CROSS LANGUAGE PRIMING IN NORMAL BILINGUAL ADULTS

Register No. L0380002

A Master's Dissertation submitted in part fulfillment for the Master of Science (Speech-Language Pathology) University of Mysore, Mysore

ALL INDIA INSTITUTE OF SPEECH AND HEARING
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"How great is your goodness which you have stored for those that fear you; which you bestow in the sight of men on those who take refuge in you."

Psalms 31:9

Thank you Lord for teaching me.....

That when you are in control, I have nothing to fear;

That whatever my trouble or difficulty or worry, you are aware of it already and that you will help me find a way around it, though you may not always remove it;

To trust to you to move my mountains but still keep climbing;

That your strength is manifested in my weakness, so that when I am weak is when I am actually strong;

The power of prayer, and finally,

That whatever happens in my life is according to your will and plan for my life and for my best!!

CERTIFICATE

This is to certify that this dissertation entitled **"CROSS LANGUAGE PRIMING IN NORMAL BILINGUAL ADULTS"** is the bonafide work in part fulfillment for the degree of Master Science (Speech-Language Pathology) of the student with **(Reg. No. L0380002).** This has been carried out under the guidance of a faculty of this institute and has not been submitted earlier to any university for the award of any other degree or diploma.

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Mysore,
May 2005.

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CERTIFICATE

This is to certify that this dissertation entitled "CROSS LANGUAGE PRIMING IN NORMAL BILINGUAL ADULTS" has been prepared under my supervision and guidance. It is also certified that this has not been submitted earlier in any other University for the award of any diploma or degree.

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Place: Mysore
May 2005

DECLARATION

This dissertation entitled **"CROSS LANGUAGE PRIMING IN NORMAL BILINGUAL ADULTS"** is the result of my own study under the guidance of **Dr. K.S. Prema ,** Lecturer in Language Pathology, Department of Speech Language Sciences, All India Institute of Speech and Hearing, Mysore and not been submitted in any other University for the award of any degree or diploma.

Mysore,

May, 2005 **Reg. No. L0380002**

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Dedicated to…..

MY PARENTS

For ALL that you have given me,

I am blessed to have you as my parents and I thank our Lord for you, now and always!!

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God be with u till we meet again
By his counsels guide and uphold you,
Beneath his wings securely hide you,
God be with u till we meet again!!

INTRODUCTION

Bilingualism, more generally, multilingualism, is a major fact of life in the world today. Everyone today is atleast a bilingual; there is no one in the world who does not know at least a few words in languages other than the native language. The processes of globalization have increased the extent and character of bilingualism and/or multilingualism. Bilinguals have opened up newer portals for research as one cannot consider a bilingual as two monolinguals in one person and generalize results from monolingual studies (Grosjean, 1989).

The nature of bilingual lexical organization is an enduring question in bilingual research (Snodgrass, 1984). Over the past couple of decades, much of the research conducted in the bilingual domain has been concerned with the organization of a bilingual's two languages. Two major theoretical view-points have been dominant. First, the *language specific hypothesis* proposes that the lexical knowledge of the bilingual may be represented in two language-specific memory systems, one for each of the bilingual's languages. Second, the *language-independent hypothesis* proposes that bilinguals have a common, language-independent, conceptual representation for words in their two languages. Numerous models have been proposed to support or refute either of these two hypotheses. A variety of experimental tasks have been employed to study the bilingual mental lexicon. Online tasks are preferred as these can be used to measure effects occurring at various temporal points during ongoing processing and are often sensitive to fast acting, automatic processes that rely on integration and interaction of several types of information. Among the online tasks, the primed lexical decision task (LDT) (Meyer and Schvaneveldt, 1971) has been frequently used to study bilingual lexical organization.

Priming refers to an increase in the accuracy, probability or speed of response to stimulus (called the target) as a consequence of a prior exposure to another stimulus (called the prime). Priming patterns when seen across different languages is termed cross-language priming. The most common interpretation of priming is that the cortical representations of the prime and target are interconnected or overlap in some way such that activating the representation of the prime automatically activates the representation of the target word.

During the past three decades, there has been a plethora of studies conducted in cross-language priming, both translation priming and semantic priming (Altarriba, 1990; Basnight Brown and Altarriba, 2005; Chen and Ng, 1989; de Groot and Nas, 1991; Frenck and Pynte, 1987; Gollan, Forster and Frost, 1997; Grainger and Beauvillain, 1988; Grainger and Frenck-Mestre, 1998; Jiang, 1999; Jiang and Forster, 2001; Jin, 1990; Keatley and de Gelder, 1992; Keatley, Spinks and de Gelder, 1994; Kirsner et al., 1984; Larsen, Fritsch, and Grava, 1994; Meyer and Ruddy, 1975; Schwanenflugel and Rey, 1986; Tzelgov and Eben-Ezra, 1992; Williams, 1994). Further, proficiency is an important variable that determines priming effects, along with others like the presence or absence of phonemic/graphemic similarity of items across languages, word frequency, level of concreteness etc. But all these studies have been done in the western context and in structurally similar languages.

Need for the Study

Bilingualism in India is different from that prevalent in the countries of Europe and America. In the light of this situation, generalization of the western research findings

to the Indian context is not appropriate. Studies investigating priming patterns in Indian-English bilinguals are thus necessary. Further, the studies investigating priming patterns across different proficiency groups using online tasks such as the primed lexical decision task have been sparse. Majority of the previous studies have employed offline tasks like translation recognition, translation production etc. But online tasks are superior to offline tasks in that they will provide a clearer understanding of the nature of bilingual mental lexicon across the different proficiency groups.

Thus many aspects concerning the nature of bilingual lexical organization need investigation. So the present study focuses on lexical organization using semantic and translation priming paradigm.

Objectives of the Study

The present study was designed with the following objectives:

1. To investigate cross-language priming (translation and semantic) in Kannada-English bilingual adults, using a stimulus set designed for automatic processing, when,
    a) The prime is presented in Kannada (L1) and the target in English (L2); L1-L2 condition.
    b) The prime is presented in English (L2) and the target in Kannada (L1); L2-L1 condition.
2. To investigate the priming patterns across high proficient and low proficient bilinguals.

REVIEW OF LITERATURE

Bilingualism has been widely viewed as the equal mastery of two languages. The phenomenon of bilingualism is so widely prevalent and multifaceted that it is indeed very difficult to define it in a manner covering all aspects. Different factors like proficiency, psychological, social interaction etc. have been used to define bilingualism.

a. Defining bilingualism

Bloomfield (1933) defined bilingualism as the native-like control of two languages. However, this is a rather strict view of bilingualism and one that limits the number of individuals or groups that could be classified as bilinguals. On the other hand, Haugen (1953) defined bilinguals as individuals who are fluent in one language but who "can produce complete meaningful utterances in the other language". Diebold (1965) saw bilingualism as including simply passive knowledge of the written language or any contact with a second language and the ability to use it in the environment of the native language. MacNamara (1967) referred to bilingualism as even the possession, to a minimal degree of one of the language skills (speaking, reading, writing and listening and their various complexities). However, the current approach in linguistic, psychological and neurolinguistic domains is to consider bilinguals as individuals who use more than one language to communicate on a regular basis.

Several neuropsychological studies suggest that it is not correct to consider bilingual subjects as two monolinguals in one person (Grosjean, 1989). Indeed it is not necessary for bilinguals to have a perfect knowledge in all the languages they know, to be considered as such. Bilinguals acquire and use their languages for different purposes, in

different domains of life with different people. Irrespective of the degree of knowledge one has of the languages he knows, he should definitely be considered a multilingual (Fabbro, 1999). The diversities in the nature and characteristics of bilingual individuals has led to different types of bilinguals.

b. Types of Bilingualism

Thirumalai and Chengappa (1986) have characterized bilingualism in different ways as given below:

1. How the languages of a bilingual context are kept separate or fused together.
2. Sequence of learning the languages in a bilingual context.
3. Whether the languages of a bilingual context are acquired under formal, instructional conditions or informal, non instructional set up.
4. An appreciation as to which of the language of a bilingual context is dominant in the individual use of languages.

Several types of bilingualism have been put forth based on various parameters. Table 1 summarizes the various types of bilinguals describing the dimensions, mode of second language acquisition etc.

No.	Dimension	Type of bilinguality	Comments
1	According to competence in both languages	a) Balanced Bilinguality b) Dominant bilinguality	L1 competence=L2 competence L1 competence>or<L2 competence
2.	According to cognitive organization	a) Compound bilinguality b) Coordinate bilinguality	L1 units equivalent to L2 unit=one conceptual unit. L1 unit= one conceptual unit L2 equivalent= one conceptual unit
3	According to age of acquisition	a) Childhood bilinguality 1. Simultaneous 2. Consecutive b) Adolescent bilinguality c) Adult bilinguality	L2 acquired before age of 10/11 L1 and L2= mother tongues L1=mother, L2=acquired before 11 L2=acquired between 11 and 17. L2=acquired before 17.
4	According to presence of L2 community in environment	a) Endogenous bilinguality b) Exogenous bilinguality	Presence of L2 community Absence of L2 community
5	According to relative status advantage of the two languages	a) Additive bilinguality b) Subtractive bilinguality	L1 and L2 socially valorized-cognitive L2 valorized at expense of L1 -cognitive disadvantage
6	According to group membership and cultural identity	a) Bicultural bilinguality b) L1 monocultual bilinguality c) L2 acculturated bilinguality d) Deculturated bilinguality	Double membership and bicultural identity L1 membership and cultural identity L2 membership and cultural identity Ambiguous membership and anomic identity

Table 1: Psychological dimensions of bilingualism (Hamers and Blanc, 2000)

c. Bilingualism in India

Bilingualism in India is different in comparison to western countries. The grass root bilingualism in India is not to be confused with the situation generally existing in some parts of the western world. According to Ferguson (1968) the majority of

bilingualism persistent in the western world is constituted of the accentuating immigrants and his/her offspring, the westernizing native, or the struggling foreign language student. In India, this is not the picture. India has been a multilingual country right from the earliest times and English bilingualism has become an integral part of modern Indian consciousness. Mohanty (1994) stated that the Indian society is characterized by grass-root type of multilingualism in which languages are maintained in a non-competitive and differentiated role relationship and language identities of people are multilayered. According to Srivastava (1980) there is not a single state in the country which is completely bilingual, not a single major modern Indian language whose speakers do not employ at least three contact languages and not a single speech community which has less than at least three distinct linguistic codes in its verbal repertoire. Thus in India, bilingualism is rather a natural state of language behavior which necessities more studies on normal and clinical bilingual populations in the Indian linguistic context. Also, the phenomenon of language representation and language processing in bilinguals differ depending on various factors. Several models have been put forth particularly to explain lexical organization in bilingual.

d. Models of Bilingual Lexical Organization

The nature of bilingual lexical organization is an enduring question in bilingual research (Snodgrass, 1984). Over the past couple of decades, much of the research conducted in the bilingual domain has been concerned with the organization of a bilingual's two languages. Two major theoretical view-points have been dominant. First, the *language specific hypothesis* proposes that the lexical knowledge of the bilingual may be represented in two language-specific memory systems, one for each of the bilingual's

languages. Second, the *language-independent hypothesis* proposes that bilinguals have a common, language-independent, conceptual representation for words in their two languages.

Numerous models have been proposed to support or refute either of these two hypotheses. All models distinguish two levels of representation: one *lexical* with two language-specific stores and one *conceptual* comprising a single store. According to Kroll and de Groot (1997) word representation in the bilingual memory literature is decomposed into form and meaning. The former is represented at the lexical level and the latter at the conceptual level. Various models have been proposed on the basis of the connections within and between the lexical and conceptual level of representation.
The most popular and experimented models are described below.

i) Word Association Model (Potter, So, Von Eckhardt & Feldman, 1984)

This model assumes that second language words (L2) gain access to concepts only through first language (L1) mediation. [L1- refers to the language acquired first; most often the native language and the dominant language, L2-refers to the language acquired later, the relatively less dominant language]. It is in this sense, that the terms will be used further in the text.

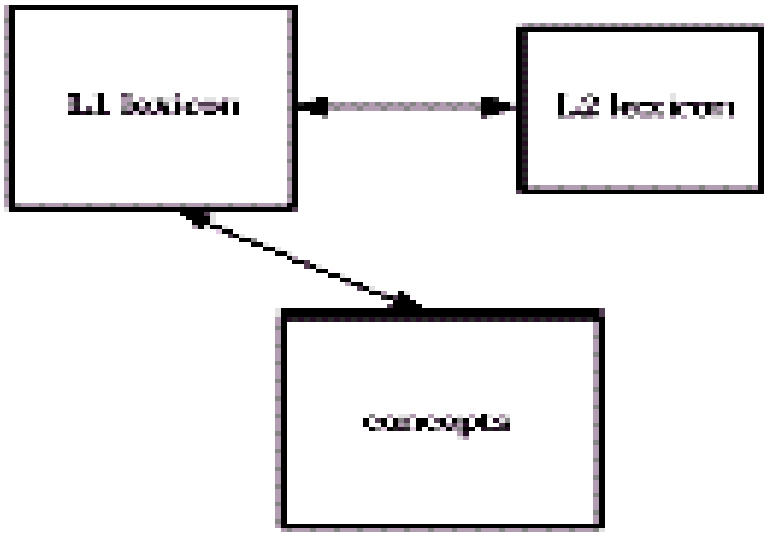

Figure 1: Word Association Model

The links between L1 and L2 are the lexical links and the links between L1 and the concepts are denoted as the conceptual links. This model predicts that translation from L1 to L2 will be faster than picture naming in L2 because translation relies on the lexical links and can thus by pass conceptual access. Thus according to this model, cross-language processing exploits the links at the lexical level.

ii) Concept Mediation Model (Potter et al. 1984)

In contrast to the above, concept mediation model proposes that second language words, i.e. L2 directly access concepts for words in both languages. This model predicts that the translation from L1 to L2 and picture naming in L2 should be similar because both require conceptual access prior to the retrieval of L2 lexical items. As there are no

lexical links in this model, cross-language processing is necessarily mediated by a concept.

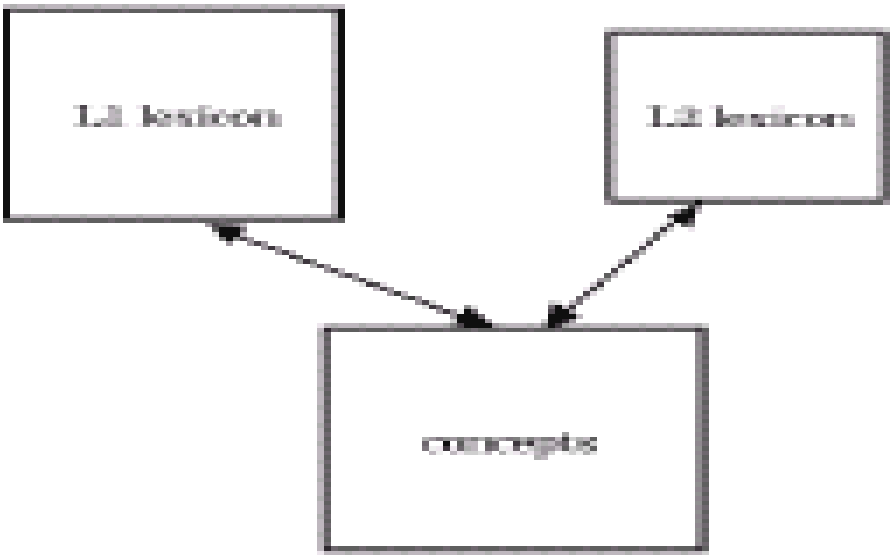

Figure 2: Concept Mediation Model

Potter et al (1984) investigated translation and picture naming in a group of fluent Chinese-English bilinguals and found that the times to translate from L1 to L2 and to name pictures in L2 were very similar, thus providing support for the model.

However, the application of these models to bilingual adults depends on the respective proficiency in each language. Kroll and Curley (as cited in Kroll and de Groot, 2002) employing a similar task as Potter et al (1984) with bilinguals with low and high

second language (L2) proficiency observed evidence for word association models in the low proficiency bilinguals and the concept mediation model in the high proficiency bilinguals.

iii) Revised Hierarchical Memory (RHM) Model (Kroll and Stewart 1990, 1994)

In this model, bilingual memory is conceived as represented in separate but interconnected lexicons. These two structures represent the bilingual's first (L1) and second language (L2) lexicons. This model's most critical assumption is that the lexical links differ in strength, and words in each language are linked to a general concept and to each other. The L2 lexicon is connected to the L1 lexicon by strong links and the L1 is connected to the L2 lexicon by weak links that are sensitive to semantic processing. Because bilinguals seldom translate from their L1 to their L2, they develop a weak link from their L1 to their L2 and it does not develop as well as the active L2 to L1 lexical links. In addition to the connections between the two lexicons, bilingual memory is thought to be composed of a conceptual store. The conceptual store is said to contain abstract representations about the world. The conceptual store is connected to both the L1 and L2 lexicons. However, the connections between the L1 lexicon and the conceptual store are strong and direct; whereas, the connections between the L2 lexicon and the conceptual store are weak. Thus, the subject's L1 is more likely to access the conceptual store directly (conceptually mediate) than the subject's L2. In other words, when exposed to an L1 concept, the bilingual is more likely to access the conceptual store because of his/her L1. Because the lexical link from the bilingual’s L2 to L1 lexicon is stronger and faster, the bilingual would most likely utilize these links to access the conceptual store. In this way, the link from the conceptual system to the bilingual's L2 lexicon remains weaker. The RHM model assumes that both lexical and conceptual links are active in

bilingual memory but that strength of those links differs as a function of fluency in L2 and the relative dominance of L1 to L2. Thus an asymmetry was hypothesized- L2 to L1 translation should be faster than L1 to L2 translation and also less sensitive to the effects of semantic factors.

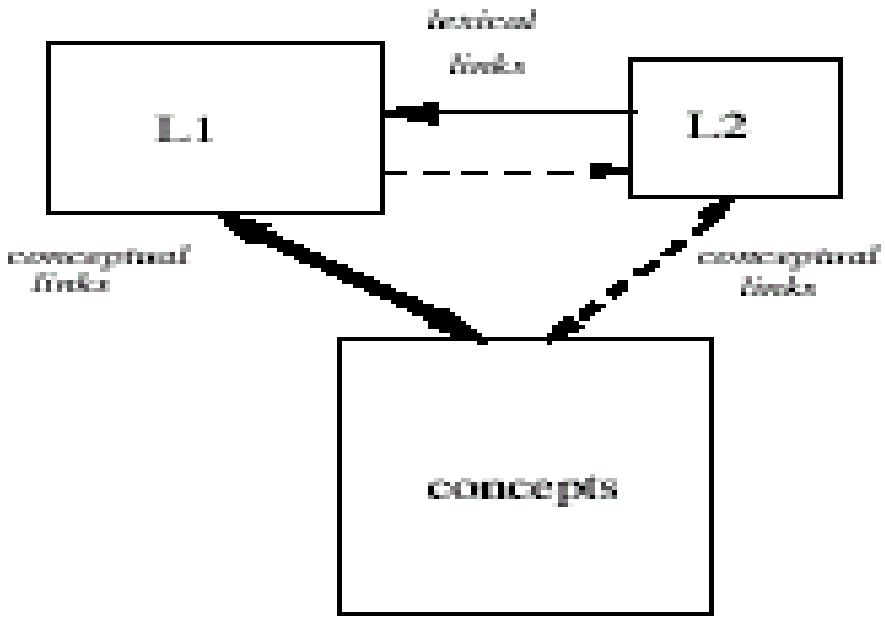

Figure 3: Revised Hierarchical Model

Several translation studies have supported a similar asymmetry (Keatley, Spinks and De Gelder, 1992; Sanchez-Casas, Davis, & Garcia-Albea, (1992); Kroll and Stewart, 1994), thus supporting the model. These findings strengthen the claim that connections between words in a bilingual's two languages and concepts are asymmetric and in particular that L2 processing is less likely to engage meaning than L1.

iv. Mixed Model (de Groot, 1992)

This model combines the word association model and the concept mediation models. This model argues that the lexicons of a bilingual are directly connected to each other as well as indirectly connected by way of a shared semantic representation.

However, de Groot (1992) based her theory on forward translation (L1 to L2) only in L1 dominant subjects. Therefore, in a follow up study de Groot, Dannenburg & Van Hell (1994) examined forward (L1 to L2) and backward (L2 to L1) translation with six variables, (imageability, context availability, definition accuracy, familiarity, word frequency and length), in two Dutch-English bilingual groups that differed in L2 proficiency. Results revealed a significant effect of imageability on forward translation, implying semantic mediation, and a smaller effect of imageability on backward translation. Therefore, while de Groot et al (1994) agree that the data support a weak version of the asymmetrical model (direct and strong L2 to L1 link in backward translation without concept mediation), they argue for mixed model since this model predicts concept mediated backward translation, but with less "strength" in the link from L2 to conceptual memory than L1 to conceptual memory.

e. Tasks to Study Bilingual Lexical Organization

Experimental tasks used to study bilinguals range from those used in production studies, namely (reading lists, retelling stories, picture naming, giving word associations) to those in perception and comprehension studies (free recall, Stroop tests, translation

etc.) all the way to those used in hemispheric lateralization studies (dichotic listening hemi-field presentation, concurrent activity tasks etc). The tasks can be generally categorized under two broad categories:

1. **Online tasks**
2. **Offline tasks**

i) Online tasks: These can be used to measure effects occurring at various temporal points during ongoing processing and are often sensitive to fast acting, automatic processes that rely on integration and interaction of several types of information. The online tasks zero in on the normal operation of language processing and allows us to learn about deficits, about fundamental sparing and loss, and hence could help us to devise focused and efficacious treatment programs.

E.g. priming studies, word monitoring tasks etc.

ii) Offline tasks: These require a patient to consciously reflect on a decision and most often includes problems solving (e.g. what does this sentence mean," is an ostrich a bird"? etc). These tasks are affected by memory and attentional demands. They measure effects observed at end points of perhaps several processes. Offline tasks thus mask a patient's strengths and weakness in any single area involving sub components of language domain.

Eg. sentence-picture matching, categorization tasks, word generation etc.

Thus online tasks are generally preferred over the offline tasks in understanding language processing.

Among the online tasks, the primed lexical decision task (LDT) (Meyer and Schvaneveldt, 1971) has been frequently used to study bilingual lexical organization.

What is priming?

Priming refers to an increase in the accuracy, probability or speed of response to stimulus as a consequence of a prior exposure to another stimulus. Priming occurs when the processing of a word (the target) is facilitated by a preceding stimulus (the prime). The first word is called the prime and the word to which a response (lexical decision or naming) has to be made is called the target. The time between when the prime is presented (its onset) and the start of the target is called Stimulus Onset Asynchrony (SOA).

The most common interpretation of priming is that the cortical representations of the prime and target are interconnected or overlap in some way such that activating the representation of the prime automatically activates the representation of the target word.

Cross-language Priming

Priming patterns described above when seen across different languages is termed cross-language priming.

E.g. Among the pairs *perro* (Spanish for dog; prime) - CAT (target) and *casa* (Spanish for house; prime) – CAT (target), responses will be faster for the former than the latter as they are semantically related. Essentially, here the prime-target pairs are of different languages.

Cross-language priming experiments' results enable us to get an insight into the bilingual memory architecture. If a bilingual's two languages are stored in separate

language specific lexicons, then no cross language semantic priming would be expected. However if semantic priming is found across languages, then one can conclude that both languages share a common representation system.

Priming can be of different types:

i) Semantic Priming/Associative Priming: It refers to easier or faster identification of a word when it is preceded by a word related in meaning.

E.g. Identification of cat (prime)-DOG (target) is faster than book (prime)-DOG (target) as the first pair is semantically related.

In the bilingual version of it, the prime is in one language and the target word in the other language.

E.g. chien (prime) - CAT (target)

ii) Phonological Priming: Phonological priming refers to the phenomenon whereby the identification of a word is made easier by the prior exposure to a word that is phonologically related than to phonologically unrelated word.

E.g. Individuals are faster to identify the word *cry* (target word) when it is preceded by a phonologically related word *try* (prime word) than when it is preceded by a phonologically unrelated word *mug*.

iii) Repetition Priming or Translation Priming: Repetition priming is the phenomenon whereby subjects are faster and more accurate at responding to a word if it is preceded by the same word (a repetition prime) than if it's preceded by a different, unrelated word.

In translation priming a prime word is presented in one language of a bilingual, followed by its translation in the other language of the bilingual.

E.g. word pairs can be presented as either *gato* (prime) – cat (target) or cat (prime) – *gato* (target). *Gato* is the Spanish translation of cat. In repetition or translation priming the presentation of a prime word automatically causes its lexical entry (Forster & Davis, 1984) to be activated, so that if the subsequent target is the same as the prime word, less target processing has to be done before a response is made.

Researchers have frequently used the translation priming task to assess lexical organization in bilinguals.

iv) Orthographic Priming / Form Based Priming: This refers to priming effects observed when the prime is orthographically related to the target.

E.g. Contrast (prime)–CONTRACT (target)

v) Syntactic Priming: It refers to the priming effects observed when the prime is syntactically related go the target

E.g. runs (prime) –RUN (target)

In the study of bilingual lexical organization, translation and semantic priming paradigms using lexical decision tasks (LDT) have been frequently used.

The LDT can be of four different types:

i) ***Visual pair-wise decision paradigm*:** refers to the standard LDT in which subjects make decisions about visually presented letter string targets preceded by a single prime.

ii) ***Auditory pair-wise LDT*:** This is similar to the above except that primes and targets are presented auditorily.

iii) ***Auditory triplet LDT*:** In such a task, subjects make lexical decisions about a single target word or non word that is preceded by two consecutively presented primes, auditorily.

iv) ***List priming LDT*:** In this task, visual letter strings are presented in a continuous list format, not pairs, and the subjects make lexical decisions about both **primes** and targets.

The present study employs the visual pair wise LDT in a cross-language translation and semantic priming paradigm. The semantic priming effects obtained with the lexical decision task may be attributed to Posner and Snyder's (1975) dual process theory of priming. According to this, priming effects may be either due to:-

i) *Automatically, fast acting, inhibition less automatic priming component.* OR

ii) Priming can be induced via *attentional processes*, reflecting subjects awareness of contextual factors that extend beyond the prime-target relationship; *strategic priming.*

Automatic priming effects can be discussed in terms of automatic spreading activation (ASA). The concept of ASA is based on the assumption that semantically/ associatively related word nodes are stored or linked closely together in lexical memory. In other words, the cortical representations of the prime and the targets are interconnected or overlap in some way. Thus the spreading activation theory of semantic priming assumes that the prime preactivates the representations of every word that is semantically related to it. Also as this spread of activation occurs only between word nodes that are semantically or associatively related, the presentation of a prime does not impact the

processing of words unrelated to the prime. Therefore, ASA can account for facilitatory effects, but not inhibitory effects.

Automatic priming occurs under conditions which discourage conscious processing of the prime for example, when the stimulus-onset-asynchrony (SOA) between prime and the target is very short (250 ms or less). SOA refers to the amount of time between the onset of the prime presentation and the onset of the target presentation. According to Neely (as cited in Fox, 1996) a short SOA discourages the use of attentional processes, as these mechanisms require more time to be operative. The relatedness proportion (RP), which is defined as the proportion of related prime-target trials out of all prime-target trials also influences automatic and strategic processing. It has been shown that when the relatedness proportion is large (i.e., more related word pairs than unrelated in an experiment), the semantic priming effect is larger than usual (de Groot, 1984). Therefore, it is suggested that RP should be kept low when designing priming experiments, if one is to obtain the most accurate estimate of priming effect (i.e., automatic processing). Nonword ratio also affects processing. The nonword ratio is best explained as the proportion of nonwords out of all nonword and unrelated word pairs. Therefore, when this ratio is below 0.50 (i.e., the experimental stimuli consists of more word pairs than nonword pairs), individuals may be biased to give a response when a nonword is presented, simply because more words than nonwords are in the experimental list. However, when the nonword ratio is above 0.50, participants may choose 'nonword'; because nonwords are presented more frequently than words (McNamara & Holbrook, 2003). The ideal nonword ratio is 0.50.

In studies investigating cross-language priming it has generally been found that cross language priming occurs with SOAs of 300ms or less (Chen & Ng, 1989; Keatley et al., 1994). With longer SOAs it is assumed that strategic factors play a role in producing priming effects. In strategic priming or priming induced via attentional process, two types of mechanisms have been proposed to explain these strategic priming effects.

a) *Expectancy and*

b) *Post lexical checking*

Expectancy accounts posit that subjects use the prime to generate a set of expectations about the forthcoming target (Becker 1980, Posner and Snyder 1975a). If the subsequent target is indeed in this expectancy set, reaction times are facilitated. If not, reaction times are inhibited because subjects must devote more attentional resources to activate the node for a word not present in the expectancy set.

Post lexical processing involves the accession of expected and unexpected targets at the same rate, but the subsequent decision to accept or reject the target as a word is influenced by subject expectations. Thus, strategic priming can be because of post lexical integration mechanism or allocation of attention to the memory area containing the representation of the target word prior to its occurrence. In either case, strategic effects (controlled, conscious), may be facilitatory or inhibitory where as automatic priming effects are always facilitatory.

To measure the relative contribution of facilitatory and inhibitory effects to the overall semantic priming effect, a neutral priming condition must be used. The purpose of using a neutral prime is to provide a baseline priming condition that is semantically

neutral in comparison to the related and unrelated word prime conditions. Facilitatory effects refer to faster and/or more accurate response in related word condition as compared to the neutral priming condition. Inhibitory effects refer to slower and/or less accurate responses in the unrelated word condition as compared to the neutral priming condition.

f. Review on Cross-language Priming Studies

During the past three decades, there has been a plethora of studies conducted on bilingual memory representation and the way in which two or more languages are stored in memory. A review of literature reveals that nearly one dozen of these studies have used semantic priming paradigm with between language stimuli (Chen and Ng, 1989; Frenck and Pynte, 1987; Grainger and Beauvillain, 1988; Keatley and de Gelder, 1992; Keatley, Spinks and de Gelder, 1994; Kirsner et al., 1984; Larsen, Fritsch, and Grava, 1994; Meyer and Ruddy, 1975; Schwanenflugel and Rey, 1986; Tzelgov and Eben-Ezra, 1992; Williams, 1994). A few relevant studies are detailed below.

Schwanenflugel and Rey (1986) conducted two experiments to examine the representation of semantic information in the bilingual lexicon. The influence of cross language semantic and translation priming in lexical decision in early Spanish – English bilinguals was tested at 300ms SOA. Results showed that robust priming was obtained in L1-L2 direction and L2-L1 direction and this is consistent with the view that bilingual lexicon is connected via language independent representation.

Frenck and Pynte (1987) conducted an experiment in French-English bilinguals to study the semantic organization of the bilingual's two languages. Instead of choosing exact lexical items or translations for the priming in Lexical Decision Task (LDT), they chose the category names for the bilingual's two languages. Facilitation due to priming was observed both across and within languages. However, it was not observed equally for both languages and not for all the lexical items. The results showed a greater facilitation effect for those words that were identified the most slowly when presented in isolation for less skilled bilinguals. Frenck and Pynte (1987) suggested that the priming facilitation observed may not have been the result of effortless automatic processing but were rather due to the conscious, strategic use of primes.

Chen and Ng (1989) investigated semantic facilitation and translation priming effects in Chinese-English bilingual speakers with a lexical decision task (LDT). A 300ms SOA was used between display of the prime and the target item. Results of the first experiment revealed that subjects lexical decision responses were facilitated to a greater extent when primed by a translation equivalent than a semantically related between-language word. Results of their second experiment revealed that pictorial between language and within language primes produced comparable effects of semantic facilitation. The results are in line with the hypothesis that lexical items in different languages and pictures are processed by means of amodal conceptual system.

In a series of experiments, Keatley Spinks and de Gelder (1994) found, employing a LDT that cross language priming does occur, but only when primes are presented in the subjects' first language (L1-Chinese) and the target words are presented in the subjects' second language (L2-English). They attributed the asymmetry in cross language priming

to stronger connections from L1 to L2, than from L2 to L1 and also suggest that this asymmetric cross-language priming can be accounted for by a language specific model of bilingual memory, where representations of words expressed in different languages are stored in separate memory system which may be interconnected via one to one links between some translation equivalent representation as well as meaning integration processes.

Fox (1996) conducted two experiments in French-English bilinguals to examine whether unattended words on one of a bilinguals language could influence processing of an attended word on the other language. A summary of the results is as follows.

a) Cross-language negative priming from semantic associates was found in the L1-L2 condition.[Negative priming is the demonstration that responses to stimuli that have been recently ignored are slower than responses to control stimuli, Fox,1995; May, Kane, and Hasher,1995)]
b) Cross-language negative priming from translation equivalents was found for both L1-L2 and L2-L1 condition, but the magnitude of negative priming was greater in the L1-L2 condition. Fox (1996) concluded that bilinguals access common conceptual representations across languages.

Samani and Sharifian (1997) investigated the facilitatory effects of cross language translation priming in Persian – English bilinguals at an SOA of 300 ms. Results reveled that (a) there was no significant facilitation from a prime in the subject's first language in L2-L1 translation (b) significant facilitation occurred from a prime in the subjects second language in L1-L2 translation (c) there was no significant difference between L1-L2 and

L2-L1, translation tasks in the unprimed condition. They concluded that bilinguals have a common representational system.

A review of these studies revealed that there are many discrepancies in the data reported due to SOA length, word/nonword ratio, length of prime and target, proficiency of bilinguals, cognate status etc. In summary, it can be said that the concept of priming asymmetry (i.e. larger priming magnitude seen from L1-L2 than L2-L1) is the present consensus among a majority of the authors.

A few studies have specifically investigated only translation priming. These studies have revealed a wide range of results (Altarriba, 1990; Chen and Ng, 1989; de Groot and Nas, 1991; Gollan, Forster and Frost, 1997; Grainger and Frenck-Mestre, 1998; Jiang, 1999; Jiang and Forster, 2001; Jin, 1990; Keatley and de Gelder, 1992; Keatley et al., 1994; Williams, 1994). The studies have focused on determining if primes that are translation equivalents of their targets will facilitate target processing. Typically the results have shown that translation primes and targets that are form related (cognates) produce larger and more consistent priming effects than translation primes that have no form overlap (noncognates). The lack of robust noncognate priming effect is especially marked when priming is in the L2-L1 direction (Gollan et al., 1997; Grainger and Frenck-Mestre, 1998; Jiang, 1999). Considering that robust cognate translation priming has been consistently reported in literature, two accounts to elucidate the same have been proposed. One view has suggested a representational basis for the cognate priming effect (Sanchez-Casas et al., 1992). In this account, cross-language priming occurs because the representations of cognate translations are strongly linked, possibly sharing representational properties in a manner similar to morphologically related within-

language words. An alternative account of the reliability of cognate priming is that it is a consequence of combined form-priming from different lexical codes. That is, a combination of orthographic and semantic similarity will lead to a pairing up of codes which in turn will allow for a faster zooming in on the correct target word (Dijkstra, Grainger and van Heuven, 1999).

Cross-script Priming

The above detailed robust cognate and fragile non-cognate translation priming effects described above were obtained with languages written in the same script (e.g., French and English, Dutch and English, and Spanish and English). This need not be the case for primes and targets written in different scripts. Only a few experiments have been done investigating cross-language priming in languages written in different scripts i.e., cross-script priming (Gollan et al., 1997; Jiang, 1999; Jiang and Forster, 2001; Jin, 1990). Gollan et al. (1997) through masked priming paradigm examined translation priming between two dissimilar languages Hebrew and English. Masked priming is a paradigm whereby the subject is consciously unaware of the stimuli presented. This is brought about by presenting a hash mark (##) preceding the prime (forward masking) which is then followed by the target. The authors investigated whether the superiority of priming for cognates (words that share semantic and phonologic properties) over non-cognates is obtained when different scripts are used. Stronger translation priming effects were obtained for cognates but only when the prime was in the dominant language (L1). Interestingly strong translation priming was also obtained for non-cognates. Overall more facilitation was obtained when primes where in L1 and targets were L2. These results show that script differences are important in cross language priming and are interpreted in

terms of a dual lexicon model, in which one lexicon must be accessed before the other. It is argued that the script provides a strong cue to the lexical processor, allowing the approximate lexicon for the prime to be accessed in time to produce priming for noncognates. For same script cognates, however, no cue is necessary since it is assumed that these words are jointly represented in both lexicons and hence translation priming is obtained whether the languages differ in script or not.

Another plausible explanation for the above finding, in line with a shared representation, would be that the orthographic competition between the same script target and prime could have prevented the emergence of any priming effect (specially when the response task suggests the importance of orthographic form information, e.g., a LDT).

Thus, when primes and targets are written in different scripts, there may be no orthographic inhibition and so any priming effect due to the overlap between the prime and target processing will become apparent. Williams (1994) contradicted the above theory by demonstrating that significant noncognate translation priming took place even in the absence of structurally dissimilar scripts (Italian-English, French-English and German-English).

Yet another study by Grainger and Frenck-Mestre (1998) employed masked priming paradigm on translation equivalents in proficient bilinguals with an aim to examine task effects in priming effects. The responses of English French bilinguals performing semantic categorization and lexical decision tasks were facilitated by prime stimuli that were noncognate translation equivalents of the targets when compared to unrelated primes. These translation priming effects were observed with very brief prime exposures (29-43ms) and forward and backward masking of the prime. In forward

masking, a hash mark (##) typically, precedes the prime which is then followed by the target. Backward masking is characterized by the hash (#) mark following the prime, which is then followed by the target. Using the same stimuli, translation-priming effects were significantly stronger in the semantic categorization task than in the LDT. This suggests that the translation priming effect obtained in semantic categorization is mediated by semantic representations in memory and not the result of form level conditions between translation equivalents at least for the highly proficient bilinguals tested in the experiment.

Kim and Davis (2003) conducted a cross-script experiment using cognates, noncognates and interlingual homographs (similar sounding prime-target pairs with no semantic overlap; e.g., pul (grass, in Korean)-PULL). All the subjects chosen were Korean (L1)-English (L2) bilinguals with L1 dominant. A masked priming paradigm was used. Results relevant to the present study reveal significant priming from both cognate and noncognate translation primes. However, no significant difference between the size of cognate and noncognate priming emerged. They support the present findings by proposing the activation of a shared prime-target semantic properties.

Thus a review of the existing literature reveal mixed results regarding the nature of cross-language priming, especially with regards to translation equivalents. Hence, it would seem worthwhile to probe into the priming patterns of individuals who use languages with different scripts.

g. Priming and Bilingual Proficiency

At the outset, a mention needs to be made regarding the paucity in studies investigating the proficiency effects on performance in a primed lexical decision task (LDT). Most of the studies reported in the literature have investigated the models of bilingual lexical organization employing tasks such as translation production, translation recognition, Stroop tasks, picture naming etc.

To quote an example, in the Revised Hierarchical Memory model (Kroll and Stewart 1990, 1994), the hypothesis that both lexical and conceptual links are active in bilingual memory but the strength of which varies with fluency in L2 and the relative dominance of L1 to L2 was tested by Kroll and Stewart (1994) and Sholl, Sankaranarayanan, and Kroll (1995) using translation tasks on fluent Dutch-English bilinguals.

A few other studies have employed the same experimental paradigm to test subjects with varying levels of proficiency. de Groot (1995) had three groups of Dutch-English bilinguals translate words from Dutch (their L1) to English (L2) and vice versa. The groups differed in their levels of proficiency in English. Group 1 comprised of University students, Group 2 and 3 comprised of secondary school students in fifth and third grade, respectively. The first group results revealed no translation asymmetries; i.e., statistically translation was as fast in the forward direction as in the backward direction, although a nonsignificant benefit was observed for forward translation (L1-L2). This pattern was seen for both cognates as well as noncognates. The data patterns for the other

two low proficient groups revealed a translation reaction time that was slower for backward translation (L2-L1).

Swaak (1993) tested Spanish-English bilinguals in one experiment and Dutch-English bilinguals in the other. The task employed with both the groups was translation recognition, both in L1-L2 and L2-L1 direction. There were low proficient and high proficient groups. The low proficiency group showed the regular concreteness effect (i.e. concrete responses were identified faster compared to abstract words) in forward translation, i.e., L1-L2. But a reverse effect was noticed in the L2-L1 direction; faster responses were obtained in the L2-L1 translation. The high proficient group, on the other hand, showed equally large concreteness effects in both the directions (i.e., in both the directions, concrete words producing the fastest responses).

Looking into the priming literature, Kroll and Borning (1987) conducted a study regarding performance asymmetries on lexical decision tasks by fluent and less fluent English-Spanish bilinguals. The task was sentence completion in which sentence fragments in English were completed by target words in English or Spanish that rendered the sentences meaningful or not. Results revealed that fluent English-Spanish bilinguals were faster to make lexical decisions for related than for unrelated target words, regardless of the language of the target, the fluent bilinguals shows effects of target relatedness only for English targets, indicating that they were unable to conceptually mediate Spanish.

Keatley et al. (1994) demonstrated priming asymmetries even in highly fluent Dutch-English bilinguals; priming was significant only in the L1-L2 direction and not in

the reverse for semantically related prime-target pairs. Similar results have been reported by Grainger and Frenck-Mestre (1998) for translation primes in highly proficient French-English bilinguals.

Frenck-Mestre and Prince (1997) found that even individuals whoa re not completely fluent in L2 can function in L2 at a level sufficiently autonomous to enable semantic access. They investigated the level of second language autonomy of French-English bilinguals at two levels of proficiency. One group of L2 speakers was comprised of relatively proficient L2 graduate students who were studying to become instructors of English. The other group included less proficient students who wre under training to become primary school teachers. Frenck-Mestre and Prince also tested a group of native speakers for comparison. One experiment was a primed lexical decision task with several types of lexical relations like antonyms (e.g., hot-cold), synonyms (e.g., small-little), and collocations (e.g., comb-hair). They found that highly proficient bilinguals showed priming similar to the native speakers, demonstrating that the proficient bilinguals were able to access conceptual information in the second language. In a second experiment, they tested a similar set of participants on a primed lexical decision task, to examine priming of the dominant and subordinate meanings of homographs (e.g., ruler). The results replicated the previous findings in that the highly proficient bilinguals performed like the English monolinguals, showing priming for both the dominant and subordinate meanings of a homograph. In contrast, the group of intermediate bilinguals showed priming for the dominant and not the subordinate meanings of the homographs. The results of both the studies together suggest that even bilinguals who are not highly proficient are able to use conceptual information to a certain degree, even under rapid

presentation conditions such as a lexical decision task with conditions manipulated to encourage automatic processing.

Studies investigating priming effects as a function of proficiency are thus, sparse and not very conclusive. Hence, the present study was chosen to examine the priming patterns across bilinguals of varying proficiency.

h. Measuring bilingualism

A bilingual's competence may encompass a range of skills, some of which may not be equally developed, in a number of languages and varieties. The fact that speakers select different languages or varieties for use in different situations shows that not all languages are equal or regarded as equally appropriate or adequate for use in all speech events. As the bilingual's skill may not be the same for both languages at all linguistic levels, proficiency needs to be assessed in a variety of areas such as Listening (L), Speaking (S), Reading (R) and Writing (W) in the two languages A and B.

MacNamara (1967) grouped the kinds of tests used to measure bilingual ability into four categories, namely,

a) *Rating scales*
b) *Fluency tests*
c) *Flexibility tests*
d) *Dominance tests*

Rating scales include various instruments such as interviews, language usage scales, and self-rating scales.

International Second Language Proficiency Rating Scale (ISLPR), previously referred to as ASLPR (Ingram 1985), is a widely accepted rating scale to assess second language proficiency. The authors of the ISLPR changed the name from Australian Second Language Proficiency Ratings (ASLPR) in 1997 in an effort to acknowledge the growing international use of the scales. ISLPR is a scale that rates the proficiency of bilinguals in all four language skills, namely, Speaking(S), Listening (L), Writing (W) and Reading(R) on a nine point scale. The authors have reported a high level of validity and reliability and that it can be confidently used to assess a bilingual person's practical skills in the second language. (See Appendix-A for details of the rating scale).

Fluency has been a parameter that has received a great deal of weight in measurements of proficiency. A variety of fluency tests have been used to assess dominance. The most common of them are- picture naming, word completion, oral reading, and following instructions. Tasks such as synonym production, word associations and word frequency estimations have also been employed.

Dominance tests use any of the above tests to assess the relative dominance of one language over another in particular areas. The outcome has been greater precision in defining different types and degrees of bilingualism at the expense of more qualitative differences in language proficiency that are hard to measure.

Given all the above different types of methods to measure bilingual proficiency, the ISLPR was chosen owing to its documented reliability and validity, ease of administration and test material availability.

Need for the study

Bilingualism research is an area with a lot of promise for the future to all those involved in the field, considering that majority of the individuals around the world are bilinguals. Studies addressing bilingual issues related to mental lexicon, lexical processing etc., have been emerging in large numbers in the American and European countries. Keeping in mind the nature of bilingualism in India, generalization from the studies done in the West is questionable.

Further, the languages that have been investigated so far are languages from entirely different language families compared to those in India (English, Italian, Spanish, French, German, Dutch, Chinese, Japanese, Korean, Hebrew and Greek). The language considered in the present study, Kannada, is a member of the Dravidian family of languages and is spoken in South India, mainly in the state of Karnataka. It follows the Brahmi script and is syllabic. English, on the other hand, is from the Latin language family and is alphabetic. There is a need to investigate such structurally distant languages for a clearer understanding of language processing in bilinguals. Moreover, using an online task like priming which taps automatic processing will provide valuable insights regarding the bilingual mental lexicon.

A need for the study also arises from the fact that there is paucity in research findings concerning the influence of varied proficiency levels and their influence on priming. Majority of the studies have employed tasks such as translation production, translation recognition, Stroop tests etc. Studies investigating how different proficiency groups perform on a primed lexical decision task have not been carried out. Thus, such a study is warranted.

A database of normative values is essential prior to making any extensions and generalizations to the strata of population not directly investigated. Such a study would help in establishing the database that is necessary for any future comparisons with the disordered population. Only when the lexical representation in normal bilinguals is clearly delineated can the aspects of disorders be inferred. Thus, from a clinical standpoint too such a study is warranted.

METHOD

The present study is designed to study lexical processing in high proficient and low proficient bilingual adults by employing a primed lexical decision task.

Objectives of the Study

The study was designed with the following objectives:

1. To investigate cross-language priming in normal bilingual adults at 250ms stimulus onset asynchrony (SOA) when,
    a. The prime is presented in the subject's first language (Kannada) and the target is presented in the subject's second language (English).
    b. The prime is presented in the subject's second language (English) and the target is presented in the subject's first language (Kannada).
2. To investigate the relationship between the pattern of priming and language proficiency levels.

Subjects

A total of thirty normal bilingual adults in the age range of 18-40 years served as subjects. Amongst the thirty, they were further grouped as high proficient bilinguals (HP) and low proficient (LP) users of English on the basis of ratings obtained on the International Second Language Proficiency Rating Scale (ISLPR). All subjects had Kannada as their first language and learnt English as second language at ages ranging

from 3.5 to 15 years (mean age of 6.1years). All subjects demonstrated sufficient visual acuity (aided or unaided) to read stimulus words presented white on black of a computer monitor. All subjects had no history of neurological, communicative or sensory impairment. Table 2 shows the particulars of subjects.

Stimulus Material

Translation equivalent word pairs, semantically related word pairs and semantically unrelated word pairs formed the stimulus material. Two base lists of one hundred and twenty five cross language prime-target containing seventy five nonrepeated word targets and fifty nonrepeated nonword targets were made. In the first list the prime was in Kannada and the target was in English and in the second list prime was in English and target was in Kannada (see Appendix B for details of the stimulus material).

Words were selected from textbooks, dictionaries and Coltheart and Karanth (1982) word list. Attempt was made to include only frequently occurring words. Part of the nonwords were selected from Coltheart and Karanth word list and the rest were formed by substituting, transposing and/or adding one or two letters of words not selected for word targets. Nonwords were pronounceable and orthographically regular.

Sl no	Age in years	Gender	Age of acquisition of L1	Age of acquisition of L2	Mode of acquisition of L2	ISLPR scores	Proficiency	Years of formal education	Years of formal education in L2	Educational qualification
1	18	F	0	3.5y	Sc+ H	S5L5W5R5	HP	15	15	12+
2	20	F	0	3.5	S c+ H	S5L5W5R5	HP	17	17	G
3	20	F	0	3.5	S c+ H	S5L5W5R5	HP	17	17	G
4	23	F	0	3.5	S c+ H	S5L5W5R5	HP	19	19	PG
5	19	M	0	3.5	S c+ H	S5L5W5R5	HP	16	16	12+
6	20	F	0	3.5	Sc	S4L4W4R4	HP	16	16	12+
7	19	M	0	3.5	Sc	S5L5W5R5	HP	16	16	12+
8	19	M	0	3.5	Sc+ H	S5L5W5R5	HP	16	16	12+
9	19	M	0	3.5	Sc	S5L5W5R5	HP	16	16	12+
10	18	M	0	3.5	Sc	S4L4W4R4	HP	15	15	12+
11	19	M	0	3.5	Sc+ H	S4L4W4R4	HP	15	15	12+
12	18	F	0	3.5	Sc	S5L5W5R5	HP	15	15	Diploma holder
13	20	M	0	3.5	Sc	S5L5W5R5	HP	16	16	12+
14	19	F	0	3.5	Sc+ H	S5L5W5R5	HP	15	15	12+
15	18	M	0	3.5	Sc+ H	S5L5W5R5	HP	15	15	12+
16	20	F	0	3.5	Sc	S3L3W3R3	LP	17	17	G
17	18	M	0	9	Sc	S3L3W3R3	LP	15	10	12+
18	18	M	0	15	Sc	S2L2R2W2	LP	15	3	12+
19	30	M	0	15	Sc	S3L3W3R3	LP	18	6	B.S.Ed
20	19	M	0	15	Sc	S2L2R2W2	LP	15	3	Diploma holder
21	19	M	0	3.5	Sc	S3L3W3R3	LP	15	15	Diploma holder
22	20	M	0	13	Sc	S3L3W3R3	LP	17	6	G
23	21	M	0	13	Sc	S3L3W3R3	LP	18	7	G
24	20	M	0	3.5	Sc	S3L3W3R3	LP	16	16	12+
25	30	F	0	13	Sc	S3L3W3R3	LP	19	9	PG
26	24	F	0	13	Sc	S3L3W3R3	LP	19	9	PG
27	19	M	0	3.5	Sc	S3L3W3R3	LP	15	15	12+

28	18	F	0	3.5	Sc	S2L2W2R2	LP	15	15	12+
29	18	F	0	3.5	Sc	S2L2W2R2	LP	15	15	12+
30	23	M	0	3.5	Sc	S3L3W3R3	LP	18	18	G

Table 2: Particulars of Subjects

S-Speaking, L-Listening, R-Reading, W-Writing, H-Home, Sc-School, HP-high proficient, LP-low proficient, G-graduate, PG- post graduate.

Out of the seventy five word targets, twenty five were preceded by translation equivalent primes, twenty five were preceded by related primes and twenty five were preceded by unrelated primes. These seventy five prime-target pairs were the critical prime target pairs and were included in the statistical analysis. Twenty five filler prime-target pairs were also made in each list. These filler targets were used to achieve the relatedness proportion of 0.3 and nonword ratio of 0.5 and were not included in the statistical analysis. The fifty nonwords were preceded by word primes. Table 3 shows the example of stimulus material used in the experiment.

	Kannada - English		English - Kannada	
Prime-target pairs	Prime	Target	Prime	Target
Translation Eq.	akki	rice	rain	maLe
Related words	thaTTe	rice	cloud	maLe
Unrelated words	enTu	rice	bunch	maLe

Table 3: Example of stimulus material used in the experiment

To counterbalance target items across the different priming conditions, three additional lists were made from each base list in the two language-order condition (i.e. Kannada-English and English-Kannada). These additional lists were formed by making new primes for the targets. Prime type was alternated across each list version such that each word target appeared equally in the translation equivalent, related and unrelated priming condition. The final list consisted of three hundred word targets and 50 nonword targets in each language-order condition. Stimulus lists were counterbalanced across subjects such that each subject received hundred prime-targets word pairs (25 translation equivalent word pairs, 25 related word pairs, 25 unrelated word pairs and 25 filler prime-target word pairs) and fifty nonword target. The final list in the two language- order condition was given to five Speech Language Pathologists and one Linguist to judge the relatedness between prime- target word pairs and also to judge the frequently occurring words of the prime and targets.

In the two language-order condition i.e. Kannada-English and English-Kannada, each list was subdivided into 5 blocks consisting of 20 word targets (5 translation

equivalents, 5 related, 5 unrelated and 5 filler prime-target word pairs) and 10 nonword targets in each list. The relatedness proportion of 0.3 and nonword ratio of 0.5 was kept constant in all the blocks in each language order condition. Prior to each experimental session (i.e. for each individual subject), the order of items within each of these blocks was randomized, and then the order of the 5 blocks was randomized. Scrambling the stimuli in this manner decreased the likelihood of extraneous serial effects such as practice or fatigue.

A practice block of 18 prime-target trials containing 12 word targets and 6 nonword targets were made in two language order condition. Primes and targets for the practice blocks were words not used in the experiment. Out of the 12 word targets, 4 were preceded by translations equivalents, 4 were preceded by related prime and 4 were preceded by unrelated prime.

Procedure

All subjects were tested individually in a room. All prime-targets in the two language-order condition were presented consecutively on the centre line of a computer monitor. Words were displayed on white letters on black background on the computer monitor. Stimulus presentation was controlled by DMDX* software. Subjects responded by pressing the right arrow key and the left arrow key on the key board. Pressing the right arrow key (for a 'yes' response) and the left arrow key (for a 'no' response). All subjects responded by pressing the keys with the index and middle finger of their right hand.

* DMDX software was developed by Kenneth I. Forster and Jonathan C. Forster at Monash University and at the University of Arizona. DMDX is a Win 32-based display system used to measure reaction times to visual and auditory stimuli. Detailed information regarding this software is available at the followingwebsite:www.u.arizona.edu.dmdx.

Reaction times were recorded to the nearest millisecond and stored in the computer. The error rates were also noted down for each of the trial.

Each prime was presented for 200ms. This was followed by a 50ms interstimulus interval (ISI) during which the screen was blank. The target word then appeared and remained on the screen for 4000ms or until the subject responded, whichever occurred first. The subsequent prime appeared 2000ms (intertrial interval) after the previous target was cleared from the screen. If a subject failed to respond to a target within 4000ms, that item was recorded as an error, the intertrial interval was initiated, followed by presentation of the subsequent prime.

Subjects were read instructions describing the task. Subjects were told that they would see pairs of letter strings on the computer screen, and that they were required to decide as quickly and as accurately as possible, whether or not the second letter string was a word or not (i.e. in Kannada-English condition, they had to respond to the English target and in the English-Kannada condition, they had to respond to the Kannada target). Two minutes break was given after each block and five minutes break after each language condition was over. The entire session took around 25-30 minutes. The reaction times of all the critical targets were subjected to statistical analysis using the Statistical Package for Social Sciences (SPSS).

RESULTS

The aim of the present study was to investigate translation and semantic priming effects across the high proficient (HP) and low proficient (LP) normal bilingual adult population across the two language conditions- Kannada (L1)-to-English (L2) and English (L2)-to-Kannada (L1). The stimulus set was designed to check for automatic processing with a relatedness proportion of 0.3 and nonword ratio of 0.5, presented at 250ms SOA. A secondary objective was to explore the priming patterns in HP and LP bilinguals and to reflect on their bilingual lexical representation.

Before the mean values for reaction times were calculated, all reaction times below 200ms and above 2000ms were considered as outliers and eliminated from the analysis (Ulrich and Miller, 1994). The reaction times for incorrect responses were also eliminated from the analysis. This elimination did not change the general pattern of results. This accounted for 1.7% of the total data, from both the groups.

Reaction Time Analysis

A 3 (prime type/relatedness) x 2 (language order) x 2 (proficiency) analysis of variance (ANOVA) was performed with item mean reaction times and the error rates. Table 4 shows the Mean reaction time (RT), mean standard deviation (SD) and mean percentage error rates (ER) in each of the language order (Kannada – English and English – Kannada) and prime type.

	Prime types								
	TE			R			UR		
	RT	SD	ER	RT	SD	ER	RT	SD	ER
HPKE	638.61	137.10	1.54	678.03	214.63	1.47	754.88	53.64	1.66
HPEK	851.13	323.99	3.25	886.55	353.55	3.40	959.53	370.82	3.46
LPKE	953.26	149.25	3.25	1028.75	282.72	2.90	1036.93	193.10	3.01
LPEK	989.87	508.18	3.37	1022.60	260.07	3.19	1037.01	234.54	5.81

Table 4: Mean reaction times (RT) standard deviation (SD) and mean error rates (ER) to word targets in each priming condition TE/R/UR.

TE= Translation Equivalent, R= Related, UR= Unrelated priming conditions

A significant main effect was obtained for all the three variables considered, namely,

1. Proficiency (HP, LP)
2. Language order (K-E, E-K)
3. Relatedness (Translation Equivalents (TE), Related (R) and Unrelated (UR)

The main effect for proficiency groups was statistically significant [$F(1, 4319)=657.438$, $P<0.05$], indicating that the high proficient subjects were faster in the lexical decision task (LDT) (791ms) as compared to the low proficient subjects (1013.64 ms).

The main effect for language order was also significant [$F(1, 4319)=157.37$, $P<0.05$] suggesting that performance was faster in K to E condition (850.52ms) than E to K (960.45ms).

The main effect for relatedness emerged significant [$F(2, 4319)=36.08$, $P<0.05$] revealing that translation equivalents (TE) were judged faster (858.86ms) followed by related (R) targets (909.29ms) and maximum reaction times to unrelated (UR) targets (945.80ms).

The interaction effect of all the three variables suggested that, out of the three interaction effects, two were significant, namely,

(i) Proficiency group and language order interaction.

(ii) Proficiency group and relatedness interaction.

Language order and relatedness failed to reach statistical significance [(F (2, 4319) =1.102, P=0.332)].

The proficiency group by language order interaction was significant [F (1, 4319) =140.67, P<0.05] indicating that high proficient subjects judged the target words faster (690.53ms) in the K-E order than the LP (1010.5ms) in the same as well as reverse language order.

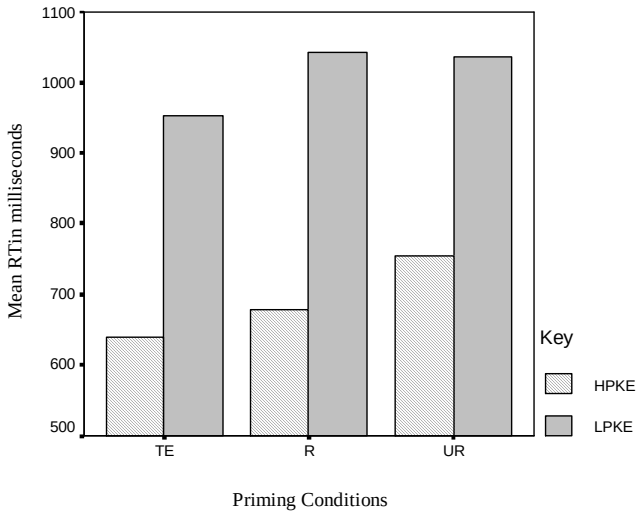

Fig: 4 Mean RT of HP and LP in K-E Condition

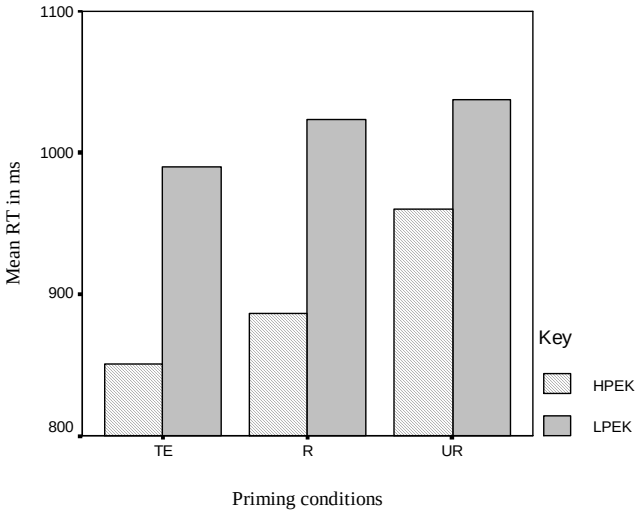

Fig: 5 Mean RT of both the groups in E-K condition

The proficiency group by relatedness interaction was also significant [F (2, 4319) =5.95, P<0.05] indicating that performance of high proficient subjects on the translation equivalents were better followed by related targets, and unrelated targets, than by the low proficient group.

Four separate one way ANOVAs were performed for each of the relatedness condition (translation equivalents , related and unrelated items) in order to determine whether facilitation (i.e. the priming effect) was significant for the K-E and E-K condition individually, across both high proficient and low proficient bilinguals.

Performance of High Proficiency Group

This analysis revealed a significant main effect for priming in the K-E direction [(F (2, 1101) =57.088, P<0.05]. A Tukey Post Hoc analysis revealed that the +116.27 ms

facilitation for translation equivalents word pairs was significant ($p<0.05$) and the +76.85 ms facilitation for the related word pairs was significant ($P<0.05$).

Significant priming was also observed in the E-K direction [$F (2, 1020) = 8.345$, $P<0.05$]. A Tukey Post-Hoc analysis of the difference between the mean reaction times obtained in each priming condition indicated that the 108.4ms facilitation obtained for translation equivalent word pairs and the +64.32ms facilitation obtained for the related word pairs was significant ($P<0.05$).

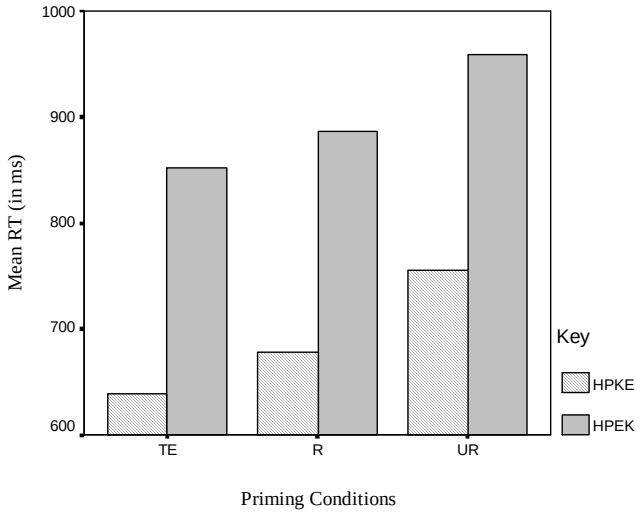

Fig: 6 Mean RTs of HP in both language orders

To summarize the results of the high proficient group, significant (both translation priming and semantic priming) was observed across both the language directions (i.e. in K-E and E-K). But the priming effects were more for translation equivalent word pairs, in both the language directions. Also L1-L2 overall priming effect was more (193.12ms) than L2-L1 (172.72ms).

Performance of the Low Proficiency Group

One way ANOVA revealed a significant main effect for priming in the K-E direction only [F (2, 1100) =20.02, P<0.05]. A Tukey Post-Hoc analysis of the difference between the mean reaction times obtained in each priming condition revealed a significant translation priming effect of +84.13ms (P<0.05). However no significant facilitation was seen for semantically related word pairs.

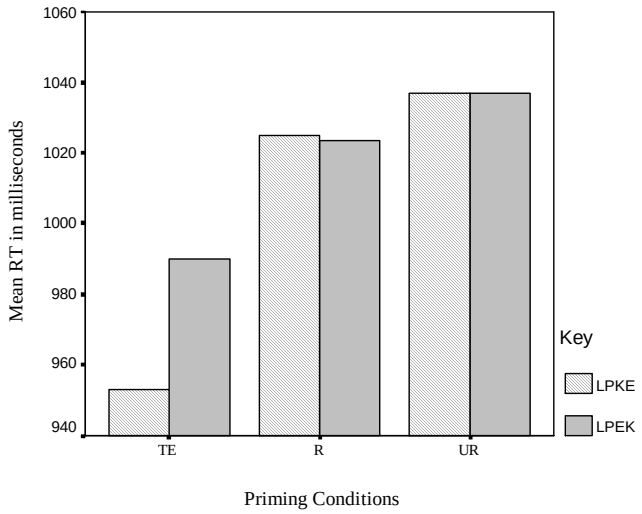

Fig: 7 Mean RT of LP in both the language orders

Priming was not significant in E-K language direction [F (2, 1105) =1.708, P= .182]. Thus the +47.14ms facilitation effect for translation equivalent and the +13.40ms facilitation for related word pairs were not statistically significant.

Significant priming was observed only in the K-E (L1-L2) direction and not in the E-K (L2-L1) direction for this group. Further, only the facilitation effect for translation

equivalent word pairs reached statistical significance. The related word pairs showed no significant facilitation effect.

The results of the reaction time analysis in general reveal asymmetry in cross-language priming. This asymmetry was especially evident in the language order and proficiency groups, with the priming effects larger in the Kannada to English direction than the reverse and larger priming effects in the high proficient groups than the low proficient bilinguals. Though priming was evident in low proficient bilinguals also, the magnitude of priming was small compared to that of high proficient bilinguals. Further, priming effects was significant across both the language directions (i.e. K to E and E to K) only for the high proficient group. In the low proficient bilinguals, priming was significant only in the K-E direction. In terms of the prime types, translation equivalent word pairs were judged relatively faster than semantically related words and maximum reaction times were evidenced for unrelated word pairs. This general trend was noticed across both the proficiency groups and in both the language directions, though a statistical significance was not reached. Table 5 shows the summary of priming effects.

	Facil TE	Facil R	Overall
KPKE	+116.27*	+76.85*	+193.12*
HPEK	+108.4*	+64.32*	+172.72*
LPKE	+84.13	-5.35	+78.78
LPEK	+47.14	+13.40	+60.54

Table 5: Priming Effects Summary (in milliseconds)

Facil TE= Facilitation for translation equivalent = (UR minus TE), Facil R= Facilitation for related = (UR minus R), Over all = Facil TE = Facil R
*indicates statistical significance at 0.05 level

Error Analysis

The total percent errors produced by the high proficient bilingual group amounted to less than 1% of the entire data. Errors in the K-E language order condition was 2.31%. Error rate was high for unrelated word pairs (3.51%).

A 2 (Proficiency group) x 2 (Language-order) x 3 (relatedness) ANOVA yielded a main effect for only the proficiency group and language direction and not for the relatedness factor. The main effect for proficiency yielded a significance [F (1, 4488) =7.02, P<0.05] suggesting that the HP group made the least errors compared to the LP group. Main effect for language direction emerged significant [F (1, 4488) =11.47, P<0.05] revealing that errors were less in the K-E direction than E-K.

The relatedness factor did not emerge statistically significant [F (2, 4488) =1.233, P=.291). Though a statistical significance was not attained, qualitatively it appears that subjects made more errors to unrelated targets than translation equivalents and related. None of the interaction effects were significant.

A one way ANOVA of the mean error rates obtained in each (priming condition-translation equivalents, related and unrelated word pairs) was performed separately in each of the proficiency groups (HP and LP) and for both the language order conditions (K to E and E to K). The results yielded no statistical significance across any of the conditions compared.

DISCUSSION

The results of the study reveal the presence of cross-language priming in both directions, Kannada-to-English (K-E, i.e. L1-L2) and English-to-Kannada (E-K, i.e. L2-L1) as evidenced by faster reaction times (RT) to the target words in either language when the prime preceding it was given in the opposite language (i.e. a Kannada prime facilitated an English target and vice-versa). Further, the performance of the high proficient group was faster as compared to the low proficient group.

Asymmetrical Priming

Though the priming effects mentioned above was significant across both the language order conditions ($P< 0.05$), the magnitude of priming was larger in the L1-L2 direction than the L2-L1, as indicated by the difference in RTs to both the language orders (850.52ms in Kannada-English and 960.45ms in English-Kannada) which reached a statistical significance ($P <0.05$).

Thus there was an asymmetry in priming; larger priming from L1-L2 than L2-L1. This finding is in consensus with previous literature reports (Altarriba, 1990; Chen and Ng, 1989; Frenck and Pynte, 1987; Keatley, Spinks and Gelder, 1990; Kirsner, Smith Lockhart, King and Jain, 1984; Meyer and Ruddy, 1974; Schwanenflugel and Rey 1986) all reporting significant L1-L2 priming than in the reverse direction.

Asymmetrical cross language priming can be accounted for by:

(i) A language specific model of bilingual memory (Keatley et al. (1990)

OR

(ii) A language independent /common storage model of bilingual memory (Kroll 1993, Kroll and Sholl (as cited in Kroll and de Groot, 2002); Kroll and Stewart 1990, 1994)

According to Keatley et al (1994) the asymmetric cross language priming can be accounted for by a language specific model of bilingual memory where the asymmetry in priming is due to the stronger connections from L1 to L2 than from L2 to L1. On the other hand, the Revised Hierarchical Memory (RHM) model outlined by Kroll and her colleagues clearly predicts that presentation of a word is more likely to activate its corresponding conceptual representation in L2 than its lexical representation in L2. In contrast, presentation of an L2 word is more likely to activate the corresponding word in L1 than the concept. Here, the asymmetry is due to different kinds of connections between the two languages; when the language order is L1-L2, it is assumed to be conceptual and when the language order is L2-L1, the connection is assumed to be lexical. Thus, the difference between the above two explanations is that in the model proposed by Keatley et al. (1994) connections differ in their *strength* where as in the RHM by Kroll and her colleagues asymmetry is attributed to the *different kinds* of connections between the languages.

The explanation proposed by Keatley et al. (1994) does not hold true for our study, as in their study, a dissociation between the priming effects and reaction time on the lexical decision task was obtained; i.e., their reaction times for both Chinese and

English targets (the two languages chosen for the study) were the same and yet a significant L1-L2 priming occurred. Hence, the explanation of one language (L1) processing taking place faster than the other language (L2) is ruled out. Posner (as cited in Keatley et al., 1994) suggest that reaction times in a lexical decision task reflect the fact that a representation is available to consciousness on the basis of its threshold and activation level. Applying the same premise to their study, the thresholds and activation levels of the representation of the words in Chinese and English must have been about the same (as evidenced by nearly same RTs). Cross-language priming on the other hand, depends on the strengths in cross language connections between the separate language systems. These connections were stronger from L1 and L2 than L2 to L1 and resulted in significant L1 –L2 priming. The stronger cross language effects from L1 to L2 may be attributable to richer and stronger representations in the L1 memory system.

But in our study such dissociation between priming effects and reaction times in the lexical decision task was not evident. There was a significant difference in the mean reaction times of both language order conditions L1-L2 and L2 –L1.Therefore the explanation proposed by RHM holds good here. According to the model, the asymmetry is attributed to the different type of connections at work in a L1-L2 condition (conceptual links) as against the L2-L1 (lexical links) condition. The link between the L1 and concepts appears to be bidirectional and very strong since a child acquiring his first language would form the strongest link between the language's lexicon and the corresponding concepts. However, as a person acquires a second language especially later in life, L2 words would be integrated into memory by developing a pathway that is attached to the lexicon of the first language. Since the link between the conceptual store and the L2 lexicon is described as being weaker than the link between the conceptual

store and the L1 lexicon, it has been suggested that priming in L2-L1 direction would be weaker and less in magnitude than L1-L2.

A more recent proposal that may provide some explanation for the priming effects observed in the current study, as well as in previous studies, was proposed by Finkbeiner et al. (2004). They proposed the "sense model" to account for the pattern of data observed in cross-language priming studies. According to the model, many words have language specific "senses" and that this aspect of language is often not taken into account in the bilingual literature. For example, they suggest that the word *black* in English and the word *kuroi* ('black' in Japanese) are translation equivalents, but in reality they really do not have much in common besides sharing the same sense for color. Black in English can refer to the color, a person of African American decent, an illegal sales market (i.e., black market), or even a cup of coffee that lacks cream and sugar. Meanwhile, the Japanese language also contains its own specific senses for the word *black* (or *kuroi*).

This characteristic of language, particularly the differences in senses across languages, can shed some light on the reported translation priming effects in that "the amount of priming may depend not only on the overlap in the semantic senses activated by the prime and target, but crucially, on the ratio of primed to unprimed senses associated with the target" (Finkbeiner et al., 2004). This idea suggests that each sense of a word is represented as a separate and specific representation in the semantic and lexical stores, which can cause a representational asymmetry between related words. Since translations are classified as "translations" they obviously have one meaning in common, but it is often the case that bilinguals are more proficient in their L1 than in their L2, which would suggest that they would be more familiar with the range of senses that a

word could have in the L1 as compared to the L2. Finkbeiner et al. (2004) point out that if priming increases as the proportion of primed to unprimed senses of the target word increases, one can expect the proportion of L2 senses primed by an L1 prime to be very high in bilinguals who are more proficient in their L1 (i.e., reliable and significant L1-L2 priming). However, in the opposite direction (L2-L1), the proportion of L1 senses primed by the L2 prime will be much lower because the L2 language skills may not be as strong as those in the L1 and as a result, many of the L1 senses will not be associated with L2 senses. This type of processing suggests that L2-L1 priming should occur to a lesser degree, a phenomenon that has been repeatedly reported.

Translation Priming and Semantic Priming

Another finding that emerged from the study was significant translation priming (calculated as mean reaction time of unrelated minus mean reaction time of translation equivalent) was observed in both language conditions, L1-L2 and L2-L1.

Semantic priming effects (calculated as the difference between the mean reaction time of unrelated and related targets) on the other hand, was smaller in magnitude compared to translation priming effects, in both the language directions L1-L2 and L2-L1. In other words, the translation priming effects for each language direction were larger than the semantic priming effects reported for the same language-order direction (i.e. L1-L2 translation priming was larger than L1-L2 semantic priming and L2-L1 translation priming was larger than L2-L1 semantic priming). A possible explanation for this could be that though semantic and translation word pairs are linked in a similar manner at the lexical level, translation equivalents may be different in that they have increased overlap

at the conceptual level (de Groot and Nas, 1991; Basnight Brown and Altarriba, 2005). This enhanced semantic overlap that translation equivalents have over semantically related words may be able to explain the larger translation priming effects as compared to semantic priming effects.

The finding of larger translation priming effects in L1-L2 than L2-L1 can be best explained by the sense model (Finkbeiner et al., 2004) discussed earlier. According to the model, many words have language specific "senses". Each sense of a word is represented as a separate and specific representation in the semantic and lexical stores, which can cause there a representational asymmetry between related words. The amount of priming may depend not only on the overlap in the semantic senses activated by the prime and target, but crucially, on the ratio of primed to unprimed senses associated with the target. The bilinguals are more proficient in their L1 than in their L2 and thus they would be more familiar with the range of senses that a word could have in the L1 as compared to the L2. the proportion of L2 senses primed by an L1 prime to be very high in bilinguals who are more proficient in their L1 (i.e., reliable and significant L1-L2 priming). However, in the opposite direction (L2-L1), the proportion of L1 senses primed by the L2 prime will be much lower because the L2 language skills may not be as strong as those in the L1 and as a result, many of the L1 senses will not be associated with L2 senses. This type of processing suggests that L2-L1 priming should occur to a lesser degree, undoubtedly in translation equivalents.

Cognate and Noncognate Priming

Most of studies on translation priming have delineated the word type effects on priming; increased priming effects for cognates (i.e. translations with similar spellings

and meaning; kalf-CALF; Dutch- English) than noncognates (i.e. translation with dissimilar spellings e.g. vrouw -WIFE). Typically, the results from a larger number of studies have shown that translation primes that are cognates (form related) produce larger and more consistent priming effects than translation primes and targets that are noncognate pairs (no form overlap)(de Groot and Nas,1991; Grainger and Frenck-Mestre, 1998; Sanchez-Casas et al., 1992; Willaims, 1994).

The script structure of Kannada and English being different, in the present study there were no cognate pairs; all translation equivalent word pairs were noncognates and priming effects were observed for these noncognate pairs as well. Results from studies investigating cross-language translation priming in orthographically dissimilar languages have reported of robust priming effects, for both cognates and non cognates in L1-L2 direction (Gollan et al., 1997; in Hebrew-English bilinguals and Jiang, 1999; in Chinese-English bilinguals). In their study, priming for non-cognates in L2-L1 direction, though significant, was reduced in magnitude. The robustness of L1-L2 priming is accounted for by the Revised Hierarchical Model (Kroll and Stewart 1990, 1994) in which L1-L2 translation may be conceptually mediated, unlike the L2-L1, which is mainly lexically mediated. Also Kroll and de Groot (1997) further suggested that L1 words are typically associated with more information and are more rapidly recognized than L2 words. Therefore these serve as more efficient primes. The results of the present study, where priming was observed for noncognate pairs as well offer a strong support for conceptual mediation in both high proficient and low proficient bilinguals.

Though the semantic priming effects were reduced in magnitude than translation priming there was a significant semantic priming effect observed and it was significant in

the L1-L2 direction than L2-L1. This finding is supported by a host of studies all coinciding with the results of the present study i.e., greater magnitudes of L1-L2 than L2-L1 semantic priming (Altarriba, 1990; Chen and Ng, 1989; Frenck and Pynte, 1987; Keatley, Spinks and Gelder, 1990; Kirsner, Smith Lockhart, King and Jain, 1984; Meyer and Ruddy, 1974; Schwanenflugel and Rey 1986). Once again the RHM explains this priming asymmetry through the different kinds of links between the two language systems. Since the link between the conceptual store and the L2 lexicon is described as being weaker than the link between L1 and the conceptual store it has been suggested that priming in the L2-L1 direction would be weaker and lesser in magnitude than that obtained in the L1-L2 direction. This phenomenon would be attributed to the fact that less semantic information is accessed in the L2, resulting in decreased priming effect in the L2-L1 direction.

Priming Patterns in High Proficient and Low Proficient Bilinguals

In general, the magnitude of priming was greater for the high proficient (HP) bilinguals than that below proficient (LP) group, and this difference reached a statistical significance ($P< 0.05$). Again, priming was larger from L1-L2 than L2-L1.

A wide variety of methods have been adopted to investigate lexical versus conceptual processes at work in individuals with varying levels of proficiency. These include studies on cross language transfer, translation production, translation recognition etc. Majority of these studies reveal an asymmetry in performance between the groups varying in proficiency. These studies have explained the asymmetry based on the word association model. As mentioned earlier, according to this model, the second language

accesses concepts via words in first language (L1). This model, through translation tasks and picture naming, states that lexical mediation through L1 appears to characterize the performance of non-fluent or LP bilinguals, where as concept mediation appears to characterize the performance of more fluent bilinguals. That is, less fluent individuals are faster to translate words than name pictures in the second language (Cheng and Leung, 1989; Kroll and Curley (as cited in Kroll and de Groot, 2002). The developmental hypothesis put forth by this model argues that with increasing expertise in L2, processing shifts from lexical to conceptual mediation. Results from various stroop studies, examining interference within and across language, also support this view (Cheng and Ho, 1986; Magiste, 1984; Tzelgov, Henik and Leiser, 1990).

Semantic priming studies have tried to test this model and have, for the most part, reported that fluent bilinguals are able to take advantage of the semantic context, even when it appears in the other language (Altarriba 1990; Chen and Ng, 1989; de Groot and Nas, 1991; Frenck and Pynte, 1987; Kirsner et al. 1984; Meyer and Ruddy 1974; Schwanenflugel and Rey 1986; Tzelgov and Henik, 1989). Our finding of larger magnitude for overall priming for HP bilinguals is thus in accordance with the previous research findings.

The results obtained from the present study reveals cross language priming even in less proficient bilinguals though the magnitude is significantly reduced when compared to the high proficient bilinguals. The word association model fails to account for the cross language priming effects seen in LP bilinguals.

A plausible explanation for our findings could be found in the RHM. In the RHM, the development of links between the conceptual store and L2 lexicon depends to a

great extent on the proficiency level. It has been suggested that this link may be very weak or non existent in a novice bilingual. A novice thus might have a weak connection between the concepts and L2 lexicon, when compared to a more balanced bilingual. Several studies have shown that bilinguals who are at the very early stages of second language acquisition can access some forms of conceptual (i.e. semantic) information (Altarriba and Mathis, 1997; de Duyck and Brysbaert 2004; Frenck-Mestre and Prince, 1997; La Heij, Hooglander, Kerling and van der Veldon, 1996). Therefore, it appears that all bilinguals regardless of their level of proficiency can access some semantic information, but the degree of that activation is influenced by proficiency and language dominance. Thus in our study, both the groups, HP and LP were able to access the semantic concepts and thereby demonstrate priming effects. But the priming effects were larger for HP group, as their connections with the L2 lexicon are stronger than the LP group.

Cross-script Priming

An interesting finding that emerged from the study was the presence of significant noncognate (different forms, similar meaning) translation priming in structurally dissimilar languages-Kannada and English.

Kannada script is syllabic, where as English is alphabetic. Studies investigating such orthographic dissimilar languages have been very few (Gollan et al., 1997; Jiang, 1999; Jiang and Forster, 2001; Jin, 1990). Among these, only that of Gollan et al. (1997) considered cognate and non cognate primes. Results from their study revealed robust masked translation priming effects for both cognates and noncognates; cognate priming

was larger than non cognates and L1-L2 priming effects were stronger than the reverse. They attributed the non-cognate priming effect to the plausible role of different scripts. According to them the bilinguals' languages are presumed to be represented in separate lexicons. When primes and targets are written in different scripts, the script of the prime would provide a powerful orthographic cue for selecting the prime's lexicon and thereby enable rapid activation of the prime and subsequent priming via preactivation of target information.

Another explanation for the effect of script on priming relies on common storage model for both the languages; there is orthographic competition between same script noncognate translation primes and targets and this prevents the emergence of any priming effect, especially in a lexical decision task. When primes and targets are written in different scripts, there may be no orthographic inhibition and so any priming effect due to the overlap between the prime and target processing becomes apparent. Thus, in the present study also, the difference in scripts between Kannada and English reduced the orthographic competition and resulted in the priming effects, thus offering support to the common storage theory of representation.

Qualitative Analysis

A qualitative analysis of the data revealed a few interesting findings emerged from the study and the same are discussed below.

Three subjects, categorized as low proficient according to their ISLPR scores, were observed to exhibit faster reaction times (RTs) and low error rates on a lexical

decision task. This trend was seen in both the language order conditions. That is, considering the fact that they were categorized as low-proficient according to the ISLPR, they were expected to perform relatively better in the Kannada-English, i.e., L1-L2 condition than the reverse. Observation during the experiment revealed that that these subject's error scores were almost equal in both the language order conditions. A look into their mean error rates and mean reaction times across the three prime conditions revealed that the mean reaction times and error rates were less for the L2-L1 condition as compared to the L1-L2 language-order. That is, the subjects were faster in judging targets in their so called not-so proficient L2.

Such a finding is rather contradictory to previous research findings, where, as mentioned earlier, a strong L1-L2 priming effect was noticed. But in a recent study by Basnight Brown and Altarriba (2005), a similar result was reported. The study was conducted on Spanish-English bilinguals who rated themselves as possessing better comprehension and writing skills in their L2, i.e., English (this was later confirmed using statistical procedures). The tasks employed were unmasked semantic and translation priming across both language-order conditions, L1-L2 and L2-L1. Results revealed a reverse trend in the asymmetry; in that L2-L1 translation and semantic priming effects were larger in magnitude than L1-L2 translation and semantic priming effects. They explained these findings on the basis of shift in dominance of the languages due to frequency of usage. Spanish, being the native language was assumed to be the dominant language too. But due to frequent usage at the university and related academic areas, the usage of English had increased. Therefore, English almost behaved like a dominant language and could be equated to L1. Considering this aspect, the findings of larger magnitude of L2-L1 priming effects are in line with the earlier research findings; L2-L1

actually behaved as L1-L2 direction due to this shift in dominance. The same premise may be used to explain the findings in the present study. A closer look into the language usage patterns in the three clients reveal that two of them were college students and the other subject was in a position where the usage of English was required for all communication situations, with the higher authorities etc. Considering this, their L2 (English) was becoming the dominant language and this was reflected in their faster reaction times in the L2-L1 direction. This indicates that a priming paradigm of this nature can detect shift in dominances at a very early stage, even before they are reflected through the rating scales. Thus, such priming patterns may be utilized to cross validate the rating scale scores to get a complete picture of the bilingual.

Summarizing the results of the present study, it can be said that the study offers interesting insights from cross-language translation and semantic priming paradigm. While both high proficient and low proficient bilingual adults revealed priming effects in both directions, the magnitude was larger from L1- L2. Also, priming on translation equivalents was relatively higher than related pairs in both low proficient and high proficient bilinguals. Further, by virtue of the structural/orthographic distance between the two languages, which as a rule led to noncognate pairs, did not influence priming negatively which offers a very clear evidence of semantic mediation and not lexical mediation nor orthographic inhibition as reported in cross-script studies with similar structural dimensions.

SUMMARY AND CONCLUSIONS

The study proposed to investigate priming patterns across high proficient and low proficient Kannada-English bilinguals. An exhaustive review pointed out to a dearth of such studies in the Indian context. Further, studies investigating script differences and priming in structurally distant languages have been very few. Hence, the present study was planned.

The aims of the study were to check for translation and semantic priming effects across the two language conditions- prime presented in Kannada and target in English and prime in English and target in Kannada; priming patterns across different proficiency groups- high proficient bilinguals and low proficient bilinguals. An attempt was also made to look into cross-script priming.

Thirty adults in the age range of eighteen to thirty, with Kannada as mother tongue and English as second language, participated in the study. The educational qualification for selection was a minimum of twelve years of formal education. The subjects were categorized as high proficient or low proficient in English based on the ISLPR scores.

The experiment comprised of two language conditions- Kannada-English and English-Kannada, with each language-order list consisting of five blocks. The stimulus set in each block contained 20 word targets (5 translation equivalents, 5 related, 5 unrelated and 5 filler prime-target word pairs) and 10 nonword targets in each list. The final list consisted of three hundred word targets and 50 nonword targets in each language-order condition. Stimulus lists were counterbalanced across subjects such that

each subject received hundred prime-targets word pairs (25 translation equivalent word pairs, 25 related word pairs, 25 unrelated word pairs and 25 filler prime-target word pairs) and fifty nonword target. Prior to each experimental session (i.e. for each individual subject), the order of items within each of these blocks was randomized, and then the order of the 5 blocks was randomized so as to decrease the likelihood of extraneous serial effects such as practice or fatigue. Stimulus presentation was controlled by DMDX software. Subjects responded by pressing the right arrow key (for a 'yes' response) and the left arrow key (for a 'no' response) on the key board. Reaction times were recorded to the nearest millisecond and stored in the computer. The error rates were also noted down for each of the trial. These were subjected to statistical analysis using the Statistical Package for Social Sciences (SPSS). The results are summarized below:

1. Significant priming was observed in both the language-orders, Kannada-English (L1-L2) and English-Kannada (L2-L1). That is, a prime presented in Kannada could activate the representation of the target word in English automatically and vice-versa. This provides evidence for a shared representation of concepts between the two languages.

2. Priming effects were found to be larger in Kannada (L1)-English (L2) direction than the reverse. This could be explained by the Revised Hierarchical Model, wherein the connections between L1 and the concepts are stronger than L2 and the concepts. Hence, larger priming effects are attributed to these strong conceptual connections from L1 to conceptual store as against the weaker connections from L2 to the concepts. Thus, a prime in Kannada activated its target representation in English faster owing to its stronger tie-up with the conceptual store than a prime

in English which will take relatively longer to activate its target representations in Kannada.

3. Translation priming effects were more robust than semantic priming effects. A possible explanation for this could be that though semantic and translation word pairs are linked in a similar manner at the lexical level, translation equivalents may be different in that they have increased overlap at the conceptual level.

4. High proficient bilinguals were quicker and more accurate to judge the targets as words or nonwords in the lexical decision task than the low proficient subjects. Semantic priming studies have reported that fluent bilinguals are able to take advantage of the semantic context, even when it appears in the other language. Our finding of larger magnitude for overall priming in highly proficient bilinguals thus serves as an addendum to the previous research findings. Priming was observed even in the low proficient group but its magnitude was lesser than the high proficient group due to the weak connections between the concepts and L2 lexicon, when compared to a more balanced bilinguals. Therefore it appears that all bilinguals regardless of their level of proficiency can access some semantic information, but the degree of that activation is influenced by proficiency and language dominance.

5. All the above stated findings are evidences for cross-script priming in structurally distant languages like Kannada and English. Priming effects among noncognate translation prime-target pairs as seen from the results can be accounted by a common storage viewpoint. According to this theory, when primes and targets are

written in different scripts, there may be no orthographic inhibition and so any priming effect due to the overlap between the prime and target processing will become apparent. Thus, the difference in scripts between Kannada and English reduced the orthographic competition and resulted in the priming effects.

6. Qualitative analysis revealed three subjects categorized as low proficient had performed faster and more accurate on the lexical decision task in both the language-orders, Kannada-English as well as English-Kannada. Inspection into their language usage patterns indicated that all of them were frequent L2 (English) users on a daily basis for official communication. This was resulting in a shift in dominance of the two languages, which in turn resulted in faster reaction times and low error rates. This indicates that a priming paradigm of this nature can detect shift in dominances at a very early stage, even before they are reflected through the rating scales. Thus, such priming patterns may be utilized to cross validate the rating scale scores to get a complete picture of the bilingual.

Implications and Directions for Future Research

1. Results of the present study can serve as normative data for bilingual adults in the age range of 18-30 years, with varying levels of proficiency as indicated by their proficiency ratings. This has further implications as the normative values can be used for comparisons with the populations with language disorders such as persons with aphasia. A preliminary study in this direction has been carried out by Sebastian (2005) on bilingual aphasics, which indicated significant priming differences between normals and bilingual aphasics. This aspect has therapeutic

implications, especially in deciding factors like language of therapy, type of cueing etc.

2. Insights obtained from the qualitative analysis suggest that a primed lexical decision task can be used as an adjunct to the existing proficiency rating scales, as these are capable of detecting shift in dominances , if any, even before they become apparent on a proficiency rating scale. A screening version of the priming paradigm can be developed so as to categorize subjects into the different proficiency groups for various study purposes. This will be both cost and time-effective.

3. The fact that a priming paradigm of this nature can detect early shift in dominances has implications from a clinical perspective too. During the course of rehabilitation, frequent administration of the priming test may tap any shift in dominances occurring due to therapy influences. This can then serve to guide modifications in the rehabilitation program.

4. The present study investigated only automatic processing in an unmasked priming paradigm. Modifying the experimental design to totally eliminate strategic processing will provide valuable and more holistic information regarding the bilingual lexical organization. The same stimulus set can be utilized in a masking paradigm as masking the prime eliminates all scope for strategic processing.

5. Much can be investigated further in cross-script priming- comparing cognates and noncognates in unmasked versus masked priming paradigms so as to better understand the representation of the translation equivalents in specific.

6. Similar studies can be extended to investigate other Indian languages from different families (e.g., Aryan v/s Dravidian).

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APPENDIX - A

International Second Language Proficiency Rating (ISLPR)

Speaking	Listening	Writing	Reading
S: 0 Zero Proficiency Unable to function in the language	**L: 0 Zero Proficiency** Unable to comprehend the spoken language	**W: 0 Zero Proficiency** Unable to function in the written language	**R: 0 Zero Proficiency** Unable to comprehend the written language
S:0 + Initial Proficiency Able to operate only in a very limited capacity within very predictable areas of need	**L:0+ Initial Proficiency** Able to comprehend only a very restricted range of simple utterances within the most predictable areas of need and only in face-to-face situations with people used to dealing with non-native speakers	**W:0 + Initial Proficiency** Able to write clearly a limited number of words or short formulae pertinent to the most predictable areas of everyday needs.	**R:0 + Initial Proficiency** Able to read only a limited range of essential sight words and short simple sentences whose forms have been memorized in response to immediate needs.
S:1 – Elementary Proficiency Able to satisfy basic survival needs and minimum courtesy requirements	**L:1 – Elementary Proficiency** Able to comprehend readily only utterances which are thoroughly familiar or are predictable within the areas of immediate survival needs.	**W:1 – Elementary Proficiency** Able to write with reasonable accuracy short words and brief familiar utterances	**R:1 – Elementary Proficiency** Able to read short simple sentences and short instructions
S: 1 Minimum Survival Proficiency Able to satisfy basic survival needs and minimum courtesy requirements.	**L:1 Minimum Survival Proficiency** Able to comprehend enough to meet basic survival needs	**W:1 Minimum Survival Proficiency** Able to satisfy basic survival needs	**R:1 Minimum Survival Proficiency** Able to read personal and place names, street signs, office or shop designations, numbers, isolated words and phrases, and short sentences

S:2 Minimum Social Proficiency Able to satisfy routine social demands and limited work requirements	**L:2 Minimum Social Proficiency** Able to understand in routine social situations and limited work situations.	**W:2 Minimum Social Proficiency** Able to satisfy routine social demands and limited work requirements.	**R:2 Minimum Social Proficiency** Able to read simple prose, in a form equivalent to typescript or printing, on subjects within a familiar context.
S:3 Minimum vocational proficiency Able to speak the language with sufficient structural accuracy and vocabulary to participate effectively in most formal and informal conversations on practical, social and vocational topics	**L:3 Minimum Vocational Proficiency** Able to comprehend sufficiently readily to be able to participate effectively in most formal and informal conversations with native speakers on social topics and on those vocational topics relevant to own interests and experience.	**W:3 Minimum Vocational Proficiency** Able to write with sufficient accuracy in structures and spelling to meet all social needs and basic work needs.	**R:3 Minimum Vocational Proficiency** Able to read standard news-paper items addressed to the general reader, routine correspondence, reports and technical material in his special field, and other everyday materials (e.g. best-selling novels and similar recreational literature).
S:4 Vocational Proficiency Able to use the language fluently and accurately on all levels normally pertinent to personal, social, academic or vocational needs.	**L:4 Vocational Proficiency** Can comprehend easily and accurately in all personal and social contexts and in all academic or vocational contexts relevant to own experience.	**W:4 Vocational Proficiency** Able to write fluently and accurately on all levels normally pertinent to personal, social, academic or vocational needs.	**R:4 Vocational Proficiency** Able to read all styles and forms of the language pertinent to personal, vocational, social, academic or vocational needs.
S:5 Native-like Proficiency Speaking proficiency equivalent to that of a native speaker of the same socio-cultural variety.	**L:5 Native-like Proficiency** Listening proficiency equivalent to that of a native speaker of the same socio-cultural variety	**W:5 Native-like Proficiency** Written proficiency equivalent to that of a native speaker of the same socio-cultural variety.	**R:5 Native-like Proficiency** Reading proficiency equivalent to that of a native speaker of the same socio-cultural variety.

APPENDIX – B

Stimulus Material (Kannada – English)

Sl. No	Translation Equivalents		Related		Unrelated	
	Prime	**Target**	**Prime**	**Target**	**Prime**	**Target**
1	su:dzi	Needle	da:ra	Needle	ka:Lu	Needle
2	a:ngi	Shirt	pa:nTu	Shirt	kappe	Shirt
3	pustaka	Book	pennu	Book	To:pi	Book
4	bekku	Cat	i:li	Cat	hu:vu	Cat
5	vima:na	Plane	a:kasha	Plane	a:ne	Plane
6	mu:gu	Nose	kaNNu	Nose	chakra	Nose
7	pi:pi	Balloon	paTa	Balloon	ondu	Balloon
8	na:ji	Dog	mu:Le	Dog	skru	Dog
9	akki	Rice	taTTe	Rice	enTu	Rice
10	ka:lu	Leg	kai	Leg	kshana	Leg
11	mane	House	tarsi	House	emme	House
12	nadi	River	ni:ru	River	baLe	River
13	tale	Head	ku:dalu	Head	va:chu	Head
14	duDDU	Money	ba:nku	Money	kudure	Money
15	ko:Ne	Room	nela	Room	kushi	Room
16	ha:Du	Song	vi:Na	Song	ba:tu	Song
17	ra:tri	Night	chandra	Night	kemmu	Night
18	ko:Li	Hen	moTTe	Hen	kavi	Hen
19	dzaDe	Hair	eNNe	Hair	baLLi	Hair
20	rakta	Blood	kempu	Blood	nakha	Blood
21	ha:vu	Snake	visha	Snake	giNi	Snake
22	kuri	Sheep	uNNe	Sheep	nowdzi	Sheep
23	kurchi	Chair	me:dzu	Chair	mu:Le	Chair
24	sha:Le	School	guru	School	peTige	School
25	ko:Te	Fort	juddha	Fort	sarpa	Fort
26	langa	Skirt	si:re	Skirt	pho:nu	Skirt
27	nari	Fox	to:La	Fox	hiTTu	Fox
28	dvipa	Island	samudra	Island	karaDi	Island
29	ghaNTe	Bell	sa:ikal	Bell	handi	Bell

Sl. No	Translation Equivalents		Related		Unrelated	
	Prime	Target	Prime	Target	Prime	Target
30	Bale	Net	mi:nu	Net	ajji	Net
31	mara	Tree	ka:Du	Tree	nu:Lu	Tree
32	giDa	Plant	be:ru	Plant	vastra	Plant
33	ka:ge	Crow	gubbi	Crow	hoNNu	Crow
34	koDa	Pot	maDike	Pot	soLLe	Pot
35	kamala	Lotus	mallige	Lotus	uppu	Lotus
36	brashu	Brush	pe:sTu	Brush	sa:ru	Brush
37	katri	Scissors	go:ndu	Scissors	ko:ti	Scissors
38	bi:dza	Seed	sasi	Seed	maina	Seed
39	di:pa	Lamp	beLaku	Lamp	na:ku	Lamp
40	si:ti	Whistle	po:lis	Whistle	garuDa	Whistle
41	onTe	Camel	maraLu	Camel	thuppa	Camel
42	ha:lu	Milk	pa:pu	Milk	du:ra	Milk
43	dze:bu	Pocket	paisa	Pocket	bisi	Pocket
44	magu	Child	ta:i	Child	ra:dza	Child
45	roTTi	Bread	beNNe	Bread	gra:ma	Bread
46	gu:be	Owl	ra:tri	Owl	uda	Owl
47	huDugi	Girl	huDuga	Girl	iruve	Girl
48	beLLi	Silver	chinna	Silver	gu:ge	Silver
49	go:di	Wheat	hiTTu	Wheat	buTTi	Wheat
50	a:lugaDDe	Potato	tarka:ri	Potato	iDDilu	Potato
51	mola	Rabbit	kyaraT	Rabbit	leka:ni	Rabbit
52	ukku	Steel	pa:tre	Steel	u:ru	Steel
53	siDilu	Thunder	minchu	Thunder	hebbavu	Thunder
54	bakiTu	Bucket	sna:na	Bucket	chennai	Bucket
55	guDi	Temple	pu:dza	Temple	gunDu	Temple
56	hoTTe	Stomach	a:ha:ra	Stomach	chauka	Stomach
57	heNa	Corpse	maraNa	Corpse	Delhi	Corpse
58	hamsa	Swan	biLi	Swan	kochi	Swan
59	chai	Tea	ka:fi	Tea	bassu	Tea
60	benki	Fire	bisi	Fire	maNNu	Fire
61	manDi	Knee	toDe	Knee	padja	Knee
62	pakshi	Bird	ha:ru	Bird	mi:se	Bird
63	kelasa	Work	ku:li	Work	giLi	Work
64	karu	Calf	hasu	Calf	muLLu	Calf
65	habba	Festival	paTaki	Festival	muchaLa	Festival
66	raita	Farmer	tra:ktar	Farmer	mo:ri	Farmer

Sl. No	Translation Equivalents		Related		Unrelated	
	Prime	**Target**	**Prime**	**Target**	**Prime**	**Target**
67	Dabba	Box	laDDu	Box	huLa	Box
68	hallu	Teeth	bai	Teeth	mancha	Teeth
69	ele	Leaf	kombe	Leaf	kaDle	Leaf
70	gombe	Doll	a:ta	Doll	marga	Doll
71	tenginka;ji	Coconut	keraLa	Coconut	ma:tre	Coconut
72	navilu	Peacock	gari	Peacock	to:ve	Peacock
73	bennu	Back	mai	Back	nundza	Back
74	mainah	Mynah	hakki	Mynah	hinde	Mynah
75	iruLLi	Onion	pala:v	Onion	vidja	Onion
76	varsha	Year	ma:sa	Year	ba:va	Year
77	akka	Sister	amma	Sister	sandze	Sister
78	vara	Groom	vadhu	Groom	soLLu	Groom
79	dardzi	Tailor	arive	Tailor	chiTTe	Tailor
80	oushada	Medicine	dzura	Medicine	uttara	Medicine
81	nimisha	Second	ganTe	Second	aDavi	Second
82	de:sha	Country	nagara	Country	sa:mba:r	Country
83	gu:Du	Nest	gubbi	Nest	bhudza	Nest
84	ardha	Half	ba:ga	Half	gaTTe	Half
85	moLe	Nail	suTTige	Nail	dwani	Nail
86	a:kasha	Sky	ni:li	Sky	ka:rja	Sky
87	mo:Da	Cloud	biLi	Cloud	pa:pu	Cloud
88	go:De	Wall	iTTige	Wall	chaLi	Wall
89	kannaDi	Mirror	ga:dzu	Mirror	karaDi	Mirror
90	railu	Train	kambi	Train	kavi	Train
91	koDali	Axe	kabbina	Axe	ga:na	Axe
92	aLilu	Squirrel	neraLe	Squirrel	haLLi	Squirrel
93	sa:vira	Thousand	rupa:ji	Thousand	su:rja	Thousand
94	vigja:na	Science	gaNita	Science	ugu:ru	Science
95	bi:ga	Lock	cha:vi	Lock	samadza	Lock
96	chi:la	Sack	mu:Te	Sack	pa:da	Sack
97	kallu	Stone	shilpa:	Stone	ka:ru	Stone
98	dzo:La	Maize	ra:gi	Maize	cha:ku	Maize
99	ma:Di	Terrace	meTiLu	Terrace	bisiLu	Terrace
100	se:bu	Apple	dra:kshi	Apple	la:ri	Apple

Stimulus Material (English – Kannada)

Sl. No	Translation Equivalents		Related		Unrelated	
	Prime	**Target**	**Prime**	**Target**	**Prime**	**Target**
1	water	ni:ru	pond	ni:ru	rubber	ni:ru
2	bone	mu:Le	body	mu:Le	cream	mu:Le
3	knife	cha:ku	spoon	cha:ku	window	cha:ku
4	plate	thaTTe	lunch	thaTTe	desk	thaTTe
5	floor	nela	roof	nela	train	nela
6	hot	bisi	sunny	bisi	tray	bisi
7	kite	paTa	sky	paTa	worm	paTa
8	glass	lo:Ta	water	lo:Ta	switch	lo:Ta
9	rain	maLe	cloud	maLe	bunch	maLe
10	snake	ha:vu	poison	ha:vu	shelf	ha:vu
11	wage	ku:li	work	ku:li	plane	ku:li
12	branch	kombe	stem	kombe	teeth	kombe
13	flour	hiTTu	bun	hiTTu	book	hiTTu
14	salt	uppu	sugar	uppu	stair	uppu
15	sand	maraLu	cactus	maraLu	camera	maraLu
16	beef	ma:msa	chicken	ma:msa	balloon	ma:msa
17	monkey	ko:ti	zoo	ko:ti	needle	ko:ti
18	jasmine	mallige	hibiscus	mallige	potato	mallige
19	flower	pushpa	lily	pushpa	thunder	pushpa
20	oil	eNNe	mustard	eNNe	bun	eNNe
21	black	kappu	blue	kappu	angel	kappu
22	cloth	baTTe	saree	baTTe	stomach	baTTe

Sl. No	Translation Equivalents		Related		Unrelated	
	Prime	Target	Prime	Target	Prime	Target
23	donkey	katte	animal	katte	mirror	katte
24	vessel	pa:tre	kitchen	pa:tre	farmer	pa:tre
25	feet	pa:da	leg	pa:da	steel	pa:da
26	thread	da:ra	tailor	da:ra	bucket	da:ra
27	lion	simha	forest	simha	money	simha
28	field	gadde	paddy	gadde	island	gadde
29	fever	dzuara	doctor	dzuara	plant	dzuara
30	egg	moTTe	omlette	moTTe	scissor	moTTe
31	grape	dra:kshi	fruit	dra:kshi	pocket	dra:kshi
32	gold	chinna	necklace	chinna	whistle	chinna
33	butter	beNNe	cheese	beNNe	river	beNNe
34	pig	handi	pork	handi	blade	handi
35	cracker	PaTaki	festival	PaTaki	lorry	PaTaki
36	rice	akki	wheat	akki	nose	akki
37	wind	ga:Li	storm	ga:Li	lotus	ga:Li
38	finger	beraLu	ring	beraLu	cycle	beraLu
39	goat	me:ke	grass	me:ke	onion	me:ke
40	rat	ili	mouse	ili	doll	ili
41	fish	mi:nu	lake	mi:nu	sister	mi:nu
42	slipper	chappali	sandals	chappali	coconut	chappali
43	mother	ta:yi	woman	ta:yi	country	ta:yi
44	father	tande	husband	tande	month	tande
45	camphor	karpu:ra	prayer	karpu:ra	peacock	karpu:ra

Sl. No	Translation Equivalents		Related		Unrelated	
	Prime	Target	Prime	Target	Prime	Target
46	Poet	kavi	poem	kavi	nest	kavi
47	jewel	oDave	earring	oDave	mynah	oDave
48	ship	nauka	titanic	nauka	leaf	nauka
49	dream	kanasu	sleep	kanasu	bread	kanasu
50	weapon	astra	battle	astra	groom	astra
51	charcoal	iDDilu	fire	iDDilu	mobile	iDDilu
52	feast	utsava	chariot	utsava	building	utsava
53	cotton	hatti	sweater	hatti	packet	hatti
54	arrow	ba:Na	bow	ba:Na	shirt	ba:Na
55	fig	andzu:ra	fruit	andzu:ra	matchbox	andzu:ra
56	blind	kuruDa	deaf	kuruDa	purse	kuruDa
57	stick	la:thi	police	la:thi	jacket	la:thi
58	brick	iTTige	house	iTTige	cauliflower	iTTige
59	radish	mu:langi	carrot	mu:langi	palace	mu:langi
60	leopard	chirathe	yellow	chirathe	delhi	chirathe
61	army	sainya	navy	sainya	pencil	sainya
62	planet	graha	earth	graha	scale	graha
63	jute	go:Ni	sack	go:Ni	elbow	go:Ni
64	button	gunDi	shirt	gunDi	eyebrow	gunDi
65	tower	go:pura	temple	go:pura	lawyer	go:pura
66	crocodile	mosaLe	reptile	mosaLe	orphan	mosaLe
67	boatman	ambiga	boat	ambiga	bangle	ambiga
68	waist	soNTa	belt	soNTa	ocean	soNTa

Sl. No	Translation Equivalents		Related		Unrelated	
	Prime	Target	Prime	Target	Prime	Target
69	Music	sangeeta	veena	sangeeta	bottle	sangeeta
70	justice	nya:ya	court	nya:ya	plastic	nya:ya
71	cage	pinjara	tiger	pinjara	diary	pinjara
72	pearl	muttu	diamond	muttu	family	muttu
73	ginger	shunTi	garlic	shunTi	parent	shunTi
74	street	bi:di	hotel	bi:di	horse	bi:di
75	news	va:rte	radio	va:rte	dog	va:rte
76	cold	chaLi	winter	chaLi	canteen	chaLi
77	wheel	charka	truck	charka	drama	charka
78	curry	sa:ru	pulses	sa:ru	drum	sa:ru
79	picture	chitra	painting	chitra	spring	chitra
80	colour	baNNa	rainbow	baNNa	guitar	baNNa
81	voice	dhwani	song	dhwani	scarf	dhwani
82	speech	ma:tu	tongue	ma:tu	card	ma:tu
83	orange	kittale	guava	kittale	vehicle	kittale
84	lemon	nimbu	juice	nimbu	paper	nimbu
85	table	me:ju	chair	me:ju	skirt	me:ju
86	dress	vastra	frock	vastra	piano	vastra
87	king	ra:ja	prince	ra:ja	garbage	ra:ja
88	queen	ra:Ni	princess	ra:Ni	violin	ra:Ni
89	spectacles	kaNNaDaka	eye	kaNNaDaka	ladder	kaNNaDaka
90	baby	magu	cradle	magu	chilli	magu
91	hand	kai	arm	kai	tempo	kai

Sl. No	Translation Equivalents		Related		Unrelated	
	Prime	**Target**	**Prime**	**Target**	**Prime**	**Target**
92	umbrella	chatri	monsoon	chatri	ketchup	chatri
93	bride	vadhu	wedding	vadhu	comb	vadhu
94	frog	kappe	toad	kappe	noodle	kappe
95	deer	jinke	bear	jinke	cabbage	jinke
96	crane	kokkare	beak	kokkare	carpet	kokkare
97	lizard	halli	chameleon	halli	airport	halli
98	hunter	shika:ri	hunter	shika:ri	office	shika:ri
99	ash	bu:di	grey	bu:di	rod	bu:di
100	thorn	mullu	rose	mullu	chain	mullu