LEXICAL SEMANTIC ACTIVATION IN HIGH AND LOW PROFICIENT BILINGUALS

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CERTIFICATE

This is to certify that this dissertation entitled **"Lexical Semantic Activation in High and Low Proficient Bilinguals"** is a bonafide work submitted in part fulfillment for degree of Master of Science (Speech-Language Pathology) of the student Registration Number: 16SLP021. This has been carried out under the guidance of a faculty of this institute and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

Mysore
April, 2018

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DECLARATION

This is to certify that this dissertation entitled **"Lexical Semantic Activation in High and Low Proficient Bilinguals"** is the result of my own study under the guidance of Dr. Abhishek B. P, Lecturer in Speech Sciences, Department of Speech Language Sciences, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

Mysore,
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Chapter I

Introduction

Bilingualism in simple sense is defined as an individual‘s ability to use two languages. However, defining bilingualism is puzzling bilingual individuals show varying characteristics. A person who is not able to read or write a language may still identify himself as a bilingual because of his ability to communicate orally. There are also bilinguals who have excellent proficiency to read and write in two or more languages. Owing to the varying characteristics in bilinguals, bilingualism has been studied extensively using various methodologies. Among the prime areas of research in bilingualism is the lexical semantic activation in bilinguals. One of the commonly asked question in bilingualism is whether the bilinguals have a common lexicon for both the languages or they have separate lexicons during the lexical semantic activation.

The lexical semantic activation includes a series of processes involved in accessing a lexical entity from ones stored mental representation .Hence it can be studied by exploring the processes involved in naming a picture (Costa, Colome & Caramazza, 2000). Picture naming entails the events involved in lexical semantic activation. Initial stage involves recognizing the picture and selecting its equivalent semantic representation from the memory (e.g. cat). It is assumed that along with the semantic representation corresponding to the picture, other related conceptual representations may also get activated (e.g. dog). These activated representations further spread activation proportionally to their corresponding lexical nodes (words) in the mental lexicon, and among these activated lexical nodes (_dog‘, _cat‘,

_mouse‘, etc.) the speaker selects the word which matches with the picture (_cat‘). Once a lexical node is selected, its corresponding phonemes are accessed (/c/, /a/, /t/). Later stages of speech production involve accessing the articulatory events corresponding to the phonological properties of the selected word which involves the exact positioning and movement of the musculature required for its production.

Lexical-semantic system in bilinguals is explained by various models. These models claim that the semantic representations of both the languages are either separate or they are shared by the languages. The contemporary models support the view that the semantic system in a bilingual is shared by the two languages (Kroll and Stewart, 1994). It assumes that in bilinguals each conceptual representation is linked to lexical nodes of both the languages. The recent theories support a parallel activation of the semantic system wherein the activation spreads to both the languages of a bilingual irrespective of the language chosen for response (Poulisse, 1997).

Interestingly, it can be noted that several models and hypotheses are developed based on different perspectives for describing the bilingual lexical organization. However a retrospection of the researches carried out in the past reveals no conclusive evidence regarding the organization of bilingual mental lexicon.

Need for the study

Numerous studies have been conducted in the past investigating on lexical semantic activation in bilinguals, very few studies have probed into the effect of bilingual proficiency on a primed paradigm naming task. The studies which are specifically done in Indian context are based on lexical decision or judgement tasks rather than the naming task. It has been found that naming task place more demands

on one‘s language proficiency compared to a lexical decision task (Nicholas, 2014). This calls for the need to interrogate the lexical activation in bilinguals using a naming task.

The study also aims at studying lexical semantic activation in regard to high and low proficient bilinguals by using a cross language paradigm (Malayalam-English), the facilitation and inhibition offered by the _language not in use‘ and thus the relationship shared by the lexical links of the two languages can be viewed in context to the proficiency levels of the participants

The study also intends to use semantically related and unrelated primes in the _language not in use‘ in the naming paradigm, this would enable in understanding about language specific lexical selection and non selection by employing a naming task. Majority of the studies done in the past have used primed lexical decision task. The lexical decision task would be diluted by false positive and false negative responses which can be counteracted by employing the naming task

Aim of the study

The aim of the study is to investigate on the effect of proficiency in lexical semantic activation in Malayalam- English bilingual adults.

Objectives of the study

- To investigate the directional pattern of facilitatory - inhibitory effects in translational priming from Malayalam to English and English to Malayalam in high and low proficient bilinguals
- To investigate language specific lexical selection and non selection in bilinguals.
- To investigate lexical semantic activation across high and low proficient bilinguals.

Chapter II

Review of Literature

Bilingualism

Bilingualism is defined as the use of at least two languages by an individual. The use of the two languages and the proficiency in each of them may change depending up on the individual‘s opportunities to use the languages and with the exposure to other users of the languages (ASHA, 2004). Dating back to 1933, Bloomfield defined bilinguals as individuals with equal control of language as a native speaker. This definition constrained the number of individuals who could be classified as bilinguals as well as made it difficult to define the term _native like fluencies‘. Haugen in 1953 stated bilinguals as individuals who are fluent in one language but who can also produce complete meaningful utterance in the other language. It can be noted that is no standard definition of bilingualism which is agreed by all. It is best to view bilingualism as occurring on a continuum (Beardsmore, 1986). On one end is a monolingual speaker and at the other end, an individual with an excellent native-like proficiency in both the languages .

Bilingualism is multidimensional in nature. Various components and aspects have been identified as associated with the complexity of bilingualism. Classification of bilinguals can be done based on their degree of proficiency in the languages, age, context, manner of acquisition of the languages, and based on the underlying language representation. This may include: (a) Balanced / Dominant/

Recessive/ Semi bilinguals (b) early/late, (c) simultaneous/successive, (d) compound/co-ordinate/subordinate bilinguals

Balanced / Dominant/ Recessive/ Semi bilinguals

Based on the degree of proficiency in both the languages, bilinguals are classified as *balanced bilinguals*, *dominant bilinguals*, *recessive bilinguals* and *semi bilinguals*. *Balanced bilinguals* refer to individuals who are fully competent in both the languages (Competency of L1=L2) (Lambert, 1959). *Dominant bilinguals* have L1 competency greater than or less than L2. In this case, the lesser competent language will be considered as the subordinate language. *Recessive bilinguals* are bilinguals who gradually loose competency in one language, mainly because of its reduced usage. *Semi bilinguals* are defined to have a limited level of proficiency in both first and second language and are hence quantitatively and qualitatively deficient compared to monolinguals (Hansegard, 1968).

Early and late Bilinguals

Based on the age of exposure to the two languages bilinguals can also be categorized into early and late bilinguals. *Early bilingualism* is defined as the acquisition of more than one language in the pre-adolescent phase of life (Beardsmore, 1986). *Late bilingualism* has been defined as the acquisition of one language before and the other language after the age of 8 years. Early and late bilinguals can also be distinguished based on their attainment of linguistic competence. Early bilinguals are mainly regarded as attaining native-like linguistic competence in both languages. Whereas most late bilinguals are regarded as non-native speakers of L2, who do not have complete competence of L2 (Beardsmore,

1986). Early bilingualism can also be classified into two types: *Simultaneous early bilingualism* and *Successive early bilingualism. Simultaneous early bilingualism* occurs when a child learns two languages at the same time, from birth. This often results in a strong bilingualism. In *Successive early bilingualism* the acquisition of the second language is followed by the acquisition of the first language.

Compound, and Coordinate Bilinguals.

Based on the organization of linguistic codes, bilinguals are termed as compound, coordinate and subordinate bilinguals (Weinreich, 1957). *Compound bilinguals* learn second language (L2) dependent on their first language (L1) and hence do not have an independent grammar for L2. Linguistic codes of both the languages are stored as single meaning unit. *Coordinate bilinguals* learn the two languages in different contexts and hence have independent grammar for these languages. Here the linguistic codes are stored as two separate meaning units.

High Proficient and Low Proficient Bilinguals.

A crucial factor distinguishing the types of bilinguals is the degree of proficiency in both the languages. Bilingual‘s proficiency in the languages can explain the extent to which his skills in one or both the languages match to an age-based native speaker or monolingual expectations. Proficiency can be defined with respect to a monolingual speaker‘s vocabulary size or grammatical skills (Bedore, Pena, Summers, Boerger, Resendiz, and Greene, 2012). Based on the proficiency attained in both the languages bilinguals can be classified as *high proficient* and *low proficient bilinguals.*

As proficiency varies across the two languages at all linguistic levels for a bilingual, it should be assessed in various domains such as understanding, speaking,

reading and writing in both the languages. Several measures have been proposed to measure proficiency levels. According to McNamara (1967) bilingual‘s proficiency is assessed under four categories, which include fluency tests, rating scales, dominance tests and flexibility tests. One commonly used rating scale is the Language Experience and Proficiency Questionnaire developed by Flege, 1999 and revised by Marian, Blumenfeld & Kaushanskaya, 2007. It assesses proficiency under four domains which includes understanding, speaking, reading and writing It is a valid and reliable questionnaire for the assessment and quantification of a bilingual‘s proficiency. It has also been adapted to the Indian context by Ramya & Goswami (2009).

Organisation of the Two Languages in Bilinguals

Bilingual speakers have the surprising skill to choose appropriate words from intended language while preventing hindrance from the unintended language in the mental lexicon. That is, bilingual speakers are able to switch to a ‒monolingual mode‖ and select representations pertaining to only one of their lexicons. This creates ambiguity whether the representations of the language-not-in-use interfere during the production of the language in use or not. If they interfere then it is not clear regarding how are they able to prevent this massive interference from other representations. There is also no conclusive evidence regarding variation in this representation in terms of bilingual‘s proficiency.

The representation of the two languages in bilingual mental lexicon has constantly been a matter of debate in the field of bilingualism. A number of

hypotheses and models have been put forth by various authors to describe the bilingual lexical semantic activation.

Hypotheses of Bilingual Language Organisation

The various hypotheses postulated regarding language representation in bilingual brain revolve around two concepts; whether both the languages have separate representations in the brain or they share a common locus.

a. **The common store hypothesis** states that in bilinguals the two languages are represented in a single system which is independent of the language. In this system, the translation equivalents of both the languages share their conceptual representation.

b. **The separate store hypothesis** states that there are two separate, language-specific, independent representational systems for both the languages. Here, each of the words in a translational pair will have its own separate conceptual representation.

Models of Language Organisation in Bilinguals

Various models have been put forth based on the above hypotheses. Models which assume separate representations of lexicons claims that there is *selective activation* of words in each of the languages whereas models which assume an integrated lexicon supports a *non-selective* and *parallel activation* of words in both the languages. The proponents of a language specific lexical selection argues that during lexical access, the two languages may get activated but the selection mechanism will activate only those language nodes related to the intended language and hence there is no competition or interference by the other language (Costa & Caramazza, 1999). In contrary, those advocating a language non-specific model

claims that the lexical nodes of both the intended and the unintended languages get activated together and then compete for their selection within the language and between the languages (Green,1986 ; Poulisse & Bongaerts, 1994). According to this model the final selection of the lexical node of the intended language occurs through the differential activation of lexicons of both the languages. This is explained through two assumptions. First assumption states that there is a higher level of activation of the lexicon of the target language compared to non-target language (Poulisse & Bongaerts,1994). The second assumption talks about the inhibition of the non-target lexicon after both the lexicons get activated equally.

The Word Association model

The Word Association model (Figure 2.1) proposes that a bilingual accesses concepts of L2 by means of the Ll lexicon. When a word in L2 is presented, a bilingual will initially translate the word into Ll and then access the conceptual representation for that word. According to this model, naming a picture in L2 includes five-steps: (1) recognizing the image; (2) retrieval of the concept; (3) retrieval of the Ll word; (4) retrieval of the equivalent L2 word; (5) naming the L2 word. Consequently, following all these longer steps picture naming may take substantially longer time than translating a word from Ll to L2 as translation involves less number of processes ((l) recognizing the Ll word; (2) retrieval of the L2 word; (3) naming the L2 word).

This hypothesis was verified by Potter,So, Eckardt, and Feldman (1984) and found that same amount of time was taken by the participants to name a picture in L2 and to translate a word from Ll to L2. This result indicated that both Ll and L2 lexicons access the conceptual store directly. Further, this finding has led to the development of the Concept Mediation model (Potter et aL, I984).

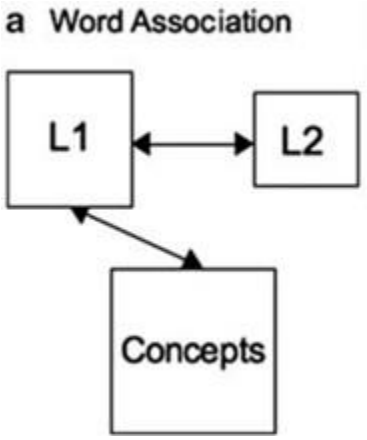


Figure: 2.1. The Word Association model (Source: Potter et al, 1984)

The Concept Mediation model

The Concept Mediation model (Figure 2.2) claims that in bilinguals concepts are mediated directly between the separate lexicons and the conceptual store (Potter et aL, I984). It means that each language has a direct access to the conceptual store, Hence picture naming and translational task will require equal number of processing steps.

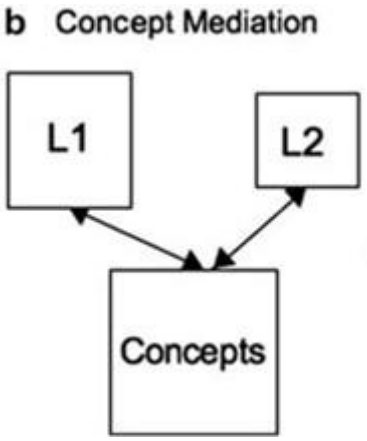


Figure 2.2 The Concept Mediation model (Source: Potter et al., 1984).

Concept mediation is also explained with respect to the development of L2. During the initial period of development of L2 the bilingual mental lexicon is

described by the Word Association model. In the later stages, as the bilingual's proficiency in L2 increases, there is a drift towards a Concept Mediation model. This notion was proved by Dufour and Kroll (1995), using sentence verification task in more fluent and less fluent bilinguals. They noted that bilinguals who were more fluent had the capability to use conceptual links in within- and cross-language conditions successfully while less fluent bilinguals were more dependent on their Ll. These findings suggest that as the proficiency in L2 increases, there is a developmental shift from translation strategies towards direct concept mediation (Chen, 1992). During the transition stage, there is a period where bilinguals employ both translating and conceptual mediation strategies. This developmental hypothesis claims that as the conceptual links becomes strong and established, bilinguals use only a direct conceptual mediation strategy which results in the deterioration of the lexical links. However, many cross language experiments provide evidences that lexical links are still maintained by high proficiency bilinguals even in the later stages of development. Studies have found that in bilinguals of all proficiency levels, translation from L2 to Ll is faster than translation from Ll to L2 (Dudsic, 1999). Thus, based on all these evidences Kroll and Stewart (1994) came up with the idea of a mixed representational model of conceptual lexical level representations, which is called the Revised Hierarchical Model (RHM).

The Revised Hierarchical Model (RHM)

The RHM claims that in bilinguals both the languages, L1 and L2, are interconnected via two links: lexical links and conceptual links (Figure 2.3). Both the languages have a shared conceptual store as well as separate language independent lexicons. A major aspect of this model is the asymmetrical link between the language specific lexicons (Kroll & De Groot, 1997). It states that while

acquiring L2, all the words in L2 get connected to L1 words whereas all L1 words may not essentially connect to L2 words (Kroll & Stewart, 1994). This means that at the lexical level there is a stronger connection from L2 to L1 than from L1 to L2. Hence backward translation from L2 to L1 is faster than forward translation from L1 to L2. At the conceptual level, there is stronger connection for L1 and weaker connection for L2, subsequently an L1 word will have a faster conceptual processing than its translational equivalent in L2. As the lexical connection between L2-L1 is stronger, when a bilingual is exposed to an L2 concept, he relies on L1 to gain access to the conceptual store. Most of the models on bilingual mental lexicon discuss about highly proficient adults and RHM is one among the few models which explains about transition from lower level to higher levels of proficiency (Hell & Tanner, 2012). According to this model the strength of the links between the two languages is dependent on the proficiency of the L2 and its relative dominance to L1. Initially bilinguals show exclusive reliance on their L1 for retrieving the concepts when they are acquiring their L2 and as their proficiency in L2 improves, they rely less on translation and access concepts more directly.

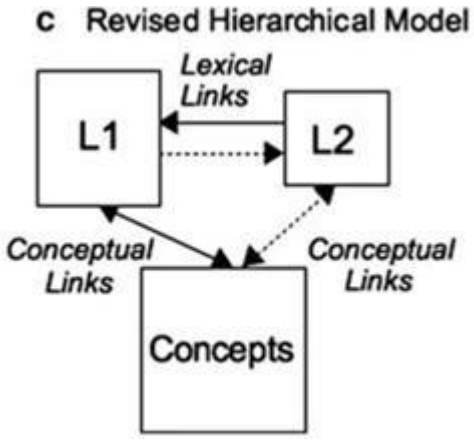


Figure 2.3 The Revised Hierarchical Model (Source: Kroll & Stewart, 1994).

Evidence for the existence of asymmetric connections between bilingual's two languages was given by Kroll and Stewart (1994) through picture naming and word translation tasks. The study was conducted in three experiments with the two tasks performed using semantically categorized or randomized lists. Experiment 1 involved naming pictures in categories. In Experiment 2, pictures and words were named alternatively and in experiment 3, the participants were asked to translate categorized and randomized word lists in L1 and L2 (Dutch and English). It was found that in experiment 1 and 3, the picture naming and translation task performances were slower for categorized than randomised condition. In experiment 2, where picture naming was alternated with word naming, this category interference effect was found to be eliminated. Combining the results from the three experiments, the authors opine that in both, translation tasks and picture naming, a conceptual representation of the word or picture is used to retrieve a lexical node. Multiple set of corresponding lexical representations get activated when the conceptual activation is sufficiently high and it causes interference in the process of retrieving the final candidate for naming or translation. It was also found that in experiment 3, category interference was observed only when translation was performed from first language to the second language suggesting that the translations in the two directions involve different inter language connections.

Evidence for RHM was obtained in a study by Talamus, et al., (1999). The study compared the English-Spanish bilinguals with different levels of fluency (more and less) on a translation recognition task. A word in either of the two languages known to the participants was presented after which the word was tested in the language not used priorly. The participants were given a task of verifying if the words presented were translational equivalents. Significantly different results

were obtained for more and less proficient bilinguals for trials using translation of related words (form related and semantically related). The group with less proficient bilinguals showed interference, which was significant for the form-related pairs and this was not seen in pairs which were semantically related. In contrast, the pattern was observed to be reversed for more fluent bilinguals. The results obtained from the current study, thus support the claims of RHM.

Bilinguals have the ability to select the words from the language of intention, while effectively inhibiting the words from another language in store. This process is explained by the Inhibitory Control model (Green 1986). According to this model, during the selection of the lexical node of the intended language, there is an inhibition on the lexical nodes of the unintended language. This happens with the help of language task schemas which are associated with every lexical node. A task schema is a mental procedural blueprint specifying the procedural subcomponents necessary to complete a task such as a translational naming or a picture naming.

Another model which explains the differential activation of target language during word recognition in bilinguals is the Bilingual Interactive Activation model (BIA) (Grainger and Dijkstra ,1992). This model claims that when a proficient bilingual speaker is presented with a visual word, a set of word candidates gets activated. This model explains the presence of a serial non-selective processing in conjunction with a parallel language specific processing occurs in while inhibiting the language not in use. A word gets activated when its activation level reaches the threshold. The resting level of activation (threshold) of each word is affected by factors such as bilingual‘s proficiency, a word‘s frequency and its use. An activated node in one language further sends activation to its corresponding language nodes which will send activation back to all words in that language and hence inhibiting

words in the other language. This ultimately results in the selection of the target language or facilitation.

Studies on lexical semantic activation in bilinguals

Various studies have been conducted ever since 1980‘s to understand the organization of both the languages in a bilingual mental lexicon. These studies have devised various procedures with different underlying principles.

Although studies have been carried out using various electrophysiological and neuroimaging techniques, a vast majority of the studies on bilingual lexical organization are behavioural studies. These studies have mainly devised a lexical decision task or a naming/ production tasks. A picture naming task was devised in studying the role of proficiency in lexical access while naming by Costa, Caramazza, Sebastian-Galles (2000). The subjects of the study included highly proficient bilingual speakers of Catalan and Spanish languages, with Spanish serving as L1 in one group, and L2, in the other. `The subjects were asked to name pictures representing cognates or non-cognates. All the subjects were asked to name in one language- Spanish; this was the dominant language of the former group, and non-dominant of the latter. It was found that cognate pictures were named faster than non-cognate pictures in both dominant L1 and non-dominant L2. This cognate facilitation effect was observed to be larger while naming in the non-dominant language which was L2.

Two major tools which have been used extensively in studying the language organisation in bilinguals are (i) Word priming and (ii) picture Interference paradigm.

i. **Priming paradigm**: Priming refers to the process wherein ones performance on a target event is facilitated by the prior presentation of a stimulus called the prime. A prime can include any stimulus such as a picture, a word or an auditory stimulus. Depending upon its relation to the target stimulus, a prime can be facilitating or inhibiting the target event. In order to see the effect of prime on the target, a baseline has to be taken using a neutral stimulus or an unrelated stimulus as the prime (Shao, 2017). In bilingual research, a word prime can be given in the same language as the target response or in another language. When the prime is given in the non-target language it is called cross-language priming. Based on how the prime is related to the target, priming can be classified as semantic priming and translational priming. In semantic priming paradigm one responds better to a target stimulus (e.g., dog) when it is preceded by prime which is semantically related to the target stimulus (e.g., cat) when compared to an unrelated prime (e.g., car). Similarly translational priming refers to the process when ones response in target language (e.g., dog) gets faster when it is preceded by its translational equivalent word prime (e.g., /na:ja/ translational equivalent for dog in Malayalam) as compared to a non-translational equivalent prime (e.g./pu:cha/ translational equivalent for cat in Malayalam). Hence altering the relationship between the prime and the target in cross language condition allows us find the effects of priming in L1–L2 or the L2–L1 direction.

ii. **Interference paradigm:** Interference paradigms are also used to see the influence of a prior stimulus (distracter) on the speed and accuracy of responding to the target stimulus. Compared to priming paradigm where the prime usually precedes the target stimulus, interference paradigm usually has the distracter presented along with the target stimulus however the stimulus onset asynchrony may vary (Shao, 2017).

A word-picture interference paradigm was used by Deravi, 2009. The experiment 1 of the study was to see the language selection in highly proficient Persian-French simultaneous bilinguals. The visual distracters (words) were presented in the L1 of the participants, that is, Persian and the participants were asked to name the pictures in L2 which was French. Each picture was tested under four conditions of visual distracters. These included (i) a word which was similar to the target semantically (ii) a word which was phonologically related to the translation of the target word in L1 (iii) a word which was related phonologically to the target word in L2 and (iv) a word which was unrelated to the target stimulus. The study also devised auditory distractors in picture naming. Experiment 2 and 3 of the study provided auditory distractors in French and Persian respectively and the participants had to name the picture in other languages. The auditory distractors were also provided in four different conditions for each picture as mentioned above in experiment 1. The testing was carried out in four SOAs: -150ms, -300ms, 0ms and +150ms. It was found that in experiment 1, a phonologically related distractors offered facilitation at SOA + 150 ms. In experiment 2, phono-translation distractors inhibited the response of target stimulus at SOA - 300 ms which suggested the interference of the language not in use during the initial stages of speech production. The results also indicated facilitation effects of phonological and semantic distractors but these effects were not statistically significant. In experiment 3, there were significant effects noted in all SOAs. These findings were in support of the assumptions of a language non-specific lexical selection model, as distractors influenced picture naming in all the stages. The observed finding of the effects of early facilitation was in line with the parallel activation model and opposed the views of serial activation model.

Studies on lexical semantic activation in bilinguals using semantic and/or translational priming paradigm

Semantic activation maybe portrayed through the spreading activation model. (Collins and Loftus, 1975) It designates words to be organized in an interconnected nodal network, which promotes simultaneous activation of many associated words. In translational priming it involves activation of shared lexical-semantic and syntactical representations, i.e., there is activation of features of both prime and target language items which share their cognitive representation (Schaeffer & Carl, 2013).

A vast majority of studies have considered cross linguistic stimuli in semantic and translation-priming paradigm. Many discrepancies have been found in the results of these studies and most of which is assumed to be caused by the variations in methodology used in these studies (Altarriba & Basnight-Brown, 2007). For example, some of the cross-language priming experiments support semantic priming effect in both the language directions. (Keatley & de Gelder, 1992), while some found it to be insignificant (Grainger & Beauvillain, 1988). Similar dissonance has also been found in many translational priming studies. These discrepancies give rise to reduced clarity regarding bilingual language representations and processing direction.

Bilingual memory organization was examined using cross language priming paradigm in Spanish- English bilinguals (Altarriba et.aL, 2007). The study consisted of two experiments using unmasked and masked semantic- translational priming. Experiment 1 comprised of a lexical decision task, wherein the participants were asked to judge whether the stimuli is a word or a non-word and it was tested using un-masked semantic and translation primes. In experiment 2, similar task was

carried out with similar stimuli except a mask was presented along with the prime. It was found that in experiment 1, there was a bi-directional effect of translation priming whereas semantic priming was seen unidirectional- L2–L1The first finding of experiment 1 relating to the translation priming was replicated in experiment- 2.

Masked translation priming paradigm was used to study the cognate and non-cognate masked translation priming effects in bilinguals with varied levels of L2 proficiency. The masked translation priming effect explains the processing advantage when translation equivalents precedes targets as opposed to the interference effects in processing caused by unrelated words of the non-target language presented prior to the target word. In the case of the non cognate masked translation priming effect, the critical prime-target translation pairs exhibit only a semantic overlap (e.g., in Spanish-_l'homme' and in English- the man). In the case of masked translation using cognates, the advantage appears while processing words either completely or partially overlapping at the formal level to their translation counterpart. Results revealed significant effects in the cross-language priming conditions and also in bilinguals with low level of L2 competence.

The lexical organization in high proficient (HP) and low proficient (LP) bilinguals was investigated by Deema (2005) using a semantic and translational cross language priming paradigm. The study was conducted on thirty normal Kannada-English bilingual adults in the age range of 18-40 years and the participants were classified as high and low-proficient bilingual using International Second Language Proficiency Rating Scale. Using the priming paradigm the participants were asked to choose if the target stimulus presented was a true word or not. The result of the study revealed the presence of cross language priming in both the directions. The study also revealed that the reaction time of HP bilinguals to be

faster than LP bilinguals. An asymmetry in priming was observed with faster priming in L1-L2 condition than L2-L1. In both the languages, the magnitude of translational priming was more than semantic priming.

The lexical processing in bilingual aphasics has been researched using semantic and translation priming paradigm. One such study was conducted in Kannada-English bilingual aphasics by Rajini in 2005. The findings of the study were indicative of significant semantic and translation priming in Kannada - English direction in aphasics and in normals. The above mentioned effect was seen in English - Kannada direction only in normals and not in aphasics. Thus the absence of priming in English to Kannada condition in aphasics showed that prime words in English are not activated to a sufficient threshold to spread to Kannada target words. Here again, translation priming was found to be larger than semantic priming in aphasics as well as in normals.

Another similar study was done by Mandira in 2013 in Kannada-English bilingual non-fluent aphasics (Brocas aphasia). The study was carried out in five priming conditions: Semantically related (SR), semantically unrelated (SUR), semantically distant (SeD), translational equivalent (TE) and a non-word (NW). It was found that Brocas aphasics had longer reaction time with reduced accuracy of responses indicating a delayed activation time compared to typical individuals. Findings also indicated variation in priming effects, wherein response was higher for TE and SR compared to SUR, SeD. The study also indicated bi-directional priming effects in both the languages of Brocas aphasics and neurotypical individuals.

Prema (2009) studied lexical semantic activation in bilinguals using lexical decision task. 30 participants were enrolled in the study. LEAP Q was administered

on the participants and their proficiency levels were determined. Primed-lexical decision task was administered on these participants. The reaction time and accuracy scores were compared for the target stimuli preceded by translational equivalent primes versus translation non equivalents, semantically related with semantically unrelated primes. A good correlation was observed between the domains of LEAP Q with the reaction time and accuracy scores for translational equivalent primes. She concluded by stating that the priming task can be used as an adjunct to proficiency assessment on rating scales.

Suma (2013) investigated on the language specific and non- specific nature of lexical selection in Kannada- English bilingual adults using lexical decision task. The study considered 30 Kannada-English bilingual adults of 18-30 years. Concrete and abstract words were selected and were paired as semantically related and semantically unrelated in L1-L1, L2-L2 and L1-L2, L2-L1 conditions. The task given was to judge the semantic relatedness of the stimuli. The results revealed that the reaction time was shorter when cross-linguistic word pairs were presented in SR conditions than in SUR conditions. It was also observed that monolingual L2-L2 word pairs had shorter reaction than cross lingual L2-L1. In SUR conditions, the reaction time for monolingual L2-L2 was shorter than L2-L1 but was not statistically significant. However, monolingual L1-L1was not found to be shorter than cross lingual L1-L2. The reaction time for concrete word was shorter than abstract words. Hence the study concluded that lexical selection in Kannada-English bilinguals is highly non-specific and is also dependent on the type of the stimulus. The study could not arrive at conclusive evidence about the activation pattern followed by Kannada-English bilinguals.

The visual word recognition in Kannada English bilinguals was studied through lexical decision and lexical judgement tasks along with naming using translated words (Sarga, 2017). The stimuli were taken from online bilingual proficiency test (Prema, 2012) and included non-words, target words and their primes in Kannada to English and English to Kannada directions. The results revealed that in both the tasks, the reaction time, and accuracy of responses (key press and verbal naming) were better for words than non-words. The reaction time was found to be lesser when both the tasks were in Kannada-English direction. The accuracy for key press in LDT was better for words in Kannada-English direction and was better for non-words in English-Kannada direction in LJT.

Chapter III

Method

The aim of the present study was to explore how the lexical semantic activation in L1 and L2 varies with proficiency in high and low proficient bilinguals. The lexical semantic activation has been widely studied using primed naming tasks.

Objectives of the study were as follows:

1. To investigate the directional pattern of facilitatory - inhibitory effects in translational priming from Malayalam to English and English to Malayalam in high and low proficient bilinguals
2. To investigate language specific lexical selection and non selection in bilinguals.
3. To investigate lexical semantic activation across high and low proficient bilinguals

Participants

Participants considered for the study were in the age range of 18-25 years. They were divided into 2 groups having 20 participants in each group. The high proficient group consisted of 13 females and 7 males (Mean age = 22.3 years) and the low proficient group consisted of 16 females and 4 males (Mean age = 20.45 years).

Participant selection criteria:

Inclusionary criteria.

All the participants were successive bilinguals having Malayalam as L1 and English as their L2.

All of the participants had exposure to L2 (English) at least from 5-6 years onwards with a minimum of 10 years of exposure to the language.

The participants were tested through informal screening for normal vision.

Exclusionary criteria.

Participants who did not have minimum of 10 years of exposure to English were excluded from the study.

The participants were divided into two groups based on bilingual proficiency.

Group 1: High proficient bilinguals (The participants had high proficiency in L2)

Group 2: Low proficient bilinguals (The participants had less proficiency in L2)

Proficiency assessment – Administration of LEAP-Q

LEAP-Q is a reliable and efficient tool for profiling the language proficiency of bilingual and multilingual, neurologically intact adult populations in research settings. It was developed by Marian, Blumenfield and Kaushanskaya (2007). It was adapted to Indian context by Ramya and Goswami in 2009. The questionnaire consists of 18 questions eliciting participant information regarding the number of languages they know, their order of acquisition, the frequency with which they use these languages in varying contexts etc. A section of the questionnaire requires the participants to rate their proficiency on four domains that is understanding, speaking,

reading and writing and it uses a four point rating scale where, 1-Zero Proficiency, 2-Low, 3-Good and 4-Perfect Proficiency). Many authors have put forth their criteria for classifying a person as high proficient bilingual based on Leap-Q. One such criterion asserted by Hayward (2013) is that if a bilingual has a score of 3 or 4 on the speaking domain of L1 they can be classified as high proficient bilinguals. The same criteria will be considered for the proficiency rating in the study.

The details of the participants and the ratings on the four domains of LEAP-Q are shown below (Table 3.1 & Table 3.2).

Table 3.1: *Details of participants in High Proficient group*

High Proficient Group			Domains of LEAP-Q			
S. No	Gender	Age	Understanding	Speaking	Reading	Writing
1	Female	25 years	3	**3**	4	3
2	Female	23 years	4	**3**	4	3
3	Female	21 years	4	**3**	4	4
4	Female	23 years	4	**3**	4	4
5	Female	23 years	4	**4**	4	4
6	Female	24 years	4	**4**	4	4
7	Female	22 years	3	**3**	4	3
8	Female	23 years	4	**4**	4	4
9	Female	25 years	4	**4**	4	4
10	Female	23 years	4	**3**	3	3
11	Female	24 years	4	**3**	4	4
12	Female	24 years	4	**4**	4	4
13	Female	19 years	4	**4**	4	4
14	Male	21 years	4	**3**	4	4
15	Male	20 years	3	**3**	4	4
16	Male	24 years	4	**4**	4	4
17	Male	20 years	3	**3**	3	3
18	Male	18 years	3	**3**	3	3
19	Male	20 years	4	**3**	4	4
20	Male	24 years	4	**4**	4	4

Table 3.2. *Details of participants in Low Proficient group*

Low Proficient group			Domains of LEAP-Q			
S. No	Gender	Age	Understanding	Speaking	Reading	Writing
1	Female	18 years	2	**2**	3	3
2	Female	19 years	3	**2**	3	3
3	Female	20 years	3	**3**	3	4
4	Female	18years	3	**2**	3	2
5	Female	19 years	4	**3**	4	3
6	Female	22 years	3	**3**	3	3
7	Female	19 years	3	**3**	3	3
8	Female	23 years	3	**3**	4	3
9	Female	18 years	3	**2**	3	3
10	Female	25 years	3	**2**	4	3
11	Female	22 years	3	**3**	3	3
12	Female	23 years	3	**3**	4	3
13	Female	20 years	3	**2**	3	2
14	Female	25 years	2	**2**	3	3
15	Female	19 years	3	**2**	3	3
16	Female	19 years	2	**2**	2	2
17	Male	18 years	2	**2**	3	3
18	Male	19 years	2	**2**	2	2
19	Male	23 years	3	**2**	4	4
20	Male	20 years	2	**2**	3	3

Research design

The present study has used a standard group comparison research design to compare between the performances of high proficient and low proficient bilinguals.

Procedure

In order to acclimatize the participants to the testing, a trial comprising of four picture stimuli (to be named in English) with unrelated cross language primes (presented in Malayalam) were presented prior to the actual testing.

Experiment 1: Primed Naming using translational equivalent primes.

Experiment 1 comprised of two tasks.

Task 1: Naming in L1 with translational equivalent and non translational equivalent primes.

Task 2: Naming in L2 with translational equivalent and non translational equivalent primes.

Stimulus selection

The present study comprised of picture naming tasks. Sixty pictures were chosen from Malayalam (L1) based on their high frequency occurrence in the language. Another set of sixty pictures were selected in English (L2) from English word lists such as the Snodgrass 260 picture word list. To validate the pictures, they were subjected to picture –word agreement. The pictures were initially named by the investigator in Malayalam and English and then these pictures with its name were circulated among three judges (Malayalam-English bilinguals). The judges were asked to decide if the label (name) given to each picture is appropriate or not.

Task 1: Naming in L1

Stimuli: In this task 30 stimuli from L1 (Malayalam) were selected. The stimuli were further divided into two sets of 15 stimuli each based on the primes preceding the stimuli (pictures).

Prime: For the first task, 15 translational equivalent primes and 15 non translational equivalent primes in English were presented. The translation equivalent and non translational equivalent primes were randomised and then presented.

Testing environment: The testing was carried in a quiet room to avoid distractions. The stimuli for the task were presented in visual mode on a 15.6 inch laptop using DMDX software. The participants were made to sit at a distance of 50cm from the laptop screen

Procedure: In each trial the prime was displayed on the screen for 500ms duration followed by an interval of 500ms. Following the interval, the stimulus picture was displayed for 2000ms. The participants were instructed as follows: ‒You will see a word displayed on the screen in English language for a short duration followed by a picture. Your task is to ignore the initial word and to name the picture which comes on the screen in Malayalam‖.

The naming responses from the participants were recorded instantly using Check vocal software available in DMDX program.

Analysis: The reaction time and accuracy of the response for word naming in L1 (Malayalam) were analyzed for translational equivalent and non-translational equivalent primes.

Example for task 1 of experiment 1:

Type of prime	Prime (Orthographic) in L2-English	Target stimulus (Picture) to be named in L1-Malayalam
Translation equivalent	LOCK	
Non-translation equivalent	BAG	

Task 2: Naming in L2

Stimuli: In this task 30 stimuli from L2 were selected. The stimuli were further divided into two 15 stimuli alike the previous task.

Prime: In the second task, 15 translational equivalent and 15 non-translational equivalent primes in Malayalam were used.

Testing environment: The testing environment was kept the same as in the previous task

Procedure: In task 2, the duration of the stimulus, interval and prime were constant as in task 1.

The participant was instructed as follows: –You will see a word displayed on the screen in Malayalam language for a short duration followed by a picture. Now you will have to name the pictures in English ignoring the words preceding the pictures‖.

Participant response was recorded as mentioned earlier for task 1.

Analysis: The reaction time and accuracy of the response for word naming in L2 (English) were analyzed for translational equivalent and non-translational equivalent primes.

Example for task 2 of experiment 1:

Type of prime	Prime (Orthographic) in L1- Malayalam.	Target stimulus (Picture) to be named in L2- English
Translation equivalent	കയർ	
Non-translation equivalent	ഉള്ളി	

Experiment 2: Primed naming using semantic primes

Experiment 2 comprised of two tasks.

Task 1: Naming in L1 using semantically related (SR) and semantically unrelated (SUR) cross- language primes.

Task 2: Naming in L2 using semantically related (SR) and semantically unrelated (SUR) cross-language primes.

Stimuli selection: In experiment 2, the stimuli selection was done similar as in experiment 1. 30 stimuli (two sets of 15 stimuli each) were chosen from both the languages.

Task 1: Naming in L1

Stimulus: In this task 30 stimuli from L1 were used. These stimuli were further divided into two sets having 15 stimuli each.

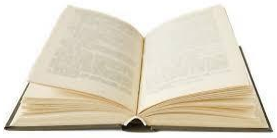
Prime: This task will considered 15 semantically related (SR) and 15 semantically unrelated (SUR) primes which were in English. Pictures with semantically related and unrelated primes were randomized and presented

Procedure: The duration of display of the prime, the stimuli and the interval were kept same as in the previous experiment. The participant was instructed as follows

–Now, you will see a word displayed on the screen in English language for a short duration followed by a picture. Your task is to ignore the initial word and to name the picture which comes on the screen in Malayalam.‖

Analysis: The reaction time and accuracy of the response for word naming in L1 were analyzed for semantically related and semantically unrelated primes.

Example for task 1 of experiment 2:

Type of prime	Prime (Orthographic) in L2- English	Target stimulus (Picture) to be named in L1- Malayalam
Semantically related	PEN	
Semantically unrelated	UMBRELLA	

Task 2: Naming in L2

Stimulus: In this task 30 stimuli from L2 were selected. These stimuli were divided into two sets having 15 stimuli each.

Prime: As in the previous task of this experiment, this task also considered 15 semantically related and 15 semantically unrelated (SUR) primes which were presented in Malayalam. Pictures with semantically related and unrelated primes were randomized and presented.

Procedure: The duration of display of the prime, the stimuli and the interval were kept the same as the previous tasks. The participant was instructed as follows –Now, you will see a word displayed on the screen in Malayalam language for a short

duration followed by a picture. Alike the previous tasks, you will have to ignore the initial word and name the picture which comes on the screen in English.‖

Analysis: The reaction time and accuracy of the response for word naming in L2 were analyzed for semantically related and semantically unrelated primes.

Example for task 2 of experiment 2:

Type of prime	Prime (Orthographic) in L1- Malayalam	Target stimulus (Picture) to be named in L2- English
Semantically related	വിരൽ	
Semantically unrelated	മുല്ല	

Statistical analysis:

The data was excluded from analysis if it was (i) pronounced wrongly (ii) contained dysfluencies (iii) named in the non-target language (iv) named after the stipulated recording time or (v) if no response was given.

Statistical analysis for calculating the mean reaction time and accuracy was done using the software Statistical Package for Social Sciences (SPSS) version 20.0 for:

1. Investigate the directional pattern of facilitatory - inhibitory effects in translational priming from Malayalam to English and English to Malayalam in normal bilingual adults.

2. Investigating language specific lexical selection and non selection in bilinguals.

3. Investigating lexical semantic activation across high and low proficient bilinguals

Shapiro Wilk's test for normality was administered for the high proficient and the low proficient group for all the parameters. The following parametric and non parametric tests were administered using the SPSS software:

i. Mixed ANOVA was administered to compare the reaction time measures in all four conditions for both the languages between the high proficient and low proficient groups.

ii. Bonferroni paired t-test was administered to check the significant differences in mean reaction time across all four conditions within high proficient and low proficient groups.

iii. Mann Whitney U test was administered to see the significant differences between accuracy measures in all four conditions for both the languages between high proficient and low proficient groups.

iv. Wilcoxon‘s Signed Rank test was administered for comparison of the accuracy scores across four conditions within high proficient and low proficient group for the two tasks.

v. MANOVA was administered for the comparison of average mean reaction time and accuracy between L1 and L2 naming across high and low proficient group.

Chapter IV

Results and Discussion

The primary aim of the study was to to investigate how the lexical semantic activation in L1 and L2 varies with proficiency in high and low proficient bilinguals. 40 Participants in the age range of 18-25 years were considered for the study. They were divided into 2 groups of high proficient and low proficient bilinguals comprising of 20 participants each based on their speaking proficiency in L2 as deferred from LEAP-Q. Shapiro Wilks test of normality was administered and two participants from each group were found as outliers. Hence, their data were removed resulting in each group having data of 18 participants. Test of normality was administered again and it was found that reaction time values were normally distributed ($p>0.05$) but accuracy values were not normally distributed for all parameters. Hence parametric tests were carried out for reaction time measures and non-parametric tests for accuracy scores. Statistical analysis for calculating the mean reaction time and accuracy was done using the software Statistical Package for Social Sciences (SPSS) version 20.0.

Objectives of the study were as follows:

1. To investigate the directional pattern of facilitatory - inhibitory effects in translational priming from English to Malayalam (L2-L1) and Malayalam to English (L1-L2) in high and low proficient bilinguals
2. To investigate language specific lexical selection and non selection in bilinguals.
3. To investigate lexical semantic activation across high and low proficient bilinguals in L1 (Malayalam) and L2 (English) naming.

The results of the present study are discussed under the following headings:

A. Comparison of reaction time and accuracy on picture naming for translational equivalent and non equivalent primes in high proficient and low proficient groups.
B. Comparison of reaction time and accuracy on picture naming in L1 and L2 separately for semantically related and unrelated primes in high proficient and low proficient groups.
C. Comparison of reaction time and accuracy in picture naming in L1 and L2 naming between high proficient and low proficient groups.

Objective 1

Comparison of reaction time and accuracy on picture naming for translational equivalent and non equivalent primes in high proficient groups. The results are explained based on Experiment 1

Task 1: In task 1 of experiment 1, the orthographic prime in L2 (English) was displayed on the screen for a duration of 500ms followed by an interval of 500ms, following which the picture stimulus was displayed for 2000ms. The participants were instructed to ***name the picture in L1*** ignoring the word displayed before. In this task, 15 primes were translational equivalent and 15 were non-translation equivalent primes, which were presented randomly. The trials were translational equivalent primes were given are termed as condition 1 and the remaining trials were non-translational equivalent primes were given are termed as condition 2.

Task 2: In task 2 of experiment 1, the duration of the prime, interval and stimulus duration were kept similar as in task 1 except that the prime was displayed in L1 and the participants were instructed ***to name the picture in L2.***

The overall mean and standard deviation (SD) were calculated for the performance of participants (Group I -High proficient and Group II -Low proficient) in terms of reaction time across the two prime conditions in L1 and L2 naming tasks. The overall mean, median and standard deviation were calculated for the accuracy measures obtained for two different prime conditions on the two tasks. Mixed ANOVA was carried out initially to compare the mean reaction time between high and low proficient groups on all naming conditions.

Further Paired-t test was carried out to check for significant difference within the high proficient group on different naming conditions (Table 4.2). Statistically significant differences were found in both L1 naming and L2 naming using translational primes. Table 4.1 and Figure 4.1 shows the performance of group I (High proficient) across the two tasks of Experiment 1

Table 4.1 *Mean and SD of mean reaction time in Group I (High proficient) across the two tasks of experiment 1.*

Tasks	Conditions	Mean	SD
Task 1	L2-L1 TE	888.82	197.01
	L2-L1 NTE	1043.74	167.22
Task 2	L1-L2 TE	831.29	136.97
	L1-L2 NTE	887.39	109.15

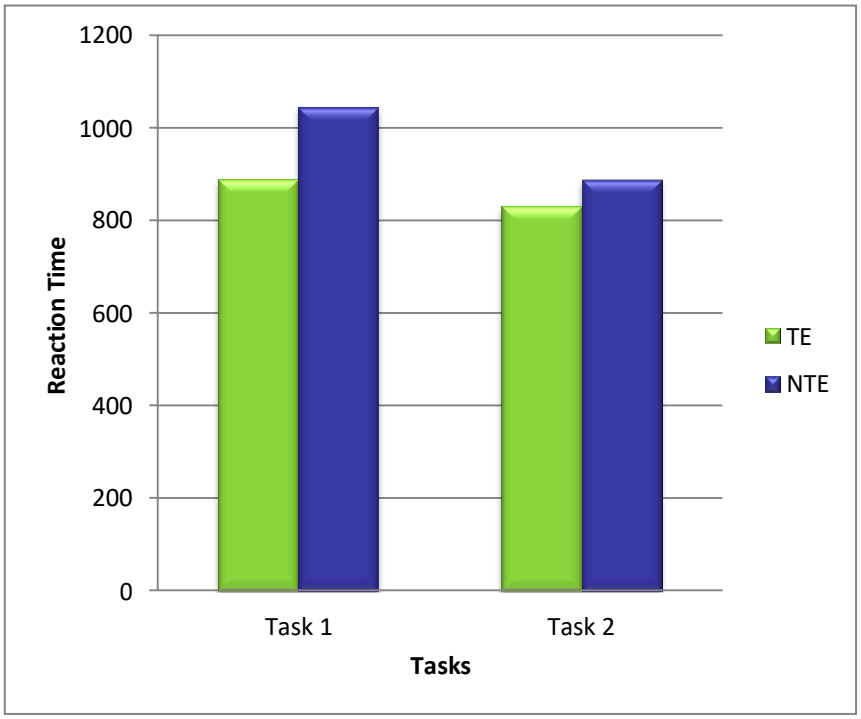


Figure 4.1. Mean reaction time of group I (High proficient) across the two tasks in experiment 1.

Table 4.2 *Test statistic (t), degree of freedom (df) and statistical significance (p) of group I (High proficient) across the two tasks of experiment 1.*

Group	Pairs	t (df=17)	P
HP	L2-L1 TE & L2-L1 NTE	-4.970	0.000*
	L1-L2 TE & L1- L2 NTE	-2.402	0.028*

NOTE: *indicates values with statistical significance of p<0.05

The mean reaction time was found to be less in condition with TE primes (Mean = 888.82) than with NTE primes (Mean= 1043.74). Similar trend is observed in task 2. The test statistic obtained was t(df) = -2.402, p = .028. That is naming in L2 with prime in L1, the mean reaction time was lesser in TE (Mean = 831.29) than in NTE condition (Mean= 887.3912) and the difference is statistically significant (p = 0 .028). In reaction time studies, it is considered that the lesser the time taken to

perform the task, the better is the performance. In both the tasks, the standard deviation (SD) was high for the first condition with TE primes.

As depicted in Table 4.1, 4.2 and Figure 4.1, for task 1 that is naming in L1 with L2 prime, the pair wise analysis yielded *t(df)* = -4.970, p= .000 for the two conditions. These findings suggest that in high proficient bilinguals cross language translational primes facilitate lexical selection in the target language which gives evidence that even if the two languages are getting activated, the selection mechanism activates only the language nodes of the intended language. This supports the language specific selection model of bilingual language representation (Costa & Caramazza, 1999). Also, this finding is in agreement with Altarriba et.al (2007) whose study showed significant translational priming effects in both language directions using masked and un-masked translational primes. This finding is also in line with Deema and Prema (2005); Rajini and Prema (2005) who found a significant effect of cross language translational priming in both the language directions. In similar lines, the performance was also analyzed considering the accuracy of scores also.

Table 4.3 *Mean, SD and Median of accuracy in Group I (High proficient) across the two tasks of experiment 1.*

Tasks	**Conditions**	**Mean (Max 15)**	**SD**	**Median**
Task 1	L2-L1 TE	14.50	1.20	15.00
	L2-L1 NTE	12.72	1.74	13.00
Task 2	L2-L1 TE	14.22	0.73	14.00
	L1-L2 NTE	14.83	0.38	15.00

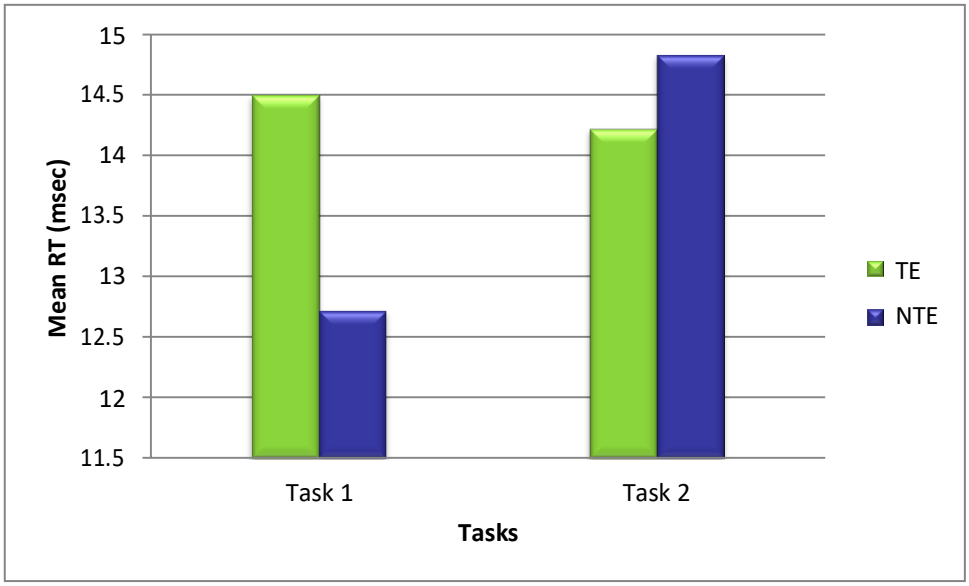


*Figure 4.2.*Mean scores for accuracy in group I across both the tasks in experiment 1

Table 4.4 $|Z|$ *score and p value of accuracy across the two tasks of experiment 1 in high proficient group*.

Group	**Pair**	**|Z|**	**P**
HP	L2-L1TE & L2- L1NTE	3.579	0.000*
	L1-L2 TE & L1-L2 NTE	2.517	0.012*

NOTE: *indicates values with statistical significance of $p<0.05$

In addition to mean reaction time, accuracy of responses was also obtained. The accuracy was better in condition 1 with TE prime (Mean= 14.50, Median = 15.00) than in condition 2 with NTE prime (Mean = 12.72, Median = 13.00). Similarly, in task 2, there was a significant difference in the accuracy scores across the two conditions (p = .012) except that the scores were better with NTE primes (Mean = 14.83, Median = 15.00) than TE primes (Mean = 14.22, Median = 14.00). The SD was obtained higher for condition 1. The maximum response was 15.

Initially Mann Whitney U test was performed to check for any significant differences in accuracy scores between the conditions. For L1 naming, comparison across both the conditions yielded $|Z| = 3.579$, $p = .000$. This suggests that there was a significant difference found for L2-L1 NTE, L1-L2 TE and L2SUR conditions. Further, within group analysis was done for both the groups using Wilcoxon's Signed Rank test. As given in Table 4.3, 4.4 and Figure 4.2, in task 1, the accuracy scores for the high proficient group was found to be significantly different for both the conditions ($p = 0.000$). These results indicate that in high proficient bilinguals the cross language translational equivalent prime facilitate the selection of the intended language. This was evidenced by better mean reaction time and accuracy scores in L2-L1 direction and better mean reaction time L1-L2 direction. The facilitation effect was reflected more by reaction time measure in L1-L2 direction.

Comparison of performance of low proficient group across L1 and L2 naming using translational primes. The performance of group II (Low proficient) across the two tasks of Experiment 1 are shown in Table 4.5 and Figure 4.3.

Table 4.5 *Mean and SD of mean reaction time in Group II (Low proficient) across the two tasks of experiment 1.*

Tasks	Conditions	Mean	SD
Task 1	L2-L1 TE	917.56	141.19
	L2- L1 NTE	1068.00	172.40
Task 2	L1-L2 TE	910.75	158.68
	L1-L2 NTE	1012.55	123.38

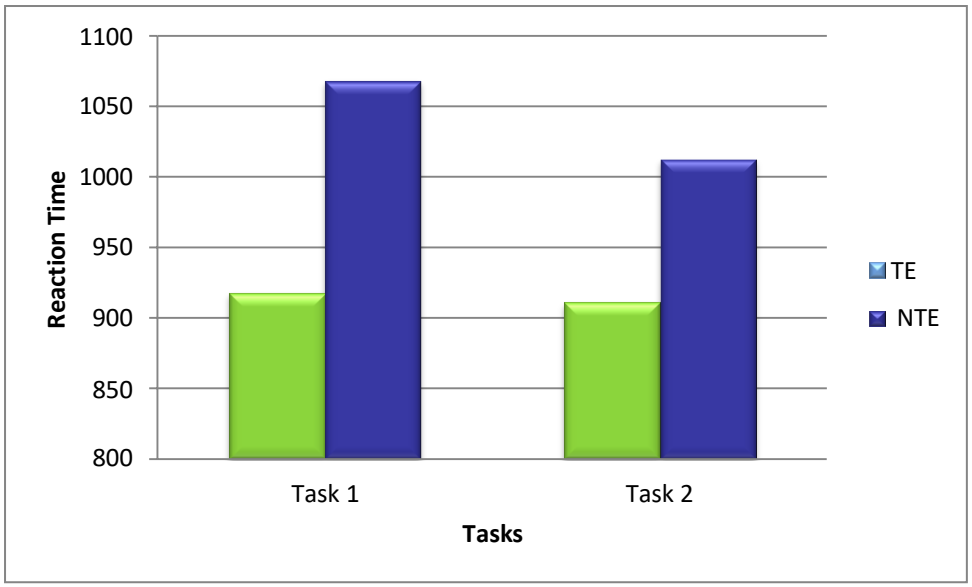


Figure 4.3. Mean scores of mean reaction time in group II (Low proficient) across the two tasks in experiment 1.

Table 4.6 *Test statistic (t), degree of freedom (df) and statistical significance (p) of group II (Low proficient) across the two tasks of experiment 1*

Group	Pairs	t (df=17)	P
LP	L2-L1 TE & L2-L1 NTE	-4.272	0.001*
	L1-L2 TE & L1- L2 NTE	-2.345	0.031*

As depicted in Table 4.5, 4.6 and Figure 4.3, group II (Low proficient) participants showed a statistically significant difference between the two conditions of TE and NTE (*t(df)* = -4.272 (17), p = 0.001) in task 1. The mean reaction time was lesser for condition 1 (Mean = 917.56) than condition 2 (Mean = 1068.00).

In task 2, alike task 1, the mean reaction time was lesser for condition 1 (Mean = 910.75) than condition 2 (Mean = 1012.55) and the p value also showed a

statistically significant difference with *t(df)* = -2.345 and p = 0.031. These findings suggest that in low proficient bilinguals also cross language TE primes facilitates lexical selection in both L2-L1 and L1-L2 directions. The facilitation effect was better seen in L1-L2 direction compared to L1-L2 condition with lesser mean reaction time in L2 naming than L1 naming. The descriptive statistics for accuracy scores of group II participants are shown in Table 4.7.

Table 4.7 *Mean, SD and Median of accuracy in Group II (Low proficient) across the two tasks of experiment 1.*

Tasks	Conditions	Mean	SD	Median
Task 1	L2-L1 TE	14.56	0.615	15.00
	L2-L1 NTE	13.83	1.20	14.00
Task 2	L1-L2 TE	12.78	1.96	13.00
	L1-L2 NTE	14.50	0.71	15.00

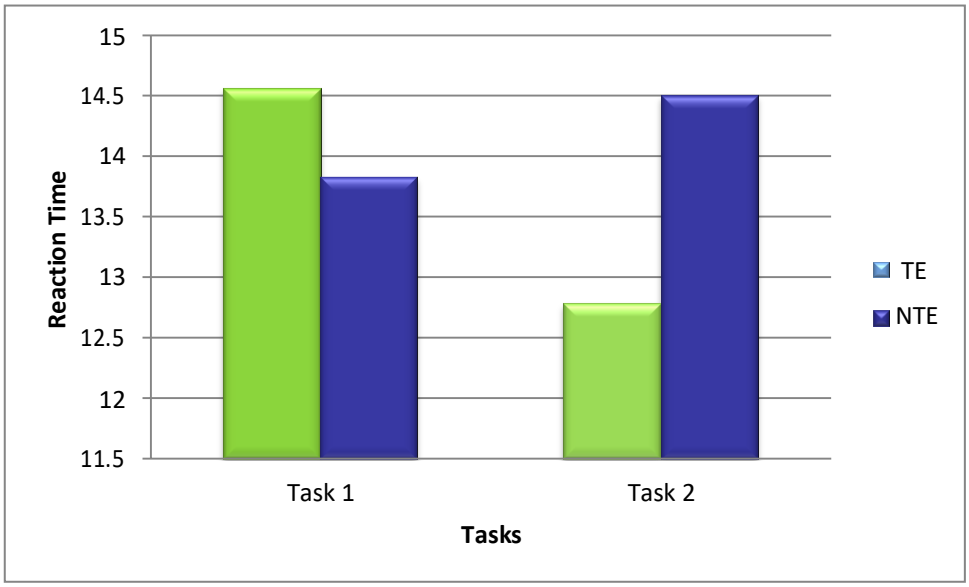


Figure 4.4. Mean scores for accuracy in Group II (Low proficient) across the two tasks of experiment 1.

Table 4.8 $|Z|$ *score and p value across the two tasks of experiment 1 in low proficient group.*

Groups	Pair	$\|Z\|$	P
LP	L2-L1TE & L2- L1NTE	2.089	0.037*
	L1-L2 TE & L1-L2 NTE	2.946	0.003*

As depicted in table 4.7, 4.8 and figure 4.4, the accuracy scores of group II participants shows that in task 1, the performance was better in condition 1 (Mean = 14.56, Median = 15.00) than condition 2 (Mean = 13.83, Median = 14.00) and the p value showed statistically significant difference (p = 0.037).

In contrast, the accuracy scores from task 2 revealed that the performance was better in condition 2 (Mean = 12.78, Median = 13.00) than condition 1 (Mean = 12.78, Median = 15.00) and the difference is found to be statistically significant (p =

0.003). The accuracy scores were following similar trend as seen in high proficient group.

To summate, the first objective of the study was to compare the reaction time and accuracy on picture naming for translational equivalent and non equivalent primes in L1-L2 and L2-L1 conditions in high proficient and low proficient groups. It was found that the high proficient group performed better with TE primes in both L2-L1 and L1-L2 directions. Accuracy scores were also better for TE compared to NTE. This facilitation effect of translational primes was reflected in terms of both mean reaction time and accuracy scores. The facilitation effect was found to be stronger in L1-L2 direction with relatively shorter reaction time hence suggesting an asymmetry between the lexical links of both the languages.

In low proficient group the findings from task 1 was similar to that of high proficient group. Whereas in task 2, naming in L2 (English), the accuracy scores were higher with NTE primes and was lower with TE primes which suggest that the accuracy scores failed to indicate the facilitatory effect in L1-L2 direction in low proficient group . However while considering the reaction time measures, the facilitation effect of translational equivalent primes were seen in both the language directions with asymmetry noted in between the links. These findings from both the high and low proficient groups support the hypothesis of the RHM model (Kroll & De Groot, 1997) which suggests an asymmetry between the language specific lexical links of both the languages.

4.2 Objective 2

Comparison of reaction time and accuracy in picture naming with semantically related and unrelated primes in L1-L2 and L2-L1 conditions in high proficient and low proficient groups.

The experiment two comprised of two tasks with two conditions each similar to the first experiment. In task 1, the participants were asked to name in L1 with semantic primes given in L2. The primes included 15 semantically related and 15 semantically unrelated primes presented randomly. The trials with semantically related (SR) primes were classified as condition 3 and trials where semantically unrelated (SUR) primes were given were classified as condition 4 in the study.

Comparison of performance of high proficient group across L1 and L2 naming using semantic primes.

Table 4.9 shows the performance of group I (High proficient) across the two tasks of Experiment 2.

Table 4.9 *Mean and SD for mean reaction time in Group I (High proficient) across the two tasks of experiment 2.*

Tasks	Conditions	Mean	SD
Task 1	L2-L1 SR	1056.85	183.05
	L2- L1 SUR	1012.55	188.66
Task 2	L1-L2 SR	896.23	135.86
	L1-L2 SUR	898.01	141.12

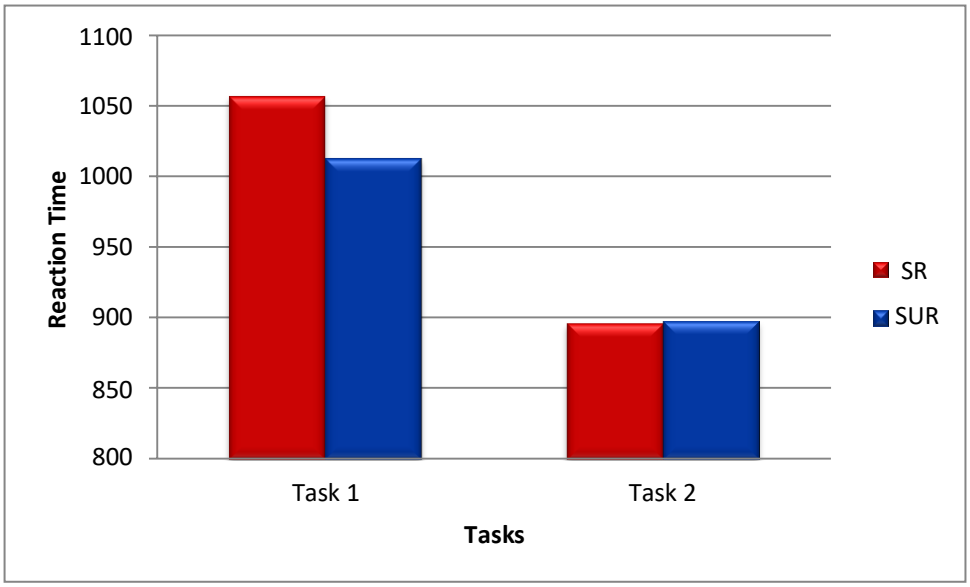


Figure 4.5 Mean scores of mean reaction time in group I (High proficient) across the two tasks in experiment 2.

Table 4.10 *Test statistic (t), degree of freedom (df) and statistical significance (p) of mean reaction time in group I (High proficient) across two the tasks of experiment 2.*

Groups	Pairs	t (df = 17)	P
HP	L2-L1 SR & L2-L1 SUR	1.194	0.249
	L1-L2 SR& L1- L2 SUR	-.094	0.926
LP	L2-L1 SR & L2-L1 SUR	.474	0.641
	L1-L2 SR& L1- L2 SUR	-2.654	0.017*

NOTE: *indicates values with statistical significance of $p<0.05$

The analysis of results from Table 4.9, 4.10 and Figure 4.5 revealed that for task 1, the mean reaction time of high proficient group was longer in condition 1 with semantically related primes (Mean = 1056.85) and shorter in condition 2 with semantically unrelated primes (Mean = 1012.55) however the difference was not statistically significant ($p = 0.25$).

In task 2, for L2 naming, the mean reaction time was slightly better in condition 1 (SR) (Mean = 896.23) than condition 2 (SUR) (Mean =898.01) and p valued showed no statistical significance (p = 0.09). In both the tasks, the SD was high for condition 2.

Table 4.11 *Mean, SD and Median of accuracy in Group I (High proficient) across the two tasks of experiment 2.*

Tasks	**Conditions**	**Mean(Max 15)**	**SD**	**Median**
Task 1	L2-L1 SR	13.17	1.58	13.00
	L2-L1 SUR	14.00	1.37	14.50
Task 2	L1-L2 SR	14.00	1.33	15.00
	L1-L2 SUR	14.28	1.01	14.50

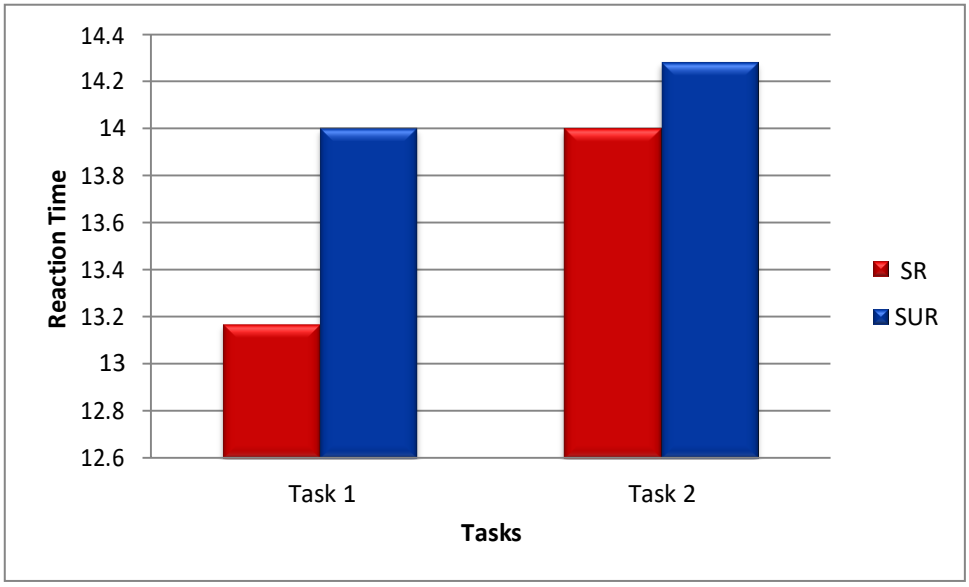


Figure 4.6. Mean scores of accuracy in group I (High proficient) across the two tasks in experiment 2.

Table 4.12 *Test statistic* $|Z|$ *and p value of accuracy in high proficient group across the two tasks of experiment 2*

Groups	Pair	$\|Z\|$	P
HP	L2-L1 SR & L2-L1 SUR	1.814	0.070
	L1-L2 SR& L1- L2 SUR	0.611	0.541

NOTE: *indicates values with statistical significance of $p<0.05$

Wilcoxon Signed Rank Test was carried out to verify if there was any significant difference between the two tasks of experiment 1. The test statistic and p value are shown in Table 4.12. The analysis of accuracy scores of group I (Table 4.11) revealed that for task 1, the mean accuracy score was higher in condition 2 with semantically unrelated primes (Mean = 14.00, Median = 14.5) than condition 1 with semantically related primes (Mean = 13.17, Median = 13.00). The difference was observed to be statistically significant ($p = 0.005$). The value of SD was observed to be higher in condition 1.

Similarly in task 2, the participants performed better in condition 2 (Mean = 14.28, Median = 14.50) than condition 1 (Mean = 14.00, Median = 15.00) with relatively higher SD observed for condition 1. However the value of p did not show statistical significance ($p = 0.110$).

Findings from accuracy scores also suggests that cross language semantically related words caused interference in lexical selection of the target word which might have resulted in the reduced accuracy of picture naming in high proficient bilinguals. This finding is in support with Keatley and Gelder (1992).

Comparison of performance of low proficient group across L1 and L2 naming using semantic primes.

Table 4.13 *Mean and SD of mean reaction time in Group II (Low proficient) across the two tasks of experiment 2.*

Tasks	Conditions	Mean	SD
Task 1	L2-L1 SR	983.47	146.26
	L2- L1 SUR	968.30	159.53
Task 2	L1-L2 SR	979.77	87.36
	L1-L2 SUR	1047.49	122.19

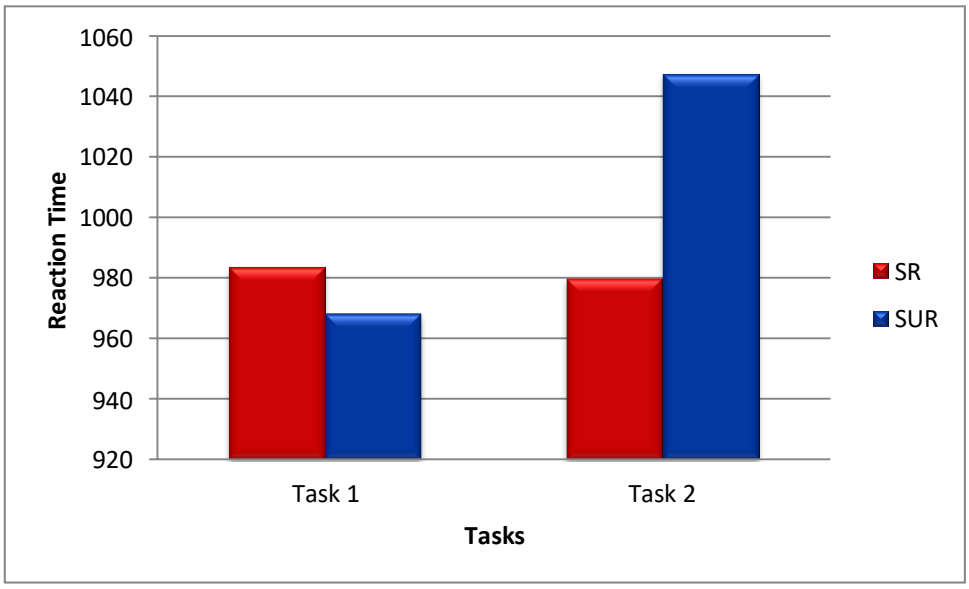


Figure 4.7 Mean scores of mean reaction time in group II (Low proficient) across the two tasks in experiment 2.

Table 4.14 *Test statistic (t), degree of freedom (df) and (p) value of mean reaction time in group II across the two tasks of experiment 2.*

Group	Pairs	t (df = 17)	P
LP	L2-L1 SR & L2-L1 SUR	.474	0.641
	L1-L2 SR& L1- L2 SUR	-2.654	0.017*

The mean reaction time for group II participants in task 1 (Table 4.13) reveals that the performance was better in condition 2 (Mean = 1012.55) than condition 1 (Mean = 1056.85) and p value did not show significant difference (p = 0.641). However in task 2, the performance was better in condition 1(Mean = 896.23) than condition 2 (Mean = 898.01) and difference was statistically significant (p = 0.017). The value of SD in both the tasks was higher in condition 2.

Table 4.15

Mean, SD and Median of accuracy for Group II (Low proficient) across the two tasks of experiment 2.

Tasks	Conditions	Mean	SD	Median
Task 1	L2-L1 SR	13.06	1.06	13.00
	L2-L1 SUR	14.56	0.78	15.00
Task 2	L1-L2 SR	13.72	1.18	14.00
	L1-L2 SUR	12.94	2.18	13.50

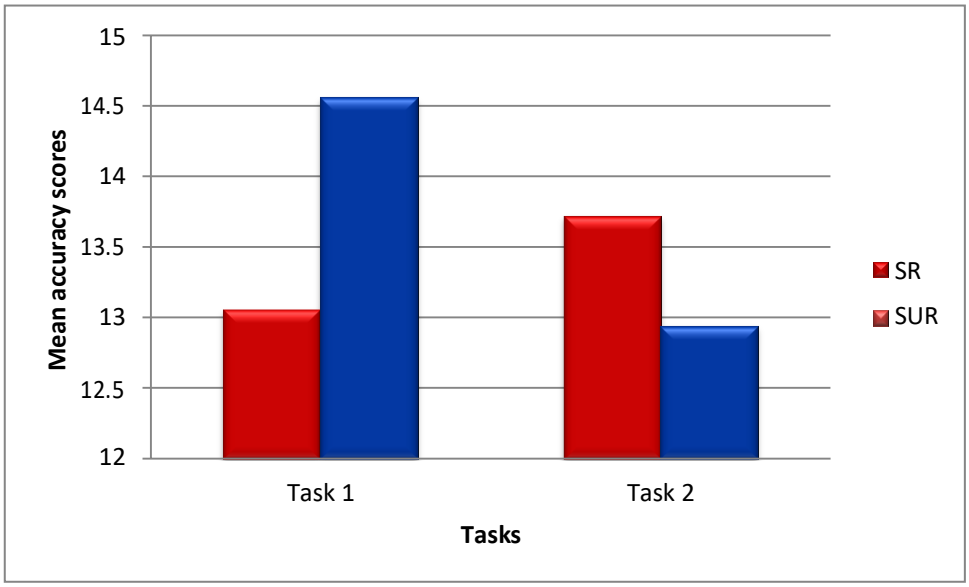


Figure 4.8. Mean scores of accuracy in group II (Low proficient) across the two tasks in experiment 2.

Table 4.16 *Test statistic* $|Z|$ *and p value of accuracy in low proficient group across the two tasks of experiment 2*

Groups	Pair	$\|Z\|$	P
LP	L2-L1 SR & L2-L1 SUR	2.839	0.005*
	L1-L2 SR& L1- L2 SUR	1.597	0.110

As represented in Table 4.15, Table 4.16 and Figure 8, the low proficient group had better accuracy scores in condition 2 (Mean = 14.56, Median = 15.00) than condition 1 (Mean = 13.06, Median = 13.00) of task 1 with p value observed to be non significant (p = 0.641). The value of SD was found to be higher in condition 1. Similar to the trend observed in task 1, results from task 2 also revealed that low

proficient participants performed better in condition 2 (Mean = 13.72, Median = 14.00) than condition 1 (Mean = 12.94, Median = 13.50) and the difference was statistically significant (p = 0.17). The value of SD was higher in condition 2 for task 2.

The findings based on accuracy scores suggest that in low proficient bilinguals semantically related words in cross language does not cause interference in naming in target language. This finding is in support of the language-specific selection hypothesis (Costa et.al, 1999, 2000)

In brief, the second objective of the present study focused on comparing the mean reaction time and accuracy scores in picture naming for semantically related and unrelated primes in L1-L2 and L2-L1 conditions in high proficient and low proficient groups. ***In the high proficient group, the reaction time was better for SUR compared to SR on L1 naming while the accuracy scores were better for SR compared to SUR. For the low proficient on L1 naming, group reaction time was better for SR compared to SUR while the accuracy score was better for SUR compared to SR. For L2 naming also the same finding (better reaction time for SR and better accuracy scores for SUR) was seen.*** The results suggest that in high proficient bilinguals, semantically related words in L2 causes interference in naming in Malayalam. This implies that during the lexical semantic activation, along with the target word in Malayalam, other semantic representations which are related to the target word may also get activated and compete with the target word for its selection. This competition further leads to interference in naming the target word. Thus, this finding supports the language non- specific selection hypotheses advocated by Green (1996) and Hermans et.al, (1998).

With respect to the low proficient group, the priming effect was similar to that of high proficient group. It was noted that semantically related words in English impeded with the selection of Malayalam words. That means there is language non-specific selection happening in L2-L1 direction. The fact that naming accuracy was better with semantically related primes in task 2 suggests that accuracy scores failed to explain the semantic interference in low proficient bilinguals as did the mean reaction time.

Objective 3

Comparison of reaction time and accuracy between high proficient and low proficient groups on L1 naming and L2 naming.

Table 4.17 *Comparison of average reaction time and SD between High and Low proficient groups across L1 and L2 translational priming conditions.*

	Groups	**Mean**	**SD**
L1Naming (TE+ NTE/2)	HP	966.28	170.34
	LP	992.78	138.73
L2 Naming (TE+ NTE/2)	HP	859.34	113.50
	LP	961.65	108.26

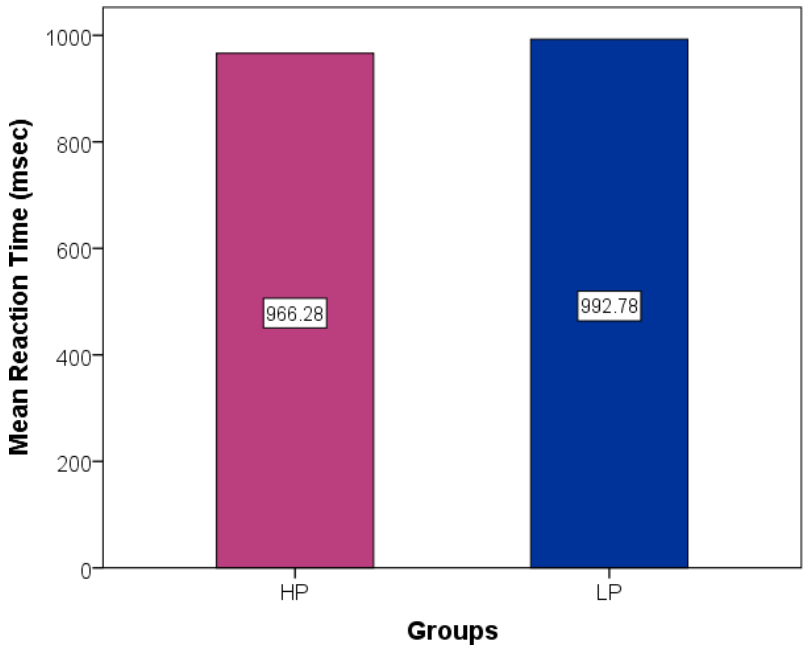


Figure 4.9 Comparison of average reaction time between high proficient and low proficient groups in L1 naming under translational priming condition.

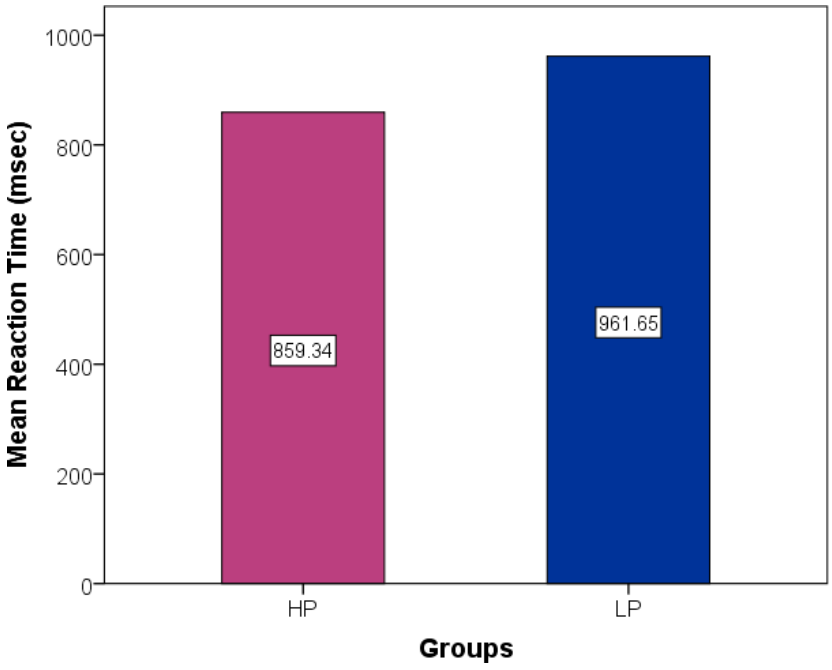


Figure 4.10 Comparison of average reaction time between high proficient and low proficient groups in L2 naming under translational priming condition.

The third objective of the study was to compare the mean reaction time and accuracy on L1 naming and L2 naming between high proficient and low proficient group. As a means, the average of the mean reaction time and accuracy was calculated for the two conditions of translational and semantic priming separately for L1 naming and L2 naming respectively. **(E.g. *L1 naming-translational prime* = */2* & L1 naming semantic priming = RT of L1 with SR + RT of L1 with SUR / 2).** Similarly, the average of mean accuracy scores was calculated. These values were then subjected to Shapiro Wilk's test of normality and were found to be following normal distribution ($p>0.05$).

Table 4.18

Comparison of 'F(df)' value' and level of significance between groups and translational priming in L1 and L2.

Groups	Naming conditions	*F(df)*	*P*
HP & LP	L1- translational prime	1.32 (1)	.259
	L2- translational prime	9.43 (1)	.004

As shown in table 4.18, further between subject analysis revealed a significant difference in two conditions, that is, in L2 naming with translational prime ($F(df) = 9.43(1)$, $p = 0.009$) and L2 naming with semantic prime ($F(df) = 7.66(1)$,$p = 0.004$). This reflects significant difference only in the average of L2 naming under both translational and semantic priming conditions.

One-way MANOVA was carried out to evaluate if there was any significant difference between the averages of mean reaction time and accuracy scores of L1 naming under semantic-translational priming and L2 naming under semantic-translational priming in high and low proficient bilinguals. Overall there was statistically significant difference found for the average reaction time between the groups ($p = 0.000$). However, the average of accuracy scores did not show statistically significant difference hence it was not considered for further statistical analysis and only the average of mean reaction time was considered.

Table 4.17, Table 4.18, Figure 4.9 and Figure 4.10 show the comparison of group I and group II in L1 and L2 naming with translational primes. It can be inferred that the high proficient group performed better than low proficient group in both L1 and L2 naming when preceded by translational primes.The mean and SD of average reaction time in L1 and L2 naming using semantic primes for high proficient and low proficient group are shown in table 4.19

Table 4.19 *Comparison of average reaction time and SD between High and Low proficient groups across L1 and L2 semantic priming conditions.*

	Groups	**Mean**	**SD**
L1SEM	HP	1034.70	168.40
	LP	975.88	137.15
L2SEM	HP	897.12	132.48
	LP	1013.63	91.39

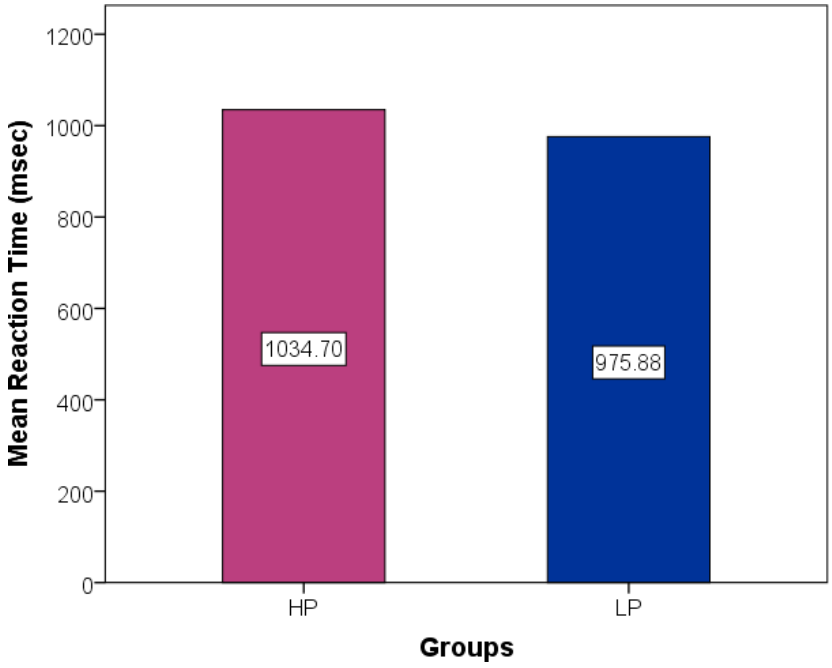


Figure 4.11 Comparison of average reaction time between high proficient and low proficient groups in L1 naming under semantic priming condition.

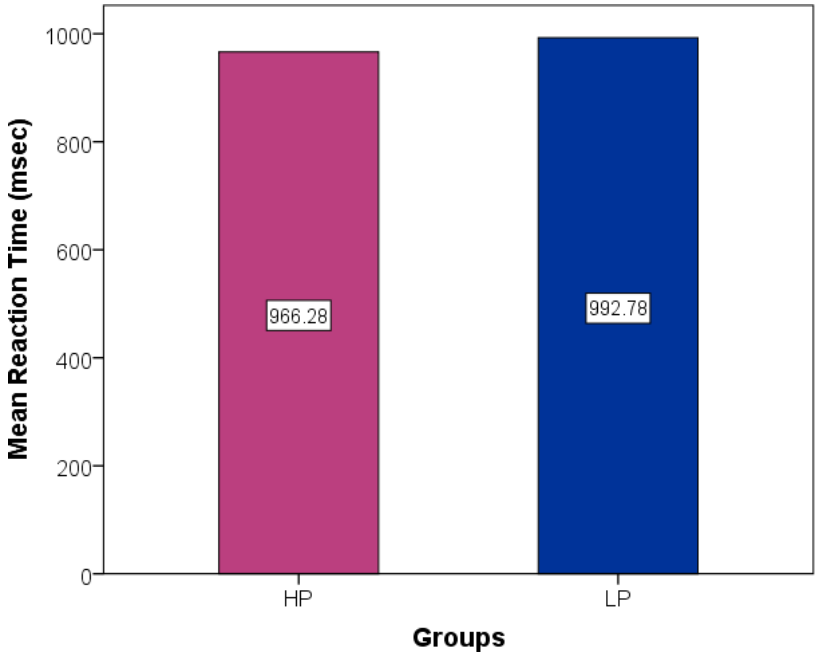


Figure 4.12 Comparison of average reaction time between high proficient and low proficient groups in L2 naming under semantic priming condition.

Table 4.20

Comparison of 'F(df)' value' and level of significance between groups and semantic priming in L1 and L2.

Groups	Naming conditions	*F(df)*	*P*
HP & LP	L1-Semantic prime	0.262(1)	.612
	L2-Semantic prime	7.66 (1)	.009

From Table 4.19, Table 4.20 Figure 4.11 & 4.12 it can be understood that on L1 naming with L2 semantic primes, the low proficient group (Mean = 975.88) performed better than high proficient group (Mean = 1034.70) . Conversely, in L2 naming with L1 semantic prime, the high proficient group (Mean = 897.12) had a shorter reaction time than low proficient group (Mean = 1013.63). These findings indicate that high proficient bilinguals performed better than low proficient bilinguals for naming in L1 and L2 under translational priming. Whereas, under semantic priming, low proficient bilinguals performed well for L1 naming and high proficient bilinguals responded well for L2 naming.

To sum up the findings, the main aim of the study was to see the effect of proficiency on lexical semantic activation. This was studied under three objectives. The first objective was to investigate the directional pattern of facilitatory - inhibitory effects in translational priming from English to Malayalam (L2-L1) and Malayalam to English (L1-L2) in high and low proficient bilinguals. The mean reaction time and accuracy in naming were compared across two language directions when presented with a cross language translational prime. The analysis of the results revealed that both high proficient bilinguals and low proficient bilinguals had a

faster reaction time when the pictures were preceded by a cross language translational equivalent prime compared to translation non equivalent prime. This facilitation effect of cross language translational equivalent primes was seen in both L1-L2 and L2-L1 directions. However, it was also noted that the accuracy scores could not demonstrate the facilitation effect of translational primes in L1-L2 direction. This signifies that the effect of lexical boost can be expressed mainly in terms of the reaction time required for processing. An asymmetry in the strength of facilitation was observed; in both the groups the facilitation effect was more in L1-L2 direction than L2-L1 which supports the asymmetry link hypothesis postulated by the RHM model (Kroll & De Groot, 1997).

The second objective of the study was to investigate the language specific lexical selection and non selection in bilinguals. This was studied by comparing the reaction time and accuracy when preceded by a semantically related (SR) or semantically unrelated prime (SUR) again in cross language condition. It was found that in L1 naming, high proficient bilinguals had a shorter reaction time and increased accuracy of naming with SUR primes and a longer reaction time and decreased accuracy with SR primes even though the difference was not statistically significant in case of reaction time. This finding suggests that there is language non-specific selection in high proficient bilinguals in L2-L1 direction. For picture naming in L2, high proficient bilinguals performed better with SR cross language primes than with SUR primes. Nonetheless, the accuracy of naming was better with SUR primes though the difference was not statistically significant. Interestingly similar finding was obtained for low proficient bilinguals in both L2-L1 and L1-L2 directions. Combining findings from both the groups, it can be inferred that semantically related words in English (L2) may offer inhibition to the activation of

Malayalam (L1) words suggesting a language non-specific selection in L2-L1 direction and semantically related words in Malayalam (L1) may facilitate the activation of English words (L2) suggesting a language specific selection in L1-L2 direction. Hence we can conclude that the pattern of lexical semantic activation does not seem to vary across the level of proficiency when preceded by semantic primes.

The third objective of the study was to investigate the lexical semantic activation across high and low proficient bilinguals in L1 (Malayalam) and L2 (English) naming. The average of the mean reaction time was calculated for the two conditions of translational and semantic priming separately for L1 naming and L2 naming respectively. Comparison of average reaction time in L1 and L2 naming under translational-semantic priming revealed a better performance of high proficient group in both L1 naming and L2 naming under translational priming. With respect to naming under semantic priming, the low proficient bilinguals showed a better performance in L1 naming whereas high proficient showed better performance in L2 naming.

Chapter V

Summary and Conclusion

Bilingualism is generally defined as one‘s capability to use two languages. Individuals classified as bilingual show varying characteristics. Various components and aspects have been identified to be associated with the complex nature of bilingualism. One major variant identified is the bilingual‘s proficiency in both the languages. Based on their proficiency in both the languages bilinguals are classified as high proficient and low proficient bilinguals. Lexical semantic activation has been actively studied in bilinguals. One of the commonly asked questions in bilingualism is whether the bilinguals share the lexicon for both the languages or allocate separate lexicons during the lexical semantic activation which indicates whether bilinguals follow a language specific-lexical selection or language non-specific lexical selection. Despite the vast number of studies conducted in the past, only few studies have essentially probed into the effect of bilingual proficiency on a primed paradigm naming task and there is still no consensus regarding the bilingual lexical selection. Studies conducted specifically in Indian context are based on lexical decision tasks or judgement tasks rather than naming task which can provide more information with respect to bilingual proficiency.

The primary aim of the study was to to investigate how the lexical semantic activation in L1 and L2 varies with proficiency in high and low proficient bilinguals. 40 Participants in the age range of 18-25 years participated in the study. They were divided into 2 groups of high proficient and low proficient bilinguals comprising of 20 participants each based on their speaking proficiency in L2 deferred from LEAP-

Q using Hayward‘s criterion. All the participants were successive bilinguals with Malayalam as L1 and English as their L2 and having exposure to L2 (English) right from their childhood for a minimum of 10 years. The study used a standard group comparison research design.

The study was carried out in two experiments with each experiment having two tasks. Experiment 1 comprised of picture naming in L1 and L2 individually with translation equivalent and non equivalent primes presented in cross-lingual condition. In task 1 the primes included translation equivalent (TE) and translation non- equivalent (NTE) which were presented in L2 (English) and the participants had to name the pictures in Malayalam. In task 2, the primes were given in Malayalam and the pictures had to be named in English. Similarly in experiment 2, semantically related (SR) and semantically unrelated (SUR) primes were used instead of translation primes for both the tasks. The stimulus for all the tasks was presented in visual mode through the DMDX software. Statistical analysis for calculating the mean reaction time and accuracy was done using the software Statistical Package for Social Sciences (SPSS) version 20.0.

The primary objective of the study was to compare reaction time and accuracy on picture naming for translational equivalent and non equivalent primes in high proficient groups and low proficient group. The overall mean and standard deviation (SD) were calculated for the reaction time measure and mean, standard deviation (SD) and median were calculated for accuracy scores in Group I (High proficient) and Group II (Low proficient) across the two tasks of experiment 1. Mixed ANOVA was carried out initially to compare the mean reaction time between high and low proficient groups on all naming conditions.

Further Bonferroni‘s Paired-t test was carried out to check for significant difference in mean reaction time within the high proficient group on different naming conditions. Mann Whitney U test was administered to see the significant differences between accuracy measures between high proficient and low proficient groups followed by Wilcoxon Signed Rank test to see significance within the group across different conditions. Based on both the tasks it was found that both the high proficient and low proficient group performed better with TE primes in L2-L1 and L1-L2 directions. This facilitation effect of translational primes was reflected in terms of both mean reaction time and accuracy scores except for task 2 in low proficient where the accuracy scores did not show the facilitation effect of TE primes. The results show that the TE primes created a lexical boost in regard to the speed of processing

The second objective of the study was to investigate the language specific lexical selection and non selection in bilinguals. It was found that bilinguals employ language non-specific selection in L2-L1 direction and a language specific selection in L2-L1 direction. Interestingly similar finding was obtained for low proficient bilinguals in both L2-L1 and L1-L2 directions. Better reaction time and accuracy scores was seen for SUR compared to SR showing that inhibition was operational owing to which the reaction time would have been poorer in SR condition

The third objective of the study was to investigate the lexical semantic activation across high and low proficient bilinguals in L1 (Malayalam) and L2 (English) naming. Comparison of average reaction time in L1 and L2 naming under translational-semantic priming manifested a better performance of high proficient group in both L1 naming and L2 naming under translational priming. In case of

semantic priming, low proficient bilinguals showed a better performance in L1 naming and high proficient showed better performance in L2 naming.

Thus the present study helps us to understand how the facilitation inhibition effects of semantic-translational primes vary across bilinguals based on degree of proficiency. It was found that the lexical semantic activation varied as a function of degree of bilingual proficiency. The direction of facilitation-inhibition during the lexical selection of both the languages varied across the tasks in high and low proficient bilinguals.

Implications of the study

The present study enables researchers to understand the lexical semantic activation (facilitation versus inhibition) in high and low proficient bilinguals by employing primed-naming task.

The findings from the study reveals that translational equivalent primes facilitates faster naming in both high proficient and low proficient bilinguals .However, the quantum of facilitation offered by the cross language semantic primes varies across proficiency.

The study also empowers ones understanding of language specific selection and non selection in regard to naming tasks and to verify this as a function of bilingual proficiency. It can be inferred from the findings that in both high proficient and low proficient groups, semantically related words in English (L2) seem to offer inhibition to the activation of Malayalam (L1) words thus suggesting a language non-specific selection in L2-L1 direction and semantically related words in Malayalam (L1) appear to facilitate the activation of English words (L2) hence suggesting a language specific selection in L1-L2 direction. To conclude, the pattern

of lexical semantic activation does not seem to be varying across the level of proficiency when preceded by semantic primes.

Limitations of the study

- It was noticed that some of the participants overrated their proficiency across certain domains in LEAP-Q. Objective measure of bilingual proficiency would have been considered but the extent of over estimation was limited to very few participants.
- Limited number of participants was considered for the study.
- Majority of the high proficient participants were mostly exposed to English language more than Malayalam language over the years.
- Pictures having borrowed names could have been exempted from the study.

Implications for future research

- The study can be extended into older bilingual population.
- Semantically related primes within L1 and L2 individually can be presented. In the present study, the primes were presented in cross-lingual conditions

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APPENDIX I

Language Experience And Proficiency Questionnaire - LEAP Q

- Ramya And Goswami , 2009

Name: Age: Gender: Male / Female

Instructions:

Please read the questions carefully and choose the most appropriate choice wherever applicable.

1. Name all the languages you know beginning with the language that you learnt first.

Using the below mentioned scale, answer the questions below.

(1- L1, 2-L2, 3-L3, 4- Combination of any of the languages)

L1- First language that you learnt, L2- Second language that you learnt in your life,

L3- Third language.

2. When you were a child, which language did you speak

- At Home 1 2 3 4
- With your father 1 2 3 4
- With your mother 1 2 3 4
- With siblings 1 2 3 4
- With guardians 1 2 3 4
- With neighbors 1 2 3 4

3. Native Language of

- Father 1 2 3 4
- Mother 1 2 3 4
- Sibling‘s 1 2 3 4
- Guardians 1 2 3 4

4. Language spoken with you by your

- Father 1 2 3 4
- Mother 1 2 3 4
- Sibling‘s 1 2 3 4
- Guardians 1 2 3 4
- Neighbors 1 2 3 4

5. Which language did you learn first for

- Understanding 1 2 3 4
- Speaking 1 2 3 4
- Reading 1 2 3 4
- Writing 1 2 3 4

6. Mention the age when you first started using each of the languages for each of the following parameters:

	Understanding	Speaking	Reading	Writing
L1				
L2				
L3				

7. Mention the age when you became proficient for each of the following parameters:

	Understanding	Speaking	Reading	Writing
L1				
L2				
L3				

8. How many years of formal education do you have? (please specify your qualification)

What was the medium of instruction?	1	2	3	4
Which language was used maximally?	1	2	3	4
Which language did you speak with teachers	1	2	3	4
Which language did you speak with classmates	1	2	3	4
Which language was spoken by your teachers with you	1	2	3	4
Which language was spoken by your classmates with you	1	2	3	4
Did you change your medium of instruction?	Yes		No	
If yes, specify the changed medium of instruction. At what age did you change your medium of instruction?	1	2	3	4
9. Have you changed your state? If yes, which language do	1	2	3	4

you use to communicate?

10. On a scale from one to five, mark your level of proficiency in each of the skill

(1-Zero proficiency, 2- Low, 3- Good, 4- Native like/perfect)

Language	Understanding	Speaking	Reading	Writing
L1				
L2				
L3				

11. How many dialects can you speak in each of the languages?

L1: L2: L3:

12. On a scale from one to five, mark your level of proficiency in each of the skill for each of the dialects in L1, L2, L3.***(1-Zero proficiency, 2- Low, 3- Good, 4- Native like/perfect)***

	L1			L2			L3		
Dialect	D1	D2	D	D1	D2	D3	D1	D2	D3
Understanding									
Speaking									

13. On a scale from one to five, mark your level of proficiency in shifting from one language to the other

1-Zero proficiency **2- Low**

3- Good **4- Perfect**

14. Use the rating scale mentioned below, indicate which language you used maximum for the following:

(1- L1 , 2- L2, 3- L3, 4- Combination of any of the languages)

Interaction with family	1	2	3	4

Education/ work	1	2	3	4
Listening to instruction tapes at school	1	2	3	4
Text books	1	2	3	4
Dictionary	1	2	3	4
Story books	1	2	3	4
Newspapers	1	2	3	4
Historical books	1	2	3	4
Internet source	1	2	3	4
Writing	1	2	3	4
Interacting with friends	1	2	3	4
Interacting with neighbors	1	2	3	4
Watching TV	1	2	3	4
Listening to the radio	1	2	3	4
Market places	1	2	3	4

15. On an average, mention below the time you are exposed to each of the languages.

Languages	Number of days per week	Number of hours per day
L1		
L2		
L3		

16. Mention the number of years you spent in each language environment:

	Family	School	State	Work place
L1				
L2				
L3				

17. Using the rating scale mentioned below, indicate the extent to which you are currently exposed to each of the languages in the following contexts in a day.

(1- never, 2- sometimes, 3- most of the time, 4- always)

	L1	L2	L3
Interaction with family			
Schooling/ work			
Listening to instruction tapes at school			
Text books			
Dictionary			
Story books			
Newspapers			
Historical books			
Internet source			
Writing			
Interacting with friends			
Interacting with neighbors			
Watching television			
Listening to the radio			
Market places			

18. Rate how frequently others identify you as a native speaker based on your accent or pronunciation in the language ***(1- Never, 2- Sometimes, 3- Most of the time, 4- Always)***

1. L1 2. L2 3. L3

APPENDIX II

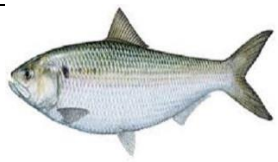
Orthographic Primes and Picture stimuli used for the study

Experiment 1: Translational Priming Paradigm

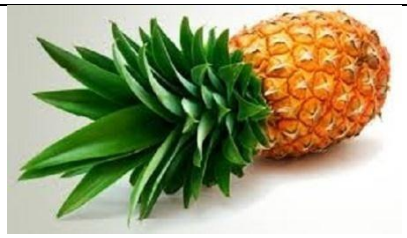
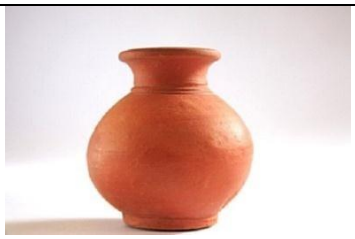
Task 1: Naming in L1 (Malayalam)					
SN	TE prime in L2	Target picture with target response in L1	SN	NTE prime in L2	Target picture with target response in L1
1.	CROCODILE		1.	STAMP	
2.	HOUSE		2.	STOVE	

3.	LADDER		3.	BLADE	
4.	CANDLE		4.	COIN	
5.	SWORD		5.	JUICE	
6.	DESERT		6.	DRAWER	

7	MATCHBOX		7.	MUG	
8.	NAIL		8.	FAN	
9.	PEACOCK		9.	SUGAR	
10.	LION		10.	TRUCK	
11.	MANGO		11.	PEBBLE	

12.	RAINBOW		12.	VIOLIN	
13.	SPIDER		13.	DIARY	
14.	GINGER		14.	DUCK	
15.	FISH		15.	WALL	

1

Task 2: Naming in L2 (English)					
SN	TE prime in L1	Target picture with target response in L2	SN	NTE prime in L1	Target picture with target response in L2
1.		 ROPE	1.		 PINEAPPLE
2.		 POT	2.		 GIRAFFE
3.		 ONION	3.		 BUS
4.		 CLOUD	4.		 JACKET

5.		 KNIFE	5.		 CYCLE
6.		 STAR	6.		 FAN
7.		 BOTTLE	7.		 CAKE
8.		 SHOES	8.		 TOOTH BRUSH
9.		 KEY	9.		 BUCKET

10.		 MIRROR	10.		 CHOCOLATE
11.		 CROW	11.		 PARROT
12.		 BRIDGE	12.		 CABBAGE
13.		 LIBRARY	13.		 BISCUIT
14.		 DOOR	14.		 DIAMOND

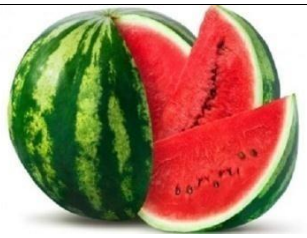
15.		 COMB	15.		 CAMERA

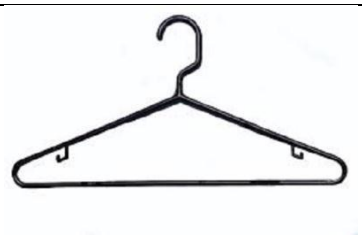
Experiment 2: Semantic Priming Paradigm

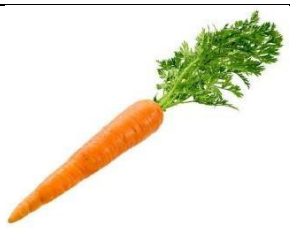
Task 1: Naming in L1 (Malayalam)					
SN	SR prime in L2	Target picture with target response in L1	SN	SUR prime in L2	Target picture with target response in L1
1.	COCKROACH		1.	TREE	
2.	HEAD		2.	ORANGE	
3.	BAT		3.	BREAD	

4.	CURTAIN		4.	CLOCK	
5.	PEN		5.	BOOTS	
6.	EYES		6.	BOTTLE	
7	WATER		7.	HONEY	
8.	PEAS		8.	NECK	
9.	RAIN		9.	TOWEL	

10.	SKIRT		10.	BASKET	
11.	DOG		11.	BALL	
12.	DUCK		12.	BEARD	
13.	SUN		13.	WALLET	
14.	PANDA		14.	TOMATO	
15.	BANGLES		15.	KING	

Task 2: Naming in L2 (English)					
SN	SR prime in L1	Target picture with target response in L2	SN	SUR prime in L1	Target picture with target response in L2
1.		 WATCH	1.		 BANANA
2.		 GOAT	2.		 WATERMELON
3.		 MONKEY	3.		 PIG
4.		 BELT	4.		 GUITAR

5.		 HELMET	5.		 CYCLE
6. 7.		 BELL  STOOL	6. 7.		 HANGER  GLASS
8.		 BEANS	8.		 CALENDER
9.		 EYE	9.		 CUCUMBER

10.		 TRAIN	10.		 CARROT
11.		 SPOON	11.		 PARROT
12.		 TYRE	12.		 LORRY
13.		 AEROPLANE	13.		 PENCIL
14.		 TORCH	14.		 SUITCASE

15.		 TIE	15.		 SHIRT