71 |
| English to Kannada | | | | | | |
| BAWS | 861.46 | 238.69 | 1121.26 | 263.60 | 1119.92 | 225.59 |
| BAWNS | 718.84 | 160.36 | 983.70 | 174.17 | 1020.97 | 268.88 |

(BAWS- Bilingual Adults who stutter; BAWNS- Bilingual Adults who do not stutter)

A 2 language (English-Kannada and Kannada-English) * 3 priming conditions (Translation equivalent, related and unrelated primes) Mixed ANOVA was performed on the SRT data of both the groups (bilingual adults who stutter and bilingual adults who do not stutter). There was a statistically significant main effect for language order [F (1, 28) = 10.52, p=0.003] priming conditions [F (2, 56) = 84.33, p=0.000] and groups [F (1, 28) = 4.14, p = 0.05]. However, the interaction effect for language order*group [F (1, 28) = 0.262, p = 0.613]; priming conditions*group [F (2, 56) =0.835, p=0.439] as well as language order*priming conditions*groups [F (2, 56) = 0.340, p = 0.714] was not significant. However, there was a significant interaction effect only for language order*prime conditions [F (2, 56) = 3.24, p=0.046].

Since there was significant interaction effect between language order*priming conditions, mixed ANOVA was performed separately for each language order (English-Kannada and Kannada-English) to find if there is any significant difference across the

priming conditions. Also paired t-test was done to find the significant difference between language orders in each priming condition.

***Within and between group comparison for English-Kannada language order:***

There was a statistically significant main effect for priming conditions [F (2, 56) = 33.16, p<0.000]. Between group comparisons, results indicated a significant difference between the two groups across three priming conditions [F (1, 28) = 4.66, p = 0.04]. However, the interaction effect between the priming conditions*groups was not statistically significant [F (2, 56) = 0.915, p = 0.407].

Pairwise comparison indicated a significant difference between translation equivalent prime & related prime ($p < 0.05$) and also between translation equivalent prime & unrelated prime ($p < 0.05$). There was no significant difference between related prime & unrelated prime ($p > 0.05$).

***Within and between group comparison for Kannada - English language order:***

There was statistically significant main effect for priming conditions [F (2, 56) = 46.28, p<0.000]. Also, between group comparisons, results indicated no significant difference between the two groups across three priming conditions [F (1, 28) = 2.97, p = 0.09]. However, the interaction between priming condition*group was not statistically significant [F (2, 56) = 0.268, p = 0.766].

Pairwise comparison indicated a significant difference between translation equivalent prime & related prime ($p < 0.05$) and also between translation equivalent prime & unrelated prime ($p < 0.05$). There was no significant difference between related prime & unrelated prime ($p > 0.05$).

Paired t-test was done between two language orders in each priming condition. The t-test results revealed statistically significant difference between two language (English-Kannada & Kannada-English) orders for translation equivalent priming condition [t (29) = 3.55, p=0.001] and related priming condition [t (29) = 2.52, p=0.018]. There was no significant difference for unrelated priming condition [t (29) = 1.76, p=0.862].

One way MANOVA was carried out to find the significance difference between the two groups separately in three priming conditions in two language orders. In English-Kannada language order, results revealed a significant difference between the two groups for related [F (1, 28) = 4.71, p = 0.039] and for unrelated [F (1, 28) = 3.92, p = 0.057] priming conditions. However, there was no significant difference between two groups for translation equivalent priming condition [F (1, 28) = 2.74, p = 0.109]. In Kannada-English language order, there was no significant difference between the two groups for all the 3 priming conditions {translation equivalent [F (1, 28) = 3.68, p = .065]; related [F (1, 28) = 2.84, p = 0.103]; unrelated priming condition [F (1, 28) =1.19, p = 0.284]}.

### **4.3** ***Results of lexical access within each language (Experiment 1) and in cross linguistic priming tasks (Experiment 2) for the dependent variable frequency of stuttering moments in BAWS***

A repeated measure ANOVA was carried out separately for experiment 1 (Lexical access within each language) and experiment 2 (Lexical access in cross-linguistic priming) for the dependent variable frequency of stuttering moments.

### *4.3.1 Experiment 1 (Lexical access within each language)*

The results of repeated measure ANOVA revealed no significant main effect for priming conditions [F (2, 56) = 0.482, p = 0.620] and languages [F (1, 28) = 0.185, p = 0.670]. The interaction between priming condition*languages was also not statistically significant [F (2, 56) = 0.132, p = 0.876].

Table 6

*Mean Speech reaction time (SRT) and Standard Deviation (SD) in each language for three priming conditions for BAWS in experiment 1*

| | **Priming conditions** | | | | | |
|---|---|---|---|---|---|---|
| **Languages** | **Neutral (Filler)** | | **Related** | | **Unrelated** | |
| | Mean | SD | Mean | SD | Mean | SD |
| **Kannada** | 2.46 | 3.46 | 2.66 | 3.19 | 3.00 | 4.19 |
| **English** | 2.13 | 1.95 | 2.33 | 2.12 | 2.33 | 2.87 |

### *4.3.2 Experiment 2 (Lexical access using cross-linguistic priming)*

The results of repeated measure ANOVA revealed no significant main effect for 3 priming conditions [F (2, 56) = 0.520, p = 0.597] and two language orders [F (1, 28) = 0.789, p = 0.382]. Also, the interaction between priming condition*language order was not statistically significant [F (2, 56) = 0.145, p = 0.8

Table 7

*Mean Speech reaction time (SRT) and Standard Deviation (SD) in each language order for three priming conditions for BAWS in experiment 2.*

| | **Priming conditions** | | | | | |
|---|---|---|---|---|---|---|
| **Language orders** | **Translation equivalent** | | **Related** | | **Unrelated** | |
| | Mean | SD | Mean | SD | Mean | SD |
| **English-Kannada** | 3.13 | 4.24 | 3.66 | 4.45 | 3.13 | 4.01 |
| **Kannada-English** | 2.20 | 2.62 | 2.40 | 1.99 | 2.26 | 2.08 |

### *4.4 Relationship between percentages of syllables stuttered and lexical access in Kannada (L1) and English (L2) in Bilingual adults who stutter*

The mean SRT of three priming conditions (Neutral, Related and Unrelated) of Kannada language were averaged to get mean SRT in (L1) Kannada. This was done in order to compare the Kannada language, lexical access scores with the percentage of syllables stuttered. Likewise, the mean SRT of three priming conditions (Neutral, Related and Unrelated) of English language were averaged to get mean SRT in (L2) English. Pearson correlation was performed to find if there is any correlation

- Between percentage of syllable stuttered for spontaneous speech and reading in (L1)-Kannada and mean SRT of all 3 priming condition in (L1)-Kannada.
- Between percentage of syllable stuttered for spontaneous speech and reading in (L2) - English and mean SRT of all 3 priming condition in (L2)-English.

The results indicated that there was no significant correlation between percentage of syllables stuttered in L1 & L2 for spontaneous speech and reading versus mean SRT of

3 priming conditions. Hence, the results indicated that the stuttering frequency did not have any relationship across different priming conditions as well as language.

Table 8

*Correlation values and p values between % syllables stuttered in L1 & L2 across three priming conditions.*

| **Dependent variables**<br>**Correlation parameters** | **Pearson correlation (r) value** | **P value** |
|---|---|---|
| % syllable stuttered for spontaneous speech in Kannada versus mean SRT of all 3 priming conditions (neutral, related & unrelated) in Kannada | -0.193 | 0.491 |
| % syllable stuttered for reading in Kannada versus mean SRT of all 3 priming conditions (neutral, related & unrelated) in Kannada | -0.290 | 0.295 |
| % syllable stuttered for spontaneous speech in English versus mean SRT of all 3 priming conditions (neutral, related & unrelated) in English | 0.080 | 0.776 |
| % syllable stuttered for reading in English versus mean SRT of all 3 priming conditions (neutral, related & unrelated) in English | 0.122 | 0.665 |

### *4.5 Comparison of error responses between two groups across priming conditions in experiment 1 and experiment 2*

#### *4.5.1* Comparison of error responses between groups (BAWS & BAWNS) in experiment 1

In experiment 1, the average values for four types of errors across the priming conditions indicates that the frequency of errors were higher in bilingual adults who

stutter compared to bilingual adults who do not stutter. In BAWS, the frequency of error responses was higher in stuttering moment error type compared to other 3 type of error responses. The four type of error responses for each priming condition in each language for BAWS and BAWNS are given in table 9 and table 10.

Table 9

*Error responses in BAWS between two languages and across the priming conditions for experiment 1*

| **Error responses** | | **English** | | | **Kannada** | |
|---|---|---|---|---|---|---|
| Priming condition | **Neutral** | **Related** | **Unrelated** | **Neutral** | **Related** | **Unrelated** |
| Incorrect responses | 0.67 | 0.92 | 1.06 | 0.53 | 0.47 | 0.07 |
| Absent responses | 1.87 | 1.4 | 2 | 0.93 | 0.6 | 0.53 |
| Stuttering moments | 2.13 | 2.3 | 2.3 | 2.47 | 2.67 | 3 |
| Other responses (preceded by cough, noise, etc) | 0.2 | 0.2 | 0.27 | 0.27 | 0.2 | 0.27 |

Table 10

*Error responses in BAWNS between two languages and across the priming conditions for experiment 1*

| **Error responses** | | **English** | | | **Kannada** | |
|---|---|---|---|---|---|---|
| Priming condition | **Neutral** | **Related** | **Unrelated** | **Neutral** | **Related** | **Unrelated** |
| Incorrect responses | 0.87 | 1.27 | 0.53 | 0.73 | 0.33 | 0.47 |
| Absent responses | 0.73 | 0.53 | 0.6 | 0.2 | 0.2 | 0.13 |
| Stuttering moments | 0.2 | 0.6 | 0.3 | 0.07 | 0.2 | 0.3 |
| Other responses (preceded by cough, noise, etc) | 0.2 | 0.2 | 0.2 | 0.4 | 0.33 | 0.2 |

### *4.5.2* Comparison of error responses between groups (BAWS & BAWNS) in experiment 2

In experiment 2 , the mean values for four types of errors across the priming conditions indicates that frequency of errors were higher in bilingual adults who stutter compared to bilingual adults who do not stutter. In BAWS, the frequency of error responses was higher in stuttering moment error type compared to other 3 type of error responses. The four type of error responses for each priming condition in each language for BAWS and BAWNS are given in table 11 and table 12.

Table 11

*Error responses in BAWS between two language orders and across the priming conditions for experiment 2*

| **Error responses** | **English-Kannada** | | | **Kannada-English** | | |
|---|---|---|---|---|---|---|
| **Priming condition** | **Translation equivalent** | **Related** | **Unrelated** | **Translation equivalent** | **Related** | **Unrelated** |
| Incorrect responses | 0.2 | 0.73 | 0.6 | 0.66 | 1.06 | 1.66 |
| Absent responses | 0.53 | 0.66 | 0.86 | 1.33 | 1.86 | 1.8 |
| Stuttering moments | 3.13 | 3.66 | 3.13 | 2.2 | 2.4 | 2.26 |
| Other responses (preceded by cough, noise, etc) | 0.26 | 0 | 0.2 | 0.2 | 0 | 0.06 |

Table 12

*Error responses in BAWNS between two language orders and across the priming conditions for experiment 2*

| **Error responses** | **English-Kannada** | | | **Kannada-English** | | |
|---|---|---|---|---|---|---|
| Priming condition | **Translation equivalent** | **Related** | **Unrelated** | **Translation equivalent** | **Related** | **Unrelated** |
| Incorrect responses | 0.53 | 0.53 | 0.53 | 0.53 | 1 | 0.66 |
| Absent responses | 0.06 | 0.2 | 0.13 | 0.73 | 0.46 | 0.66 |
| Stuttering moments | 0.53 | 0.26 | 0.26 | 0.26 | 0.33 | 0.2 |
| Other responses (preceded by cough, noise, etc) | 0.2 | 0.13 | 0.06 | 0.06 | 0.6 | 0.26 |

# CHAPTER 5

# DISCUSSION

The aim of the present study was a) to compare the percentage of syllables stuttered between L1 (Kannada) and L2 (English) in bilingual adults who stutter (BAWS), b) investigate lexical access in BAWS in comparison with bilingual adults who do not stutter (BAWNS) using semantic and cross-language priming paradigms, c) to investigate the relationship between percentages of syllables stuttered and lexical access scores. The results revealed several points of interest.

## *Stuttering in L1 and L2*

First, the results showed that BAWS stuttered in both the languages, i.e, in both Kannada and English. This result is consistent with previous research that examined stuttering in BAWS and found that stuttering occurred in both the languages (Van Borsel et al., 2001; Jayaram, 1984; Nwokah, 1988). The result of frequency of stuttering analysis in L1 and L2 for bilingual adults who stutter, indicated that bilinguals stuttered differently in both the languages. The present results support the "different- hypothesis" postulated by Nwokah (1988). Similar results were reported by other authors (Dale, 1977; Jayaram, 1983; Nwokah, 1988; Lim, Lincoln, Chan, & Onslow, 2008).

Second, in the present study, all bilingual adults who stutter had Kannada as L1 and English as L2. Scores of LEAP-Q suggested that all BAWS rated their proficiency as 4, suggesting native like/perfect proficiency in all four domains (understanding, speaking, reading & writing) for Kannada language. Further, they rated their proficiency as 3 suggesting good proficiency in English language; the cloze test scores also indicated

good proficiency in L2. The results revealed that, the frequency of stuttering was higher in L2 (English). This result supports the earlier cross-linguistic studies conducted in bilinguals adults who stutter (Ardila, Ramos & Barrocas 2011; Jankelowitz & Bortz, 1996; Lim, Lincoln, Chan, & Onslow, 2008; Schafer & Robb, 2012). All these studies highlighted the role of proficiency of language for the differences in the frequency of stuttering in two languages. Their results also indicated that the frequency of stuttering was higher in non dominant/ less proficient language. Due to less proficiency in non dominant language the bilingual adults with stuttering may have difficulty in formulating the linguistic features of the language (Jankelowitz & Bortz, 1996; Lim, Lincoln, Chan, & Onslow, 2008). This would result in high demands on speech motor planning in non dominant language which increases the frequency of stuttering (Lim, Lincoln, Chan, & Onslow, 2008). The other factors suggested for the increased frequency of stuttering in non-dominant language are cross-linguistic differences (stress, phonetic complexity, etc.,) between the two languages that are spoken by a bilingual adult with stuttering (Nwokah, 1988; Lim, Lincoln, Chan, & Onslow, 2008; Ardila, Ramos & Barrocas, 2011).

Third, there was no significant difference in the percentage of syllables stuttered in reading between L1 and L2. This indicates that the frequency of stuttering was same between the two languages. Only few studies support this result since most of the studies on bilinguals adults who stutter, have considered only spontaneous speech analysis in the procedure. Ardila, Ramos and Barrocas (2011), report the similarities and differences in stuttering pattern observed in a Spanish-English bilingual. Stuttering was present in both languages during spontaneous speech and conversation, whereas it was absent during the verbal fluency test and reading in both languages. Roberts (2002), report that the 4

French-English bilinguals had similar percentage of dysfluency across the languages during reading task.

In the present study only overall percentage of syllables stuttered were compared between two languages. It would be interesting to explore further to see whether the type of dysfluencies are also significantly different between two languages. Presently there is no clear consensus about this issue. Some studies report that types of dysfluencies in two languages are different in BAWS (Jankelowitz & Bortz, 1996; Howell et al., 2004). Whereas Lim, Lincoln, Chan, and Onslow, (2008) reported similar types of dysfluencies in two languages.

Fourth, the present study used lexical priming paradigm and found that bilinguals who stutter are not significantly slower when compared to bilinguals who do not stutter indicating their retrieval of linguistic frames were similar in naming the target pictures compared to BAWNS. The present study is the first study investigating lexical access in bilingual adults who stutter. Hence, there are no supporting studies for comparison purposes. However, present results can be compared to similar work done in monolingual adults who stutter. The present results contradict the previous investigations, who found slower reaction time in monolinguals adults who stutter compared to monolingual adults who do not stutter (Arunkumar & Yeshoda, 2006; Santosh & Arunkumar, 2006; Newman & Ratner, 2007; Hennessey, Nang, & Beilby, 2008; Wingate, 1988; Perkins, Kent, & Curlee, 1991). Wingate (1988), and Perkins, Kent, and Curlee (1991) suggested stuttering as a disturbance of lexical access, and they hypothesized that, along with other factors, slow lexical retrieval of linguistic frames as one of the necessary conditions for the stuttering to occur. Whereas Packman, Onslow, Coombes and Goodwin (2001),

compared frequency in reading standard English passage and non-word passages, and found similar amount stuttering in both the tasks. Their results suggested that slower lexical access may not be the necessary condition for the stuttering to occur.

Fifth, the result of experiment-1 also revealed that there was no significant difference in mean SRT values between two languages across both the groups. This indicates that both bilinguals who stutter and bilinguals who do not stutter did not show any difference in SRT while naming pictures in L1 (Kannada) as well as L2 (English), even though both groups were less proficient in L2-English. The results highlight that even though bilingual adults who had difference in the percentage of syllable stuttered in L1-Kannada and L2-English, their speech reaction time in L1 and L2 did not differ. Hence, there may not be any relationship between the frequency of stuttering and lexical access scores. The correlational analysis also confirmed above finding where it was noticed no-significant correlation between lexical access scores and frequency of stuttering in Kannada and English.

Sixth, there was no significant effect of three priming conditions in the experiment-1. Other studies on lexical access in adults who stutter report the priming effect on reaction time; i.e., faster reaction time in related priming condition compared to unrelated priming condition (Arunkumar & Yeshoda, 2006; Santosh & Arunkumar, 2006; Newman & Ratner, 2007). These studies support the facilitation effect of priming which results in less reaction time. Such a phenomenon was not observed in the present study.

Seventh, the results of experiment 2 indicated a significant difference in mean SRT between the two language orders across the three priming conditions. The present

results indicated that cross-language priming had an effect in bilinguals in facilitating lexical access compared using semantic priming paradigm in the same language; whereas a study by Costa, Miozzo and Caramazza (1999), on Catalan–Spanish normal bilinguals contradicts the present result stating that, facilitation of priming was larger for the same, and semantically related in the same language compared to different-language pairs.

The result of experiment-2 also indicated that English-Kannada language order had lower mean SRT (faster reaction time) compared to Kannada-English. Thus, there is interaction between L1 and L2 in facilitation of lexical representation. That is English prime facilitating in faster speech reaction time for target picture naming in Kannada. This result supports the study of Lee and Williams (2001), who report that cross-language priming facilitated faster reaction response for the dominant language. Whereas the results of Deema, (2005) and Rajini (2005), done with normal bilinguals and bilingual aphasics, found that the effect priming was faster for Kannada-English language order compared to English language order. The results of present study can be supported by revised hierarchical model, as participants had good proficiency in L2, conceptual store of L2 could be also stronger and hence link between L2-L1 may be strong. Further, research in the treatment of bilingual adults who stutter can find if the therapy in English language can reduce the stuttering frequency in Kannada.

In English- Kannada language order, there was a significant difference between the two groups, indicating that BAWS were slower compared to BAWNS. This suggests that in BAWS, the prime words in L2 did not facilitate sufficiently target word access in L1. This supports the results of Rajani, (2005), who also found similar results for lexical

decision task i.e., the absence of priming in English-Kannada language order in aphasic group whereas it was present in normal group.

Across three priming conditions, only translation equivalent and related had lower mean SRT compared to unrelated priming condition. This result supports other studies (Deema, 2005; Rajani, 2005) who found that reaction time was lower for translation equivalent followed by translation related and more reaction time for translation unrelated priming condition. Only translation equivalent and related priming conditions had lower mean SRT because these prime words activates the conceptual representations that are shared across the languages (De Groot & Nas, 1991; Van Hell & De Groot, 1998).

Eighth, the result for dependent variable frequency of stuttering moments of lexical access in experiment 1 & 2 in BAWS revealed that, there is no relation between the frequency of stuttering moments across the language, and priming conditions. Even though, the effect of priming conditions was present for speech reaction time, there was no effect on the frequency of stuttering moments. Hence, this frequency of stuttering moments may not be a sensitive paradigm to find the effect of priming. The numbers of error responses were higher in BAWS compared to BAWNS, because BAWS produced more stuttering moments which included stuttering like dysfluencies and also interjections, tongue click sounds. As their duration of stuttering moment was more, they were not able to respond within 4000ms that were excluded as absent responses.

# CHAPTER 6

## SUMMARY AND CONCLUSION

The objectives of the present study were a) to compare the percentage of syllables stuttered between L1 (Kannada) and L2 in bilingual adults who stutter (BAWS), b) investigate lexical access in BAWS in comparison with bilingual adults who do not stutter (BAWNS) using semantic and cross-linguistic priming paradigms, c) to investigate the relation between percentages of syllables stuttered and lexical access scores. The results revealed several points of interest.

The participants in the study included fifteen Kannada-English bilingual adults who stutter and fifteen Kannada-English bilingual adults who do not stutter, matched for age, gender and proficiency in L2. The age range of the participants ranged from 18 to 26 yrs. For bilingual adults who stutter, the stuttering severity was assessed in both languages i.e., L1-Kannada and L2-English using SSI-3 (Riley, 1994). The percentage of syllable stuttered was calculated for spontaneous speech and reading for both languages. Language proficiency was evaluated for each participant using LEAP-Q, a self-rating scale, and Cloze test given to assess L2 proficiency.

Lexical access was studied in two experiments using cross modal priming paradigm. In the first experiment lexical access was investigated within each language. That is the auditory prime as well as the expected target response were in the same language. Here, three priming conditions were included: neutral-prime condition, related-prime condition and unrelated-prime condition.

In the second experiment, the effect of cross-linguistic priming task on lexical access was investigated. Here, lexical access was investigated using the cross linguistic priming paradigm which included two language order conditions, i.e., Kannada to English and English to Kannada. In the first condition, the prime presentation was in L1-Kannada, the target response expected was in L2-English and in the second condition it was vice-versa. Three priming conditions were included in both the language orders: translation equivalent, related and unrelated. DMDX software controlled the presentation of the target picture and auditory prime, and recorded the speech reaction time in milliseconds i.e., from the target picture onset to the subject's verbal response. For both the experiments, in each task, the order of stimulus presentation was randomized in DMDX programming and the order of conditions was counterbalanced across participants.

The analysis of target word responses was done using Check vocal software. Three variables were measured using this software: a) Speech Reaction Time (SRT) was extracted using Check Vocal software which was recorded by DMDX software during related, unrelated, translation equivalent and neutral prime-target conditions; b) stuttering frequency was obtained by calculating the frequency of stuttering moments in each priming condition and; c) Response errors- Four types of responses were considered as errors: Incorrect response, absent response, stuttering moments and other response. These errors were excluded for SRT analysis. These data were analyzed using SPSS (17.0 version) software and results are summarized below:

1. Frequency of dysfluency analysis in L1 and L2 revealed significant difference in percentage of syllable stuttered between L1 and L2 for spontaneous speech task.

BAWS stuttered more in English (L2) compared to Kannada (L1). But there was no significant difference in percentage of syllable stuttered between L1 and L2 for reading task.

2. Results of lexical access in experiment-1 revealed that there was no significant difference in mean SRT between bilingual adults who stutter and bilingual adults who do not stutter.
3. Also, there was no significant difference in mean SRT between two languages and three priming conditions.
4. The results of experiment-2 indicated that, there was a significant difference in mean SRT between two language orders, and English-Kannada language order had a lower mean SRT compared to Kannada-English language order.
5. In experiment 2, there was a significant effect of two language orders (English-Kannada & Kannada- English) only for translation equivalent and for related priming conditions.
6. Results of correlation between the percentage of syllable stuttered and lexical access scores in each language (L1 and L2) indicated no significant relationship between these two variables.
7. Results also revealed there is no relation between the frequency of stuttering moments across the language, and priming conditions.

Hence, the present study finding highlights that bilingual adults who stutter do not differ in lexical access from bilingual adults who do not stutter. This suggests that bilingual adults who stutter do not have difficulties in lexical retrieval, it may at further

level syntactic encoding or phonological encoding. Also, lexical access does not have any relation with frequency of stuttering.

**Limitations of the study:**

- The gender effect could not be studied as the group included only male participants.
- Different severities of stuttering were included, as mechanism underlying stuttering may vary in each severity.
- Successive bilinguals were considered hence in L2 the proficiency was not high/native like compared to L1.

**Future directions:**

1. Similar studies on lexical access in bilingual adults who stutter can be extended in other languages.
2. Further research in stuttering should focus on bilinguals to study the other linguistic process- phonological encoding, syntactic encoding.
3. Other experimental studies can be carried out to investigate lexical access using other lexical naming task such as cross-script priming and also using lexical decision tasks.
4. Comparison of different proficiency speakers, i.e., simultaneous and sequential bilinguals can be done.
5. Similar study can be replicated in Kannada-English bilingual children.
6. Lexical access through other methods such as non-word reading task can be studied.

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