# VISUAL WORD RECOGNITION IN MALAYALAM-HINDI BILINGUALS USING ORTHOGRAPHIC PRIMING

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Manasagangothri, Mysuru-570006

**September 2023**

**CERTIFICATE**

This is to certify that this dissertation entitled **"Visual Word Recognition in Malayalam-Hindi Bilinguals Using Orthographic Priming"** is a bonafide work submitted in part fulfilment for the degree of Masters in Science (Speech-Language Pathology) of the student Registration Number P01I21S0011. This has been carried out under the guidance of the faculty of this institute and has not been submitted earlier to any other University for an award of any other Diploma or Degree.

Mysuru, September 2023

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Mysuru, September 2023


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**DECLARATION**

This is to certify that this dissertation entitled **“Visual Word Recognition in Malayalam-Hindi Bilinguals Using Orthographic Priming”** is the result of my own study under the guidance of Dr. M. Irfana., Assistant Professor in Speech Science, Department of Speech-Language Sciences, All India Institute of Speechand Hearing, Mysuru and has not been submitted earlier to any other University for an award of any other Diploma or Degree.

Mysuru, September 2023 **Registration No: P01II21S0011**

بسم الله الرحمن الرحيم

*"Bismillahir Rahmanir Raheem"*

"In the name of Allah, Most Gracious, Most Merciful."

# *Dedicated*

# *To Umma & Vappa*

' ***Whatever I am today***, It's just ***because of you***! '

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"Remember Allah, the Great – He will remember you. Thank Him for His favors – He will increase you therein. And seek forgiveness from Him – He will forgive you. And be conscious of Him – He will provide you a way out of difficult matters. And establish the prayer."

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# CHAPTER I

# INTRODUCTION

The process of learning to read takes years and requires the coordination of a variety of subskills. Building a sight vocabulary and mastering decoding are two fundamental components of reading in an alphabetic system. The aim of reading, however, is not only word-level decoding but comprehension, which calls for the integration of meaning across sentences and within texts, making proper use of contextual clues and inferences based on general knowledge (Snowling, 1998). The basic step in reading was visual word recognition (VWR); this comes before the semantic representation of a word. When a word was recognized, its orthographic and phonological description, which was retained in long-term memory and it was compared to data generated online about the letters that were present in the printed word. Readers reconstruct the message's phonological and linguistic structure using the visual cues offered by the print. The ability of readers to distinguish between words and non-words or pseudowords has been studied earlier, and it has been found that readers can distinguish between actual words more readily than non-words or pseudowords. Also, they suggested that there were distinct storage locations for words and non-words. 'Mental lexicon' was the term used to describe the organization of words. The term "mental lexicon" refers to the area of the brain where words were stored. A long-running argument exist on how the mental lexicon was represented, specifically whether it was composed of words or morphemes. Two approaches to word recognition have been proposed in research, one based on whole-word storage and the other on morphological analysis. It was important to comprehend how word recognition works with a mental vocabulary.

There were many models explained the process of VWR, and the ultimate and chief type of model was the computational model and in that the interactive activation (IA) model was one of the earliest connectionist models. Almost all IA models portray the characteristics of words and letters as nodes in a network (Norris, 2013). The multiple read-out model of visual word recognition offers an integrated framework for examining different experimental findings acquired in response-limited and data-limited paradigms (Grainger et al., 1996). It has been successful in simulating many features of healthy individual VWR using a number of computational models. The entire process can be varied in bilingual speakers in comparison to a monolingual.

### 1.1 Bilingualism

Individuals or groups that have acquired the knowledge and usage of more than one language were commonly referred to as bilinguals (Butler & Hakuta, 2004). Bilinguals can converse in one of their two languages without the other language getting in the way. However, once a bilingual learns anything in one language, they can access that knowledge in the other language. Amidst the fact that the language systems were distinct in theory, it was generally known that some data was frequently shared. Two models were developed to recognize the characteristics of bilingual semantic memory. According to the Word Association Model, the conceptual system was directly connected to the lexical representations from L1 but not to the words from L2, which were solely associated with L1. The Concept Mediation Model, an alternative theory, contends that interpretations in the two languages were not always linked (Potter et al., 1984). Language representations instead function as independent systems, each of which was connected to a conceptual system. Age of acquisition, linguistic structure, use of languages in daily life, and other variables all affect the quantitative and qualitative differences between monolingual and bilingual word recognition.

Visual word recognition in bilinguals can be explore through psycholinguistic and neuro linguistic techniques. Reaction time tests were a common psycholinguistic technique, such as lexical decision and priming. In the lexical decision task, the participant has to decide manually and as quickly as possible whether a string of letters shown on the computer was a word or not. This task can be modified based on the study's purpose, the subjects being studied, and the stimuli being employed. To investigate the organization of bilingual lexicon, studies on language processing in bilinguals, experimental paradigms of semantic and translation priming was frequently used. Priming paradigms make it easier to examine automatic processing, which was essential to comprehending how bilinguals process language. Translation priming includes presenting the prime word in a language (L1/L2) and the target term in theother language (L1/L2), which was the prime word's translation. For instance, if the English “water" was the prime word, the target word will be "niru" (Kannada). It involves presenting a prime word, which automatically activates lexical entry (Forster & Davis, 1984), reducing theamount of target processing necessary before a response was formed short Stimulus Onset Asynchrony (SOA), often known as the processing lag between the beginning of the prime and the beginning of the target (Jose, 2017).

## 1.2 Priming

Priming was the process whereby the earlier presentation of a stimulus known as the prime facilitates one's performance on a target event. Any input, including visual, verbal, or aural stimuli, can be a prime. A prime may facilitate or hinder the target event depending on how it relates to the target stimulus. It was necessary to establish a baseline utilizing a neutral or unrelated stimulus as the prime in order to observe the impact of the prime on the target (Shao et al., 2017). The most typical explanation for priming was that the target and prime representations in the cortex were interrelated so that when the prime representation was activated, similarly, the target representation was also gets activated. Two words were often offered one after the other in a priming experiment. The first word was the prime, and the second word was the word that needs a response. SOA was the period of time between the prime and the target's initiation. When prime makes it easier to respond to targets, it was said to have a priming effect.

### *1.2.1 Types of Priming*

The following were some examples of several priming styles that have been frequently employed to comprehend linguistic processing: (a) Semantic priming: In semantic priming, the prime and the target would have some characteristics and be members of the same semantic category. For instance, because both tigers and cats were animals and have remarkably similar visual characteristics, the word cat was a semantic prime for tigers. Theoretically, spreading neural networks enable semantic priming to function. The brain primes (stimulates, activates) related objects when a person thinks of one item in a category. (b) Translation Priming: In this method of priming, the prime word was first offered in the L1 or L2 of a bilingual person before being translated into the L2 or L1 of the other language. For instance, /naji/ (prime in Kannada, L1) was followed by the target, /dog/, in L2 (English). In translation priming, the display of a prime word automatically activates its lexical entry, denoting short SOAs (Foster & Davis., 1984). (c) Phonological priming: In this technique, the prime and target were related phonologically. For instance, two words share the same initial phoneme as in the case of /kʌp/ (prime) and 'kaet' (target) were phonologically linked. This similarity would cause the target to initiate activation way before the presentation. (d) Syntactic priming: In this case, the prime and the target have a syntactic connection. Using the graphic symbol, “The judge was awarding the medal to the player” as the prime keyword and picture of the same as the target (e) Orthographic Priming: Because it makes use of orthography, this kind of priming has a particular impact on visual word recognition. Here, the target word and a visual prime were spelled similarly. Typically, all but one of the letters in the prime and target words were the same. Example: "farm" (prime), then "barn" (target). (f) Repetition Priming: In this case, the prime and the target stimuli will be identical. Effect of initial presentation of the stimulus on repeated target presentation after a few milli seconds (ms) later. (g) Cross-linguistic priming: The impact of priming when two or more languages were used for communication was investigated. It was possible to study how processing in one language affects processing of the other language that the individuals were familiar with. In this case, the prime and the target were presented in two separate languages, and their impacts on one another were taken into consideration for language processing. For instance, /bekkU/ (prime in L1) - 'dog' (target) in L2. Any of the types of priming previously described can be followed by cross-linguistic priming. All of the aforementioned forms of priming tasks were used in priming experiments, which were often carried out using unmasked and masked paradigms. (h) Unmasked priming: This type of priming involves the presentation of both the prime and the target without the presence of any other distracting stimuli, such as hash marks (###). As shown in figure 1, the prime was displayed for 200–250 ms, followed by a SOA that lasts for around 50 ms, and finally, the target was displayed for 2000 ms.

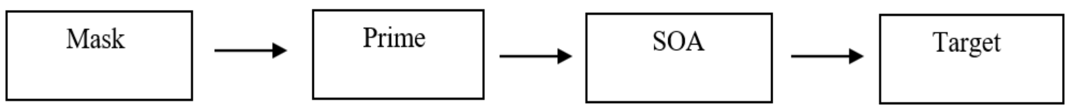
**Figure 1.1**

*Sequence of Presentation of Prime And Target in Unmasked Priming*


In this case, prime will be displayed for a time frame of roughly 200–250 milliseconds, followed by a SOA of more than 50 milli seconds. Depending on the task and participants, the target will be shown again after this brief interval for up to 2000 milli seconds. (i) Masked priming: There were two methods to perform masked priming: forward masking and backward masking. In forward masking, the hash mark (##) will come first, then the prime, followed by the target. However, the target was always followed by the hash (#) symbol in backward masking, therefore in this case, the sequence will be prime - ### - target. Forward masking refers to the presentation of the mask right before the prime, which was represented by a row of hash marks (###), whose breadth varies to encircle the prime entirely. Example: ######## for “ATTITUDE”. Foster and Davis (1984) referred to this kind of priming as a "sandwich" strategy because the target stimulus was sandwiched between the prime and a pattern that serves as a mask.

**Figure 1.2**

*Sequence of Presentation of Prime and Target in Masked Priming*



Here, a prime was provided in lower case for 50 milli seconds after a mask (###) was displayed for 500 milli seconds. Between the prime and the target, there was relatively short SOA that was maintained. The target word was then displayed in capital letters for 500 milli seconds.

**Need for the Study**

The asymmetry in the L1-L2 translation priming effect can be described using bilingual wordrecognition models. Jiang and Forster's (2001) episodic L2 hypothesis provides one explanation. This assumption claims that because L1 words were kept in lexical memory, L2 representations were different from L1 representations. L2 words were, however, maintained in episodic memory. It follows that L1 prime words can activate lexical memory, making it simpler to process L2 translation peers; in opposition, L2 primes do not make it simpler to processL1 translation equivalents that were lexically represented. The findings from Jiang and Forster (2001) serve as the foundation for the episodic L2 hypothesis. In an episodic recognition test, participants were initially taught a set of L1 words. Then, they used an old/new decision recognition memory test in which a prime word in L2 was hidden and presented before a targetword in L1 to assess participants' decision-making skills. For the recognition memory test, it was discovered that the L2 translation prime settings had a quicker reaction time than the L2 unrelated prime settings. Chinese-English bilingual speakers who were native Mandarin talkers and began studying English in China were used to generate these results.Witzel and Forster (2012) were successful in duplicating this result.

Between L1 and L2, there was a startling difference in lexical processing.

When examined, L1 speakers frequently delivered a consistent priming effect for pairs of prime-targets that were morphologically related but not for orthographically identical pairs (e.g., reader-read) or pairsthat were orthographically similar but not morphologically related (e.g., carnival-car) (Longtin,et al., 2003; Rastle et al., 2000; Rastle et al., 2004). Additionally, L2 speakers generated a priming effect for both kinds of items when evaluated with similar stimuli. Diependaele et al. (2011) were the earliest to describe this L1-L2 difference. They used three different prime-target pairs, each with its own control condition, to compare the morphological priming between L1 and L2 speakers which include pairs that were orthographically similar but were morphologically and semantically unrelated (suchas corner-corn), pairs that were morphologically capable but not semantically related (such as viewer-view), and pairs that were both (e.g., freeze-free). English native speakers did not display any orthographic priming effects for pairs of words that were orthographically similar but morphologically and semantically different. Native speakers of Spanish and Dutch, however, clearly exhibited orthographic priming effects (Jiang & Wu, 2022). The word-initial position may have some unique status in visual word recognition, and the priming effects for word initial position overlap (Li et al., 2017b). However, the priming effect in the word final overlap position was reported in another study (Li & Taft, 2020). The priming effect varies among non-native speakers according to proficiency (Heyer & Clahsen, 2015).

In an Indian study, proficient biliterate readers of Hindi and Urdu participated in two primed naming tasks to test the orthographic depth hypothesis. The expressive levels of these languages were comparable, yet the writing systems were majorly different. The findings support the theory that script clarity affects how much phonological assembly was relied upon. Even though Urdu was the first taught script, the greater graphemic complexity of the Urdu script compared to Hindi has made single-word reading in Urdu slower and less accurate overall (Rao et al., 2011).

Referring to previous studies that happened in the past, morphologically and semantically related word pairs were used as the prime target pairs to investigate the orthographical priming effect in bilinguals that results in inconclusive inferences. In light of earlier studies, it was crucial to identify orthographical priming effects among diverse proficient bilinguals without any morphological or semantic effects. The present study planned to understand the effect of orthographic priming in L1 and L2 (i.e., Malayalam & Hindi), whose graphemes were entirely different. Hindi was written in the Devanagari script from left to right. High variations of Hindi take ideas and linguistic refinement from Sanskrit. The writing system was known as Hindi Varnamala. The pronunciation of Hindi letters was the same as how they were written. In Hindi, the horizontal line that sits on top of the letters was significant. This line links words that were created using various letter combinations. It was employed to describe a full stop. Over 24 of the 36 consonants, a dot was placed using a vertical right stroke. It serves as a substitute for a full stop. Nasal sounds can be represented by a dot above letters (King, 2001). Nevertheless, the Dravidian language family includes the Malayalam script, one of the recognized Indian scripts. The distinctive orthographic element in the script was commonly referred to as the "Akshara," and words in the Malayalam language were typically written as a series of syllables. There was no distinction between lowercase and uppercase characters, and the text was written non-cursively from left to right. Graphemes in Malayalam were often rounder than those in other Indian scripts (Manjusha et al., 2019).

**Aim and Objectives of the Study**

To understand the effect of orthographic priming in Malayalam-Hindi bilingual speakers with the following objectives:

1. To find the effect of orthographic priming within language groups.
2. To compare the priming effect across L1 and L2 speakers.
3. To find the effect of different types of orthographic priming within each language groups.
4. To find the effect of proficiency of L2 on visual word recognition.
5. To find the gender effect.

# CHAPTER II

# REVIEW OF LITERATURE

## 2.1 Visual Word Recognition

Visual word recognition was traditionally conceived as the process of selecting a single object stored in lexical memory in the form of a word from a printed string of letters. Lexical memory, often known as the "mental lexicon," was a mental dictionary that has storage for all of the words that a reader was familiar with. Based on "lexical access" or "lexical selection" words were supposed to be stored in an individual's memory as lexical entries. Researchers examined all previous ideas on word/visual word recognition, which led to the formulation of different models.

### *2.1.1 Orthography and Visual Word Recognition*

It was considered that all writing systems in the world fall into one of four categories, those were as follows: (a) Pictographic systems: the relation between written form and meaning was not random in this systems. Instead, what was written was a visual representation of the concept being expressed, (b) Ideographic systems: like pictographic systems, a single written symbol can represent an entire word, morpheme, or notion, (c) Syllabic systems: pictographic and ideographic writing systems were part of word-writing systems. These elements were known as syllables in syllabic systems. The Japanese Kana alphabet was one such example (Sasanuma, 1985). Similarly, script called Devanagari was the writing system of several Indian languages (Karanth, 1985). (d) Alphabetic system: here, the phonological parts were very approximately phonemes; Cyrillic and Roman alphabets were examples of such systems (Coltheart, 1986).

Recognition of words in different writing system has been studied. Some common processing paradigms to study visual word recognition were lexical decision, lexical decision with blocking of neighbourhood density, progressive, semantic categorization and naming. There were reports of variation across paradigms in Spanish and found high orthographic neighbourhood density in the semantic-categorization task and for low-density words in the naming task. It showed the inhibitory effects of neighbourhood frequency (Carreiras et al., 1997). An inhibitory status was seen in the progressive-demasking task at higher levels of neighbourhood density, as well as facilitation in lexical decision making and a strong facilitation impact in naming.

In an article by Ventura et al. (2020) talks about Holistic processing of visual words may be a sign of faster word recognition. The study investigated whether there was a direct relationship between the word-composite effect and fast access to the orthographic lexicon by visual word experience. In an independent lexical decision task, they used the word-frequency effect as an added credit for fast access to lexical orthographic representations. Advanced readers who had a higher word-composite impact had a lower word-frequency impact. This connection was primarily led by a link between a bigger composite effect and faster lexical decisions on low-frequency words, most likely because these lexicons were less stable and integrated, allowing advanced readers to differentiate themselves. As a result, they demonstrated that holistic processing of visual words was associated with increased effect in visual word recognition by experienced readers.

### *2.1.2 Pictography and Visual Word Recognition*

Experiments conducted by Shepard (1967) and Standing, Conezio, and Haber (1970) indicate that memory for visuals was virtually limitless. Neisser (1967) stated that such performance was dependent on a "visual memory," while Haber (1970) proposed that there may be "one kind of memory for pictorial material and another for linguistic material". However, it was obvious that not all pictorial images were equally well remembered, since tests using meaningless forms and patterns showed significantly lower levels of performance (Goldstein & Chance, 1971). As a result, it was not the visual modality that facilitates recognition of Images. In another study by Goldstein and Chance (1971) investigated recognition memory for heterogeneous graphic stimuli, indicating an extremely wide storage and retrieval capability. In the first experiment, six independent groups of participants were shown three sets of homogenous visuals (faces, ink blots, and snow crystals), and recognition was performed immediately or 48 hours later. Accuracy was great for faces and less for snow crystals at both time intervals. Accuracy levels for homogenous stimuli were lower than trials using heterogeneous arrays.

In another study, the accuracy for tachistoscopically presented images of common objects was examined for independent groups of subjects. Despite the pattern of results was comparable, recognition with verbal alternatives was often poorer than with graphic counterparts. The findings were explained in terms of pictorial recoding of verbal information, allowing for the identification of a set of essential traits that distinguish between pictorial and verbal alternatives and direct selected perceptual processing of an upcoming pictorial target Redding et al. (1976).

## 2.2 Priming

Priming describes the change in a person's ability to recognize or generate a piece of information as a result of earlier exposure to a certain thing (Tulving & Schacter, 1990). It is a kind of non-declarative memory in which exposure to previously presented stimuli affects how the brain processes incoming information. The most prevalent hypothesis of priming explains how the target and prime representations interact in the cortex. The target word was also displayed when the representation of the prime was active. In priming experiments, two words were usually spoken consecutively and the target, on which a reaction must be developed, was the second phase after the prime (Soldan et al., 2008).

### *2.2.1 Priming Effect on Related and Unrelated Words*

There were many studies that support the priming effect in native and non-native language groups in terms of Reaction time (RT) and Accuracy. The earlier study by Bodner et al. (2001) explains the masked priming effect on related and unrelated primes. subjects were randomly assigned to either the low group or the high group of the orthographic neighbourhood. The outcomes provide credence to the notion that resource recruitment was more probable to take place when the resource's validity was high orthographic neighbourhood. It enhances prime recruitment by creating an environment that supports it.

A similar study by Assche and Grainger (2006) explained that unrelated prime trails produced considerably lengthier RTs than the related trails at the word level, but when compared to related primes, RTs for unrelated primes in non-word analysis were not noticeably longer. Researchers used masked priming paradigm in four lexical decision tasks to investigate how letter location information affects orthographic processing. The experiment included the priming difference among superset, subset, identity and unrelated primes.

Rao et al. (2010) selected the words in such a way that the initial syllable of each experimental target was related to the associated experimental prime, but the prime and target pairs were semantically and morphologically different. Control prime-target pairs were otherwise unrelated and different in form. They had to say the target word out loud as rapidly as they could. According to the findings, faster RT and accurate response for related prime words over unrelated prime words which was evident in their study. Similar results were seen in another study by Jiang and Wu (2022) and they selected a total of 44 related English words with the target embedded at the first place and 44 related English words with the target embedded at the last position made up the study's test materials. In addition to the test questions, there were 88 unrelated control primes and 88 nonwords. The study's findings indicate that related overlapping targets react more quickly and more accurately than unrelated control primes.

These factors of variance in priming were also studied in bilingual individuals. Nakayama and Lupker (2018) investigated whether bilinguals who process L2 words in distinct scripts engage in a lexical rivalry process. Word neighbour primes enhanced target identification for Japanese-English bilinguals in lexical decision studies with masked priming (67 ms prime length), but they had the opposite effect on L1 English readers. The results of subsequent studies supported the validity of the facilitatory priming effects, demonstrating that they were not caused by bilinguals' failure to interpret masked L2 primes at the lexicon level or by their reliance on sublexical activation from neighbouring primes when acting to targets with uppercase letters in English. However, with easily apparent primes (employing a 175 ms prime period), some lexical rivalry was detected. These results suggest that distinct-script bilinguals and L2 readers approach orthographic resemblance in L2 words in distinct ways. The researchers look at possible disparities between bilinguals who use different scripts in their L2 lexicon. Kinoshita et al. (2018) hypothesize that phonology rather than orthography may be the basis for the priming effect in the same-different task in the literature. The result showed native speakers were faster and more accurate in the orthographic overlap condition, with RTs of 594 ms and 95% for L1 and 672 ms and 76% for L2, respectively. According to the results, phonology only has a minor impact on the priming brought about by orthographically similar primes in the same-different task for Roman script letter strings of English and Japanese.

Shorter lexical decision latencies to their present-tense targets were found in masked presentations of past-tense verb primes (Wanner-Kawahara et al., 2022). Additionally, responses to targets primed by orthographic primes were noticeably quicker than responses to the same targets primed by unrelated primes. Overall, compared to orthographically related and unrelated primes, past-tense verb primes eased lexical judgements to their present-tense targets. Orthographically related primes also increased target recognition in comparison to unrelated primes, replicating earlier masked priming tests with L2 readers and demonstrating that orthographic familiarity enhances L2 target recognition. Even though the connections and processing of lower level, lexical information may vary, the additional facilitation from past-tense verb primes beyond that provided by orthographic primes suggests that connections based on morphological relationships develop in the L2 English lexicon in a manner similar to how they develop in the L1 English lexicon.

Parallel results were seen in multiliterate Yee et al. (2023) evaluated phonological processing in three multilingual and multiliterate groups using an English visual rhyme judgment task. The first group included 45 multilingual individuals who were literate in English and a transparent Latin orthography; the second group included 45 such individuals who were literate in English and transparent orthographies, and the third group included 45 such individuals who were literate in English, transparent orthographies and Mandarin Chinese, an opaque orthography. The findings showed that between orthographically similar and dissimilar pairs, accuracy rates when word pairs rhymed differed dramatically. Particularly, accuracy rates were higher for rhyming word pairs with similar orthographic overlaps than for word pairs with different orthographic overlaps. When word pairs did not rhyme, significant differences between orthographically similar and dissimilar pairs were observed. Accuracy rates were higher for non-rhyming word pairs with different orthographic overlaps than those with the same orthographic overlaps.

### *2.2.2 Priming Effect across L1 and L2 Speakers*

There were many studies conducted on the priming effect across L1 and L2 speakers. There were many supporting and contrastive studies that tell the effect of orthographic priming on both speakers. Grainger and Jacobs (1996) considered a total of 120 native speakers of French for the study. Stimuli were 15 low-frequency five-letter French words and a total of 4 experiments conducted including progressive demasking task, lexical decision with high frequency nonwords, lexical decision with low frequency nonwords and lexical decision with high frequency nonwords and speed instructions. The result findings revealed a strong impact of orthographic priming on RT data among native French speakers in all the experiments except lexical decision with high-frequency nonwords. In another study by Assche and Grainger (2006), 40 psychology students reported to be native speakers of French were selected as participants.60 French words were included as the targets in a masked priming lexical decision experiment. The experiment included superset primes (related), unrelated primes and identity primes for the study. The results revealed that French native speakers have large priming effects from superset primes compared with the unrelated prime condition.

There were studies support the claim that L1 speakers did not focus on surface-level information such as orthography during visual word recognition. Longtin et al. (2003) showed that pure orthographic overlap produced marginal inhibition in French native speakers. Rastle et al. (2004) study finding revealed that native English speakers did not show an orthographical priming effect. Nevertheless, they showed a priming effect in morphologically related words. He also stated that early visual recognition of English words was significantly influenced by morphological structure, independent of semantic and orthographic relatedness (Rastle et al., 2000). Jiang and Wu (2022) revealed that L1 speakers did not show an orthographical priming effect in similar orthographical pairs.

Ciaccio and Jacob (2019), examined the role of orthography in native (L1) and non-native (L2) speakers processing of German words which were morphologically difficult in an overt visual priming experiment. In contrast, merely orthographically related pairs, and also compare the priming effects for inflected and derived morphologically related prime-target pairs. In both the L1 and L2 groups, the data demonstrate morphological priming effects, with no discernible distinction between inflection and derivation. However, L2 speakers demonstrated strong priming for orthographically related pairs, but not L1 speakers. Findings were consistent with the idea that during visual word recognition, L2 speakers pay more attention to surface-level information such as orthography. This may result in orthographic priming effects that were morphologically related and could mask variations in morphological processing between L1 and L2. Jiang (2021) tried to confirm the results using materials that were created with familiarity, duration, and frequency factors. 40 English target words that were preceded by prime words that were either orthographically unrelated to them or their neighbours were tested by both native and non-native English speakers. Native speakers generated a nonsignificant impact of 11 ms, while nonnative speakers displayed a significant priming effect of 63 ms. This result indicated that terms in the L2 lexicon only appeared to identify and communicate with one another when their orthographies overlapped (thus, orthographic friends). They had little lexical interaction or competitiveness and did not appear to be acting in accordance with their lexical status

Prior research has provided evidence that orthographic similarity may affect the results of studies on priming. The majority of past research has focused on the interactions between bilinguals or second-language learners and languages that share an orthographic family. Fewer studies have focused on bilinguals who speak languages that differ orthographically. Most investigations on languages with orthographic relationships found evidence of an imbalance in the priming effect between L1-L2 direction and L2-L1 direction.

Based on revised hierarchical model, Picture naming and bilingual translation were slower in the categorized than in the randomized list conditions both in mono lingual and Dutch-English bilinguals (Kroll & Stewart, 1994). Also, conceptual representation was employed to retrieve a lexical entry in both picture naming and bilingual translation. Interference was created when conceptual activity was strong enough to activate many related lexical representations. Only when translation was done from the first to the second language did Category Interference occur, indicating that the two translation directions use different interlanguage connections. Thus, it showed that the lexical connection from L2 to L1 was stronger than L1 to L2. Similar results were seen in Jiang (1999) and revealed that priming from L1 to L2 was relatively strong compared to L2-L1. Three different iterations of the processing hypothesis were looked at in the study. In five trials, Chinese-English bilinguals were put to the test on pairs of Chinese-English translations using a masked priming paradigm. The findings demonstrated that none of the three processing explanations adequately explains the asymmetry. The results were reviewed in light of the most recent bilingual memory organization models.

However, Alonso et al. (2016) showed disparity with the previous studies and stated that both the native speakers and non-native speakers responded faster to compound words while displaying no assistance from orthographic circumstances. The semantic information of the compound had no bearing on these effects, which presents a challenge for models that view morphological effects as a fictitious byproduct of the form-meaning interface. The primary disparities in accuracy and RTs across the groups do not appear to be caused by anything outside their native language. The data shows subtle variations between native and non-native speakers when the frequency and family size aspects of the target compounds were taken into account, which was consistent with an explanation based on L2 having a generally slower processing speed.

There were studies on better accuracy in L1 compared to L2. In research by Diependaele et al. (2011) compared performance of native speakers of English to that of Spanish and Dutch bilinguals. Results showed higher accuracies for the targets in opaque and orthographic conditions. Also showed priming effect in accuracy for both transparent and opaque condition but not for orthographic condition. The result showed that the accuracy of the responses was more for English native speakers than for Spanish and Dutch speakers. There were other studies which did not support higher accuracy in

L1 speakers. In a study by Rao et al. (2010) the author compares the speed and accuracy at which Hindi and Urdu target words can be named using form-related primes. The results revealed that Hindi target words showed more accuracy than Urdu target words because of the graphemic complexity of Urdu words.

### *2.2.3 Effect of Orthographic Overlap*

Present study considered forward and backward orthographic overlapping positions as prime. There were many studies on forward and backward overlapping positions to understand visual word recognition. Few studies do provide evidence for the priming effect in both overlapping positions. However, other set of studies only provide the evidences of having effect of forward orthographic priming. Li et al., (2017a) examined the sensitivity of Chinese-English bilinguals in position effect. A group of three sets of words were selected for the study, such as transparent prime target pairs, opaque prime target pairs, and orthographically related pairs. The result showed that orthographically related pairs had priming effect in both forward overlapping and backward overlapping positions. In a similar study by Jiang and Wu (2022) had explained that both forward and backward priming have a significant orthographic priming effect.

However, Fiorentino and Fund-Reznicek (2009) conducted two masked priming experiments with English transparent and opaque compound primes. The result showed no significant priming effect in purely forward orthographic overlap. Spanish and Dutch bilinguals also showed similar results for transparent primes, opaque primes, and orthographic primes (Diependaele et al., 2011). Heyer and Clahsen (2014) reported that morphologically derived prime words had shown facilitation effects for late bilinguals. Contrary to what has been suggested for native speakers, there were indications that non-native visual word recognition can also be primed by pure forward orthographic prime-target overlap. Orthographically related and derived prime-target pairings were directly compared in the investigation. For non-native readers, the two prime types produced the same levels of facilitation, while native readers displayed morphological but not formal overlap priming. Li et al. (2017b) conducted a study on transparent, opaque, and orthographical primes-target pairs. The study revealed that orthographic priming effect was observed in the forward overlap positions but no such effect in the backward overlap positions. Diependaele et al. (2009) studied masked morphological priming with Dutch prefixed words in four lexical judgment tests. In the absence of effects resulting from pure form overlap, reliable effects of morphological relatedness were established using visual primes and visual targets. Even with very small (40-msec) prime durations, the priming effects with semantically transparent prefixed primes (such as rename-name) were statistically different from those obtained with orthographically prefixed words (such as relate-late). Significant facilitation was observed in all related prime circumstances with visual primes and auditory targets (cross-modal priming), regardless of whether primes and targets were morphologically related or not. The findings explained in terms of a bimodal hierarchical model of word recognition in which supralexical (morpho-orthographic) and sublexical interactions produce morphological effects.

Definite first-place advantage in RTs for starting letters and similar patterns emerged from the accuracy data. This implies that these findings were consistent with a quick deployment of spatial attention to a target string's beginning that takes place after the introduction of the stimulus (Aschenbrenner et al., 2017). Jiang and Zhang (2021) conducted a study on the accuracy effect of the type of priming that facilitates native and non-native speakers. The study results revealed that native speakers had more accurate priming effect than the non-native peers as L1 was facilitated by semantic priming rather than orthographic priming.

### *2.2.4 Priming Effect on Linguistic Proficiency*

There were shreds of evidence that support the orthographic priming effect in low proficient L2 speakers than high proficient and L1 speakers. Li et al. (2017a) conducted a study on Chinese-English bilinguals of different proficiency levels i.e., low and high level of English proficiency. Findings revealed that the orthographic priming effect was more for low-proficient L2 speakers than the high-proficient speakers and native speakers of English. In another study by Wanner-Kawahara et al. (2022) explained an experiment on Japanese-English bilinguals with different level proficiency in morphologically related prime targets and orthographically related prime targets. They revealed that low-proficient L2 speakers were less sensitive to morphological priming compared with the L1 group. As the L2 speakers attain advanced proficiency in the non-native language, they did not show a priming effect for orthographical pairs rather, it showed morphological priming effect. Li and Taft (2020) examined the morphological priming effect in Chinese-English bilinguals with both low and advanced proficient in transparent, opaque and form related condition. The magnitude of priming in the form condition was significantly smaller for the bilinguals than for monolinguals. The result revealed that more the proficiency more the effect of morphological priming.

### *2.2.5 Priming Effect across Gender*

There were scares of studies on the priming effect across gender. However, Grissom et al. (2019) conducted a study on gender differences in executive function, one of the cognitive skills. The findings revealed that slight amount of support for significant gender difference in executive function. In another study by Abbassi et al., (2019) used divided visual field (DVF) paradigm and investigated the lateralization of affective word priming and gender effect. A total 24 congruent positive emotional prime-target pairs and 24 congruent negative emotional prime-target pairs were examined on both males and females. The study found there was gender effect on the emotional feature of affective words in females, not otherwise.

To conclude, the process of choosing a single item from a printed string of letters that is retained in lexical memory in the shape of a word was traditionally referred to as visual word recognition. Both pictorial and orthography stimuli can be used for visual word recognition. priming is a type of non-declarative memory in which being exposed to stimuli that have already been presented has an impact on how the brain interprets new information. Priming could have an effect on related and unrelated primes. There were numerous supporting findings that show that related overlapping targets respond faster and more precisely than unrelated primes. Plenty of investigations have been done on the priming effect between L1 and L2 speakers. There is evidence from previous studies that tell the presence of orthographic priming effect in native language speakers. Also, Studies have been done to support the idea that L1 speakers do not concentrate on surface-level information during visual word recognition, such as orthography. Nevertheless, there are pieces of evidence that show the orthographic priming effect in L2 speakers. There were both congruent and non-congruent confirmations from previous investigations on better accuracy in L1 compared to L2. To explain visual word recognition, there are numerous studies on forward and backward orthographic overlapping positions. There are not many studies that show the priming effect in both overlapping positions. In contrast, a few research other research only offer proof that forward orthographic priming has an impact. As L1 is assisted by semantic priming rather than orthographic priming, the previous findings showed that native speakers had a more accurate priming impact than their non-native peers. There were some evidences that low proficiency L2 speakers are more susceptible to the orthographic priming effect than high proficiency and L1 speakers. Studies on the priming effect across gender are quite rare. The previous study revealed that a slight amount of differences across gender.

# CHAPTER III

# METHOD

## 3.1 Participants

The present study considered 10 equal numbers of Hindi Native Speakers (HNS-L1) and Native Malayalam speakers with Hindi (Non-Native speakers, i.e., NNS-L2) as second language as participants. The age range of the participants taken was above 18 years with equal number of males and females and also precluded participants having any history of speech, language, hearing, neurological or cognitive issues. Also, this study included individuals who have adequate visual acuity with or without correction. Primary education in Hindi was considered as an inclusion criterion for L2 speakers. They evaluated and categorized based on the Indian adaptation of the questionnaire on language experience and proficiency (LEAP-Q) (Ramya & Goswami, 2009). Information consent was obtained from the participants prior to the study.

## 3.2 Stimuli

A grant total of 60 pairs of Hindi words with equal number of stimuli under three different sets were used for the present study. The first set consisted of 20 words, in which the prime word was embedded in the forward position (e.g., prime word-/सड़क/; target-/सड़/). The second set of the 20 words chosen with the prime word embedded in the backward position (e.g., prime word-/बरबाद/; target-/बाद/). These words contained embedded words that serve as primes and the embedded words as targets. All the prime words in the forward and backward position were in a length of 3 to 6 syllables, and the targets were with 2 to 3 syllables. In this study, (a)morphologically related words as both primes or targets(/पकड़/-/पकड़ना/), (b) inflected words (/लड़का/-/ लड़के/), (c) prime-targetpairs with an overlap of only one syllable was also not considered for the study (e.g., /विदेश/-/देश/) were excluded.The third set consisted of 20 words, which were selected as control primes; the control primes, and the targets have orthographic overlap to a letter or less.

### 3.3 Instrumentation

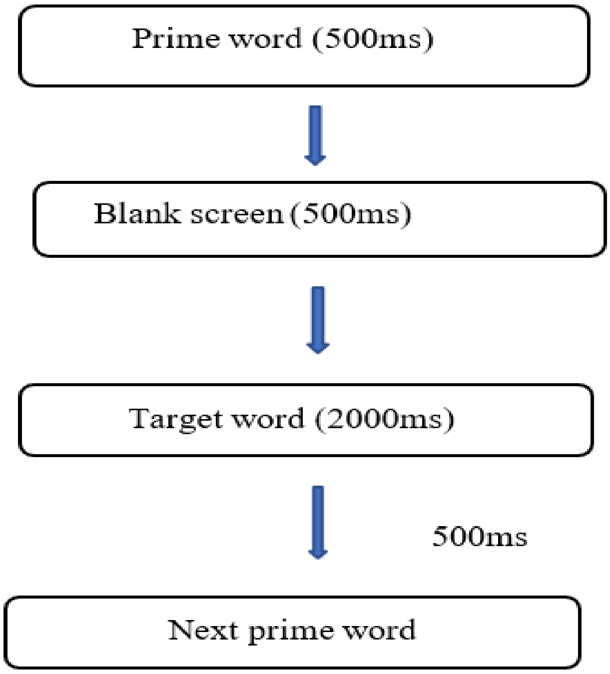
The word list was prepared and entered as code in DMDX software (Forster & Forster, 2003). The reaction time (RT) was used to analyse through the same software. For the analysis of Accuracy, check vocal (Protopapas, 2007) was used. Each stimulus was presented in the center of the screen with a screen time of (a) prime word for 500ms (b) inter-stimulus difference of 0.7 seconds and (c) target word for 200ms as shown in figure 3.1. Each stimulus was uploaded in bold font on a white screen as the background. Both Prime words and target words were presented in black color. Font size was limited to 22 in height. Responses tracked based on the reading task, and the system microphone was used to identifythe initiation of the vocal output.

### 3.4 Procedure

The participants were tested in a quiet room individually where the testing was done without interruption. They were asked to read the target words aloud and the prime word silently as soon and precisely as they can. The following steps were taken when a test word was displayed on a system:

**Figure 3.1**

*Flowchart Representing the Prime-Target Presentation*




The blank screen of 50ms was added to allow the NNS participants to process the prime. This display approach was used to ensure that the presentation was the same for both the HNS and NNS participant groups. The DMDX program (Forster & Forster, 2003) was used for the display of the stimuli and data gathering. The test started with two practice questions, and then the 60 test questions were presented in random order.

**Instruction:** The participants were instructed as “Now we will do a reading task in Hindi. Random words will be presented on the center of the laptop screen, you have to read the evenly occurring words aloud as soon as possible and odd words in mind.”

### 3.5 Data Analysis

In the present study, both the reaction time and accuracy of the response were analysed using DMDX software (Forster & Forster, 2003) and check vocal (Protopapas, 2007), respectively. For analysing the RT measures, the RT in milli seconds was extracted from the DMDX software and uploaded into the Microsoft Excel sheet. For analysing Accuracy measures, the responses were scored and added to a Microsoft Excel sheet. A score of "1" was given for the correct response and a score of "0" was given for the incorrect response. Later, both RT and accuracy measures were added to the software Statistical Package for Social Sciences (SPSS version 29.0) for further statistical analysis to find the descriptive and inferential statistics. Since the data satisfied the Test of normality using the Shapiro-Wilks test, parametric tests were conducted. Parametric tests such as independent t-tests and paired t-tests were used to analyse data. data was compared within and across languages, gender, and priming proficiencies to understand each objective of the present study.

# CHAPTER IV

# RESULTS

The primary aim of the study was to investigate visual word recognition in Malayalam-Hindi bilinguals using orthographic priming. 20 Participants in the age range of above 18 years were considered for the study. They were divided into two groups of Native speakers of Hindi (HNS) and Non-Native speakers of Hindi (NNS) i.e., Malayalam, comparing 10 participants from each language group based on their speaking proficiency in L2 as per the LEAP-Q (Ramya & Goswami, 2009). Reaction Time (RT) and Accuracy of each stimulus were recorded and statistical analysis was done using the software Statistical Package for Social Sciences (SPSS, Version 29.0). Descriptive statistics and parametric tests were used to test the null hypothesis. Since the data satisfied the Test of normality, parametric tests were conducted. In the present study parametric tests such as independent t-tests and paired t-tests were used to analysis data.

The results discussed under each objective were as follows:

1. To find the effect of orthographic priming within language groups.
2. To compare the priming effect across L1 and L2 speakers.
3. To find the effect of different types of orthographic priming within each language groups.
4. To find the effect of proficiency of L2 on visual word recognition.
5. To find the gender effect.

### 4.1. Effect of Orthographic Priming within Language Groups

The present study explores to find the effect of priming within native and non-native language groups where the priming was provided as graphemes of L2 words written in the same language. RT and accuracy of responses were individually recorded and analysed descriptively and inferentially.

As it was shown in Table 4.1.1, the mean RT was found less in backward priming (mean=823.72) than in forward priming (mean= 876.58) and non-priming (mean=984.30) in Hindi native speakers (HNS). The same was observed for Malayalam speakers (NNS) and it was considered that the lesser the time taken to perform the task, the better the performance. In all three groups, the standard deviation (SD) was high for the non-priming task in both languages. When the SD value was high it infers that the value was more deviated from the mean. Paired t-test was performed to see the effect of orthographical priming. The Table 4.1.2, show that there was a significant difference between non-priming and forward priming tasks in both language groups and non-priming and backward priming in orthographic priming within groups Hindi and Malayalam. Mean reaction time was greater for non-priming than forward and backward in both language groups.

**Table 4.1.1**

*Mean and SD of RT within Language Groups*

| | Hindi | | Malayalam | |
|---|---|---|---|---|
| | Mean | S. D | Mean | S. D |
| Non-priming | 984.30 | 146.54 | 1117.60 | 161.18 |
| Forward priming | 876.58 | 94.69 | 974.48 | 142.52 |
| Backward priming | 823.72 | 121.95 | 908.10 | 88.19 |

**Table 4.1.2**

*Test Statistics (t) and Statistical Significance (p) of RT within Language Groups*

| | Hindi | | Malayalam | |
|---|---|---|---|---|
| | t | p | t | P |
| Forward priming | 2.103 | 0.065 | 3.807 | 0.004 |
| Backward priming | 3.03 | 0.014 | 4.307 | 0.002 |

Table 4.1.3 shows that the mean accuracy was found less in backward priming (mean=0.96) than in forward priming (mean=0.99) and non-priming (mean=0.97) in Hindi native speakers (HNS), but for Malayalam speakers (NNS) backward priming (mean=0.94) had more accuracy than in forward priming (mean=0.88) and non-priming (mean=0.71). The above Tables conclude that mean accuracy was more in Hindi native speakers compared to NNS. It was also found that reduced SD for the HNS with respect to NNS for the accurate production. Paired t-test was performed to see the accuracy of orthographic priming within language groups and t and p values were shown in the Table 4.1.4. The results shows that there was a significant difference between non-priming and forward priming (p=0.001) and non-priming and backward priming ($p<0.001$) in orthographic priming within Malayalam in terms of accuracy. However, it was significant difference seen only between non-priming and forward priming within Hindi (p=0.037). Forward priming has better accuracy in Hindi, whereas backward priming showed greater accuracy in Malayalam.

**Table 4.1.3**

*Mean and SD of Accuracy within Language Group*

| | Hindi | | Malayalam | |
|---|---|---|---|---|
| | Mean | S.D | Mean | S.D |
| Non-priming | 0.97 | 0.02 | 0.71 | 0.14 |
| Forward priming | 0.99 | 0.02 | 0.88 | 0.08 |
| Backward priming | 0.96 | 0.03 | 0.94 | 0.06 |

**Table 4.1.4**

*Test Statistics (t) and Statistical Significance (p) of Accuracy within the Language Group*

| | Hindi | | Malayalam | |
|---|---|---|---|---|
| | t | p | t | p |
| Forward priming | -2.449 | 0.037 | -4.543 | 0.001 |
| Backward priming | 0.118 | 0.909 | -4.716 | 0.001 |

**4.2. Effect of orthographic priming across L1 and L2 speakers**

The present study explores to find the effect of priming across L1 and L2 speakers. Descriptive and inferential statistics were done to understand the orthographic priming effect across native and non-native language.

Table 4.1.1 shows that mean RT was found less in Hindi compared to Malayalam in all three priming categories. It was considered that the lesser the time taken to perform the task, the better the performance. In all three groups, the SD was high for the Malayalam speakers except in backward priming (88.19). Independent t-test had used to perform inferential statistics of RT. The analysis of the result in Table 4.2.1 shows that there was no significant difference in the priming effect across L1 and L2 in terms of RT. In all the three priming groups shows the p value greater than 0.05. Hence the RT measures shows no difference in orthographic priming across languages. There were similar patterns seen in both languages with least mean reaction time for backward priming and highest for non-priming task.

**Table 4.2.1**

*Test Statistics (t) and Statistical Significance (p) of RT and Accuracy across L1 and L2 speakers*

| | RT | | Accuracy | |
|---|---|---|---|---|
| | Hindi vs Malayalam | | Hindi vs Malayalam | |
| | t | p | t | P |
| Non-priming | -1.935 | 0.069 | -5.534 | 0.000 |
| Forward priming | -1.809 | 0.087 | -3.938 | 0.003 |
| Backward priming | -1.773 | 0.093 | -0.937 | 0.364 |

Table 4.1.3 also shows the descriptive statistics of the mean and standard deviation of the accuracy. Mean accuracy was found less in backward priming (mean=0.96) than in forward priming (mean=0.99) and non-priming (mean=0.97) in Hindi native speakers (HNS), It was believed that performance improves with decreasing task completion time. In all three groups, the SD was high for the Malayalam

speakers. Independent t-test was performed for inferential statistics of the accuracy. Table 4.2.1 shows t and p value of accuracy, the analysis of the result of the Table shows that there was a significant difference between the priming effect in accuracy across L1 and L2. The p value for accuracy is less than 0.005, which indicate that L1 speakers have more accurate correct response than the L2 speakers.

## 4.3. The Effect of Different Types of Orthographic Priming within each Language Groups

The Present study explores to find the effect of forward and backward priming words within language groups. Comparison of forward and backward priming was done. Descriptive and inferential statistics were performed to understand the effect of different types of orthographic priming.

The mean RT of forward and backward priming were found less in Hindi (mean=52.86) compared to Malayalam(mean=66.38) in forward and backward priming groups. It was believed that performance improves with decreasing task completion time. Within the two groups, the SD (SD=157.47) was high for the Malayalam speakers. Paired t-test was performed for checking the RT of forward and backward overlapping words. From the Table 4.3.1, it can be concluded that no significant difference between the two priming types. That was, the orthographic priming effect between forward and backward priming in HNS was p=0.23, whereas it was p=0.21 in NNS. This demonstrates that there was no distinction.

**Table 4.3.1**

*Test Statistics (t) and Statistical Significance (p) of RT and Accuracy of Forward and Backward Overlapping Words*

| | RT | | | | Accuracy | | | |
|---|---|---|---|---|---|---|---|---|
| | Hindi | | Malayalam | | Hindi | | Malayalam | |
| | t | p | t | p | t | p | t | P |
| Backward priming -Forward priming | -1.268 | 0.237 | -1.333 | 0.215 | -2.49 | 0.03 | 1.88 | 0.09 |

Table 4.1.3 shows the descriptive statistics of the mean and standard deviation of the accuracy. The mean accuracy was found less in Malayalam (mean =0.94) than in Hindi (mean =0.96) in backward priming. The same was seen the forward priming group. It was believed that performance improves with decreasing task completion time. In both groups, the SD was high for the Malayalam speakers than Hindi speakers. Paired t-test was used to administer the test statistics (t) and statistical significance (p) of the accuracy. Table 4.3.1 concluded that in HNS there was a significant difference in the orthographic priming effect between forward and backward priming where, $p= 0.03$ and in contrast, in NNS the statistical significance of orthographic priming effect of forward and backward priming was $p<0.05$. From the Table 4.3.1, it possible to the conclude that there was a significant difference between the two types of orthographic priming in HNS but not in NNS.

**4.4 The Effect of Proficiency of L2 on Visual Word Recognition**

The Present study explores the effect of proficiency of L2 on visual word recognition. NNS were divided into high and low-proficient groups for the purposes of this study. RT and accuracy of responses were individually recorded and analysed descriptively and inferentially.

Table 4.4.1 shows the descriptive statistics, which was used to calculate the mean and standard deviation of the RT. High proficient speakers (mean=1031.10) have more mean than low proficient speakers (mean=972.60) except in forward priming. The SD was more for low proficient speakers in all the types of priming except forward priming. Independent t-test was administered to see t and p value of the RT. Table 4.4.1 shows the NNS the orthographic priming effect between high proficient and low proficient was insignificant. The p value for all types of priming were greater than 0.005. Hence, it came to the conclusion that no significant difference between the low and high proficient speakers.

**Table 4.4.1**

*Descriptive and inferential statistics of RT across proficiency of L2*

| | | Mean | S.D | t | p |
|---|---|---|---|---|---|
| Non-priming | Low Proficient | 972.60 | 155.18 | -0.483 | 0.642 |
| | High proficient | 1031.10 | 138.66 | -0.521 | 0.662 |
| Forward priming | Low Proficient | 891.00 | 80.87 | 0.959 | 0.366 |
| | High proficient | 818.87 | 163.09 | 0.607 | 0.643 |
| Backward priming | Low Proficient | 803.21 | 128.64 | -1.072 | 0.315 |
| | High proficient | 905.72 | 34.82 | -1.982 | 0.086 |

Table 4.4.2 shows the descriptive statistics was used to calculate the mean and standard deviation of the accuracy. The mean accuracy was found to be the same in backward priming for both high (mean=0.94) and low proficient speakers (mean=0.94) and different in both forward and non-priming conditions. The non-priming group showed a better mean value for high proficient (mean=0.65) than the corresponding one. In both groups, there was an insignificant difference in the SD. An Independent t-

test was performed to administer t and p value of the accuracy of the response. Table 4.4.2 also shows the NNS the orthographic priming effect between high proficient and low proficient was minimal. The p value for the groups were greater than 0.005. As the Table it shows, there was no significant difference between the two conditions.

**Table 4.4.2**

*Descriptive and Inferential Statistics of Accuracy across Proficiency of L2*

| | | Mean | S.D | t | P |
|---|---|---|---|---|---|
| Non-priming | Low Proficient | 0.73 | 0.15 | 0.696 | 0.506 |
| | High proficient | 0.65 | 0.00 | 1.455 | 0.189 |
| Forward priming | Low Proficient | 0.86 | 0.07 | -1.304 | 0.228 |
| | High proficient | 0.95 | 0.07 | -1.415 | 0.311 |
| Backward priming | Low Proficient | 0.94 | 0.06 | 0.000 | 1.000 |
| | High proficient | 0.94 | 0.07 | 0.000 | 1.000 |

## 4.5 Effect of Gender in Orthographic Priming

The Present study explores to find the effect of gender in orthographic priming. For the same equal number of males and females were selected as the subjects. There were descriptive and inferential statistics used.

Table 4.5.1 shows the mean and standard deviation of the RT. When compared to Hindi speakers (mean, M=929.92), the mean was higher for Malayalam speakers (mean, M=997.54), and male speakers clearly outperformed female speakers everywhere else save Hindi Forward priming. Additionally, male SDs were often higher than female SDs. Independent t-test was performed to test the statistical significance (p) of the RT. Table 4.5.2 conclude that there was no significant difference in the priming effect between males to females. The p value was greater than 0.005. Hence proved, that no significant difference across gender.

**Table 4.5.1**

*Mean and SD of RT across Gender*

| | | Hindi | | Malayalam | |
|---|---|---|---|---|---|
| | | Mean | S. D | Mean | S. D |
| Non-priming | Males | 975.54 | 150.42 | 1190.23 | 155.06 |
| | Females | 993.06 | 159.69 | 1044.98 | 145.69 |
| Forward priming | Males | 929.92 | 44.812 | 997.54 | 199.54 |
| | Females | 823.24 | 105.15 | 951.43 | 67.53 |
| Backward priming | Males | 869.72 | 94.901 | 933.53 | 101.59 |
| | Females | 777.72 | 138.45 | 882.67 | 74.58 |

**Table 4.5.2**

*Test Statistics (t) and Statistical Significance (p) of RT and Accuracy across Gender*

| | | RT | | Accuracy | |
|---|---|---|---|---|---|
| | | t | p | t | p |
| Non-priming | Males | 0.86 | 0.401 | -5.532 | 0.00 |
| | Females | 0.86 | 0.401 | -5.532 | 0.00 |
| Forward priming | Males | 1.36 | 0.192 | -3.935 | 0.001 |
| | Females | 1.36 | 0.118 | -3.935 | 0.003 |

Table 4.5.3 shows the mean and SD of the accuracy across gender. The mean accurate was higher for female in Hindi and mean was higher for male Malayalam speakers. The SD was more for Hindi with respect to Malayalam. Independent t-test was performed to find statistical significance (p) of accuracy. The Table 4.5.2 conclude that there was no significant difference in the priming effect between males to females in accuracy of their response**.** where the P value for both the gender are almost the same.

**Table 4.5.3**

*Mean and SD of Accuracy of across Gender Effect*

| | | Hindi | | Malayalam | |
|---|---|---|---|---|---|
| | | Mean | S. D | Mean | S. D |
| Non-priming | Males | 0.67 | 0.08 | 0.97 | 0.02 |
| | Females | 0.97 | 0.02 | 0.76 | 0.18 |
| Forward priming | Males | 0.86 | 0.09 | 1.00 | 0.00 |
| | Females | 0.98 | 0.0 | 0.91 | 0.06 |
| Backward priming | Males | 0.92 | 0.07 | 0.98 | 0.023 |
| | Females | 0.94 | 0.03 | 0.96 | 0.047 |

To sum up the findings, the main aim of the study was to investigate visual word recognition in Malayalam-Hindi bilinguals using orthographic priming. This was studied under five objectives. The first objective was to find the effect of orthographic priming within each language group. The mean reaction time and accuracy of priming were compared within two language groups. The analysis of the results revealed that there was a significant difference between non-priming and forward priming and non-priming and backward priming in orthographic priming within groups Hindi and Malayalam for both RT and accuracy.

The second objective of the study was to compare the priming effect across L1 and L2 speakers. This was studied by comparing the reaction time and accuracy across Hindi and Malayalam speakers. It was found that there was no significant difference in the priming effect across L1 and L2. Nonetheless, the accuracy shows that there was a significant difference in the priming effect in accuracy across L1 and L2.

The third objective of the study was to investigate effect of different types of orthographic priming within each language group. The mean reaction time was calculated for the both conditions and the result revealed that no significant difference between the two conditions in both RT and accuracy.

The fourth objective of the study was to find the effect of proficiency of L2 on visual word recognition. The results concluded that there was no significant difference between low proficient speakers and high proficient speakers for both RT and accuracy. This can be because of selection of subjects was random. The final objective of the study was to find the effect of gender in orthographic priming. The mean reaction time and accuracy of males and females revealed that there were no significant differences between the gender.

# CHAPTER V

# DISCUSSION

The present study investigated the orthographic priming effect on Malayalam-Hindi bilinguals through visual word recognition. The current study included 10 equal numbers of HNS and NNS subjects over the age of 18, with an equal number of males and Females. For L2 speakers, primary education in Hindi was seen as a strong inclusion factor. LEAP-Q (Ramya & Goswami, 2009) was used to evaluate and categorize the participants into two groups. The study used a total 60 pairs of Hindi words with an equal number of stimuli from three separate sets: forward position, backward position, and control primes. DMDX software (Forster & Forster, 2003) and check vocal (Protopapas, 2007) were used for RT and accuracy analysis, respectively. Both the RT data and the Accuracy response were retrieved and analysed using SPSS version 29.0 to determine descriptive and inferential statistics. Parametric tests were performed because the data passed the Shapiro-Wilks Test of normality with $p > 0.005$. Data was analysed using parametric tests such as independent t-tests and paired t-tests to compared across languages, gender, and proficiency groups.

The first objective of the study was to find the priming effect within native and non-native language groups where the priming was provided as graphemes of L2 words written in the same language. RT and accuracy analysis confirm a significant effect of orthographic priming within language groups. This result supports the previous study by Rao et al. (2010) who stated that faster RT and accurate response for related prime words over unrelated prime words which was evident in their study. The current study findings also support the results of Jiang et al. (2022) who stated that orthographically overlapped items produce faster RT than those without overlap. It has been believed that a high incidence of related primes increases priming (Bodner & Masson, 2001). This set of findings offers a convincing example of how interactions between the prime and target settings can significantly alter the degree to which a prime influences target processing. Hence, the response time to targets primed by orthographic primes was substantially faster than the response time to targets primed by unrelated primes. This effect confirmed Nakayama and Lupker's (2018) findings that orthographically related English word primes considerably shortened lexical choice delays to English targets in bilingual Japanese-English speakers. A similar finding was also observed in Wanner-Kawahara et al., (2022) study where the targets primed by orthographic primes were likewise substantially faster to respond than the similar targets primed by unrelated primes. Earlier research by Assche and Grainger (2006), the unrelated prime trails resulted in substantially greater RTs than the related trails at the term level, but in non-word analysis, the difference was not statistically significant. According to this process, every unrelated letter in the prime stimulus will impede the representation of the target word, with low reaction times in comparison to the related prime stimulus. The accuracy rates differed when word pairs rhymed significantly between orthographically similar and dissimilar pairs, according to research by Yee et al. (2023). More specifically, accuracy rates were greater for rhyming word pairs with similar orthographic overlaps than for word pairs with different orthographic overlaps. Significant differences between orthographically related and unrelated pairs were observed when word pairs did not rhyme. Accuracy rates were larger for non-rhyming word pairs with different orthographic overlaps compared to non-rhyming pairs with the same orthographic overlaps. According to a study by Kinoshita et al., (2018), native speakers were faster and more accurate in the orthographic overlap condition, with RTs of 594 ms and 95% for L1 and 672 ms and 76% for L2, respectively. The lack of any substantial decline in priming effects with the inclusion of unrelated letter primes provides strong evidence against any bottom-up letter-word inhibition as implemented in the interactive-activation paradigm. These arguments, therefore, imply that managing incongruent conditions was more difficult than managing congruent ones.

The second objective of the study was to find the priming effect across L1 and L2 speakers. The analysis of results showed no significant difference in the priming effect across L1 and L2 in terms of RT whereas, the accuracy analysis showed a major difference in the priming effect across L1 and L2. This means to say that accuracy was better in L1 than in L2 showing orthographical priming across both speakers. Similar findings were also confirmed in a study by Grainger and Jacobs (1996) revealed a strong impact of orthographic priming on RT data among native French speakers. In another study by Assche and Grainger (2006), French native speakers have greater priming effects from superset primes in comparison with the unrelated prime condition. However, there were few studies showed conflict results, where L1 speakers did not show an orthographical priming effect in orthographical similar pairs (Jiang & Wu, 2022; Longtin, et al., 2003; Rastle et al., 2000; Rastle et al., 2004) The results of this research confirm that during visual word recognition, L1 speakers do not pay attention to surface-level information, such as spelling. (Ciaccio & Jacob, 2019). Mental lexicon in both L1 and L2 shares certain semantic overlap which leads to surface form relatedness in L2 than in L1. There were studies that compared meaning related and form related responses (Jiang & Wu, 2022; Jiang & Zhang, 2021). Based on Jiang's study from the year 2021, L2 speakers produced 13.7% of form-related responses as opposed to L1 speakers, who only produced 1.5%. Thus, more extensive form-based lexical links in the L2 lexicon than in the L1 lexicon may explain orthographic priming effects and higher percentages of form-related answers in word association in L2 speakers.

There was evidence from earlier studies that orthographic similarity may influence the outcomes of studies on priming. The majority of earlier studies have looked at how bilinguals or second-language learners interact with orthographically related languages. Fewer researches have looked at bilingual speakers of orthographically distinct languages. The majority of studies on orthographic-related languages discovered evidence of an imbalance in the priming effect between L1-L2 direction and L2-L1 direction. The effect of priming between the L2-L1 direction may be stronger than the L1-L2 direction according to Kroll and Stewart's (1994) revised hierarchical model, which predicted that the lexical connection from L2 to L1 was stronger than L1 to L2. However, it's also important to take the conceptual link's influences into account. Furthermore, whereas the independent hypothesis contends that memory stores pertaining to two languages were stored separately and supports the potential of an interaction between two languages, the interdependent hypothesis does not support the priming effects of one language on another. Some studies that utilised masked priming or non-masked priming discovered the priming effect in the L1-L2 direction and L2-L1 direction. The priming effects in Jiang (1999) were less strong in the L2-L1 direction than in the L1-L2 direction. Some investigations, however, failed to detect the effect of priming in the L2-L1 pathway. A study by Alonso et al., (2016) does not go congruent with the current study where both the native speakers and non-native speakers responded faster to compound words while showing no facilitation from orthographic trails. These findings show that non-native speakers have morphologically structured lexical representations and that they employ this knowledge in ways that were nearly similar to native speakers, at least at intermediate to advanced levels of skill. L1 speakers showed more accurate responses for all the tasks since they were more proficient in their mother tongue than the NNS. Diependaele et al. (2011) showed the similar evidence that the accuracy of the responses was more for English native speakers than for Spanish and Dutch speakers. The study by Rao et al. (2010) does not support the result of the current study. The results of the previous study showed that Hindi target words show more accuracy than Urdu target words because of the graphemic complexity of Urdu words. This study also showed evidence of non-native speakers (NNS) might be influenced by orthography according to earlier studies (Diependaele et al., 2011). Thus, the current finding shows one more added evidence that NNS produce an orthographic priming effect without any morphological or semantic priming relationship.

The third objective was to find the effect of different types of orthographic priming within each language group. The result of the RT analysis showed that evidence of the priming effect for the target overlapped in both the forward and backward positions. The same results were also observed in the following studies (Jiang & Wu.,2022; Li et al., 2017a). The similar kind of result found might be due to the shorter word length of prime and target in the current study. This finding was not congruent with the contrastive pattern of research by Fiorentino and Fund-Reznicek (2009), the purely orthographic overlap condition in L1 processing should not have any discernible forward priming impact. Orthographic priming effects only in word-forward overlap position were also seen in previous studies (Heyer & Clahsen, 2014; Diependaele et al., 2011; Li et al., 2017b) gave evidence of the priming effect for orthographic pairs at forward overlapping positions but not for those with backward overlapping positions. In the context of compound processing, there was a priming effect in the word-forward overlap position but not one in the word-backward overlap position. In a visual word recognition task, compound priming effects were in fact challenging to distinguish from priming at the word-Forward position (Li et al., 2017a). The priming effects for compound word-final components converge with the pattern of priming seen for the root of Dutch words with derivationally prefixed terms (Diependaele et al., 2009). In another study by Aschenbrenner et al. (2017), there was a definite first place benefit in RTs for starting letters, and identical patterns emerged from the accuracy data albeit being less consistent. This suggests that these results were in accordance with the rapid onset of spatial attention to the beginning of a target string that occurs following the introduction of the stimulus. The current study does not go congruent with the earlier studies on position effect might be due to either a longer length of priming words or due to the lower degree of letter overlap between targets and primes in that study. When the degree of overlap was high there will be less chance for word-final letters to be get primed. Thus, the lengthier the prime word, the more difficult to process the overlaps at backward positions. When it comes to the accuracy of the responses the current study showed a major difference between the two types of orthographic priming in HNS but not in NNS. This might be due to the semantic knowledge of HNS on their native script and for NNS relay on surface form relatedness for L2 processing (Jiang & Zhang, 2021).

The fourth objective was to find the orthographic priming effect in terms of proficiency. After RT and Accuracy analysis, it came to the conclusion that there was no significant difference between the two proficient groups. It can be reasoned as the participants of L2 speakers orthographically trained in school, hence they could perform similar to L1 speaker. LEAP-Q (Ramya & Goswami, 2009) was all about verbal proficiency than orthographical proficiency. The development of an Orthographical proficiency scale was necessary for Orthographical related research. However, previous study reported that the orthographic priming effect was more for low-proficient L2 speakers than the high proficient speakers (Li et al., 2017a). Earlier studies by Wanner-Kawahara et al., (2022) and Li & Taft (2020) revealed that low-proficient L2 speakers were less sensitive to morphological priming compared with the L1 group. As the L2 speakers attain advanced proficiency in the non-native language and not show a priming effect for orthographical pairs rather it will show morphological priming effect. It was known that when L2 learners get more proficient in their target language, their lexical representations in the target language become more quickly and strongly activated as a result of the speaker's increasing exposure to L2 lexical items. As a result, both the amount of activation and the intensity of the L1 and L2 representations, both at the lexical and sublexical levels, become increasingly comparable.

The final objective was to find the orthographic priming effect across gender. Both RT and Accuracy analysis showed that there was no significant difference in the priming effect between males to females. This could be because executive functions were similar for both males and females regardless to the gender (Grissom et al., 2019). According to the study by Abbassi et al., in (2019) there was gender effect to the emotional feature of affective words in females, not otherwise.

To summarise, the first objective showed supportive findings on the priming effect within native and non-native language groups because unrelated prime words will convey inhibition to the target word representation by slowing RT and accuracy when compared to the related prime words. The second objective showed evidence of no major difference in the priming effect across L1 and L2 since orthographic similarity may influence the priming outcomes in both the native and non-native languages. There were supporting studies that show that accuracy was better in L1 speakers since native speakers were more proficient in their mother tongue. The third objective showed the supporting pieces of evidence where priming effect in both forward priming and backward priming groups as it might be due to the shorter word length of prime and target. The accuracy of HNS was better since they have added advantage of semantic knowledge over NNS. The second last objective also showed similar supporting findings on insignificant priming effect in terms of proficiency as it might be due to the orthographical knowledge of L2 speakers in Hindi since they were trained in schools to read and write. The Final objective also showed congruent shreds of evidence on no significant gender effect as executive functions were similar in both males and females and it reiterate the futile effect of gender.

# CHAPTER VI

## SUMMARY AND CONCLUSION

Understanding the representation of the mental lexicon depends greatly on the ability to recognise words visually. Since many years, psycholinguistics has been conducting study on the representation of mental lexicon in bilinguals. Language structure and a person's use of many languages both have an impact on word recognition. The frequency effect, language proficiency, and other factors can also affect how well people recognize words. It was crucial to understand how orthographically various languages were represented in the mental lexicon because India is a country where many different languages were spoken, and everyone today studies English as a second language. Studies on cross-linguistic communication have used lexical decision, lexical priming, lexical judgment tasks, etc. The primary aim of the study was to investigate visual word recognition in Malayalam-Hindi bilinguals using orthographic priming.

The objectives of the study were as follows:

1) To find the effect of orthographic priming within language groups.
2) To compare the priming effect across L1 and L2 speakers.
3) To find the effect of different types of orthographic priming within each language groups.
4) To find the effect of proficiency of L2 on visual word recognition.
5) To find the gender effect.

A total of 20 Participants in the age range of above 18 years were considered for the study. They were divided into two groups of Native speakers of Hindi (HNS) and Non-Native speakers of Hindi (NNS) i.e., Malayalam, comparing 10 participants from each language group based on their speaking proficiency in L2 as per the LEAP-Q (Ramya & Goswami, 2009). The word list was prepared and entered as code in DMDX software (Forster & Forster, 2003). The reaction time (RT) was used to analyse through the same software. For the analysis of accuracy, check vocal (Protopapas, 2007) was used. The participants were tested in a quiet room individually where the testing was done without interruption. They were instructed to read the target words aloud and the prime word silently as soon and precisely as they can. Reaction Time (RT) and Accuracy of each stimulus were recorded and statistical analysis was done using the software Statistical Package for Social Sciences (SPSS, Version 29.0). Descriptive statistics and parametric tests were used to test the null hypothesis. Since the data satisfied the Test of normality, parametric tests were conducted. In the present study parametric tests such as independent t-tests and paired t-tests were used to analyse data.

The results of the current study revealed that

- The priming effect within native and non-native language groups do have a significant effect since unrelated prime words will convey inhibition to the target word representation by slowing RT and Accuracy when compared to the related prime words.
- Both HNS and NNS showed an orthographic priming effect since orthographic similarity might influence the priming outcomes in both the native and non-native languages. L1 speakers showed better accuracy than L2 speakers because of the proficiency of the formers did in their native language.
- The result findings showed the effect of different types of orthographic priming

within each language groups as because of the shorter word length of prime and target. The accuracy of HNS was better since HNS has added advantage of semantic knowledge over NNS.

- The study finding revealed that no significant orthographic priming effect in terms of proficiency as it might be due to the orthographical knowledge of L2 speakers in Hindi since they were trained in schools.
- The current findings did not show any evidence of priming effect across gender as executive functions were similar in both males and females regardless of gender.

### 6.1 Implications of the Study

Clinical implications from the present study were as follows:

- Orthography priming can be used in second language learning. This learning method will help the migrants for quick acquisition of a second language.
- Orthographic priming will assist Bilingual children at school. It will help second-language students to learn orthography in a better way.
- Orthographic priming was useful for preparing assessment Material, especially for learning disabilities. Test material can be included different kinds of overlapping positions to understand the reading deficit in a better way.
- Orthographic priming helps in treatment purposes. It will help set different activities with various overlap positions to achieve the goal of improving reading.

### 6.2 Limitations of the Study

- All the bilingual participants selected were not balanced under the proficiency group.
- A proper orthographic proficiency scale should have been used to categorize the L2

speakers in terms of their proficiency.

### 6.3 Future directions of the Study

- Word recognition in balanced bilinguals can be investigated.
- Word recognition can be done across different age groups (children and older adults) and different disordered populations.
- Word recognition can be done in nonwords.

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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 neighbours | 1 | 2 | 3 | 4 |

3. Native Language of

| | | | | |
|---|---|---|---|---|
| • Father | 1 | 2 | 3 | 4 |

| | | | | |
|---|---|---|---|---|
| • Mother | 1 | 2 | 3 | 4 |
| • Siblings | 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 |
| • Siblings | 1 | 2 | 3 | 4 |
| • Guardians | 1 | 2 | 3 | 4 |
| • Neighbours | 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 thefollowing 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 whatage did you change your medium of instruction? | 1 | 2 | 3 | 4 |
| 9. Have you changed your state? If yes, which language do you use to communicate? | 1 | 2 | 3 | 4 |

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 thedialects in L1, L2, L3.***(1-Zero proficiency, 2- Low, 3- Good, 4- Native like/perfect)***

| | L1 | | | L2 | | | L3 | | |
|---|---|---|---|---|---|---|---|---|---|
| Dialect | D1 | D2 | D3 | 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 tothe other

**1-Zero proficiency** **2- Low**

**3- Good** **4- Perfect**

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

***(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 neighbours | 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 currentlyexposed 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 neighbours | | | |
| 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 prime and target stimuli used for the study

1. L1      2. L2 Bold- Control Prime-Target      3. L3
Italics- Forward Prime-Target
Underlined-Backward Prime-Target

| Sl No: | Prime word | Target word |
|---|---|---|
| 1. | **लिपटाना** | **लिख** |
| 2. | *मगरमच्छ* | *मगर* |
| 3. | **आवाज़** | **परदा** |
| 4. | <u>बरबाद</u> | <u>बाद</u> |
| 5. | <u>सितार</u> | <u>तार</u> |
| 6. | **उधर** | **शहर** |
| 7. | *सड़क* | *सड़* |
| 8. | **अनोखा** | **शक** |
| 9. | *बंदर* | *बंद* |
| 10. | *लालची* | *लाल* |
| 11. | <u>चमन</u> | <u>मन</u> |
| 12. | **कल्पना** | **याद** |
| 13. | <u>ऊचल</u> | <u>चल</u> |
| 14. | *वरना* | *वर* |
| 15. | <u>प्रतीशत</u> | <u>शत</u> |
| 16. | **सहज** | **जुनून** |
| 17. | **संजीव** | **लपथा** |

| | | |
|---|---|---|
| 18. | *मतलब* | *मत* |
| 19. | पुस्तक | तक |
| 20. | **सहमत** | **क्षमता** |
| 21. | नाराज | राज |
| 22. | अखबार | बार |
| 23. | *खिलाफ़* | *खिल* |
| 24. | **उपासना** | **सरल** |
| 25. | **अभियान** | **लगन** |
| 26. | **विलासिता** | **लालच** |
| 27. | *कानून* | *कान* |
| 28. | अखबार | बार |
| 29. | *जननी* | *जन* |
| 30. | *भूतकाल* | *भूत* |
| 31. | **चमत्कार** | **कमल** |
| 32. | संसार | सार |
| 33. | विमान | मान |
| 34. | **समारूह** | **प्रभव** |
| 35. | *आगमन* | *आग* |
| 36. | बीमार | मार |
| 37. | **रिमचिम** | **हरामी** |
| 38. | व्याकुल | कुल |
| 39. | *तालाब* | *ताला* |

| | | |
|---|---|---|
| 40. | *नमक* | *नम* |
| 41. | **हुशियार** | **धरती** |
| 42. | **कामचोर** | **माल** |
| 43. | <u>खतरनाक</u> | <u>नाक</u> |
| 44. | <u>खुबसूरत</u> | <u>सूरत</u> |
| 45. | *कार्यकर्म* | *कार्य* |
| 46. | <u>तस्वीर</u> | <u>वीर</u> |
| 47. | **सफर** | **विचार** |
| 48. | *समझना* | *समय* |
| 49. | *कलम* | *कल* |
| 50. | **सन्दूक** | **सीधा** |
| 51. | *जंगल* | *जंग* |
| 52. | <u>सावधान</u> | <u>धान</u> |
| 53. | **अँगूठी** | **तौलिया** |
| 54. | <u>वरदान</u> | <u>दान</u> |
| 55. | *बादल* | *बाद* |
| 56. | **संकट** | **मांगना** |
| 57. | <u>किरण</u> | <u>रण</u> |
| 58. | *सुरक्षित* | *सुर* |
| 59. | *पलटन* | *पल* |
| 60. | <u>विखास</u> | <u>खास</u> |