LANAGAUGE NON- SPECIFIC LEXICAL SELECTION

IN BILINGUAL ADULTS

Suma D R

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A Dissertation Submitted in Part Fulfilment for the Degree of

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ALL INDIA INSTITUTE OF SPEECH AND HEARING

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May, 2013

Certificate

This is to certify that this dissertation entitled **"Language Non-Specific Lexical Selection in Bilingual Adults"** is a bonafide work in part fulfilment for the degree of Master of Science (Speech-Language Pathology) of the student (Registration No. 011SLP026). This has been carried out under the guidance of a Faculty of this institute and has not been submitted earlier for the award of any other Diploma or Degree to any other University.

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This dissertation entitled **"Language Non-Specific Lexical Selection in Bilingual Adults"** is the result of my own study under the guidance of **Dr. K. S. Prema**, Professor of Language Pathology & Head Department of Special Education, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier for the award of any Diploma or Degree to any other University.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Language is a system of communicating one's thoughts and ideas in spoken, written, signed or other forms. In the process of language production, the selection of the intended word from the mental lexicon among other semantically related words is a highly complex mechanism. Lexical selection is the process of retrieving words from the lexicon that match the speaker's communicative intention (Caramazza, 1997; Dell, 1986; Levelt, 1989, 2001). Lexical selection mechanism has been explained by the widely accepted theory of Spreading Activation by Collins and Loftus (1975). According to this theory, each concept will spread the activation to other representations with which it is connected. For example, when naming the picture of a 'dog', other related words such as 'animal', 'four legs', 'fur' etc. also get activated. It may also activate the lexical node, 'cat' which shares similar features as 'dog'. The word 'cat' may thus become a competitor and interfere in the selection of the target lexical node, 'dog'. Thus the lexical selection mechanism has to function efficiently and select the lexical node that has the highest level of activation. The lexical selection mechanism, hence, is quite intriguing for researchers to study the process in monolinguals and bilinguals.

The ability to speak in more than one language, otherwise known as Bilingualism, has been extensively studied, owing to the fact that there is a rapid increase in the bilingual population. Bilinguals are individuals who use more than one language to communicate on a regular basis (Grosjean, 1982, 1998). The task of lexical selection seems to be even more difficult for a bilingual owing to the fact that there would be lexical interferences from not just the related lexical nodes of the target language, but also from the other languages. In bilingual research, there are several questions that are generally addressed.

A. During lexical selection, do both the lexicons of a bilingual get activated in parallel?
B. If yes, do the lexical nodes of both the languages compete for selection or are the lexical nodes of the target language alone involved in the lexical selection?
C. If lexical nodes of both the languages compete for selection, how does the bilingual select a word in the intended language while preventing massive interference from the non-response language?

Most theories of bilingual lexical access assume that both the lexicons of a bilingual are activated in parallel (De Bot, 1992; Green, 1986; Poulisse & Bongaerts, 1994). This suggests that the lexical nodes of both the languages compete for selection. So, the question that remains unanswered is how a bilingual selects a word in the intended language while preventing interference from the non-response language.

There have been two main models reported in the literature to explain these issues. The first model states that the lexical selection mechanism is *language specific* (Costa & Caramazza, 1999; Costa, Miozzo, & Caramazza, 1999; Roelofs, 1998). This model states that the lexical selection mechanism considers only the activation levels of the lexical nodes in the lexicon of the intended language. That is, the lexicon which needs to be accessed will be decided, and only the lexical nodes of that lexicon will be activated for selection. Consequently, according to this proposal, there would be no lexical interference or competition between lexical items of different languages (Costa & Caramazza, 1999; Costa, Miozzo, & Caramazza, 1999; Roelofs, 1998).

On the other hand, the second model of bilingual lexical selection assumes that the lexical selection mechanism is language non-specific in nature. Alternately stated, lexical selection is insensitive to the language in which the speaker intends to express his ideas, and would consider for selection all activated lexical nodes, irrespective of the language to which they belong (De Bot, 1992; Green, 1986, 1998; Finkbeiner, Almeida, Janssen, & Caramazza, 2006; Poulisse & Bongaerts, 1994). Thus, the lexical nodes of both the intended and unintended language enter into lexical competition. According to this model, the target lexical node is selected in the target language by a differential activation in the two lexicons of the bilingual. This differential activation of the lexicon has been explained in two ways. The first assumption is that the activation level of the lexicon of the target language will be higher compared to that of the non-target language (La Heij, 2005; Poulisse & Bongaerts, 1994). This is referred to as the *Differential Activation*. The second assumption is that both the lexicons are activated equally, but the lexicon of the non-target language will be inhibited (De Bot, 1992; Green, 1986, 1998; Poulisse & Bongaerts, 1994) as explained by the Inhibitory Control Model (Green, 1986, 1998). This model proposes that the lexical selection in bilinguals occurs by the inhibition of the lexical nodes of the non-target language with the help of language task schemas that are associated with every lexical node. In the present study, the language non-specific nature of the lexical selection was investigated in Kannada- English bilingual adults with special emphasis on the Inhibitory Control Model (Green, 1986).

1.1 Need for the study

In everyday communication, there are thousands of ideas formed, and hundreds of words expressed. The task of choosing the right word seems to be very simple, yet a highly important job. This task is carried out by a mechanism called lexical selection. There have been several theories and models discussed above which are proposed to explain the lexical selection mechanism and therefore it becomes imperative to conduct research for examining the proposed theories. It is also important to understand whether selection of words is independent of one's language. The studies reported in the literature (De Bot, 1992; Green, 1986, 1998; Costa & Caramazza, 1999; Costa, Miozzo, & Caramazza, 1999; Finkbeiner, Almeida, Janssen, & Caramazza, 2006; Roelofs, 1998; Poulisse & Bongaerts, 1994) do not show consensus on the lexical selection process in bilinguals thus generating a need to explore this area.

The need for such studies in the Indian context is important as the definitions of bilingualism suggested by different authors classically do not include several issues such as ethno-cultural, socio-economic status, literacy, education and vocation. Also, the studies discussed above have been conducted on population who speak English and other non-Indian languages. Although there have been very few attempts to use semantically related and unrelated words to investigate the lexical selection in bilinguals (Costa & Caramazza, 1999; Finkbeiner, Almeida, Janssen, & Caramazza, 2006), research in the area of language non-specific lexical selection in bilinguals is limited in the Indian context (Krishnan & Tiwari, 2010; Shivabasappa, Rajashekhar & Krishnan, 2011). Thus, it is important to address the question- Does the lexical selection mechanism function as language-specific or language non-specific? This issue is explored in Kannada-English bilinguals in the present study.

1.2 Aim of the study

The aim of the study was to investigate the lexical selection mechanism in Kannada-English bilingual adults using a lexical decision task (LDT). The study was designed to examine the language-specific or language non-specific nature of lexical selection in bilingual adults.

CHAPTER II

REVIEW OF LITERATURE

One of the most special abilities of humans is to communicate their ideas with fellow beings using language, be it verbal, manual, or non-verbal. Language is a socially shared code, or conventional system, that represents ideas through the use of arbitrary symbols and rules that govern combinations of these symbols (Owens, 2005). Communication among humans using language systems happens to be the most efficient, and no other form of communication followed by other lower species, can match up to this extent. The process of attaining such a smooth and rapid flow of language for communication is termed as language development.

2.1 Language development

Language development is a dynamic process that begins early in life. There have been several theories and models proposed to explain language acquisition and development. Language acquisition was explained by Skinner (1957) in operant conditioning paradigm using the behaviouristic approach. Chomsky (1957, 1965) proposed a language acquisition device and said that language acquisition is an interaction between the innate linguistic capacities and the linguistic experiences that the child gains as he grows up. Staats (1968, 1971) refuted Chomsky's ideas and suggested the presence of a stimulus-response mechanism which would promote language development. Piaget (1971) believed that early cognitive behaviours lay a foundation for language development. He explained language development through the following five stages of cognitive development, viz., Sensori-motor stage (Birth-2 years); Pre-operational stage (2-7years); Concrete operational stage (7-11years) and

Formal operational stage (11-18+ years). According to Wood (1997), language acquisition takes place in six stages: Pre-linguistic stage (Birth-1year); Holophrase stage (10-13months); Two-word sentence stage (18months onwards); Multiple word sentence stage (2.5 years onwards); Complex grammatical stage (2.5 to 3years); and Adult-like language structure (5-6years).

All these theories explain that language development depends on the child's age, physical state, language exposure, cognitive processing, social interactions and many more factors. The language exposure has an influence on language development in terms of number of languages that the child is exposed to, duration of exposure, and age at which the second language was introduced.

When a child is exposed to more than a single language during the development period, research suggests that the linguistic milestones are no different from a child being raised with a single language. A person exposed to more than one language can be termed a 'bi/multilingual' and a person exposed to a single language, a 'monolingual'. In case of a bilingual child, the pattern of language acquisition may vary. If a child is exposed to more than one language simultaneously before three years of age, then the pattern is simultaneous bi/multilingualism. In such a condition, it is assumed that there are two separate language systems which interact with each other during language production. Cobas and Chan (2001) have found that in simultaneous bilinguals, up to three years of age there will be undifferentiated language system leading to language mixing and blending. By four years and above, each language is differentiated into separate systems.

On the other hand, if a child is exposed to one language for the first three years of life, and then exposed to another language, the pattern of acquisition is sequential bi/multilingualism. In such a condition the second language is acquired with the help of the language system of the first language. Cobas and Chan (2001) have found that in sequential bilinguals, the first language is acquired in the traditional pattern. The second language is acquired in four phases. Initially there is a non-verbal communication during the interaction phase, followed by, mixing the grammatical rules of first language with the second, during the inference phase. This may or may not be followed by a silent period during which neither of the languages is used. The last phase would be code-switching where languages are switched during conversations.

The question that arises next is how is the language processed in a bilingual? And is it different from that of the processing in a monolingual? Several studies conducted in the language processing have indicated that there are differences in the processing of language in bi/multilinguals when compared with monolinguals.

2.2 Language processing in monolinguals

The process of converting thoughts into linguistic expressions has been explained by many researchers. One of the widely accepted models of language processing is the Connectionist Model (Dell & Reich, 1977; Harley, 1984; MacKay, 1982; Stemberger, 1985). According to the Connectionists, language processing involves four interconnected domains: Semantics, Syntax, Morphology and Phonology. The Spreading Activation Theory (Collins & Loftus, 1975) is one of the Connectionist models. According to the Spreading Activation Theory, language is produced with the activation of conceptual representations at the semantic level. Then, by means of the spreading activation principle, the intended lexical node and the semantically related lexical nodes are activated. The interconnections are explained by several models. The spreading activation model is one of the widely accepted models to understand the language processing in monolinguals.

For example, if the target concept is “Chair”, then the lexical nodes such as “Table”, “Wood”, and “Desk” which are semantically related would also be activated. Because of these multiple activations, a lexical selection mechanism is required to ensure the selection of the correct lexical node. Lexical selection is the process of retrieving words from the lexicon that match the speaker's communicative intention (Caramazza, 1997; Dell, 1986; Levelt, 1989, 2001). Once the target lexical node is selected by the lexical selection mechanism, the corresponding morphological and phonological forms are activated. The selected words are then ordered in adherence with the syntax of the language. Finally, the intended thought is expressed linguistically. However, this process seems to be rather straight forward as it includes the processing of a single language. The processing of language in bi/multilingual is more challenging as other languages can interfere in the processing of the intended language.

2.3 Bilingualism and language processing

Bilingualism is a norm in today’s society, and consequently it has been studied extensively. Macnamara (1967) defined a bilingual as an individual possessing one of the language skills (speaking, reading, writing, and listening) and their various complexities even to a minimal degree. Understanding the language processing in the brain of a bilingual is the focus of bilingual research for centuries. And as such there have been several models proposed to explain the language processing in bi/multilinguals.

2.3a Hierarchical models

All the hierarchical models have the common assumption with regard to the bilingual language organisation that there is a general conceptual store which is shared by more than one language, and a lexical level that is particular for each language. Two hierarchical models have been proposed to explain the bilingual language processing.

A. Word association model: This model was proposed by Potter, So, von Eckardt and Feldman (1984). According to the model, the bilinguals' first language has a direct connection with the conceptual store, but the second language is mediated by the lexicon of the first language. Access to the general conceptual store is possible for L2, only if the L2 word is translated into L1. Thus, for a Kannada-English bilingual, the meaning of any English word can be accessed only if the individual is aware of its translation equivalent.

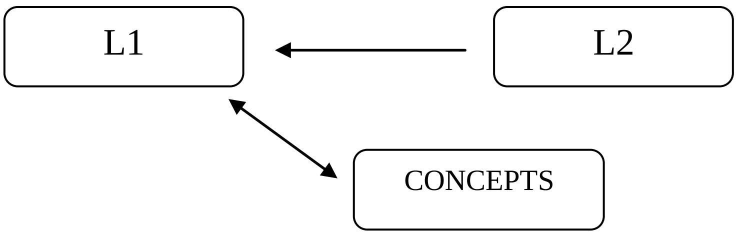

Figure 1. The Word Association Model (Potter et al., 1984).
(Source: Altarriba and Heredia, 2008).

B. Concept mediation model: This model was also proposed by Potter, So, von Eckardt and Feldman (1984). In this model, the assumption was that the two languages of a bilingual have direct access to the conceptual store. Thus, a bilingual can access the meaning of a word in any language without translating it to his first language.

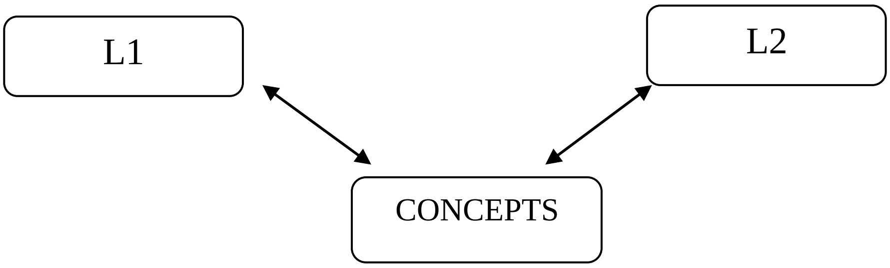

Figure 2. The Concept Mediation Model (Potter et al., 1984).
(Source: Altarriba and Heredia, 2008).

Several research findings indicated that bilinguals translated their L2 to L1 faster than their L1 to L2. This translation asymmetry could not be explained by Word Association or Concept Mediation models. To account for these findings, Kroll and Sholl (1992) and Kroll and Stewart (1994) proposed a revised version in which both the Word association model and Concept mediation model were incorporated into the model.

*C. The Revised hierarchical model***:** This model was proposed by Kroll and Sholl (1992) and Kroll and Stewart (1994). According to this model, lexicons of the bilingual are connected by the directional arrows via lexical links. The lexical link from L2 to L1 is stronger than that from L1 to L2 to explain the L2 learning. This also explains the translation asymmetry of bilinguals. The conceptual store and lexicons are connected via conceptual links. The conceptual link from L1 is stronger than L2 which reflects the fact that the bilinguals are familiar with word meanings in their native language. Although the link from L2 may develop strong connections, Kroll and Stewart (1994) argue that L2 conceptual link is weaker even for bilinguals with high L2 proficiency levels.

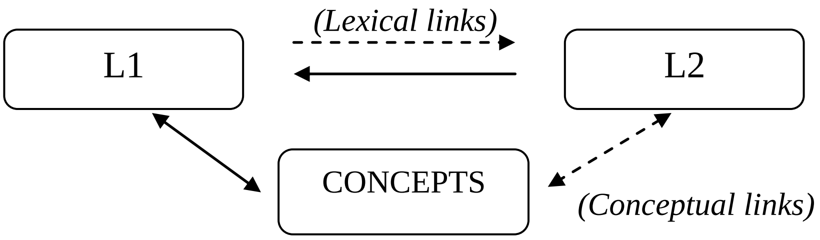

Figure 3. The Revised Hierarchical Model (Kroll & Sholl, 1992; Kroll & Stewart, 1994). (Source: Altarriba and Heredia, 2008).

These hierarchical models explain how languages are processed by having connections with a common conceptual store. The bilingual models of language production assume that there is a common semantic representation for the two languages of a bilingual at the conceptual level (Finkbeiner, Nicol, Nakamura & Greth, 2002; Kroll & Stewart, 1994; Li & Gleitman, 2002). That is, bilinguals have a common semantic system which stores lexical items from both the languages known. However, the representations of the two languages are different at the lexical level. Thus, the question that arises is, does the semantic system activate both the lexicons of a bilingual?

Most models of lexical access assume that the lexical nodes of both languages of a bilingual receive activation from the semantic system (Costa & Santesteban, 2004; Costa, Colome, Gomez & Sebastian-Galles, 2003; Costa, Caramazza, & Sebastian-Galles, 2000; Poulisse, 1999; De Bot, 1992). The evidence for the simultaneous activation of lexicons of bilinguals comes from a study by Colome (2001). Highly proficient Catalan-Spanish bilinguals were included in the study. The task of the participants was to decide whether a pre-designated phoneme was present in the Catalan name of the target picture. The study revealed that longer time was required to reject phonemes belonging to the translation word, supporting the assumption of simultaneous activation of bilinguals' two lexicons.

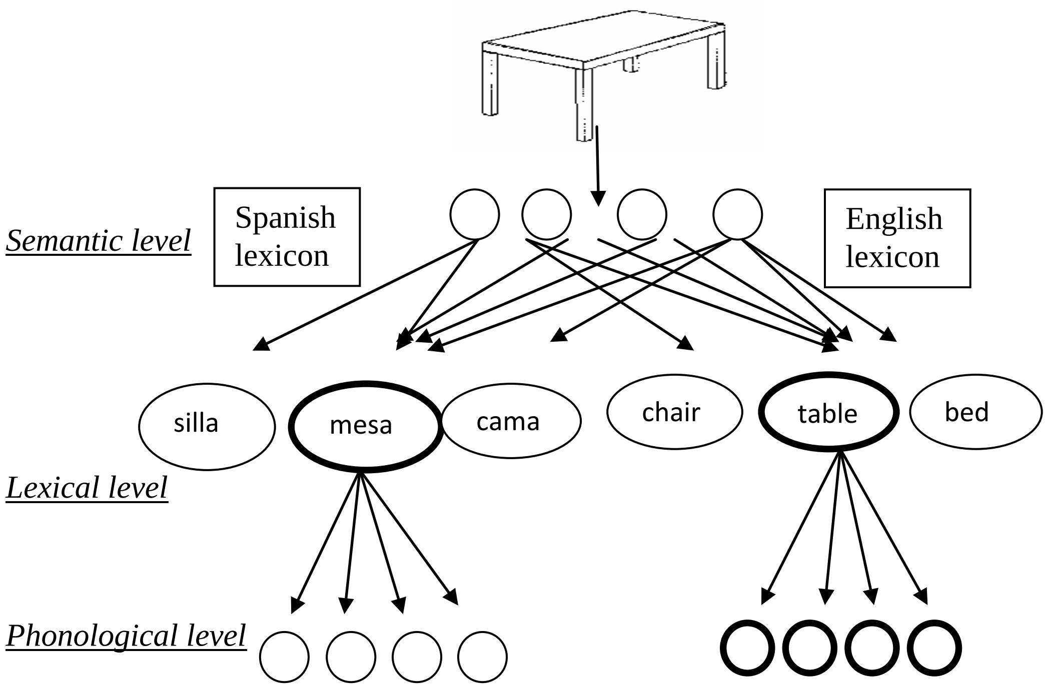

Figure 4. Schematic representation of a bilingual language production system. The arrows represent the flow of activation, and the thickness of the circles indicates the level of activation of the representations. Hence, the activation spreads to the two lexicons of the bilinguals. However, finally only the lexical node "table" is selected. (Source: Costa and Caramazza, 1999).

2.3b Lexical selection in bilinguals

The process of selecting appropriate lexical node from a set of activated, semantically related lexical nodes is termed as lexical selection. A monolingual will have to select the target lexical node by overcoming the competition from the other activated lexical nodes in one language alone. It is clear that the task of lexical selection is more difficult for a bilingual than a monolingual, as the competition in lexical selection will not only be from the activated lexical nodes of the target language but also from the unintended language (Figure 4). The question in this context is, how does the bilingual select a word in the intended language while preventing interference from the non-response language?

There have been two main models reported in the literature to explain these issues. The first model states that the lexical selection mechanism is *language specific* (Costa & Caramazza, 1999; Costa, Miozzo, & Caramazza, 1999; Roelofs, 1998). This model considers the activation-level of words in the intended language alone. According to this idea, lexical intrusions from the non-target language would be prevented. Hence, they would not be able to compete with the target language lexical nodes during lexical access. Consequently, according to this proposal, there would be no competition at all between lexical items of different languages.

Support for this model is based on the results from a bilingual version of the picture-word interference paradigm (Costa et al., 1999). In this study, Catalan-Spanish speaking highly proficient bilinguals were asked to name pictures in Catalan while ignoring printed distracter words in Catalan and Spanish. The main results showed semantic interference and phonological facilitation effects for both Catalan and Spanish distracters. The crucial result supporting a language-specific selection model is the facilitatory identity effect found for both same- and different-language distracters. The authors proposed a language-specific selection model in which the cross-language identity effect is explained. For example, when a distracter activates not only its corresponding lexical representation but also its translation and the distracter is the translation of the target picture name, the latter will receive extra activation from the former. According to Costa et al., (1999), the distracter word (Spanish) can be ignored because it does not have a target language (Catalan) word tag.

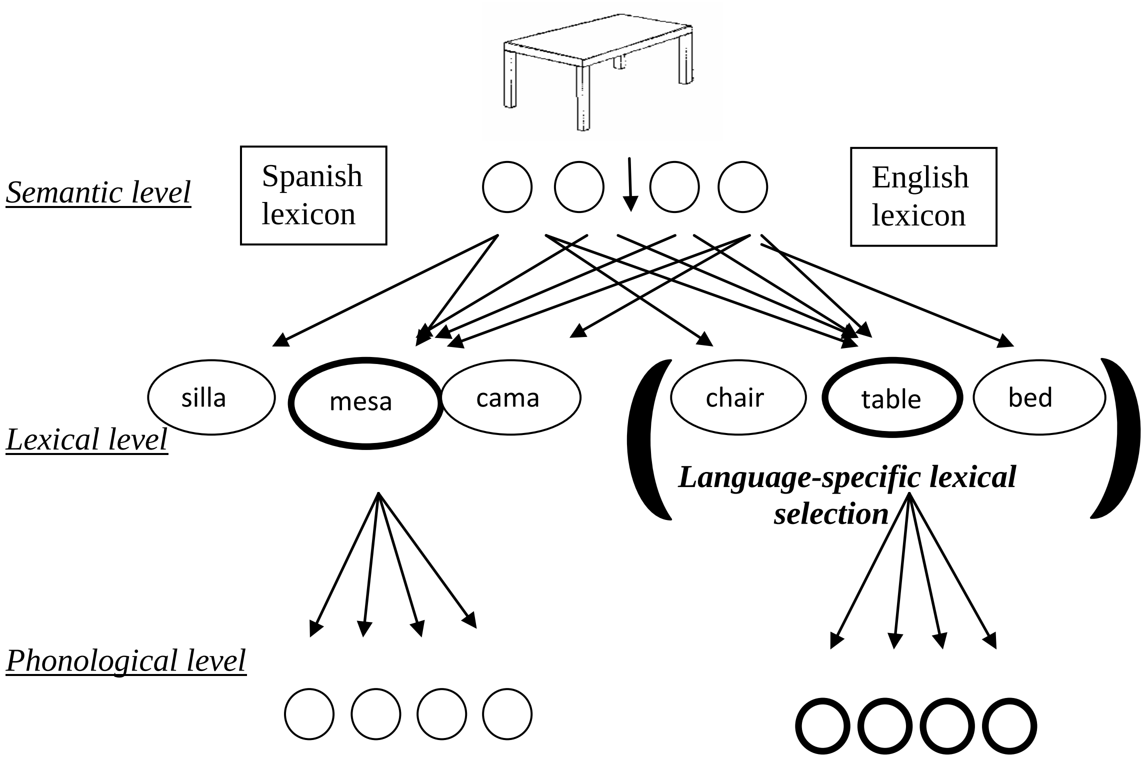

Figure 5. The language-specific selection model (Costa et al., 1999).

(According to this model, the lexical selection mechanism only considers for selection those lexical representations belonging to the response language (L2, English). The lexical nodes of the non-response language (L1, Spanish) are not considered for selection).

(Source: Costa and Caramazza, 1999).

There are several arguments against the *language-specific* view of lexical selection. Costa and Caramazza (2000) refuted this view on the basis of their finding that words which do not belong to the set of permitted responses in an experiment (words that do not possess a tag in Costa's study) did induce semantic interference. The fact that the distracter words in the non-intended language do induce semantic interference, suggests that they are taken into consideration during lexical selection. Although Costa et al., (1999) accounted for this semantic interference effect by assuming that words in the non-intended language induce this effect via their translation equivalents in the intended language, it was not entirely convincing.

Another argument against language-specific lexical selection is that, if this mechanism were to be true, it must have been concluded that the lexical selection mechanism can ignore all words that do not belong to a certain categorization-level tags. Then there would be innumerable tags owing to the innumerable categories of words in the semantic system. This seems to be highly unrealistic. Considering these reasons and many more, most of the current models do not account for the facilitation effects reported by Costa et al., (1999) in support of language-specific lexical selection.

On the other hand, the language *non-specific* lexical selection model assumes that the lexical selection mechanism is insensitive to the language in which the speaker intends to express his ideas. This model proposes that for selection all activated lexical nodes, irrespective of the language to which they belong would be considered (De Bot, 1992; Finkbeiner, Almeida, Janssen, & Caramazza, 2006; Green, 1986, 1998; Poulisse & Bongaerts, 1994). Thus, according to this model, the lexical nodes of both the languages would compete for selection. To explain the successful selection of the proper lexical node (i.e., in the correct language), there have been two assumptions.

A. Differential activation of lexical nodes: According to this assumption, there will be a higher activation level of the lexical nodes in the target language than the lexical nodes of the unintended language. Thus, the correct lexical node is selected because of the higher activation level in that language (La Heij, 2005; Poulisse & Bongaerts, 1994).

B. Equal activation of lexical nodes with an inhibitory mechanism: According to this assumption, there will be an equal amount of activation for target lexical nodes in both the languages. However, there exists an inhibitory mechanism to inhibit the lexical node from the unintended language and select the lexical node from the target language (Finkbeiner, Almeida, Janssen, & Caramazza, 2006; Green, 1998).

The most articulated model assuming that bilingual lexical selection is achieved through language non-specific mechanisms is the Inhibitory Control Model proposed by Green (1986, 1993, & 1998). Based on this model, the control of lexical representation is achieved through the language task schemas. That is, each lexical node is associated with a language tag or schema (such as L1 or L2). These task schemas are claimed to exert control over the bilingual lexicon by inhibiting or activating the lexical nodes based on the language tags they possess. Task schemas also exert control through the suppression of competing task schemas of the non-target language.

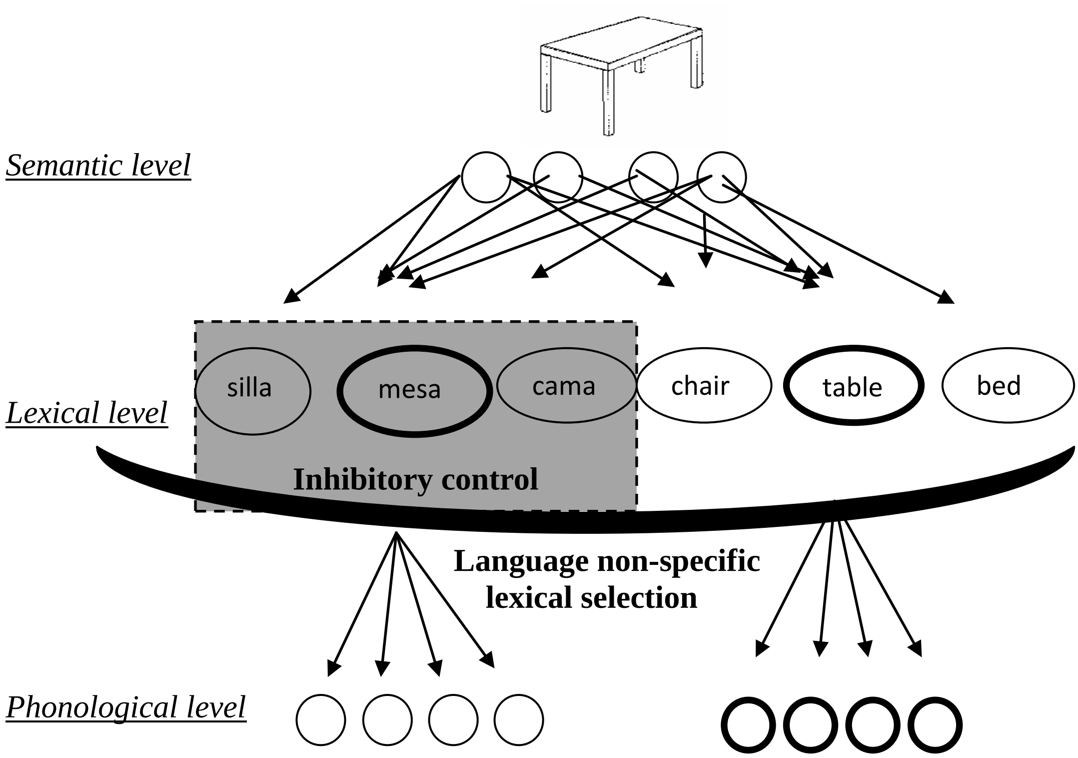

Figure 6. The Language non-specific lexical selection model explained by Green's Inhibitory control model (1998).

[According to this model, lexical nodes of both the languages are initially activated and considered for selection. However, the inhibitory control mechanism inhibits the lexical nodes of the unintended language (L1, Spanish), and thus helps in the selection of the target lexical node 'table' in the target language (L2, English). The shaded area in the box indicates inhibitory control]. (Source: Meuter and Allport, 1999).

An important feature of the ICM is that inhibition is proposed to be reactive in nature. That is, the more non-target lexical representations become activated initially, the stronger those representations are then inhibited. The amount of inhibition applied on one language depends on the proficiency level of the person in that language. That is, while speaking in a dominant language (say, L1) less inhibition is required on L2 due to poorer activation of lexical nodes from non-dominant L2. Also, the ICM suggests that the amount of inhibition applied on a language is equivalent to the time taken to overcome the inhibition in the subsequent production tasks. That is, producing a word from a language that has just been inhibited previously will be relatively difficult because it takes time to overcome the inhibition that was applied (Green, 1998). These features of the ICM have been supported by several studies.

One of the most vital evidences for the lexical selection by inhibitory control hypothesis was provided by Meuter and Allport (1999). In their study, unbalanced bilingual speakers participated in a task of naming a series of digits in their L1, if the background colour was blue, and in L2, if the background colour was red. There were four conditions: switch to L1, switch to L2, non-switch to L1, and non-switch to L2. The results revealed that naming latencies for switching conditions were higher than non-switch conditions. More importantly, switching from L2 to L1 took a longer time than from L1 to L2. This asymmetrical switching cost in bilinguals is found to be a characteristic feature in most of the studies on language non-specific lexical selection by inhibitory control.

The asymmetrical switching cost was explained by Meuter and Allport (1999) by reasoning that the amount of inhibition applied to L1 while speaking L2 should be greater than the reverse i.e., L2 to L1. That is, the time taken to overcome the inhibition applied over L1 is responsible for the delay in switching from L2 to L1. However, since the L2 lexicon is not strongly inhibited, overcoming the inhibition over L2 is easier and takes lesser time during switching from L1 to L2. Meuter and Allport (1999) also hypothesized that the differences in the L2-L1 proficiency levels could contribute to the asymmetrical switching cost. A high L2 proficiency could result in a smaller switching cost. Thus they suggested that amount of inhibition applied over both the languages will be similar as there would be minimal differences in the proficiency between the two. However, the main limitation of this study is that it is based on the data from low-proficient unbalanced bilinguals. Also, Finkbeiner, Almeida, Janssen, and Caramazza (2006) have argued with Meuter and Allport's views by suggesting that asymmetrical switching cost does not necessarily indicate language inhibition. The nature of the stimuli (concrete versus abstract words as stimuli) also plays an important role in lexical selection. This is explained by the dual coding theory (Paivio, 1986).

According to the dual coding theory, both visual and verbal information is used to represent information (Sternberg, 2003). It postulates that there are two types of semantic systems involved in the processing of words. The processing of concrete words takes place by the verbal 'linguist' semantic system and non-verbal 'imagistic' semantic system whereas abstract words are processed only by non-verbal 'imagistic' system. This theory was supported by Jessen, Heun, Erb, Granath, Klose, Papassotiropoulos and Grodd (2000) who found that concrete nouns are processed faster and more accurately than abstract nouns in various cognitive tasks. The theories and studies discussed above indicate that there is no consensus in findings either on the lexical selection mechanism by bilinguals or on the nature of the stimuli employed for the study. The findings are intriguing to explore the lexical selection mechanism more extensively to understand the distinctive and processes for either language specific or language non-specific nature of lexical selection.

2.4 Studies in the Indian context

The evidence for the Inhibitory Control- Based model for lexical selection in Malayalam- English bilinguals was provided by Krishnan and Tiwari (2010). They investigated the lexical selection mechanism in Malayalam- English bilinguals using a semantic relatedness paradigm. Semantically related monolingual and cross-lingual stimuli were judged faster than their semantically unrelated counterparts indicating the language non-specific nature of lexical selection highlighting the inhibitory control of the non-target language in bilingual lexical selection.

In another study, Shivabasappa, Rajashekhar and Krishnan (2011) adopted a phoneme monitoring task to assess lexical selection in Kannada- English bilinguals. The results revealed that the rejection of phonemes in the non-target language picture names required more time supporting the language non-specific view of bilingual lexical selection.

2.5 Summary of the review

The process of communication encompasses several stages such as concept formation, framing a lexical concept, lexical selection, morphological encoding, phonological encoding, phonetic encoding and articulation. The stage of lexical selection is very complex owing to the ever increasing vocabulary in one's lexicon. Lexical selection involves choosing the correct word in the correct language that one intends to speak in. To explain this phenomenon, there are two main models proposed. The language-specific model explains that only the lexical nodes of the target language are activated during lexical selection, and there will be no competition from the lexical nodes of the non-target language. However, the study by Costa et al., (1999) revealing that cross-linguistic distracter words created a facilitatory effect in naming tasks was not persuasive enough to support the language-specific model.

The language non-specific lexical selection model, on the other hand, believes that the lexical nodes of both the languages are activated, and compete for lexical selection. The selection of the target lexical node according to the language non-specific model occurs in two ways. One is by differential activation of lexical nodes so that the nodes that are activated stronger get selected. Another is by equal activation of lexical nodes in both the languages. Here, the lexical nodes of the non-target language get inhibited by the presence of an inhibitory mechanism using language task schemas. The study by Meuter and Allport (1999) provided strong evidence to the Inhibitory Control Model (ICM) initially proposed by Green (1998). Although the asymmetrical switching cost was believed to explain the ICM, it was later questioned by Finkbeiner, Almeida, Janssen, & Caramazza (2006).

Considering the mixed results from several studies, it is yet to be understood whether the lexical selection mechanism is language-specific or language non-specific in nature. If it is language non-specific, it is important to investigate if the selection of lexical nodes happens by the inhibitory control mechanism or by the differential activation. Thus the review of literature indicates that although there have been studies conducted in the several languages to investigate the lexical selection mechanism, it is still not conclusive. Thus there is a need to conduct studies to provide more corroborative evidence for understanding the lexical selection mechanism, and more specifically in Indian languages.

2.6 Working Hypotheses

Considering the review of literature, the study was proposed with a positive hypothesis that there would be a language non-specific lexical selection in bilingual adults. The hypothesis was explored by using the mean reaction time for the task of semantic relatedness. In order to explore this, the study considered reaction time as a measure and proposed that, a faster reaction time in-

A. Semantically related condition than the semantically unrelated condition in cross-lingual pairs, may indicate the language-nonspecific nature of lexical selection.
B. Monolingual semantically related pairs than the cross-lingual semantically related pairs, may indicate differential activation of lexical items from the two languages with an advantage of monolingual items.
C. Monolingual semantically unrelated pairs than the semantically unrelated pairs in cross-linguistic conditions, may indicate non-semantic-based lexical selection mechanism.
D. Concrete pairs than abstract pairs in cross-linguistic conditions may further support the language non-specific lexical selection in bilingual adults.

CHAPTER III

METHOD

During the process of communication, choosing the right word from one's lexicon is important. The process of selection of a word amidst all the activated words refers to as lexical selection. Literature indicates two schools of thought regarding lexical selection mechanism. One views lexical selection to be language-specific, while the other believes that lexical selection is independent of language. In order to investigate the lexical selection mechanism in Kannada-English bilingual adults, the present study was conducted by employing a single group research design.

3.1 Aim of the study

The aim of the study was to investigate the lexical selection mechanism in Kannada-English bilingual adults using a lexical decision task (LDT). The study was designed to examine the language-specific or language non-specific nature of lexical selection in bilingual adults.

3.2 Working Hypotheses

The study was proposed with a positive hypothesis that there would be a language non-specific lexical selection in bilingual adults. The hypothesis was explored by using the mean reaction time for the task of semantic relatedness. In order to explore this, the study considered reaction time as a measure and proposed that, a faster reaction time in-

A. Semantically related condition than the semantically unrelated condition in cross-lingual pairs, may indicate the language-nonspecific nature of lexical selection.

B. Monolingual semantically related pairs than the cross-lingual semantically related pairs, may indicate differential activation of lexical items from the two languages with an advantage of monolingual items.

C. Monolingual semantically unrelated pairs than the semantically unrelated pairs in cross-linguistic conditions, may indicate non-semantic-based lexical selection mechanism.

D. Concrete pairs than abstract pairs in cross-linguistic conditions may further support the language non-specific lexical selection in bilingual adults.

The study was conducted in two phases.

Phase I: Selection of stimuli

Phase II: Administration of the stimuli

3.3 Phase I: Selection of stimuli

A list of semantically related (SR) and semantically unrelated (SUR) noun pairs was selected from the stimuli prepared by Johnson and Prema (2005) and Sebastian and Prema (2005). Also, abstract and concrete noun pairs in Kannada and English were selected from a research project report by Prema (2011). The selected stimuli were based on the linguistic background of the participants. Ten Kannada-English bilingual speech language pathologists rated semantic relatedness of all the noun pairs on a nominal scale of 1 to 3, (1-Highly unrelated, 2-Partially related, 3-Highly related) and also rated the abstractness/concreteness of each pair on a scale of 1 to 3 (1- Highly concrete, 2-Partially concrete/abstract, 3-Highly abstract).

The following operational definitions were used for rating the stimuli.

Semantically related versus semantically unrelated word pairs: Semantically related words refer to the words which are meaningful in nature and are also associated with each other based on one or more of the following features: a) Same semantic field (E.g.- *Cat- dog*) b) Common properties (e.g.- *wood- tree*) c) Antonym (e.g.- *happy-sad*) and d) Meronym (e.g.- *tyre- car*).

Semantically unrelated words refer to words which are meaningful in nature, but do not belong to the same semantic field, or share common properties, or are not associated with each other in any manner. For Example: *Book and Farmer.*

The rating of semantic relatedness of word pairs is based on a 3-point scale:

1- *Highly related refers to* words which can be easily associated with each other based on one or more features. For example – Book and pen are closely related to each other.

2- *Partially related refers to* words which have some common properties which are not easily noticeable. For example- Book and blackboard- are partially related.

3- *Highly unrelated refers to* words which are not associated with each other based on any feature. For example- Apple and Shoes- are not at all related to each other.

Abstract versus Concrete words pairs: Abstract words refer to words which have no physical referents, and which are used to refer to concepts such as ideas and emotions rather than concrete or physical reality. For example: Anger, happiness and dream.

Concrete words refer to persons, places and objects that are available to the senses. For example: Finger, Soap, Shirt and Watch.

The rating of concreteness of word pairs is based on a 3-point scale:

1- Highly concrete refers to words which are readily available to the senses. (e.g.- dog and mat)

2- Partially concrete refers to words which may be available to the senses, yet depict an abstract notion. (e.g.- light, which could mean the sunlight and the feeling, light-headedness)

3- Highly abstract refers to words which do not have any physical referent, and depict a nonfigurative meaning. (e.g.- heavy and laugh)

On semantic relatedness rating, the noun pairs which were rated 1 were selected as SUR pairs and those which were rated 3 were selected as SR pairs. On concreteness/abstractness rating, those pairs which were rated 3 were selected as abstract pairs and those which were rated 1 were selected as concrete pairs. The selection of stimuli as SR, SUR and also concrete and abstract were based on a cut-off score of 90% of the ratings by the Speech language pathologists.

Finally two sets of stimuli were obtained- concrete and abstract. Under each, 10 Kannada – Kannada semantically related pairs, 10 English - English semantically related pairs, 10 Kannada-English semantically related pairs, 10 English-Kannada semantically related pairs, 10 Kannada – Kannada semantically unrelated pairs, 10 English – English semantically unrelated pairs, 10 Kannada – English semantically unrelated pairs, and 10 English-Kannada semantically unrelated pairs were selected. The details of the distribution of stimuli across languages, semantic relatedness and concreteness are depicted in Table 1. Each noun pair that was selected had a rating of above 90% in terms of semantic relatedness and abstractness as rated by the Speech Language Pathologists. The final lists of stimuli are depicted in Appendix IA, IB, IC and ID.

Table1
Details of the concrete and abstract stimuli in Kannada and English

Sl. No.		CONCRETE (N=10)	ABSTRACT (N=10)
1.	SR	K-K	K-K
2.		E-E	E-E
3.		K-E	K-E
4.		E-K	E-K
5.	SUR	K-K	K-K
6.		E-E	E-E
7.		K-E	K-E
8.		E-K	E-K
Sub Total of stimuli		80	80
Total stimuli		160	

**- SR- Semantically Related; SUR- Semantically Unrelated; K-L1- Kannada; E-L2- English.*

The selection of these stimuli was based on the assumption that semantically relatedness task taps the lexical selection mechanism.

3.3a Programming the stimuli with DMDX software

The final set of stimuli (Appendix IA, IB, IC and ID) was programmed in the DMDX software which was developed by Jonathan Foster and Kenneth Forster (2003) in the Department of Psychology at the University of Arizona. This software is used to control the presentation and timing of the stimuli, and also to measure the accuracy and response time. All the 160 stimuli were fed into the software. A black dot was programmed to be presented for 1000ms before every pair of stimuli to indicate the stimulus onset. The prime word was programmed to be presented for 750 milliseconds, followed by a blank screen for 250 milliseconds, and followed by the target word. Since this procedure included semantic relatedness judgment task, the strategic priming phenomenon was used as the Stimulus Onset Asynchrony (SOA) (which is calculated from the onset of prime till the onset of the target word) is 1000 milliseconds (750 + 250). The target word was programmed to be presented for a total duration of 4000 milliseconds, which included the response time. The right and left in-built mouse buttons were programmed to be the response keys. The inter-stimulus interval was programmed to be 1000 milliseconds during which the black dot was presented to signal the onset of the next stimulus. An example of the programmed semantically related concrete noun pair of stimuli is depicted in Table 2.

Table 2
An example of the programmed semantically related concrete pair of stimuli

Parameter	**Black Dot** ●	**Prime word SUN**	**Blank screen**	**Target word MOON**
Time (ms)	1000	750	250	4000

3.4 Phase II: Administration of stimuli

Participants: 30 neurotypical adult bilinguals (Kannada as L1 & English as L2) in the age range of 18 to 30 years participated in the study. The purpose and procedure of the study were explained to the selected participants, and a formal ethical consent was obtained from them.

3.4a Inclusionary criteria

- All the participants were native speakers of Kannada language and had acquired Kannada (L1) for both academic and communicative purposes.
- All the participants had acquired English as their second language (L2) for both academic and communicative purposes.
- Participants with present/ past history of neurological, psychological and/or sensory deficits were not included.
- Participants who were proficient in L1 and L2 were selected. The proficiency of each participant was assessed using Language Efficiency and Proficiency

Questionnaire (LEAP-Q) - An adaptation in Indian context (Maitreyee & Goswami, 2009).

As depicted in Table 3, all the participants were rated to have 'native-like' proficiency in L1 and 'good' proficiency in L2. Thus, the participants were not equally proficient in both the languages. Also, most of the participants were Undergraduate students pursuing courses in Speech and Hearing discipline.

Table 3
Details of the participants

Sl. no	AGE	SEX	Age of acquisition of L1	Age of acquisition of L2	Years of formal education	Proficiency in L1	Proficiency in L2
1.	23	M	0	3	19	Native-like	Good
2.	26	F	0	3	22	Native-like	Good
3.	23	F	0	3.5	19	Native-like	Good
4.	23	F	0	4	19	Native-like	Good
5.	23	F	0	4	19	Native-like	Good
6.	23	F	0	4	19	Native-like	Good
7.	22	M	0	3	18	Native-like	Good
8.	23	M	0	4.5	19	Native-like	Good
9.	20	F	0	3.5	16	Native-like	Good
10.	18	M	0	4	14	Native-like	Good
11.	18	F	0	3	14	Native-like	Good
12.	18	F	0	3	14	Native-like	Good
13.	18	F	0	3.5	14	Native-like	Good
14.	18	F	0	3	14	Native-like	Good
15.	19	F	0	3.5	15	Native-like	Good
16.	19	F	0	3	15	Native-like	Good
17.	20	F	0	3	16	Native-like	Good
18.	21	M	0	3.5	17	Native-like	Good
19.	22	F	0	3	18	Native-like	Good
20.	20	F	0	3.5	16	Native-like	Good
21.	18	F	0	4	14	Native-like	Good
22.	23	F	0	4	19	Native-like	Good
23.	18	F	0	3	14	Native-like	Good
24.	18	F	0	3.5	14	Native-like	Good
25.	18	M	0	4	14	Native-like	Good
26.	18	F	0	3.5	14	Native-like	Good
27.	19	F	0	3.5	14	Native-like	Good
28.	18	F	0	3.5	14	Native-like	Good
29.	18	F	0	4	14	Native-like	Good
30.	20	F	0	3	14	Native-like	Good

3.5 Procedure

The presentation of the stimuli and response measurement was controlled using DMDX software program for Windows (Forster & Forster, 2003). The experiment was carried out by presenting the stimuli through the DMDX software in a personal computer. The participants were seated comfortably and were instructed to click the ‘Right’ button on the in-built mouse pad of the laptop, if the word pair is related, and to click the ‘Left’ key if the word pair is unrelated. Pressing of buttons on the in-built mouse is taken up to eliminate the time lag to reach the key after every trial. Before the commencement of the experiment, every participant was given a set of five trial items for practice and familiarization. The experiment began with a display of a dot at the centre of the screen for 1000 milliseconds to signal the presentation of the stimuli. The prime word (first word of the SR/SUR pair) was presented for 750 milliseconds, followed by a blank screen for 250 milliseconds. The target word (the second word of the SR/SUR pair) was displayed on the centre of the screen for 2000 milliseconds (approximate scanning time for persons with Aphasia, Swinney & Taylor, 1975). The participants were asked to click the appropriate keys on the mouse pad (‘Right’ or ‘Left’) as soon as the stimuli were displayed until 4000 milliseconds. A response time of 2000 milliseconds was given. The inter-stimuli interval was 1000 milliseconds during which the dot was displayed at the centre of the screen. The accuracy and reaction time were measured for every pair of stimulus.

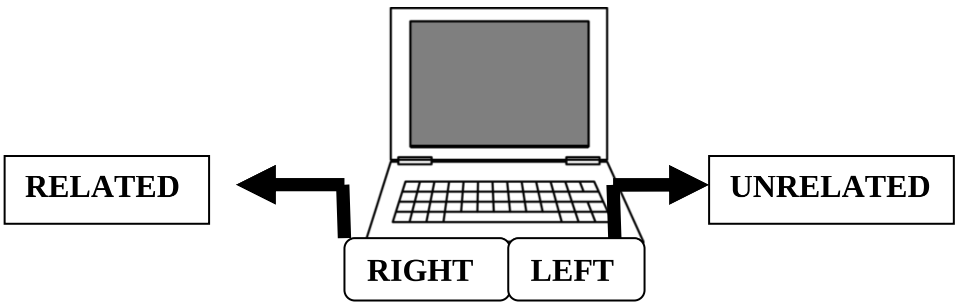

Figure 7. Representation of the experimental procedure.

3.6 Statistical analysis

The data collected was recorded and analyzed statistically using SPSS 17.0 software. The Mean (M) and Standard Deviation (S.D) of the reaction time for semantic relatedness tasks were obtained. Parametric tests were used to obtain the significant difference between the measures. Two-way Repeated Measure ANOVA was used to determine if there was any statistically significant difference in the mean reaction time across SR and SUR stimuli in monolingual and cross-lingual conditions, and abstract and concrete stimuli in cross-lingual conditions. Bonferroni's test was carried out to analyze the main effect of monolingual and cross-lingual conditions across different linguistic pairs. Further, Paired t-test was used to determine any statistically significant difference across paired comparisons of data. The results of the study are explained in Chapter IV.

CHAPTER IV

RESULTS AND DISCUSSION

The aim of the study was to investigate the lexical selection mechanism in Kannada-English bilingual adults using a lexical decision task (LDT). The study was designed to examine the language-specific or language non-specific nature of lexical selection in bilingual adults.

A total of 30 neurotypical adult bilinguals (Kannada as L1 & English as L2) in the age range of 18 to 30 years served as participants in the current study. The study was proposed with a positive hypothesis that there would be a language non-specific lexical selection in bilingual adults. The hypothesis was explored by using the mean reaction time as a measure for the task of semantic relatedness. The study proposed that a faster reaction time for:

A. Semantically related condition than the semantically unrelated condition in cross-linguistic pairs, may indicate the language-nonspecific nature of lexical selection.
B. Monolingual semantically related pairs than the cross-lingual semantically related pairs, may indicate differential activation of lexical items from the two languages with an advantage of monolingual items.
C. Monolingual semantically unrelated pairs than the semantically unrelated pairs in cross-linguistic conditions, may indicate non-semantic-based lexical selection mechanism.
D. Concrete pairs than abstract pairs in cross-linguistic conditions may further support the language non-specific lexical selection in bilingual adults.

The data obtained on LDT was coded, analyzed and subjected to descriptive statistical analysis. Mean and SD scores for Reaction Time (RT) for semantically related (SR), semantically unrelated (SUR) in monolingual and cross-lingual pairs were obtained and analyzed using SPSS 17.0 software. Table 4 and Graph 1 show the details of Mean and SD scores for monolingual and cross-lingual pairs in SR and SUR conditions.

Table 4
Overall Mean and SD scores for semantically related and unrelated monolingual and cross-lingual pairs

PAIRS	Mean (N=30)	Std. Deviation
L1-L1SR	936.84	252.45
L2-L2SR	852.38	226.53
L1-L2SR	965.38	238.19
L2-L1SR	1105.54	301.46
L1-L1SUR	1280.86	402.23
L2-L2SUR	1228.32	385.63
L1-L2SUR	1130.54	339.35
L2-L1SUR	1273.25	382.88

*- *L1: Kannada; L2- English; SR- Semantically Related; SUR- Semantically Unrelated.*

Table 4 and Figure 8 indicate that the mean reaction time is lesser for pairs in SR condition than SUR condition. The mean reaction time is the least for L2-L2SR (852.38, SD=226.53), followed by L1-L1SR (936.84, SD=252.45), L1-L2SR (965.38, SD=238.19), L2-L1SR (1105.54, SD=301.46), L1-L2SUR (1130.54, SD=339.35), L2-L2SUR (1228.32, SD=385.63), and L2-L1SUR (1273.25, SD=382.88). The mean reaction time was highest for L1-L1 pairs in SUR condition (1280.86, SD=402.23). These mean scores were further analyzed to examine the proposed hypothesis.

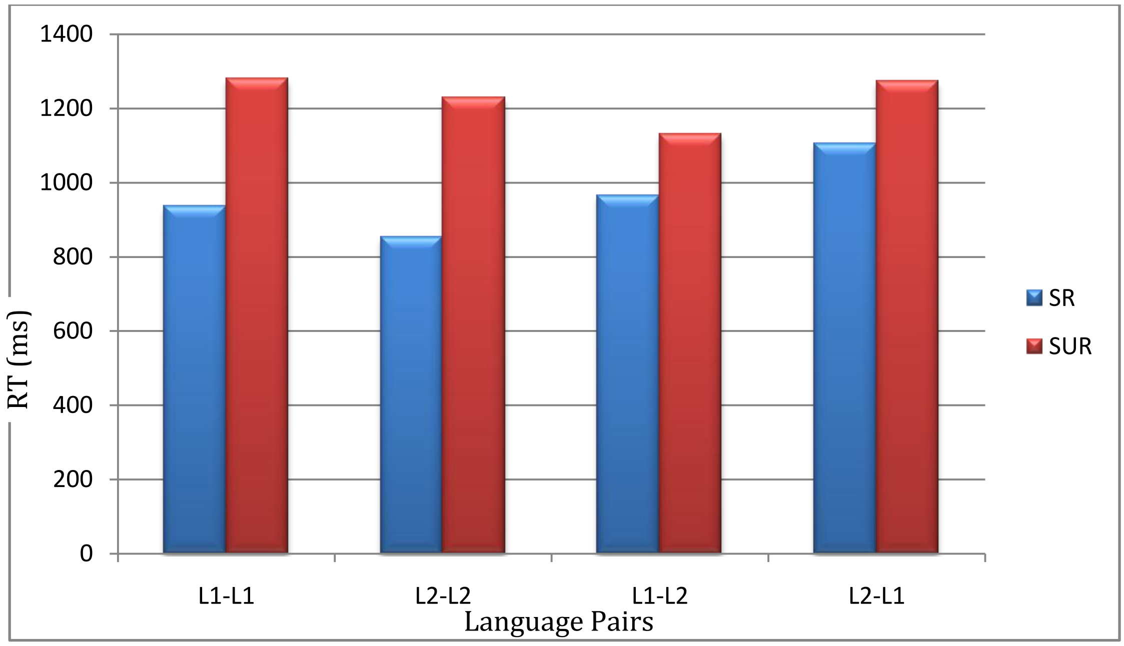

Figure 8. Overall Mean and SD scores for monolingual and cross-lingual pairs semantically related (SR) and unrelated (SUR) conditions.

4.1 Comparative analysis for language non-specific lexical selection

To investigate the lexical selection mechanism, the data was analyzed under four phases.

Phase I: Analysis of RT in cross-lingual pairs of stimuli in SR and SUR conditions

The first assumption of the working hypothesis was that there would be a faster reaction time in semantically related than unrelated conditions for cross-lingual pairs of stimuli. To investigate this assumption, the mean reaction time for L1-L2 and L2-L1 pairs in semantically related and semantically unrelated conditions was subjected to two-way repeated measure ANOVA and Paired-t-test. The scores were compared across the two cross-lingual pairs in SR and SUR conditions to examine the language non-specific nature of lexical selection. The mean reaction time for cross-lingual pairs in SR and SUR conditions has been illustrated in Table 5 and Figure 9.

Table 5

Mean and Standard Deviation scores of reaction time for cross-lingual pairs in semantically related and unrelated conditions

Pairs	Mean (N=30)	Std. Deviation
L1-L2SR	965.38	238.19
L2-L1SR	1105.54	301.46
L1-L2SUR	1130.54	339.35
L2-L1SUR	1273.25	382.88

**- L1: Kannada; L2- English; SR- Semantically Related; SUR- Semantically Unrelated.*

From Table 5 and Figure 9, the mean reaction time was found to be the fastest for L1-L2SR (965.38, SD=238.19), followed by L2-L1SR (1105.54, SD=301.46), and L1-L2SUR (1130.54, SD=339.35). The slowest reaction time was observed for L2-L1SUR (1273.25, SD=382.88). Two observations that can be made from Table 5 and Figure 9 is that RT is faster in SR than SUR condition, and the RT is faster for L1-L2 pair than L2-L1 pair.

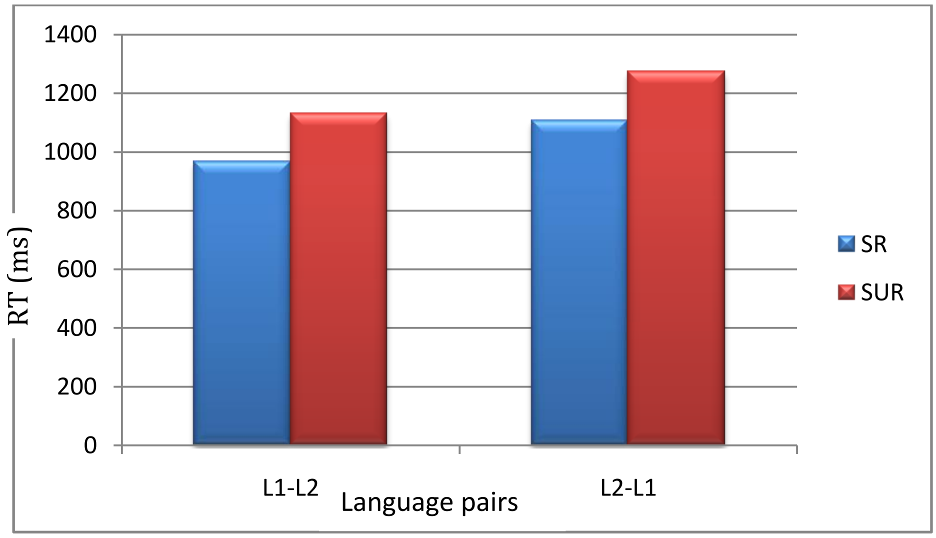

Figure 9. The mean reaction time for cross-lingual pairs in semantically related (SR) and semantically unrelated (SUR) conditions.

From Table 5 and Figure 9, the mean RT showed a difference between SR and SUR conditions. To determine if, this difference in RT between SR and SUR conditions was statistically significant, the data was further subjected to Two-way Repeated Measure ANOVA. The results of the Two-way Repeated Measure ANOVA revealed a statistically significant difference in RT between SR and SUR conditions at [F= (3, 87) =18.95, $p<0.05$].

Although the results from Two-way Repeated Measure ANOVA showed a statistically significant difference between the RT in SR and SUR conditions, it is important to examine whether language has any effect on the task of semantic relatedness. Thus, the data was further analyzed using Bonferroni's test to determine the effect of L1 and L2 on SR and SUR conditions. The results of this test revealed that there was a statistically significant difference in the reaction times between the L1 and L2 pairs in both SR and SUR conditions.

The results from the Bonferroni's test indicated that there was a significant effect of language on the task of semantic relatedness by the statistically significant difference in RT between the cross-lingual pairs. Further, to determine which pairs of cross-lingual stimuli demonstrated a statistically significant difference, Paired t-test was carried out. The t-values and level of significance obtained from the Paired t-test are depicted in Table 6. The results of the Paired t-test as depicted in the Table 6 which indicates a significant difference ($p<0.05$) across the following pairs- L1-L2SR vs. L1-L2SUR; L2-L1SR vs. L2-L1SUR.

Table 6
Pair-wise comparisons, t-values and level of significance of Paired t-test for SR and SUR conditions

Pairs	t-value	Level of significance (2-tailed)
L1-L2SR - L1-L2SUR	-6.380	0.00
L2-L1SR - L2-L1SUR	-5.521	0.00

*- *L1: Kannada; L2- English; SR- Semantically Related; SUR- Semantically Unrelated.*

Consequently, the findings from the Paired t-test suggest that the faster reaction time in SR than SUR condition for both the cross-lingual pairs (L1-L2 and L2-L1) is statistically significant. Hence, based on the above findings, the first assumption of the working hypothesis i.e., there would be a faster reaction time in semantically related condition than the semantically unrelated condition for cross-lingual pairs is accepted.

Tasks which measure reaction time assess the speed of performance of participants, but do not reflect on the accuracy of the performance. Thus the accuracy of responses in the task of semantic relatedness for SR and SUR conditions was also calculated. The results revealed that the percentage of accuracy varied from 98.4 to 89.4. The details of the same have been depicted in Table 7.

Table 7
Percentage of accuracy and error in responses for cross-lingual pairs in SR and SUR conditions

Pairs	Accuracy in percentage (%)	Error in percentage (%)
L1-L2SR	97.5	2.5
L2-L1SR	91.0	9.0
L1-L2SUR	98.4	1.6
L2-L1SUR	89.4	10.6

**- L1: Kannada; L2- English; SR- Semantically Related; SUR- Semantically Unrelated.*

It can be observed from Table 7 that the accuracy percentage was highest for L1-L2SUR (98.4), followed by L1-L2SR (97.5), L2-L1SR (91.0), and the least was found in L2-L1SUR (89.4). Thus, the results from statistical measures reveal that there is a faster reaction time in semantically related conditions than semantically unrelated condition for both L1-L2 and L2-L1 pairs. However, during the accuracy measurement it was observed that accuracy percentage was higher for L1-L2 pair in both semantically related and unrelated conditions. On the other hand, a relatively lower percentage of accuracy was observed for L2-L1 pair in both semantically related and unrelated conditions. The supporting research evidence for the above findings is being illustrated below.

Shorter reaction time for semantically related pairs of stimuli than the unrelated pairs can be attributed to semantic priming. Therefore, when a target item is presented, semantic priming facilitates the activation of semantically related counterparts. This occurs not only in monolingual pairs but also in cross-lingual pairs, as observed in the present study. That is, a target item (such as /kalU/**)** in one language (L1) activates semantically related items of not only L1 (such as /kaI/ and /bɛra!U/) but also L2 (such as /lɛg/ and /hænd/). Thus, the conceptual accessibility of such semantically related items in both the languages becomes easier, leading to shorter reaction times in lexical decision tasks. This indicates that the lexical selection mechanism is probably governed by the concept and not just language non-specific in proficient bilingual adults (Kannada-English bilinguals in this particular study).

The first assumption receives support from a study by Krishnan and Tiwari (2010) where they reported faster reaction time for semantically related word pairs compared to semantically unrelated words. The results of their study stated that language non-specific nature of lexical selection occurs in Malayalam- English bilinguals. Similar reports have also been documented by Shivabasappa, Rajashekhar and Krishnan (2011) where phoneme monitoring task was used to assess lexical selection in Kannada- English bilinguals. The results of their study also provided evidence for language non-specific lexical selection.

However, there have been reports in the literature which stated otherwise. Costa et al., (1999) conducted a study in Catalan-Spanish bilinguals and reported language-specific lexical selection with contradictory views presented by many other researchers (De Bot, 1992; Finkbeiner, Almeida, Janssen, & Caramazza, 2006; Green, 1986, 1998; Poulisse & Bongaerts, 1994). Thus the results of the present study support the above view for language non-specific lexical selection in bilingual adults.

Faster reaction time and higher accuracy percentage for L1-L2 pairs in both SR and SUR conditions observed in the study is explained on the basis of the Inhibitory Control Model (ICM, Green, 1988; 1998). According to ICM, lexical nodes of the non-target language are inhibited. The amount of inhibition depends on the proficiency of the non-target language. That is, greater inhibition is required for a more proficient language compared to a less proficient language. Thus, faster reaction time and higher accuracy for L1-L2 pairs can be attributed to lesser inhibition applied over L2 (less proficient language).

Also, slower reaction time and lesser accuracy percentage for L2-L1 pairs in both SR and SUR conditions is also explained by the ICM (Green, 1986, 1998). When a word in L2 is presented, L1 (more proficient language) lexicon will be strongly inhibited. If this is followed by a word in L1, then it requires a relatively longer time to overcome the stronger inhibition applied over L1. Thus, slower reaction time and lesser accuracy for L2-L1 pairs can be attributed to the stronger inhibition applied over L1 (more proficient language).

The results of the present study are in accordance with the report stated by Meuter and Allport (1999), where they explained asymmetrical switching cost in bilinguals. They reasoned that the amount of inhibition applied to L1 while speaking L2 should be greater than the reverse for asymmetrical switching cost. The findings from Phase I analysis, also suggests that amount of inhibition applied over L1 is greater than L2, which explains the better performance (higher accuracy and faster RT) in L1-L2 pairs than L2-L1 pairs.

Following is the summary of the results of Phase I.

A. A faster reaction time was observed in SR conditions than SUR conditions for cross-lingual pairs. This indicates language non-specific lexical selection in Kannada –English bilingual adults.

B. Also, faster reaction time and higher accuracy percentage was observed for L1-L2 pairs than L2-L1 pairs in both SR and SUR conditions. This indicates the action of the inhibitory control mechanism during lexical selection in Kannada- English bilingual adults.

Phase II: Analysis of RT in monolingual versus cross-lingual pairs of stimuli in semantically related conditions

In order to examine the second assumption of the working hypothesis i.e., there would be a faster reaction time for monolingual than the cross-lingual pairs in semantically related conditions, the data was subjected to two-way repeated measure ANOVA and Paired t-test. The mean reaction time for monolingual and cross-lingual pairs in semantically related conditions is illustrated in Table 8 and Figure 10.

Table 8
Mean and SD scores of reaction time for monolingual and cross-lingual pairs in semantically related conditions

Pairs	Mean (N=30)	Std. Deviation
L1-L1SR	963.84	252.45
L2-L2SR	852.38	226.53
L1-L2SR	965.38	238.19
L2-L1SR	1105.53	301.46

**- L1- Kannada; L2- English; SR- Semantically Related*

Table 8 and Figure 10 clearly show that, the mean reaction time was found to be the fastest for L2-L2SR (852.38, SD=226.53), followed by L1-L1SR (963.84, SD=252.45), and L1-L2SR (965.38, SD=238.19). The slowest reaction time was observed for L2-L1SR (1105.53, SD=301.46). Two observations that can to be made from Table 8 and Figure 10 are that there is a faster RT for monolingual pairs than cross-lingual pairs, and L2-L1SR had the slowest reaction time among the pairs.

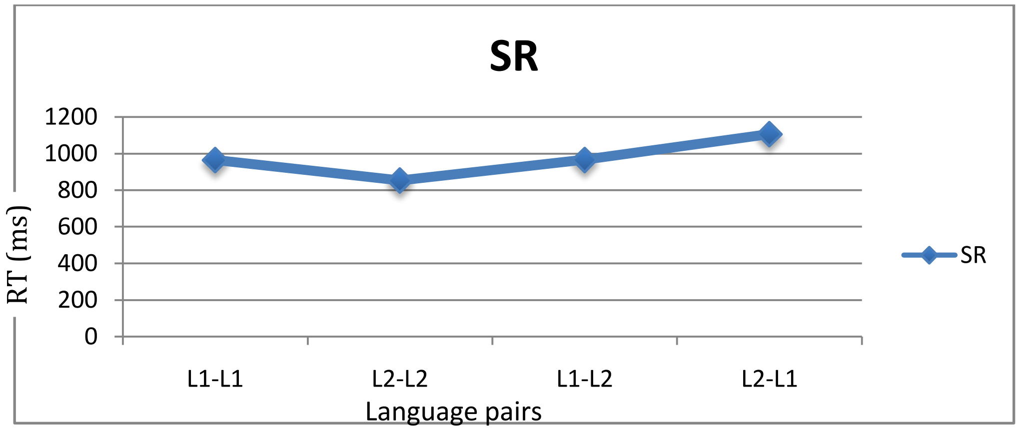

Figure 10. The mean reaction time for monolingual and cross-lingual pairs in semantically related (SR) conditions.

Table 8 and Figure 10 showed that there was a difference in RT between monolingual and cross-lingual pairs in SR condition. To determine if this difference in RT between monolingual and cross-lingual pairs was statistically significant, the data was further subjected to Two-way Repeated Measure ANOVA. The results of the Two-way Repeated Measure ANOVA revealed a statistically significant difference between monolingual and cross-lingual pairs in SR condition at [F= (3, 87) =20.33, p<0.05].

Although the results from Two-way Repeated Measure ANOVA showed a statistically significant difference in RT between the monolingual and cross-lingual pairs, it is important to examine whether language has any effect on the task of semantic relatedness. Thus, the data was further analyzed using Bonferroni's test to determine the effect of L1 and L2 on SR condition alone. The results of this test revealed that there was a statistically significant difference in the reaction time between the L1 and L2 pairs in SR condition.

The results from Bonferroni's test suggested that there was a significant effect of language on tasks semantic relatedness by the statistically significant difference in RT between the monolingual and cross-lingual pairs. Further, to determine which pairs of stimuli (monolingual versus cross-lingual) showed a statistically significant difference, Paired t-test was carried out. The t-values and level of significance obtained from the Paired t-test are depicted in Table 9.

Table 9
Pair-wise comparisons, t-values and level of significance of Paired t-test for monolingual and cross-lingual pairs in SR conditions

Pairs	t-value	Level of significance (2-tailed)
L1-L1SR – L1-L2SR	-1.03	0.31
L2-L2SR - L2-L1SR	-7.77	0.00

**- L1- Kannada L2- English; SR- Semantically Related*

The results of the Paired t-test as illustrated in Table 9 revealed a significant difference ($p<0.05$) across the pair L2-L2SR vs. L2-L1SR. However, there was no statistically significant difference between L1-L1 and L1-L2 pair. Thus, the results obtained from the statistical analyses of L2-L2 and L2-L1 support the second assumption i.e., a faster reaction time for monolingual than cross-lingual pairs in semantically related condition. But this does not hold good for L1-L1 and L1-L2 pair. Hence, the assumption in working hypothesis- 2 is partially accepted.

RT measures should be considered along with accuracy for understanding the performance since it is plausible that a participant shows shorter RT but has minimum accuracy in performance. Therefore, the accuracy of responses for monolingual and cross-lingual pairs in semantically related condition was also calculated. The percentage of accuracy varied from 91.0 to 98.8. The accuracy and error of responses in percentage are depicted in Table 10. It is clear from Table 10 that the monolingual pairs have a higher accuracy percentage than cross-lingual pairs in SR condition.

Table 10
Percentage of accuracy and error of responses for monolingual and cross-lingual pairs in semantically related conditions

Pairs	Accuracy in percentage (%)	Error in (%)
L1-L1SR	98.7	1.3
L2-L2SR	98.8	1.2
L1-L2SR	97.5	2.5
L2-L1SR	91.0	9.0

*- *L1- Kannada L2- English; SR- Semantically Related*

Thus, the results from statistical analyses reveal that there is a faster reaction time for monolingual pairs than cross-lingual pairs in semantically related condition only for L2-L2 and L2-L1 pairs. However, the accuracy measurement indicates that both the monolingual pairs have a greater accuracy than cross-lingual pairs. The supporting evidence for these findings is discussed below.

The shorter reaction time for lexical decision for monolingual semantically related items (L2-L2) compared to cross-lingual items (L2-L1) can be credited to the phenomenon of differential activation of the lexical nodes of both the languages with an advantage for monolingual items. When two semantically related items (such as ‘hand’ and ‘leg’) of the same language (such as L2) are presented, then the reaction time is comparatively faster than for two items (such as ‘hand’ and ‘/kalU/’) belonging to two different languages. This indicates that although the lexicon of both the languages get activated during lexical selection, lexical nodes of the same language require shorter reaction time because of an advantage of monolingual items during differential activation. Similar reports have also been documented in the literature where the concept of differential activation with monolingual advantage has been stated as one of the reasons for better performance of participants in monolingual semantically related condition than cross-lingual conditions (Krishnan & Tiwari, 2010).

The RT for monolingual L1-L1 pair was found to be faster than cross-lingual pair L1-L2, but this difference was not statistically significant. The reason for the RT in cross-lingual pair (L1-L2) being similar to a monolingual pair (L1-L1) can be explained by ICM (Green, 1986, 1998). When the target word is in L1, the inhibition applied over the non-target language (L2) will be minimal due to the relatively lower proficiency in L2, although the difference in proficiency is fairly equal by being not statistically significant (Table 9). As a result, the time taken to overcome the inhibition applied on L2 is also minimal, leading to faster reaction time in L1. Therefore, the RT for cross-lingual pair (L1-L2) stimuli was not significantly different from that for monolingual (L1-L1) stimuli.

Higher accuracy for monolingual pairs than cross lingual pairs in SR condition is also explained by the Inhibitory Control Model (Green, 1988, 1999). The errors in the task of semantic relatedness seen in cross-lingual semantically related pairs can be due to greater inhibition applied on the non-target language. When a word in L2 is presented, the lexicon of the non-target language (L1) will be inhibited. So, when cross-lingual pairs of stimuli are presented, then the probability of error is higher due to the task of overcoming the inhibition applied over the non-target language. Therefore, the accuracy will be more for monolingual than cross-lingual pairs of stimuli. This has been supported by Meuter and Allport (1999) in their study explaining the asymmetrical switching cost in bilingual adults. The results of Phase II are summarized as follows:

A. A faster reaction time was observed for monolingual pairs (L2-L2) than cross-lingual pairs (L2-L1) in SR condition. This suggests differential activation of lexical nodes with monolingual advantage.

B. No significant difference was observed in RT for monolingual (L1-L1) and cross-lingual (L1-L2) pairs. This suggests the role of ICM in the lexical selection mechanism in proficient bilingual adults (Kannada-English bilinguals in the present context).

C. Also, a higher accuracy percentage was observed for monolingual pairs than cross-lingual pairs in SR condition. This can be explained by the inhibitory control mechanism.

Phase III: Analysis of RT in monolingual versus cross-lingual pairs of stimuli in semantically unrelated conditions

The data was subjected to two-way repeated measure ANOVA and Paired t-test to examine the third assumption of the working hypothesis i.e., there would be a faster reaction time for monolingual pairs than cross-lingual pairs in semantically unrelated condition (SUR).

The mean reaction time for monolingual and cross-lingual pairs in semantically unrelated condition is depicted in Table 11 and Figure 11. The mean reaction time was found to be the fastest for L1-L2SUR (1130.54, SD=339.35), followed by L2-L2SUR (1228.54, SD=385.63), and L2-L1SUR (1273.25, SD=382.88). The slowest reaction time was observed for L1-L1SUR (1280.86, SD=402.23).

Table 11
Mean and SD scores of reaction time for monolingual and cross-lingual pairs in semantically unrelated conditions

Pairs	Mean (N=30)	Std. Deviation
L1-L1SUR	1280.86	402.23
L2-L2SUR	1228.32	385.63
L1-L2SUR	1130.54	339.35
L2-L1SUR	1273.25	382.88

**- L1- Kannada L2- English; SUR- Semantically Unrelated*

It is important to note from Table 11 and Figure 11 that the mean RT of the monolingual pair (L2-L2) is faster than the cross-lingual pair (L2-L1). However, the mean RT of the monolingual pair (L1-L1) is not faster than either of the cross lingual pairs (L1-L2 or L2-L1). Also, the mean RT of cross-lingual pair (L1-L2) is found to be the fastest of all pairs. Thus, although there are differences in RT between the monolingual and cross-lingual pairs, it cannot be clearly stated that the mean reaction time is faster for monolingual pairs than cross-lingual pairs in SUR condition.

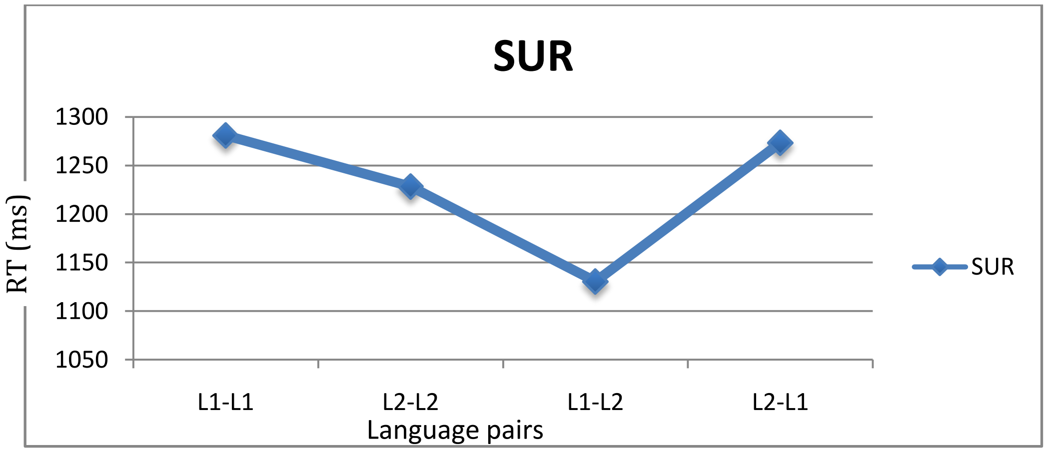

Figure 11. The mean reaction time for monolingual and cross-lingual pairs in semantically unrelated (SUR) conditions.

As observed in Table 11 and Figure 11, the mean RT is different for monolingual and cross-lingual pairs in SUR condition. To determine whether this difference is statistically significant, Two-way Repeated Measure ANOVA was carried out. The results of this test revealed a statistically significant difference between the monolingual and cross-lingual pairs in SUR condition at [F= (3, 87) =20.33, p<0.05].

The influence of language on the task of semantic relatedness is an important factor. Thus, the data was further analyzed using Bonferroni's test to determine the effect of L1 and L2 on SUR condition alone. The results of this test revealed that there was a statistically significant difference in the reaction time between the L1 and L2 pairs in SUR condition.

The results from the Bonferroni's test suggested that there was a significant effect of language on tasks of semantic relatedness by the statistically significant difference in RT between the monolingual and cross-lingual pairs. Further, it is necessary to determine which pairs of stimuli (monolingual versus cross-lingual) showed a statistically significant difference in SUR condition. Hence, Paired t-test was carried out. The t-values and level of significance obtained from the Paired t-test are depicted in Table 12.

Table 12
Pair-wise comparisons, t-values and level of significance of Paired t-test for monolingual and cross-lingual pairs in SUR conditions

Pairs	t-value	Level of significance (2-tailed)
L1-L1SUR – L1-L2SUR	4.61	0.00
L2-L2SUR - L2-L1SUR	-1.47	0.15

*- *L1- Kannada L2- English; SUR- Semantically Unrelated.*

The results of the Paired t-test as illustrated in Table 12 revealed a significant difference (p<0.05) across the pair (L1-L1SUR and L1-L2SUR). However there was no significant difference between the pair (L2-L2SUR and L2-L1SUR). Although the mean reaction time was different in both the pairs (L2-L2 and L2-L1), statistically no significant difference was obtained. Thus, although the results from statistical analyses showed that the difference in mean reaction time was statistically significant for the pairs (L1-L1SUR and L1-L2SUR) it should be observed that the mean RT of the monolingual pair (L1-L1) is slower than the cross-lingual pair (L1-L2). This finding is contradicting the proposed assumption i.e., there would be a faster reaction time for monolingual pairs than cross-lingual pairs in semantically unrelated condition. Also, although the mean RT of the monolingual pair (L2-L2) was faster than the cross-lingual pair (L2-L1), this difference was not statistically significant. Hence the third assumption of the working hypothesis is rejected.

Further, the accuracy of responses in monolingual and cross-lingual pairs in semantically unrelated condition was calculated. The percentage of accuracy varied from 83.2 to 98.4. The accuracy and error of responses in percentage have been depicted in Table 13.

Table 13
Percentage of accuracy and error in responses for monolingual and cross-lingual pairs in semantically unrelated conditions

Pairs	Accuracy in percentage (%)	Error in percentage (%)
L1-L1SUR	83.2	16.8
L2-L2SUR	87.7	12.3
L1-L2SUR	98.4	1.6
L2-L1SUR	89.4	10.6

*- *L1- Kannada L2- English; SUR- Semantically Unrelated.*

Thus, in contrary to the third assumption, the results from statistical analyses reveal that the mean RT for the pair L1-L1SUR and L1-L2SUR is significantly different from each other with the cross-lingual pair having a faster reaction time than monolingual pair. On the other hand, the pairs L2-L2SUR and L2-L1SUR did not have a significant difference in their mean RT, although the monolingual pair had a faster RT than cross-lingual pair. However, the accuracy measurement indicates that cross-lingual pairs have a greater accuracy than monolingual pairs. The supporting evidence for these findings is discussed below.

When a target item is presented, only the semantically related items get activated. Thus, in semantically unrelated condition, participants require a relatively longer time to decide the relatedness as the items presented will not be activated. This has been observed in the present study as well. The overall reaction time in SUR condition is found to be higher than SR condition. This draws support from the Spreading Activation theory (Collins & Loftus, 1975), which also states that a concept will trigger only the semantically related lexical nodes.

Although the results from Phase III did not show statistically significant difference in RT for monolingual and cross-lingual pairs, the mean RT of one monolingual pair i.e., L2-L2 was found to be faster than one cross-lingual pair i.e., L2-L1. The mean RT of monolingual (L2-L2) being better than cross-lingual (L2-L1) pair in SUR condition can be explained by the ICM (Green, 1986, 1998). Since the condition is semantically unrelated, there is no scope for activation of nodes that are semantically unrelated. The faster RT for monolingual pairs (L2-L2) than cross-lingual pairs (L2-L1) can be attributed to the inhibition that takes place on the lexicon of the non-target language (L1). However, why is the RT of the other monolingual pair i.e., L1-L1 not similar to L2-L2 is debatable.

The mean RT of L1-L1 pair is found to be the slowest of all the pairs, and the accuracy percentage is found to be the least for L1-L1 pair in SUR condition. The reason for this could be the usage of L1 (Kannada). Although the participants of the present study rated themselves to have native-like proficiency in their L1 (Kannada), the results of the present analysis do not seem to reflect the same. This can be supported by an on-going study (Jevoor & Prema, In progress) which also states that the usage of a language is important over knowledge of a language.

In SUR condition, the cross-lingual pairs (L1-L2) took shorter reaction time than either of the monolingual pairs (L1-L1 and L2-L2). ICM model (Green, 1986, 1998) fails to explain this finding as according to ICM, producing a word from a language that has just been inhibited previously will be relatively difficult because it takes time to overcome the inhibition that was applied. However, the present finding shows that cross-lingual pairs (L1-L2) required lesser time than both the monolingual pairs. In order to understand this finding better, the mean reaction time for the same pairs was further analyzed with respect to the nature of stimuli i.e., concrete or abstract. That is, the mean RT for concrete and abstract pairs under each of the monolingual and cross-lingual pairs in SUR condition was extracted. This was done to investigate the role of concrete and abstract stimuli in the current findings. The mean reaction time of the concrete and abstract stimuli is depicted in Table 14.

Table 14
Mean reaction time for concrete and abstract pairs in monolingual and cross-lingual semantically unrelated conditions

Pairs	Mean (N=30) (Concrete)	Mean (N=30) (Abstract)
L1-L1SUR	1195.49	1366.24
L2-L2SUR	1119.19	1337.44
L1-L2SUR	1045.64	1215.44
L2-L1SUR	1180.33	1366.18

*- *L1- Kannada L2- English; SUR- Semantically Unrelated.*

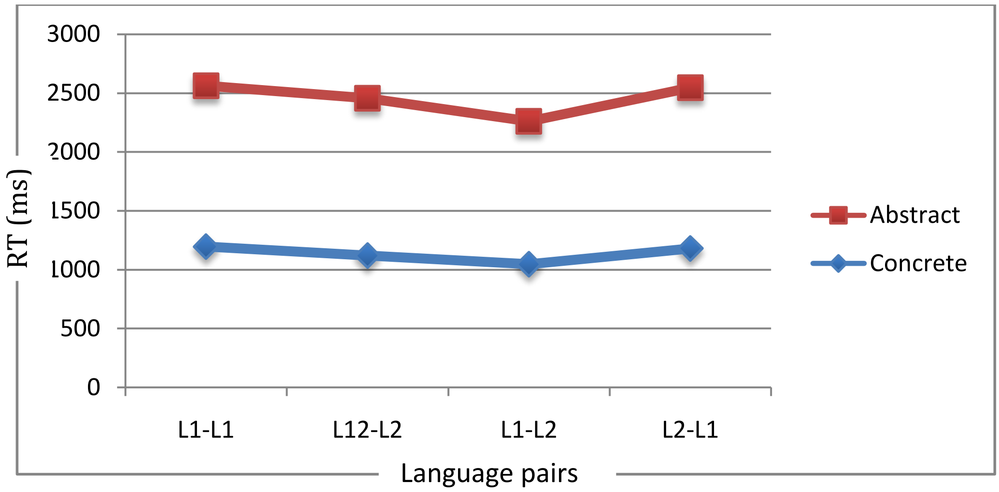

Figure 12. Mean reaction time for concrete and abstract stimuli in semantically unrelated condition (SUR).

The scores depicted in Table 14 and Figure 12 indicates that the mean RT is faster for concrete pairs than abstract pairs in SUR condition. Also, the mean RT is fastest for L1-L2 pairs in both concrete and abstract stimuli. It is obvious from Table 14 and Figure 12, that the performance of participants in semantically unrelated condition is influenced by the nature of the stimuli. Thus, it can be stated that concrete stimuli requires shorter reaction time than abstract stimuli for the task of semantic relatedness.

Considering the third assumption for analysis of concrete and abstract words, the mean reaction time for L2-L2 is shorter than L2-L1 in both concrete and abstract pairs. However, the mean reaction time for L1-L1 is not shorter than L1-L2 in either concrete or abstract pairs. Thus, the third assumption may hold true only for L2-L2 (monolingual) and L2-L1 (cross-lingual) conditions. Thus, the functioning of inhibitory control mechanism is not conclusive in Kannada – English bilingual adults. However, it appears that the nature of stimuli (concreteness/abstractness) plays an important role in the lexical selection mechanism. Also, there is a need for further research to explore the lexical selection mechanism considering the nature of stimuli.

The results of this study clearly give an indication about the importance of nature of stimuli in the lexical selection mechanism.

Thus, after analyzing the concrete and abstract stimuli in SUR condition, the reason for L1-L2 pairs having faster RT than monolingual pairs can be attributed to the usage of languages and nature of stimuli (concreteness versus abstractness). Since in SUR condition, there is no semantic mediation, the RT for two unrelated words of the same language (L1-L1 or L2-L2) (such as /kranthI/-/gnana/ and /mɛmərI/-/rIlif/) depends on how well the participant uses that language. However, the RT for two unrelated words of different languages (L1-L2) (such as /asthI/-/soljuʃən/) might be faster due to the shared lexical links by the two languages. This explanation can be supported by the Revised Hierarchical Model (Kroll & Sholl, 1992; Kroll & Stewart, 1994) which states that the conceptual links might be weaker than lexical links depending on the usage or proficiency of languages. The RT of L1-L2 pairs might also be influenced by the nature of the stimuli, with concrete words having a faster RT than abstract words, due to the differential nature of processing mechanism. Although the abstract words require longer reaction time, the RT of abstract L1-L2 pairs is relatively faster due to the functioning of stronger lexical links than conceptual links as per the Revised Hierarchical Model (Kroll & Sholl, 1992; Kroll & Stewart, 1994).

Considering the accuracy of performance in SUR condition, the monolingual pairs had poorer accuracy than cross-lingual pairs (Table 13). This finding is also explained by the Revised Hierarchical Model. The higher accuracy of cross-lingual pairs may be attributed to the lexical links shared between the lexicons of two languages. On the other hand, the lesser accuracy of monolingual pairs in SUR condition indicates that the nature of stimuli and the usage of languages have a prominent role in lexical selection.

The findings from Phase III can be summarized as follows.

A. The mean RT was faster for cross-lingual pair (L1-L2) than monolingual pair (L1-L1) in SUR condition, and this difference was statistically significant. This suggests that the lexical selection depends on the usage of languages. Also, this indicates that non-semantic based lexical selection may not take place in these conditions. Also it should be observed that although all the stimuli were subjected to rating by speech language pathologists, the participants showed poor performance in certain conditions such as L1-L1SUR. This suggests the importance of usage language as demonstrated by the participants over the knowledge of language as demonstrated by the raters of the stimuli.
B. The mean RT was faster for monolingual pair (L2-L2) than cross-lingual pair (L2-L1) in SUR condition, and this difference was not statistically significant. This suggests that inhibitory control mechanism takes place in Kannada-English bilingual adults, but it might be affected by the nature of stimuli and usage of languages.
C. The mean RT for concrete words was faster than abstract words in SUR condition indicating the influence of nature of stimuli in lexical selection mechanism.
D. The mean RT of L1-L2 pair was the fastest in the SUR condition, indicating the importance of lexical links between two languages in lexical selection.

E. The accuracy for lexical decision was lesser for monolingual pairs than cross-lingual pairs in SUR condition indicating that the nature of stimuli and the usage of languages are likely to exercise significant influence during lexical selection.

Phase IV: Analysis of RT in concrete and abstract cross-lingual pairs of stimuli

To investigate the fourth assumption of the working hypothesis i.e., there would be a faster reaction time for concrete words than abstract words in cross-lingual pairs, the data was subjected to appropriate statistical measures. The mean reaction time for concrete and abstract words in both L1-L2 and L2-L1 pairs has been illustrated in Table 15 and Figure 13.

The mean reaction time was found to be the least for concrete pairs in L1-L2 pair (955.44, SD=249.34), followed by L2-L1 (1088.01, SD=324.91). The highest reaction time was observed for abstract pairs in L2-L1 pair (1290.77, SD=355.91), followed by L1-L2 pair (1140.47, SD=328.35).

Table 15
Mean and SD scores of reaction time for concrete and abstract pairs of stimuli in cross-lingual pairs of stimuli

Pairs	Mean (N=30)	Std. Deviation
Concrete L1-L2 (K-E)	955.44	249.34
Abstract L1-L2 (K-E)	1140.47	328.35
Concrete L2-L1 (E-K)	1088.01	324.91
Abstract L2-L1 (E-K)	1290.77	355.91

**- L1- Kannada; L2- English.*

Thus, Table 15 and Figure 13 show that, the reaction time is less for concrete stimuli in both the cross-lingual pairs (L1-L2 and L2-L1). Contrary to this, the abstract stimuli required higher reaction time in both L1-L2 and L2-L1 pairs. Also, the RT for L1-L2 pairs was lesser than L2-L1 pairs in both concrete and abstract pairs.

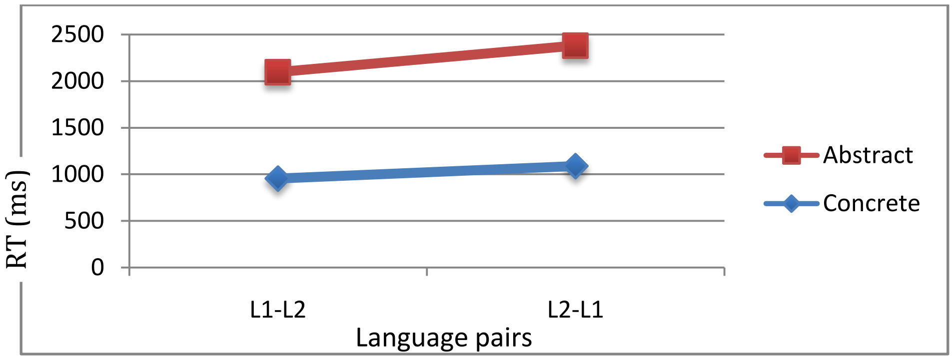

Figure 13. The mean reaction time for concrete and abstract cross-lingual pairs of stimuli.

Since Table 15 and Figure 13 show differences in the mean RT between concrete and abstract stimuli in cross-lingual pairs, it leads us to determine which pair showed statistically significant difference. Consequently, Paired t-test was conducted. The results of the Paired t-test revealed a significant difference ($p<0.05$) across both the pairs- (concrete L1-L2 - abstract L1-L2) and (concrete L2-L1 - abstract L2-L1) as shown in Table 16.

Table 16
Pair-wise comparisons, t-values and level of significance of Paired t-test for concrete and abstract pairs of stimuli

Pairs	t-value	Level of significance (2-tailed)
Concrete L1-L2 - Abstract L1-L2	-7.94	0.0
Concrete L2-L1 - Abstract L2-L1	-8.46	0.0

**- L1- Kannada; L2- English.*

Therefore, the fourth assumption i.e., there would be a faster reaction time for concrete words than abstract words in cross-lingual pairs, is observed to be true. Thus, the fourth assumption of the working hypothesis is accepted.

Also, the accuracy of responses for concrete and abstract pairs of stimuli in cross-lingual conditions was calculated. The percentage of accuracy varied from 84.2 to 98.7. The accuracy and error of responses in percentage have been depicted in Table 17.

Table 17
Percentage of accuracy and error in responses for concrete and abstract cross-lingual pairs of stimuli

Pairs	Accuracy in percentage (%)	Error in percentage (%)
Concrete L1-L2	98.7	1.3
Abstract L1-L2	97.0	3.0
Concrete L2-L1	95.9	4.1
Abstract L2-L1	84.2	15.8

*- *L1- Kannada; L2- English.*

The mean RT was found to be faster for concrete words than abstract words in both the cross-lingual pairs. However, the accuracy for L1-L2 pair was higher than L2-L1 pair in both concrete and abstract nature of stimuli. The following discussion substantiates the reason for accepting the fourth assumption.

A faster reaction time for concrete words than abstract words can be attributed to the concreteness effect. The concreteness effect refers to the phenomenon that concrete nouns are processed faster and more accurately than abstract nouns in various cognitive tasks (Jessen, Heun, Erb, Granath, Klose, Papassotiropoulos & Grodd, 2000). This finding also draws support from the dual coding theory (Paivio, 1986) which states that concrete words are processed by verbal 'linguist' semantic system and non-verbal 'imagistic' semantic system whereas abstract words are processed only by non-verbal 'imagistic' system. Thus, the concrete words have an advantage over abstract words. Hence, it can be stated that the lexical selection of concrete words which are more frequently used can take place at a conceptual level.

However the lexical selection of the less frequently used abstract words occurs at the linguistic level.

If frequency of usage is high, lexical selection might happen at the conceptual level whereas if frequency of usage is less, it might happen at linguistic level. So, language non-specific hypothesis proposed for lexical selection need to addressed taking into consideration the nature of stimuli.

Better performance for concrete words than abstract words in cross-lingual conditions further supports the language non-specific lexical selection. Similar to the discussion stated in the first assumption, when a target concrete word was presented, semantically related words of L1 and L2 get activated, thus proving the language non-specific lexical selection. Hence, lesser reaction time for concrete words further substantiates the language non-specific lexical selection.

From Table 17, it should also be observed that the accuracy percentage is the least for abstract words in L2-L1 pairs. Consider the examples of the abstract word pairs used in the study, L2-L1- ('peace'-'/thapassU/'). Such abstract word pairs require longer reaction time in tasks of semantic relatedness. This receives support from the dual coding theory (Paivio, 1986) which states that the processing of abstract words involves only the imagistic system, unlike concrete words which involve both linguist system and imagistic system. Further, the reason for lower accuracy percentage for abstract words in L2-L1 pairs but not in L1-L2 pairs can be explained by the ICM (Green, 1986, 1998). According to ICM, if the non-target language has a higher proficiency, then the inhibition applied over that language is more, leading to higher probability of errors.

Thus, based on the findings discussed above, it can be stated that, lexical selection mechanism is largely language non-specific in nature in Kannada-English bilingual adults. Also, the language non-specific mechanism of lexical selection does depend on the nature of stimuli (concreteness/abstractness). However, during language non-specific lexical selection, the type of activation being differential or equal was not conclusive from the present study. But, it can be stated that the type of activation depends on nature of stimuli (concreteness/abstractness) for language non-specific lexical selection mechanism. Also, from the results obtained, it can be assumed that lexical selection mechanism follows inhibitory control mechanism only for monolingual L2-L2 (English), and cross-lingual L2-L1, but not for L1-L1 (Kannada) and L1-L2. It was also observed that the reaction time for abstract words was greater than concrete words, indicating that the lexical processing of abstract words follows a different mechanism which was not probed into in the present study. Thus, to understand the processing of abstract words, further research is required.

The results of the present study indicate the need for studying the lexical selection mechanism in the clinical population. Studying the lexical selection mechanism in clinical population gives us a better understanding of the processes involved in the lexical selection mechanism. This in turn helps in planning appropriate strategies for eliciting responses to improve their communication skills. Further, the paradigms used in the present study such as semantically related and unrelated stimuli, monolingual (L1-L1 and L2-L2) and cross-lingual (L1-L2 and L2-L1) stimuli, and concrete and abstract stimuli, can be used in the assessment and management of persons with language disorders.

CHAPTER V

SUMMARY AND CONCLUSION

Lexical selection is a process of selecting words from the lexicon. The language non-specificity of lexical selection refers to the mechanism in which the lexical selection is independent of the languages known to a person. The study of lexical selection mechanism is important in the Indian context, because of its multi-lingual culture. The aim of the study was to investigate the lexical selection mechanism in Kannada-English bilingual adults using a lexical decision task (LDT). The study was designed to examine the language-specific or language non-specific nature of lexical selection in bilingual adults. The study was conducted with a positive working hypothesis that there would be a language non-specific lexical selection mechanism in Kannada- English bilingual adults. The hypothesis was explored by using the mean reaction time for tasks of semantic relatedness. To explore the hypothesis, a faster reaction time in-

A. Semantically related conditions than the semantically conditions unrelated in cross-lingual pairs, may indicate the language-nonspecific nature of lexical selection.
B. Monolingual semantically related pairs than the cross-lingual semantically related pairs, may indicate differential activation of lexical items from the two languages with an advantage of monolingual items.
C. Monolingual semantically unrelated pairs than the semantically unrelated pairs in cross-linguistic conditions, may indicate non-semantic-based lexical selection mechanism.

D. Concrete pairs than abstract pairs in cross-linguistic conditions may further support the language non-specific lexical selection in bilingual adults.

A total of 30 adults in the age range of 18 – 30 years with Kannada as mother tongue (L1) and English as acquired (L2) language served as participants for the study. A total of 160 words (80- Concrete; 80- Abstract) were selected, and paired as semantically related (SR) and semantically unrelated (SUR) conditions. The stimuli were paired as- monolingual (L1-L1 and L2-L2), cross-lingual (L1-L2 and L2-L1). DMDX software was used for presentation of the stimuli. The task of the participants was to judge the semantic relatedness between the pairs of stimuli appearing on the screen of the computer. The participants were instructed to click the 'Right' button of the in-built mouse pad if the word pair is related, and to click the 'Left' button if the word pair is unrelated. The reaction time and accuracy of responses were measured.

The data was tabulated and analyzed using SPSS 17.0 software. The mean and standard deviation of the reaction times were calculated. Two-way Repeated Measure ANOVA was carried out to determine the differences in the mean reaction time across monolingual and cross-lingual pairs of stimuli. Bonferroni's test was carried out to analyze the effect of each pair over the SR and SUR conditions. Further, Paired t-test was carried out to explore the significant difference in the performance for different pairs.

The results obtained from the present study are discussed below.

A. The comparison of the mean reaction time in SR and SUR conditions in cross-lingual pairs revealed that the SR conditions required shorter reaction time than SUR conditions indicating that the lexical selection mechanism is language independent.

B. The comparison of the mean reaction time in monolingual and cross-lingual pairs in SR condition revealed that the monolingual pairs (L2-L2) required shorter reaction time than cross-lingual pairs (L2-L1), indicating that the differential activation of lexical nodes occurs in Kannada-English bilingual adults with an advantage for monolingual items. However, there was no significant difference between the RT of monolingual (L1-L1) and cross-lingual (L1-L2) indicating that the inhibitory control mechanism acts on L1-L2 pairs in SR condition, boosting its reaction time.

C. On the other hand, when the reaction time of monolingual and cross-lingual pairs of SUR condition was compared, it was observed that the mean reaction time for monolingual L2-L2 was shorter than cross-lingual L2-L1, but it was not statistically significant. However, monolingual L1-L1 was not shorter than cross-lingual L1-L1. This was in contrary to the proposed assumption. Thus, further analysis of the responses was done in terms of concreteness and abstractness of the stimuli. The mean reaction time of concrete words was shorter than abstract words in SUR condition. Thus, it was suggested that lexical selection mechanism depends on the nature of stimuli and usage of language.

D. When the reaction time for concrete words was compared with abstract words, it was observed that the reaction time for concrete words was shorter than abstract words. This indicates that nature of stimuli (concrete versus abstract) plays an important role in the lexical processing. It also suggested that the lexical selection of concrete words is language non-specific, but it may not be the same for abstract words.

Thus, it can be concluded from the results of the study that lexical selection mechanism in Kannada- English bilingual adults is largely language non-specific. This language non-specificity depends on the nature of stimuli (concrete versus abstract). However, there is no conclusive evidence regarding the activation pattern followed in the Kannada- English bilingual adults.

5.1 Implications of the study

The present study throws light on the lexical selection mechanism in Kannada-English bilingual adults. The results of the study reveal that the lexical selection mechanism is language-independent. Further, the results also reveal that the nature of stimuli (concrete versus abstract) plays a prominent role in the lexical selection mechanism in Kannada- English bilingual adults. Also, the study supports the earlier findings (Collins & Loftus, 1975) that the activation of lexical nodes is always semantically related to the target stimulus. The study also provides evidence for the language non-specific lexical selection model (Finkbeiner, Almeida, Janssen, & Caramazza, 2006; Green, 1998, 1986; Poulisse & Bongaerts, 1994; De Bot, 1992). Thus, the study helps in understanding the lexical semantic processing in Kannada-English bilingual adults.

Though the study was conducted on neurotypical bilingual adults, it indicates the need for investigating the lexical selection mechanism in clinical population. Studying the lexical selection mechanism in clinical population will help in better understanding of the processes involved in the lexical selection mechanism. This in turn paves way for better assessment and management of clinical conditions. The stimuli used in the present study can be a part of assessment and management especially at semantic level. The semantically related and unrelated stimuli, concrete and abstract stimuli can be used in the various approaches to language intervention such as Stimulation Facilitation Approach, Thematic Language Stimulation, Constraint Induced Therapy, Language Oriented Treatment and Semantic Feature Analysis, to improve communication skills in persons with adult language disorders.

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APPENDIX I-A

Semantically Related (SR) Concrete Noun Pairs

STIMULI				
	K-K	**E-E**	**K-E**	**E-K**
1	ಕಳ್ಳ–ಪೋಲಿಸ್	**Sun-Moon**	ಕಾಲು– **Knee**	**Water-** ಲೋಟ
2	ಬೆಕ್ಕು– ಇಲಿ	**Bread-Butter**	ತಾಯಿ– **Father**	**Saree-** ಬಟ್ಟೆ
3	ರೋಗಿ–ವೈದ್ಯ	**Doctor-Hospital**	ಹೂವು– **Petals**	**House-** ಇಟ್ಟಿಗೆ
4	ಹೆಂಗಸು–ಸೀರೆ	**Pencil-Pen**	ಮೋಡ– **Rain**	**Carrot-** ಮೂಲಂಗಿ
5	ಗಾಡಿ-ಚಕ್ರ	**Coffee-Tea**	ದಾರ – **Needle**	**Shirt-** ಗುಂಡಿ
6	ಮೋಸಂಬಿ- ಕಿತ್ತಳೆ	**Car-Bus**	ಕೈ – **Leg**	**Cradle-** ಮಗು
7	ಕುರ್ಚಿ–ಮೇಜು	**Key-Lock**	ಮೊಟ್ಟೆ - **Hen**	**Garlic-** ಶುಂಠಿ
8	ಕಣ್ಣು-ಕನ್ನಡಕ	**Brother-Sister**	ಹುಡುಗ -**Girl**	**Belt-** ಸೊಂಟ
9	ಮಳೆ–ಛತ್ರಿ	**Furniture-Wood**	ಹಸು - **Calf**	**Beak-** ಕೊಕ್ಕರೆ
10	ಬೆಲ್ಲ–ಕಬ್ಬು	**Fork-Spoon**	ಬಾಯಿ - **Teeth**	**Guava-** ಕಿತ್ತಳೆ

APPENDIX I-B

Semantically Unrelated (SUR) Concrete Noun Pairs

STIMULI				
	K-K	**E-E**	**K-E**	**E-K**
1	ಗಡಿಯಾರ–ದಾರ	Eagle-Crackers	ಹೂವು –Cat	Rubber- ನೀರು
2	ಪುಸ್ತಕ–ಬಟ್ಟೆ	Candle-Mountain	ಆನೆ – Plane	Desk- ತಟ್ಟೆ
3	ರಸ್ತೆ–ಬೆಣ್ಣೆ	Rose-Crocodile	ಚಕ್ರ – Nose	Train- ನೆಲ
4	ಹಲ್ಲಿ- ಲಾಠಿ	Lamp-Kerchief	ಬಳೆ – River	Shelf- ಹಾವು
5	ಮೊರ–ಮೀಸೆ	Rat-Petrol	ಬಳ್ಳಿ – Hair	Balloon- ಮಾಂಸ
6	ಬಾಳೆಹಣ್ಣು–ಕೆನ್ನೆ	Clay-Hospital	ಹಿಟ್ಟು – Fox	Potato- ಮಲ್ಲಿಗೆ
7	ಕರು–ಅರಮನೆ	Bell-Shoe	ಅಜ್ಜಿ – Bell	Drum- ಸಾರು
8	ಮಣ್ಣು–ಚಾಕು	Tree-Diary	ಸೊಳ್ಳೆ – Pot	Vehicle- ಸೇಬು
9	ದಡ–ಬಾಗಿಲು	Skin-Paper	ತುಪ್ಪ –Camel	Ketchup- ಛತ್ರಿ
10	ವಾಹನ–ದವಡೆ	Teacher-Floor	ಇರುವೆ –Girl	Noodles- ಕಪ್ಪೆ

APPENDIX I-C

Semantically Related (SR) Abstract Noun Pairs

STIMULI				
	K-K	E-E	K-E	E-K
1	ಕನಸು– ನಿದ್ರೆ	Winter-Summer	ಸಂತೋಷ - Excitement	Death-ಕೈಲಾಸ
2	ತೃಪ್ತಿ– ಶಾಂತಿ	Dream-Fantasy	ಪದ್ಯ – Stanza	Plan- ಗುರಿ
3	ಉಪವಾಸ– ಹಸಿವು	Asthma-Allergy	ಧ್ವನಿ - Pitch	Attraction- ಚೆಲುವು
4	ಕರ್ತವ್ಯ– ನಿಷ್ಠೆ	Anniversary-Marriage	ಸಮಾಜ - Community	Peace- ತಪಸ್ಸು
5	ಉಪಾಯ–ಬುದ್ಧಿ	Year-Month	ಕನಸು – Nightmare	Talent–ಜಯ
6	ಶಿಕ್ಷೆ–ದಂಡನೆ	Sorrow-Pain	ಉತ್ಸವ – Crowd	Injustice-ಅಕ್ರಮ
7	ಸಂಭ್ರಮ-ಹಬ್ಬ	Holiday-Relaxation	ಸಂಗೀತ – Melody	Influence–ಅಧಿಕಾರ
8	ಅನುಗ್ರಹ–ದೇವರು	Richness-Poverty	ನ್ಯಾಯ – Crime	Uproar-ಶಬ್ದ
9	ಕಲ್ಪನೆ–ಕವಿ	Strength-Unity	ಮಾಹಿತಿ– Knowledge	Life- ಭೂಲೋಕ
10	ಸೋಲು-ಆಟ	Beauty-Attraction	ನೋಟ– Hearing	Atmosphere-ಹವಾಮಾನ

APPENDIX I-D

Semantically Unrelated (SUR) Abstract Noun Pairs

STIMULI				
	K-K	**E-E**	**K-E**	**E-K**
1	ಅಪೂರ್ವ– ಅಭಯ	**Memory-Relief**	ಆಸ್ತಿ– **Solution**	**Possibility-** ಆಕಾರ
2	ನ್ಯಾಯ–ಸೋಲು	**Privacy-Danger**	ಕೀರ್ತಿ **–Theft**	**Satisfaction-** ದೋಷ
3	ಆಸಕ್ತಿ–ವಿಚಾರಣೆ	**Trouble-Victory**	ಸಂಶೋಧನೆ - **Laughter**	**Investigation-** ಚಟುವಟಿಕೆ
4	ಜಾಣ್ಮೆ– ಉತ್ಸಾಹ	**Beginning-Sickness**	ಚೌಕ - **Dawn**	**Patience-** ಪ್ರಾರ್ಥನೆ
5	ಪರಿಸ್ಥಿತಿ– ತೀರ್ಮಾನ	**Blame-Caution**	ಸಾಕ್ಷಿ **– Thunder**	**Movement-** ಸಂಚಿಕೆ
6	ದೇವರು–ಸಾಹಿತ್ಯ	**Effort-Feeling**	ನೋವು - **Fraction**	**Permission-** ಪವಿತ್ರ
7	ಕೊಲೆ–ಪ್ರಶ್ನೆ	**Age-Safety**	ದೃಷ್ಟಿ- **Rhythm**	**Relation-** ಹಾಸ್ಯ
8	ಕವಿತೆ– ಗುಣ	**Speed-Specialty**	ನೆನಪು- **Growth**	**Quarrel-** ಸೂಕ್ಷ್ಮತೆ
9	ಕ್ರಾಂತಿ– ಜ್ಞಾನ	**Nature-Secrecy**	ಮೋಸ - **Encouragement**	**Duration-** ಸಂಬಂಧ
10	ಯಂತ್ರ– ಮನಸ್ಸು	**Law-Moisture**	ಆಯಾಸ- **Fame**	**Gravity-** ಸಂಸಾರ