INFLECTIONAL AND DERIVATIONAL WORDS PROCESSING IN L2: A MASKED PRIMING STUDY IN KANNADA-ENGLISH BILINGUALS

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Dedicated To

MOM, DAD

and

MOSSA

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CERTIFICATE

This is to certify that this dissertation entitled "**Inflectional and derivational words processing in L2: A masked priming study in Kannada-English bilinguals**" is a bonafide work submitted in part fulfilment for the Degree of Master of Science (Speech- Language Pathology) of the student (Registration No: 12SLP014). This has been carried out under the guidance of a faculty of this institute and has not been submitted earlier for the award of any other Diploma or Degree to any other University.

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May, 2014

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CERTIFICATE

This is to certify that this dissertation entitled "**Inflectional and derivational words processing in L2: A masked priming study in Kannada-English bilinguals**" has been prepared under my supervision and guidance. It is also certified that this has not been submitted earlier for the award of any Diploma or Degree to any other University.

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DECLARATION

This is to certify that this dissertation entitled "**Inflectional and derivational words processing in L2: A masked priming study in Kannada-English bilinguals**" is the result of my own study under the guidance of Mr. R. Rajasudhakar, Lecturer, Department of Speech Language Sciences, All India Institute of Speech and Hearing, Mysore and has not been submitted earlier for the award of any Diploma or Degree to any other University.

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CHAPTER 1- INTRODUCTION

"Language is the systematic and conventional use of sounds (or signs or written symbols) for the purpose of communication or self expression" (Crystal, 1995). According to Syal and Jindal (2007), language consists of five different components. They are phonology, syntax, semantics, pragmatics, and morphology. Phonology is the study of sounds in a language. A collection of rules about word combinations and sentence structures within a language is called syntax. Semantics is the study of the meaning of words and word combinations of a language. Pragmatics is the study of language production in the social context. Morphology deals with the grammar of words (Booij, 2005). Morphology is the study of word structures. The morphemes are the smallest units of meaningful words within a language. Most morphemes are words, but some morphemes are smaller than words. Linguists recognize two kinds of morphemes- free and bound morphemes. A free morpheme conveys meaning by standing alone and cannot be broken down into smaller parts. Any word without affixes is a free morpheme, also referred to as a root or base word. Bound morphemes are those suffixes and prefixes which are attached to a root word. Bound morphemes cannot stand alone, as they convey no meaning until they are combined with a root word. There are two types of bound morphemes: (1) Derivational bound morphemes and, (2) Inflectional bound morphemes.

Derivational bound morphemes are elements of language that help create entirely new words from root words (e.g., abstract→ abstractness). They can include suffixes or prefixes. Inflectional bound morphemes are elements of language that are attached to a root word to add meaning of the root word, but not to create a new word. Examples of inflectional bound morphemes include the present progressive '***-ing***', the past tense '***-ed***', and the possessive and plural '***-s***'. Content words like nouns, adjectives, and verbs are usually free morphemes. On the other hand, bound morphemes can be function words or content words. The affixes can be of the derivational or inflectional type. Derivational affixes are those that usually change the part of speech and the derived word is completely different from the root word's meaning. For example, 'govern' means to rule, while 'governor' means one who rules. Here, the part of speech is changing from a verb to a noun. Inflectional morphemes usually do not change the part of speech, but only change the grammatical aspects of the word. For example, the root word 'jump' can have a past- tense form of 'jumped', a present- tense form of 'jumping' and they remain as verbs.

Those words which have one morpheme are known as mono-morphemic words or words that are morphologically simple. Words which have greater than one morpheme are called as morphologically complex words or Poly-morphemic forms. In a poly-morphemic word, usually, there is one content morpheme and one or greater than one affix attached to it which will change or modify the meaning of the content morpheme.

Theories of morphology

Morpheme- based theories

According to these theories, the morphemes are the major units required in word forming. The process of concatenation occurs, where the combination of morphemes occurs and words of a language are created. These theories also believe that root words and affixes have their own independent representations in the lexicon.

For morpheme-based theorists, morphemes are the building blocks of word creation; morphemes are combined, via concatenation, to create the words of the language. Furthermore, most morpheme-based theories assume that roots and affixes, both have their own independent lexical representations. Some morpheme-based theories additionally list (some) complex words in the lexicon, but this is not a crucial assumption of these theories (Halle 1973, Selkirk 1982, & Lieber, 1992).

Word-based theories

These theorists are of the opinion that the building blocks for the process of word formation are words (Jackendoff, 1975; Aronoff, 1976; & Bochner, 1993), and not morphemes. This means that only real root words are stored in the lexicon and there is no representation for the bound morphemes in the mental lexicon.

Models related to morphology

Item and Arrangement (IA) models

As per the IA models, there is a representation for all morphemes in the mental lexicon and the words are formed by the process of selecting the morphemes that are required and blending them to get the complex word of interest. If a person wants to say a word that is opposite to the word 'do', the root word 'do' is selected and an affix that is appropriate is selected 'un' and both the root and the affix are concatenated together to the complex word ‘undo’.

Item and Process (IP) models

According to the IP models, the formation of words happens by using the rules that are specific to word formation, and not through concatenation. The root words have representations in the mental lexicon, while the affixes are like the rules associated with the root words and have no representation in the lexicon.

Explicit morpheme (EM) model

This model says that words are made up of morphemes and these help in organization in the lexicon. Some of the versions of the EM model support the word- based models, while some others support the morpheme- based models. The proponents of this model say that the storage of derived words happens within their root entry. These models also have a ‘satellite organization, wherein the derivational forms are all linked to the root word (Lukatela et al., 1980, Feldman & Fowler 1987).

Implicit morpheme (IM) model

According to this model, there are independent representations in the mental lexicon for the morphemes (Rueckl & Raveh 1999, Plaut & Gonnerman 2000). The relationship between morphemes is because of lexical activation due to semantic and phonological overlap.

According to Toth (2007), there are many morphological systems existing across the globe, of which, two morphological systems are Isolating morphology and Agglutinating morphology systems. Chinese is a language with isolating morphology, in which, each word tends to be a single isolated morpheme. An isolating language lacks both derivational and inflectional morphology. Using separate words, Chinese expresses certain content that an inflecting language might express with inflectional affixes. It does not have tense markers or gender markers on pronouns. Instead, it uses a separate word. In agglutinating languages, words can have several prefixes and suffixes, but they are distinct and readily segmented into their parts. English and all the Dravidian languages including, Kannada, Malayalam, Tamil and Telugu are agglutinating languages.

Kannada is one of the major languages of the Dravidian family in South India. According to Sridhar (2007), in Kannada, case- marking and post-positions are used extensively in the language to express syntactic and semantic function. Case- markers are defined as bound suffixes which do not occur independently as words and are not attached to any other category other than the noun phrase. Tense is marked by a suffix, which immediately follows the verb root. The agreement features for person, number, and gender are different in different tenses. In an agglutinating language such as Kannada, the integrity of the stem and the subsequent morphemes is mostly unaffected by the derivational process. The derivational history of the word is reflected in the sequence of morphemes in a fairly straightforward manner. In the Dravidian languages, maximum number of affixes occur at the back of words (that is, as suffixes). A regular and productive means of forming nouns from adjectives is by adding the suffix –*tana* (for example, volleya*tana* for goodness). For Sanskrit- derived words, -*te* is used (for example, visa:la*te* for largeness).

One of the behavioural techniques used to study the processing of the complex morphological forms is the priming technique or the reaction time measurement. It gives information about the processing speed for different morphological forms, in different kinds of populations like normals, individuals with aphasia, those with learning disability, and others.

Priming

Priming is defined as a memory form that is not conscious that brings about a change in the ability of the person in classifying, or identifying a particular item due to a previous exposure to that item or an item that is related to it.

There is literature to support a facilitatory effect of the prime on the target in the morphological priming experiments. Stanners, Neiser, Hernon, and Hall (1979) reported a full priming effect in English for the regular past- tense inflectional marker first. There was strong priming effect noticed for even at SOAs of 30 ms and 60 ms in masked visual priming studies (Rastle, Davis, and New, 2004 ; Frost, Deutsch, and Forster, 2000; Boudelaa and Marselen- Wilson, 2005). Another example is that Boudelaa and Marselen- Wilson (2005) got very strong priming effects for morphological structures at all the four SOAs that they tested (32 ms, 48 ms, 64 ms, 80 ms). However, semantic and orthographic priming occurred at only at the longest SOA of 80 ms. This means that the morphologically complex words are decomposed automatically without conscious effort even before the semantic component is activated.

The priming studies that were conducted were mostly in languages such as English, French, German, Spanish, Hebrew, Chinese, and others. The morphological structure of these languages is very different from those of the Indian languages, which makes it inappropriate to extrapolate the findings of those studies to the Indian languages.

Need for the Study

1) Since neuro- imaging techniques are expensive and it is not very easily available for use at all set- ups, more *Reaction Time* measures can be used, which is a direct measure of the processing speed and is comparatively less expensive than neuro- imaging techniques. It can be used even in an institutional or remote clinical set- up where there is no availability of neuro- imaging methods.

2) While a few studies in the literature are of the view that L2 processing is slower, less automatic, more cognitively demanding and is influenced by L1, others say that L2 learners use the same mechanisms for language processing as L1 individuals. Hence, as there are equivocal findings in L2 processing, especially with morphologically complex forms.

3) Many of the previous studies on adult L2 learners focussed mainly on the language production aspects to describe the individual's linguistic knowledge. More studies are required to explain the processing aspects, as in reaction time measures, which can make it possible to study the morphological processing in L2 even in individuals with limited verbal output, such as in aphasia, mental retardation, apraxia of speech, and so on.

4) Moreover, there is a dearth of literature on the influence of age on L2 morphologically complex words processing in Kannada- English bilinguals. There are many studies that have been done on L1 processing, but only very few studies have been conducted on L2 processing, particularly in the Indian languages.

Hence, there is a need to investigate the processing of morphological complex words like inflectional and derivational word forms in non- native speakers of English.

Aim of the study

To investigate the effect of age and Stimulus- Onset Asynchrony (SOA) on the processing of English inflectional and derivational forms in Kannada- English bilingual individuals.

Objectives of the study

1) To measure the reaction times and accuracy in the inflectional and derivational morphological processing task at a Stimulus- Onset Asynchrony (SOA) of 60 ms in Kannada-English bilingual younger and older adults.

2) To measure the reaction times and accuracy in the inflectional and derivational morphological processing task at an SOA of 30 ms in Kannada- English bilingual younger and older adults.

3) To compare the gender differences, if any, on the inflectional and derivational morphological processing task in Kannada- English bilingual younger and older adults.

Method in brief

A total of 40 adult native speakers of Kannada participated in the study. There were two groups: Group I comprised of younger adults aged between 20 to 30 years and Group II which comprised of older adults between 50 to 60 years of age. In the present study, 120 critical prime- target pairs were used, and they were divided into 3 sets of 20 words each under the criteria of Identity (e.g., BOIL- BOIL), Test (e.g., WATCHED- WATCH) and Unrelated (e.g., HANG- OPEN) for the Experiments 1 and 3 which are for inflected past-tense '-ed' form at Stimulus Onset Asynchronies (SOAs) of 60 ms and 30 ms, respectively. For the Experiments 2 and 4, which are for the processing of derivational morpheme '-ness', 60 prime- target pairs were divided into the Identity (e.g., BOLD- BOLD), Test (e.g., KINDNESS- KIND), and Unrelated (e.g., LIMP- JUST) were presented at SOAs of 60 ms and 30 ms respectively. A set of 108 fillers were used, which were divided into a set of 54 pairs for experiments 1 and 3 and 54 pairs for experiments 2 and 4. The fillers had semantically unrelated pairs, nonword- word pairs, word- nonword pairs, and nonword- nonword pairs. The stimuli were presented using the DMDX software, which was also used for reaction time and accuracy measurement. The stimuli were presented on a 15 inches screen laptop. The font size used was 72 and the stimuli appeared in black colour over a white background. The instruction given to the participants was to press the 'right arrow key' for a word and the 'left arrow key' for a non- word on the laptop's keyboard as quickly as they can for the ‘target word’ which appeared after a forward mask pattern as a series of XXXXXX, followed by the prime and then, the target. Before each experiment, 10 practice items were given so that the participant became familiar with the task.

Clinical Implications

1) The results of the present study will enhance the knowledge of the Speech Language Pathologists (SLPs) and will help in understanding how normal L2 learner of English processes the complex morphological forms such as inflectional and derivational words.

2) In the present study, since SOA as low as 30 ms had been taken, it might hint at the detrimental effects of age on the morphological processing as the cognitive load or demand increases at lower SOAs.

3) The results of the present study augment the SLPs clinical skills while planning or formulating the treatment goals for individuals with brain damage regarding which morphological form is easier to process, so that, it can be incorporated in the treatment plan and activities.

CHAPTER 2- REVIEW OF LITERATURE

"The ability of an individual in identifying or classifying a particular item as a result of a previous exposure to it or to another item which is related to it depends on a form of memory that is called as priming".

Priming experiments are of importance to investigate whether the presentation of a 'prime' before the 'target' can increase the accuracy of performance and reduce the reaction time (facilitation), or reduces the accuracy of performance or increases the reaction time. Priming involves presenting material before the word to which a response has to be made. One of the most common paradigms involves presenting one word prior to the target word to which a response has to be given. The first word is called the 'prime' and the word to which a response has to be made is called the 'target'. The time between the onset of the prime to the onset of the target is called the Stimulus- Onset Asynchrony (SOA).

Masked priming experiments also support the role of morphemes in lexical access. In masked priming studies, the prime word is presented followed by a pattern that covers the place where the prime was (backward masking). If the mask appears before the prime, it is known as forward masking. Masking the prime stimulus prevents the visual system from activating additional information about the prime word once the mask is displayed. At very short prime exposure durations of 30 ms or less than that, semantic priming (doctor – nurse) does not occur. The opposite pattern happens for morphological primes. At very short prime durations, morphological priming is robust, but that priming effect disappears at longer prime exposure durations (Marslen- Wilson & Tyler, 1998).

One problem with the lexical decision task is Speed Accuracy Trade-offs, that is, faster the participants respond, the more errors they make (Pachella, 1974), and therefore researchers must be careful about the precise instructions the participants are given. Encouraging participants to be accurate tends to make them respond more accurately, but more slowly. The frequency of a word, orthographic similarity, word length and so on are some of the important factors in word recognition.

Even though many studies were conducted to examine how words that are morphologically complex are represented or processed in the mental lexicon, there is no sure conclusion that has emerged. Some researchers believe that all the words that are complex morphologically are represented in the lexicon as a whole and are accessed directly (Butterworth, 1983; Lukatela, Gligorijevic, Kostic, & Turvey, 1980; Manelis & Tharp, 1977). The other school of thought is that the mental lexicon is organized in such a way that the root words are accessed after stripping or separation of the affixes from the root word. (Taft, 1985; Taft & Forster, 1975). The first hypothesis is known as the Supralexical Hypothesis, where, morphological affixes are retrieved after retrieving the representation of whole words. For example, when complex words such as *goodness* are presented, the whole- word is activated followed by activation of the affix.

The second hypothesis is known as the Sublexical Hypothesis where, representations for affixes are retrieved before representations for the whole words. Following the proposal of these two views, that holistic representation of words that are morphologically complex and decomposition of the word into the base word and affix, a third view which incorporates both these previous views emerged (Caramazza, Laudanna, & Romani, 1988; Frauenfelder & Schreuder, 1992; Schreuder & Baayen, 1994; Schriefers, Friederici, & Graetz, 1992; Zwitserlood, 1994). According to Matthews (1974), words with inflectional or derivational affixes are known as words that are morphologically complex. To test the hypotheses of the organization of complex morphological structures, in English, inflectional markers like the past tense marker of verbs are used, which may be of the regular type (wash- washed) or of the irregular type (sing- sang).

In a study done by Giraudo and Grainger (2001), primes that had free roots or derivational suffixes were used and their latencies were compared in a lexical decision task. According to them, if the Sublexical hypothesis holds good for processing of complex morphological words, latencies for the root primes will be shorter than the latencies for the derivational primes as the root primes need not undergo the parsing process. Therefore, the authors assume that additional computation is required to isolate the root from a derivational form, leading to lesser priming due to the slowing down in the processing of the complex word. However, based on the Supralexical hypothesis, even the primes with derivational suffixes are as effective as the root primes. The participants were 40 University students whose native language was French. The stimuli used consisted of 40 words with derivational suffixes and another 40 words which were free roots in French that were the targets. The primes presented before the derivational form targets were of four types, including free root, same word, derivational suffix word, or an unrelated word. The primes for the root word targets were also of the same conditions as that for the derived word targets. There were 80 non- word fillers also that were included, out of which, 40 were simple, pronounceable ones and another 40 which were made complex by using a true suffix to the non- word. Five Stimulus Onset Asynchronies (SOAs) were used (0 msec, 14 msec, 29 msec, 42 msec, and 57 msec) for each participant. A masked priming paradigm was used, in which, a series of hash marks (####) was presented for a duration of 500 msec, which acted as the forward mask, then, the prime for any one of the previously mentioned SOAs, followed by the target word or non- word, which was displayed on the screen until the participants gave a response. They had to respond through button-press. The results showed that both the free root and derivational suffix primes had a facilitatory effect on the derivational suffix target words and that the reaction times for the root primes were not significantly shorter than the condition involving the derivational suffix forms, thereby disproving the sublexical hypothesis.

When a prime precedes the target word and facilitates the target word's processing, the process of priming is said to have occurred. In experiments used to examine the morphological priming using the task of lexical decision, it could be possible that priming is occurring because the prime and the target might be overlapping or maybe due to a relationship between the prime and the target that makes the lexical decision easy. Therefore, in order to avoid this interpretation, some methods such as having a very short duration for which the prime is presented so that the participant is not aware of the existence of the prime because of the short duration. This technique was given by Forster and Davis (1984). Even though the participants are not aware of the short duration-prime, it can have a strong priming effect. It was observed that maximum priming occurs for the identity condition (e.g., heal- HEAL) at approximately 50 ms. Next in strength of priming is a prime which is just different by a single letter (e.g., Attitude- APTITUDE), which occurs at about 30 ms. The effect of priming is least in the unrelated condition, where the prime and the target are completely different (e.g., goodness- Borrow).

Even during a masking paradigm, non- words are always better 'primes' when compared to real words because if the prime is a real related word to the target, it interferes with the target more and the competition between the two is higher than when the prime is a non- word. However, some authors say that this view may be true, or, may not be true (e.g., Ferrand & Grainger, 1992; Forster & Veres, 1998). According to Forster and Veres (1998), if the non- word stimuli are very similar to real words, that is if the non- words that are used are different from real words only by a single letter, then, no priming occurs due to the similar form of both the real words and the primes (e.g., PENSIL). However, if the non- word is different from the real word by two or more letters, both the non- word and word primes can show strong effects of priming (e.g., PANSIL).

In English, the overlap in terms of orthography or form for words that are morphologically related is high compared to languages like Hebrew. Therefore, to be able to identify morphological priming, the experiments should include non- words as distractors and also have a prime duration of not less than 30 ms to decrease the chances of orthographic or form priming from occurring so that reliable information about morphological processing can be obtained (Frost, Forster, & Deutsch, 1997; Deutsch, Frost, & Forster, 1998).

The past- tense morphological form has gained a lot of importance in the priming experiments. In a study done by Stanners et al. (1979), the reaction times were shortest for identical pairs (e.g., reach- reach) than the others. They also observed an almost equal amount of facilitation when the prime used was a inflectional morpheme, that is, the regular past- tense '-ed' form, followed by its root word as the target (e.g., reached- reach). Other studies conducted following this study also found results similar to those of Stanner et al. (1979), that is, a full priming effect was noticed for regular paste- tense inflectional morpheme (Kempley & Morton, 1982; Fowler, Napps & Feldman, 1985; Napps, 1989; Marslen-Wilson et al., 1993). According to Bybee and Hopper (2001), in English, the reaction times for high frequency '-ed' forms were shorter than those for low frequency '-ed' forms. This is because the morphologically complex words are accessed easily if they are used more frequently.

Morphology in processing L1 and L2

Neuroimaging data also support a unique role for morphemes in lexical processing, because prime- target word pairs that share a root morpheme are associated with decreased neural activity in the left anterior frontal lobe (Bozic, Marslen- Wilson, Stamatakis, Davis & Tyler, 2007), while other kinds of other prime- target pairs are not. According to Laudanna and Burani (1995), the processing of derived morphologically complex words is regulated by the likelihood with which a given affix occurs as a processing unit in a language, that the affixal salience. A variety of factors such as productivity, frequency, orthographic length, and affix confusability have been shown to affect the relative salience of affixes (Baayan, 1994; Laudanna & Burani, 1995). According to Anshen and Aronoff (1988), the more productive derivational affixes in English are the ones that determine which derived words will be produced. They found that productive affixes such as *–ness* resulted in a wider variety of word types and a greater number of new words than less productive affixes such as – *ity*.

***Orthographic versus Morphological & Derivational versus Inflectional priming*:** In a study by Diependaele, Dunabeitia, Morris, & Keuleers (2011), facilitation effects were found for derivationally related prime-target pairs in L2 English. Morphological priming is long-lived, while orthographic priming is very transient (Napps & Fowler 1987). In the masked-priming paradigm, if primes are presented very briefly and then immediately masked by the target, morphological priming is facilitatory, while orthographic priming is inhibitory (Grainger, 1994; Drews & Zwitserlood 1995). Feldman (1994) also compared inflectional and derivational priming in Serbian (the same language previously referred to as Serbo-Croatian). Although both inflectionally and derivationally related words produced facilitatory priming effects and the priming effect was more for inflectional words than derivational word forms.

Devaki (1983) studied morphological development in Kannada language and she reported that development of different types of morphemes in Kannada is complete by the age of seven years. Study by Karanth and Suchitra, (1993) and Scholes, (1993) revealed that school going children become increasingly proficient in identifying grammatical inaccuracies from Grade I through VII. In a study done by Kuppuraj, Abhishek, and Rao (2012), a reading task along with inflectional/derivational morphologies in sentence completion and priming task through grades IV, V and VI in order to find out the relation between morphological sensitivity and reading were used. Results showed that the knowledge of inflectional and derivational morphemes increases with increase in the grade. However, the increment was more prominent between Grade IV to Grade V.

In a study done by Ann and Venkatesh (2012), grammaticality judgment abilities were assessed among typically developing children in English in the Indian context. Grammaticality judgment was studied using sentence acceptability and sentence correction tasks in two groups of children; one group of children studying in grade II (7-year olds) and another group of children studying in grade V (10-year-olds). Results revealed a developmental trend in the performance of the two groups of children on the two grammaticality judgment tasks in English. Consistent with earlier findings from English speaking children, word order reversals were easier to detect in sentence acceptability task and also easier to correct relative to other errors in sentences such as morpheme deletions and wrong syntactic agreements for children in both grades.

Processing of Morphologically complex forms in L2 learners

Early research in Age of Acquisition (AoA) and Proficiency (e.g., Kim, Relkin, Lee, & Hirsch, 1997) showed cortical activation differences between late and early bilinguals in Second Language (L2) production tasks. The two models Declarative/Procedural model (Ullman, 2001, 2004, 2012) and Shallow structure hypothesis (Clahsen & Felser, 2006) propose that late L2 learners do not decompose inflected words until they reach an unspecified high level of proficiency. Second language learners have smaller lexicon than native speakers of that language (Crossley, Salsbury & McNamara, 2012). The L2 learners are less sensitive to morphological markers than native- speakers (Jiang, 2007). In a study conducted by Silva and Clahsen (2008), the adult native (L1) speakers of English showed efficient priming for both inflectional and derived word forms, while the Second Language (L2) learners of English which included native speakers of Chinese, German, and Japanese demonstrated no priming for inflected and reduced priming for derived word forms. This difference has been attributed to the reason that L2 learners rely more on lexical storage and less on combinatorial processing of morphologically complex words than native speakers.

Effect of frequency

In a lexical decision task, the reaction times are shorter for high frequency words in L1 speakers due to repeated exposure and usage of the word has made the memory traces strong.

A few studies have reported that the performance of individuals for a late leaned L2 and L1 showed frequency effects that were similar for inflectional verb forms (Portin, Lehtonen & Laine, 2007) and speeded production (Beck, 1997). It can be said from these findings that the processing of morphologically complex words by an adult L2 learner is similar to an L1 speaker (Portin et al., 2007). When processing of irregular and regular verb forms was analysed in German, Neubauer and Clahsen (2009) found that the reaction times were drastically shorter for the high- frequency words than the low frequency inflectional forms in the L2 group. However, the L1 group showed the advantage of frequency effect for irregular verb forms, but not for the regular forms. These two studies indicate that the frequency effect is more prominent and stronger in the processing of L2 than L1 because the L2 learners depend more on the storage of and retrieval of even inflectional forms as a whole without parsing (Ullman, 2005).

Initially, to study how knowledge of language develops in adults who are learners of a non- native language, research focussed mostly on the production aspects rather than the processing. The trend has changed in the present days and many techniques like monitoring eye- movements, reaction time measurements, brain potentials, and imaging studies are being used to study the processing of language in adult learners of a second language (L2). These recent techniques have helped in understanding the differences in processing L1/L2 (Clahsen and Felser, 2006a, b). There are two views that have surfaced. The first view says that the processing of L2 is more difficult with respect to processes related to cognition such as the processing speed, working memory and so forth even though both L2 and L1 have only one system. The processing of L2 might be less automatic and slower than the processing of L1 as the L2 may come under the influence of the L1 or native language of the individual. The second view is that processing of L2 differs from the processing of L1 (Ullman, 2001, 2004, 2005; Clahsen and Felser, 2006a, b). To support this view, Ullman (2005) proposed the Procedural or Declarative model. According to this model, for the processing of the mother tongue or native language, two types of memory systems in the brain are required. The first one is the Declarative memory which stores phrases and words that are memorized. The other one is the Procedural memory system where the processing of rules related to combination occurs.

In a study done by Brovetto and Ullman (2001), for native speakers, responses were faster for irregular past- tense verb forms of high frequency and there were slower responses for regular past- tense verbs of high frequency. However, L2 learners had the effect of frequency for regular past- tense verb forms, as well as, the irregulars. They concluded that the regular past- tense forms are in the form of unanalyzed whole words in the lexicon in learners of L2, and not in L1 speakers.

In a study done by Silva and Clahsen (2008), four experiments were conducted to see whether Native speakers of English and L2 learners of English had similar ways of processing inflectional and derivational forms. The participants were adult native speakers of English, and L2 English learners who were native speakers of Chinese, German, and Japanese. They were tested for processing of inflected '-ed' form at SOAs of 60 ms and 30 ms, the derivational forms '-ness' and '-ity' at 60 ms SOA. The first, third and fourth experiments were for L1 speakers, German and Chinese L2 learners, while the second one included an additional group of Japanese L2 learners of English. The L1 group showed efficient priming for the inflectional as well as derivational word forms. Since German is more similar to English than is Chinese to English in terms of the past- tense affix, the German L2 learners of English had more native- like patterns of priming compared to the Chinese L2 group. Even the Japanese L2 learners who were tested in the second experiment performed better than their Chinese counterparts as there is a regular past- tense marker even in Japanese, while there is no such affix in Chinese language.

***Anatomical and functional changes in aging which affect performance*:** In vivo studies using magnetic resonance imaging (MRI) revealed that generally, brain volume decreases with advancing age (Raz, 2005). Gray matter volume declines in a linear fashion beginning in childhood (Pfefferbaum et al., 1994; Courchesne et al., 2000). In contrast, white matter volume shows a linear increase until the early twenties. An ensuing plateau continues into the sixties, after which there is a linear decline into old age.

Researchers have identified three principal components of cognitive aging (Park, 2000) - decrease in processing speed, deficit in working memory, and decrease in suppression (i.e., the ability to focus attention on relevant material in the presence of irrelevant stimuli). Each of these abilities is involved in some stages of L2 acquisition and routinely in language use (L1 and L2). With increasing age, both L1 and L2 use are affected via declines in these areas of language processing. In L2 use, age effects in these domains are likely to be more pronounced than in the L1 case, due to a relatively low degree of automaticity in L2 processing (Segalowitz & Hulstijn, 2005). On tasks where speed and efficiency are involved, the decline across the adult life span is generally linear and, in all cases, continuous (Backman & Farde, 2005).

Studies on lexical processing show that reaction time differences between task conditions were greater for older adults than for young adults (Madden, Pierce, & Allen, 1993). Only very few studies have considered the effect of aging on morphology. Studies of language in individuals with probable Alzheimer's disease showed that healthy old Hebrew speakers who served as control participants made very few morphological errors in spontaneous speech relative to a higher number of semantic–conceptual errors and appropriately used a wide range of morphological forms (Kave & Levy, 2003). Older persons also showed the morphological priming effects (Kave & Levy, 2004), that had been previously documented in young speakers of Hebrew (Frost, Deutsch, Gilboa, Tannenbaum, & Marslen-Wilson, 2000).

The Reaction times (RTs) are said to become slower and more variable with increasing age. A sample of 7,130 adult participants, originally reported by Huppert (1987) was analyzed by Der and Deary (2006) and they found that on simple reaction time and four- choice reaction time measures, there were age differences. There was slight slowing down in reaction time at around 50 years for the simple reaction tasks, but a continuous slowing down in choice reaction time measures throughout adulthood. Gender differences are also more prominent for choice RT measures. According to Madden (2001), the speed of processing is determined by Reaction Times. According to Goral and Obler (2003) there is no correlation between age and performance.

Pierson and Montoye (1958) measured simple reaction times in 400 males between 8 and 83 years. The researchers concluded that the consistency of the responses increases with age until 30 years of age, following which, a decline starts. They found that an individual is capable of giving the fastest response at around 20 years of age.

In a study done by Li et al. (2004), where 291 participants between 6 to 89 years were taken, they found that the strength of processing, fluid intelligence and speed of processing were maximum in the mid 20s.

Tests that help in assessing the ability of an individual to control objects, tracking and aiming, object manipulation, reaction time, fine and precise movements are known as Psychomotor tests. Thorson et al. (2011) assessed psychomotor abilities in men and women and found that women performed worse than men on reaction time and also made more errors. Studies related to hand steadiness across a number of age groups showed a female advantage (Briggs & Tellegen, 1971; Brito & Santos-Morales, 2002; Ruffer, 1984). Other

Making accurate and fast marks on paper (Peters & Servos, 1989), or small parts assembling (Brito & Santos-Morales, 2002), showed better results for women. According to Thorson et al. (2011), men performed better on reaction time, speed of wrist- finger, precision in control, quick limb movement, aiming. Women performed better on tasks involving dexterity of fingers, motor coordination, manual dexterity and steadiness. The intra- individual variability was found to be greater for inconsistency in performance for the older adults in comparison to their younger counterparts for some tasks involving speed of processing. The inconsistency across the trials in reaction time experiments tends to increase with age. (Anstey, 1999; Fozard, Vercruyssen, Reynolds, Hancock, & Quilter, 1994; Salthouse, 1993). Thus, the above studies pointed out to the existing differences between males and females on certain psychomotor abilities, particularly the complex morphological aspects among the two genders and to evaluate any gender differences especially in inflectional and derivational processing skills.

CHAPTER 3- METHOD

The present study was aimed at investigating the effect of age and Stimulus- Onset Asynchrony (SOA) on the processing of English inflectional and derivational forms in Kannada- English bilingual individuals.

Participants

The total number of participants in the study was 40 normal individuals. The participants were divided into two groups: Group I, consisted of 20 young Kannada- English bilingual adults in the age range of 20- 30 years and Group II, consisted of 20 older Kannada- English bilingual adults in the age range of 50- 60 years. 10 males and 10 females were considered for the study in each group.

Participant Inclusion Criteria

- The participants were native speakers of Kannada.
- All the participants in the study had 12 years of formal education in Kannada and English.
- They had native- like proficiency in English (which was ensured using the LEAP- Q).
- They had normal or corrected- to- normal vision.

- The participants had normal speech, language, hearing, and communication skills at the time of the study (with no past history of any neurological or psychological problems).

Stimuli

Two sets of stimuli were prepared. One set consisted of the critical items [as in Silva & Clahsen, 2008] and another set consisted of filler items. In the present study, 120 critical prime- target pairs were used, and they were divided into 3 sets of 20 words each under the criteria of Identity (e.g., BOIL-BOIL), Test (e.g., WATCHED- WATCH) and Unrelated (e.g., HANG- OPEN) for the Experiments 1 and 3 which are for inflected past- tense '-ed' form at Stimulus Onset Asynchronies (SOAs) of 60 ms and 30 ms, respectively. For the Experiments 2 and 4, which are for the processing of derivational morpheme '-ness', 60 prime- target pairs were divided into the Identity (e.g., BOLD- BOLD), Test (e.g., KINDNESS- KIND), and Unrelated (e.g., LIMP- JUST) were presented at SOAs of 60 ms and 30 ms respectively. A set of 108 fillers were used, which were divided into a set of 54 pairs for experiments 1 and 3 and 54 pairs for experiments 2 and 4. The fillers had semantically unrelated pairs, nonword- word pairs, word- nonword pairs, and nonword- nonword pairs. The critical items were selected based on the frequency of occurrence rating as rated by three experienced Speech Language Pathologists. In addition to frequency of occurrence, the number of letters in the root word was also considered and each root word was not more than four to five letters in length. Therefore, each experiment consisted of 114 prime- target pairs, that is, 60 critical item pairs and 54 filler items. The list of the 120 critical items and 108 filler items is given in Appendix A, B and C.

Apparatus

DMDX software USA (Forster & Forster, 2003) was used for the stimuli presentation and for the computation of the reaction time and accuracy. A DELL 15 inches laptop was used for presentation of the visual stimuli.

Procedure

The participants were made to sit comfortably in a room with minimal auditory and visual distractions and the distance between the laptop screen and the participants' eye- level was adjusted according to the participants' convenience. Those individuals who were prescribed eyeglasses for correcting vision were asked to participate in the experiments with their eyeglasses. Participants were given the instruction to press the 'right arrow key' for true word and the 'left arrow key' for non- word on the keyboard of the laptop as quickly as possible for the target word, which will appear after a series of XXXXXX pattern and the prime. A practice trail of ten prime- target pairs were provided before the beginning of the actual lexical decision task experiments in order to make the participants familiar with the task. After a few practice trails for familiarization of the task, the stimulus will be presented to the participants through Dell Inspiron 15 inches laptop using DMDX software. There were four experiments- (1) Presentation of inflectional morpheme (*-ed)* word pairs at a Stimulus Onset Asynchrony of 60 ms, (2) Presentation of inflectional morpheme word pairs at a Stimulus Onset Asynchrony of 30 ms, (3) Presentation of derivational morpheme (*-ness*) word pairs at a Stimulus Onset Asynchrony of 60 ms, and (4) Presentation of derivational morpheme word pairs at a Stimulus Onset Asynchrony of 30 ms.

In each of the four experiments, the subjects were presented with three critical pairs of presentation of prime- target pairs: (1) ***Identical*** (e.g., pray-pray), (2) ***Test*** (e.g., prayed- pray), and (3) ***Unrelated*** (e.g., bake- pray/ cool-poor). In order to prevent the occurrence of the same target more than once, for each experiment, out of the 60 prime- target pairs, 20 were of the Identity-Target type, another 20 were of the Test- Target type and 20 were the Unrelated-Target type. A total of 54 filler words were also used in each of the experiments in order to prevent participants from developing expectations about the prime-target relations. Out of the 54 fillers, 14 pairs of existing words which were semantically unrelated to each other, the primes of which have either inflected or derived forms, 14 pairs of non-word/word pairs, 13 pairs of word/non- word pairs and 13 pairs of non-word/non-word pairs. These filler prime- target pairs were orthographically related. Half of the non-words were created by changing the onset of the first syllable of the existing words and the other half by changing the nucleus of the first syllable of existing words. The order of presentation of the stimuli was randomized by the DMDX software and the order of appearance of the stimuli to which the participants were exposed to differed from one participant to another.

DMDX software was used for the presentation, measurements of the stimulus reaction time and accuracy of responses. Each experiment had three visual events - (1) Forward mask consisting of series of Xs on the screen for 500 ms, followed by (2) Prime word which was displayed for 60 ms for experiments 1 and 2 and 30 ms for experiments 3 and 4, followed by (3) Target word presentation for 500 ms. The visual stimuli was presented in 72 font size on the laptop screen. The letters were black over a white background. The primes and the target words appeared in upper case at the centre of the laptop screen.

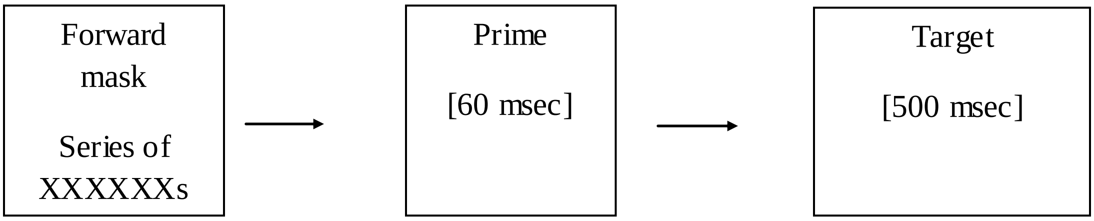

Figure 3. 1- Block diagram of the sequence of the three visual events in experiments 1 and 3

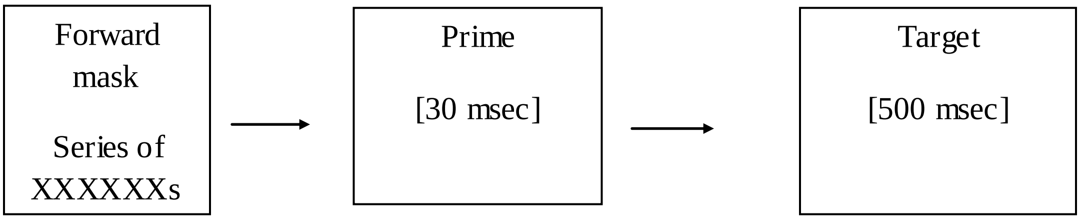

Figure 3. 2- Block diagram of the sequence of the three visual events in experiments 2 and 4

Each participant was presented with the experiments in the following order:

- Experiment 1
- Experiment 3
- Experiment 2
- Experiment 4

Experiment 1: Inflectional morpheme (past tense form '-ed') at a Stimulus Onset Asynchrony of 60 ms.

Experiment 3: Derivational morpheme ('-ness') at a Stimulus Onset Asynchrony of 60 ms.

Experiment 2: Inflectional morpheme (past tense form '-ed') at a Stimulus Onset Asynchrony of 30 ms.

Experiment 4: Derivational morpheme ('-ness') at a Stimulus Onset Asynchrony of 30 ms.

This was done to avoid some predictive strategies that might develop when the same set of stimuli are repeated across two successive experiments.

Scores and Analysis

The participants' scores that were recorded using DMDX software were saved in excel sheets. Then, the dependant variables like reaction times, percentage of correct responses (response accuracy), mean reaction time for the identity, test and unrelated conditions were obtained and a comparison was made between the two age groups (younger and older adults), between the two SOAs (60 ms and 30 ms) and between genders (males and females).

Statistical Analysis

Statistical analysis was performed for the reaction time, accuracy data using mixed ANOVA for between subject comparisons and repeated measures of ANOVA (Analysis of Variance) for within the subject comparisons were made.

CHAPTER 4 - RESULTS AND DISCUSSION

The present study was aimed at investigating the effects of age and stimulus- onset asynchrony (SOA) on the processing of English inflectional and derivational forms, that is, the regular past- tense inflectional form ‘ed’ and the derivational form ‘ness’ in normal Kannada- English bilingual individuals. The data that was obtained was analyzed and comparisons were made between the age groups (younger versus older adults), gender (males versus females), criteria or conditions (identity versus test versus unrelated) and morphological forms (inflectional versus derivational) for the reaction time, priming effect, and accuracy rate.

Reaction Time

Experiment 1 (inflectional at 60 ms SOA)

Males

As it can be seen from Table 4.1, the younger males (20 to 30 years) had shorter reaction times compared to the older group (50 to 60 years) of males. The mean reaction times were different between both the age groups across criteria (identity, test, and unrelated). The mean of reaction times were 407.67 ms for the younger males and 500.66 ms for the older adults for the inflectional form in the identity condition. The mean values for reaction time were again different between the two age groups in the test condition, which were greater than the mean reaction times obtained for the identity condition. The mean value of reaction times for the younger group of males was 421.04 ms, while it was 540.69 ms for the older group of males. There was further increase in mean values at the unrelated condition with the younger males obtaining a value of 451.44 ms and the older group obtaining a value of 562.56 ms, which indicates that there is a difference in the reaction times between the two age groups of males and also that the mean reaction times for the identity condition were the shortest, followed by the test and then the unrelated conditions.

Table 4.1
Mean reaction time and standard deviation (for the two groups of males)

Condition	Age group	Mean (SD)
Identity condition	Younger males	407.67 (31.81)
	Older males	500.66 (104.56)
Test condition	Younger males	421.04 (32.64)
	Older males	540.69 (107.29)
Unrelated condition	Younger males	451.44 (28.99)
	Older males	562.56 (148.61)

Females

Amongst the females, the younger females (20 to 30 years) had shorter reaction times compared to the older group (50 to 60 years) of females. Even for this group, the mean reaction times were different between both the age groups across criteria (identity, test, and unrelated) as noticed in males. The mean of reaction times were 371.43 ms for the younger females and 560.91 ms for the older adults for the identity condition. The mean values for reaction time also differed between the two age groups in the test condition. The mean value of reaction times for the younger group of females was 418.67 ms, while it was 600.10 ms for the older age group of females. There was a further increase in mean values at the unrelated condition with the younger females acquiring a value of 433.02 ms and the older group obtaining a value of 620.93 ms, which indicates that there is a difference in the reaction times between the two age groups of females and also that the mean reaction times for the identity condition were the shortest, followed by the test and then the unrelated conditions as seen in Table 4.2 given below.

Table 4.2
Mean reaction time and standard deviation values for younger and older females

Condition	Age Group	Mean (SD)
Identity condition	Younger females	371.43 (74.97)
	Older females	560.91 (121.18)
Test condition	Younger females	418.67 (79.22)
	Older females	600.10 (119.07)
Unrelated condition	Younger females	433.02 (77.08)
	Older females	620.93 (85.00)

Experiment 2 (inflectional at 30 ms SOA)

Males

At an SOA of 30 ms, there were differences in the reaction times for the younger and older groups of participants as already observed at 60 ms. As it can be seen from Table 4.3, the younger age group males had shorter reaction times compared to the older age group of males. There were differences in the mean reaction times between both the age groups for the three criteria (identity, test, and unrelated). In the identity condition, the mean of reaction times were

410.34 ms and 490.23 ms for the younger and older age group males respectively. The mean reaction times were 436.34 ms and 518.87 ms in the younger and older group of adults for the test condition. For the unrelated condition, the reaction times were different at both the ages and the mean of the reaction times was higher for this condition compared to the other two conditions. The younger males obtained a mean reaction time value of 474.66 ms and the older group of males obtained a value of 568.73 ms. The mean reaction time values were least in the identity condition and the highest for the unrelated condition, with the test condition was in the intermediate position with a mean between the identity condition and the unrelated condition means of reaction times.

Table 4.3
Mean and standard deviation of reaction times for males in experiment 2 (Inflectional at 30 ms)

Condition	Age Group	Mean (SD)
Identity condition	Younger males	410.34 (63.16)
	Older males	490.23 (93.19)
Test condition	Younger males	436.24 (41.01)
	Older males	518.87 (95.50)
Unrelated condition	Younger males	474.66 (68.73)
	Older males	568.73 (108.04)

Females

For the females, at an SOA of 30 ms, the younger females had shorter reaction times compared to the older group of females. Even for this group, the mean reaction times were different between both the age groups across criteria (identity, test, and unrelated) as noticed in males. The mean reaction times for the identity condition were the shortest, followed by the test and then the unrelated conditions as seen in Table 4.4 given below.

Table 4.4
Mean and standard deviation of RT between the two groups of females (inflectional at 30 ms SOA)

Condition	Age Group	Mean (SD)
Identity condition	Younger females	362.39 (39)
	Older females	633.55 (132.82)
Test condition	Younger females	394.20 (76.93)
	Older females	627.97 (99.37)
Unrelated condition	Younger females	418.08 (80.46)
	Older females	635.62 (122.34)

Experiment 3 (Derivational at 60 ms)

Males

For the derivational form at 60 ms, both groups had differences in their reaction times (RT). As it can be seen from Table 4.5, young males had shorter reaction times compared to the older age group (50 to 60 years) of males. There were differences in the mean reaction times between both the age groups for the three criteria (identity, test, and unrelated). In the identity condition, the mean of reaction times were 448.47 ms and 557.31 ms for the younger and older age group males respectively. The mean reaction times were 440.26 ms and 575.00 ms in the younger and older group of adults respectively for the test condition. For the unrelated condition, the reaction times were different at both the ages and the mean of the reaction times was higher for this condition compared to the other two conditions. The younger males obtained a mean reaction time value of 488.47 ms and the older group of males obtained a value of 626.96 ms. The mean reaction time values were least in the identity condition and highest for the unrelated condition, with the test condition was in the intermediate position between the identity condition and the unrelated condition.

Table 4.5
Mean and SD of reaction times for males in experiment 3 (derivational at 60 ms)

Condition	Age Group	Mean (SD)
Identity condition	Younger males	448.11 (57.33)
	Older males	557.31 (83.02)
Test condition	Younger males	440.26 (78.77)
	Older males	575.00 (100.69)
Unrelated condition	Younger males	488.47 (85.53)
	Older males	626.96 (121.12)

Females

For the females, the younger females (20 to 30 years) had shorter reaction times compared to the older group (50 to 60 years) of females. Even for this group, the mean reaction times were different between both the age groups across criteria (identity, test, and unrelated) as noticed in males. The mean of reaction times were 445.18 ms for the younger females and 650.72 ms for the older adults in the identity condition. The mean values for reaction time also differed between the two age groups in the test condition. The mean value of reaction times for the younger group of females was 480.43 ms, while it was 676.71 ms for the older age group of females. There was a further increase in mean values at the unrelated condition with the younger females acquiring a value of 526.84 ms and the older group obtaining a value of 634.22 ms, which indicates that there is a difference in the reaction times between the two age groups of males and also that the mean reaction times for the identity condition were the shortest, followed by the test and then the unrelated conditions as seen in Table 4.6.

Table 4.6
Mean and standard deviation of reaction time values between two groups of females

Condition	Age Group	Mean (SD)
Identity condition	Younger females	445.18 (95.15)
	Older females	650.72 (132.28)
Test condition	Younger females	480.43 (109.31)
	Older females	676.71 (170.96)
Unrelated condition	Younger females	526.84 (137.33)
	Older females	634.22 (69.28)

Experiment 4 (Derivational at 30 ms)

Males

At an SOA of 30 ms, as in Table 4.7, there are differences between the mean reaction times for younger and older adults, where it was observed that the younger males performed better than the older males.

Table 4.7
Mean and SD of reaction times for younger and older males (Derivational at 30 ms)

Experiment 4	Age Group	Mean (SD)
Identity condition	Younger males	445.44 (42.22)
	Older males	562.25 (86.28)
Test condition	Younger males	467.09 (41.28)
	Older males	572.81 (108.81)

Unrelated condition	Younger males	503.57 (50.99)
	Older males	604.85 (96.56)

Females

It can be inferred from the table 4.8 that the younger females had shorter reaction times compared to the older group of females. Even for this group, the mean reaction times were different between both the age groups across criteria (identity, test, and unrelated) as noticed in males. The mean of reaction times were higher in this experiment when compared to the first two experiments involving processing of the inflectional form.

Table 4.8
Mean and standard deviation of reaction time between the two groups of females.

Condition	Age Group	Mean (SD)
Identity condition	Younger females	453.43 (84.84)
	Older females	579.58 (64.61)
Test condition	Younger females	482.06 (81.57)
	Older females	667.81 (87.74)
Unrelated condition	Younger females	493.87 (83.15)
	Older females	606.63 (89.94)

In brief, the following findings were evident from the four experiments-

The mean reaction times were shorter for the younger group of participants compared to the older group in both the gender groups.

There was also an increasing trend in the mean of the reaction time values from identity- to - test - to - unrelated conditions for both the gender groups across all the four experiments (inflectional at 60 ms, inflectional at 30 ms, derivational at 60 ms, and derivational at 30 ms).

The mean RT values were higher at an SOA of 30 ms in comparison to those at an SOA of 60 ms for both the inflectional and derivational forms.

The means and standard deviations were compared between the age groups as there was not a very significant difference with respect to the gender. Mixed ANOVA results revealed that there is no statistical significant difference between genders, that is, males and females on reaction time measures in the four experiments. Hence, the mean and SD of reaction time across the four experiments were combined for both males and females and the values are shown in table 4.9.

Table 4.9
Mean RTs in milliseconds and SD for the two age groups, that is, the younger age group and the older age group.

Experiment	Condition	Age group	Mean	SD
Inflectional at 60 ms	Identity	Young	389.55	59.05
		Old	530.79	114.41
	Test	Young	419.86	58.98
		Old	570.40	114.44
	Unrelated	Young	442.23	57.46
		Old	591.74	121.85
Inflectional at 30 ms	Identity	Young	386.37	76.93
		Old	561.89	133.70
	Test	Young	415.22	63.76
		Old	573.42	110.13
	Unrelated	Young	446.37	78.40
		Old	602.18	117.45

Derivational at 60 ms	Identity	Young	446.65	76.47
		Old	604.01	117.69
	Test	Young	460.34	94.99
		Old	625.85	146.18
	Unrelated	Young	507.65	113.07
		Old	630.59	96.11
Derivational at 30 ms	Identity	Young	449.44	65.35
		Old	570.91	74.72
	Test	Young	474.57	63.39
		Old	620.31	107.84
	Unrelated	Young	498.72	67.31
		Old	605.74	90.82

From the Table 4.9, it can be observed that the mean reaction times are shorter for the participants of the younger age group compared to the older age group individuals for all the four experiments (inflectional at 60 ms, inflectional at 30 ms, derivational at 60 ms, and derivational at 30 ms) and for the three criteria (identity, test, and unrelated conditions), with higher total means obtained for the experiments 3 and 4 involving the derivational 'ness' form.

The reaction times obtained during the experiments were subjected to a mixed- design analysis of variance (ANOVA) with morphological form (inflectional and derivational), SOA (60 ms and 30 ms), and the conditions (identity, test, unrelated) as within- subject factors and age group (younger and older adults) and gender (males and females) as between- subject factors. Incorrect responses and reaction times lesser than 200 ms and greater than 1500 ms were excluded to eliminate outliers from the calculation of the reaction times.

Tests of Between- Subjects Effects

The following Table 4.10 gives the results for between- subject variables like group, gender and group x gender interaction.

Table 4.10

Tests of Between- Subjects Effects results

Variable	df	F value	p value
Group	(1, 36)	42.200	0.000 *
Gender	(1, 36)	1.682	0.203
Group x Gender	(1, 36)	2.967	0.094

(‘*’ indicates a statistical significant difference at 0.05 level)

There was significant main effect seen for the Group variable [F (1, 36) = 42.200, p < 0.05], but no significant main effect was observed for Gender [F (1, 36) = 1.682, p > 0.05], and no interaction effect was observed between Group x Gender [F (1, 36) = 2.967, p > 0.05]. Therefore, repeated measures ANOVA was performed for comparison of criteria (identity, test, and unrelated) for the younger (20 to 30 years) and older (50 to 60 years) age groups of participants separately.

Table 4.11

Tests of Within- Subjects Effects results

Parameters	df	F value	p value
Form	(1, 36)	21.144	0.000 *
SOA	(1, 36)	0.028	0.867
Criteria	(2, 72)	38.018	0.000 *
Form x group	1	0.814	0.373
Form x gender	1	0.207	0.652
SOA x group	1	0.074	0.788
SOA x gender	1	0.330	0.569
Criteria x group	2	1.932	0.152

Criteria x gender	(2, 72)	5.266	0.007 *
Form x SOA	(1, 36)	1.064	0.309
Form x criteria	(2, 72)	0.434	0.650
SOAx criteria	(2, 72)	0.212	0.810
Form x Group x gender	1	3.713	0.062
SOA x group x gender	1	1.417	0.242
Criteria x group x gender	2	3.260	0.044 *
Form x duration x group	1	1.647	0.208
Form x duration x gender	1	1.175	0.286
Form x Criteria x group	2	1.112	0.334
Form x Criteria x gender	2	1.131	0.328
SOA x Criteria x group	2	0.036	0.965
SOA x Criteria x gender	2	0.625	0.538
Form x SOA x criteria	2	3.049	0.054
Form x SOA x group x gender	1	1.891	0.178
Form x	2	1.093	0.341

Criteria x group x gender			
SOA x criteria x group x gender	2	0.847	0.433
Form x SOA x Criteria x group	2	1.539	0.222
Form x SOA x criteria x gender	2	2.032	0.139
Form x SOA x criteria x group x gender	(4, 180)	4.474	0.015 *

('*' indicated a statistical significant difference at 0.05 level)

From the Table 4.10, Mixed ANOVA revealed a significant main effect for morphological form [F (1, 36) = 21.144, p < 0.05] and Criteria [F (2, 72) = 38.018, p < 0.05]. There was no main effect for duration [F (1, 36) = 0.028, p > 0.05]. There was an interaction effect noticed between Criteria x Gender [F (2, 72) = 5.266, p < 0.05]. However, there was no interaction effect noticed for the other variables except for Form x Duration x Criteria x Group x Gender [F (4, 180) = 4.474, p < 0.05].

1. Inflectional at 60 ms SOA

a) Younger group

Tests of Within- Subjects effects revealed the following findings for Group I (younger adult participants)

Table 4.12

Results of Tests of Within- Subjects effect for inflectional forms at 60 ms for group I

Parameter	df	F value	p value
Inflectional at 60 ms	(2, 36)	33.383	0.000

As it can be observed from Table 4.12, there is a significant difference in performance in the younger age group [F (2, 36) = 33.383, p < 0.05] within the experiment 1 (inflectional at 60 ms). Further, Pair wise Comparisons were made between the identity, test and unrelated conditions for the first experiment using the Bonferroni test for adjustment for multiple comparisons, based on estimated marginal means the mean difference was significant at the 0.05 level between all the three criteria as seen in Table 4.13. There was significant difference between identity- test, identity- unrelated, and test- unrelated.

Table 4.13

Results of Bonferroni test for multiple comparisons for inflectional form 60 ms SOA for the younger groups.

Criteria pairs	Mean difference	Significance level
Identity- Test	-30.308 *	0.001
Identity- Unrelated	-52.684 *	0.000
Test- Unrelated	-22.376 *	0.001

('*' indicates a statistically significant difference at 0.05 level)

b) *Older group*

Tests of Within- Subjects effects revealed the following findings for Group II (older adult participants)

Table 4.14
Results of Tests of Within- Subjects effect for inflectional forms at 60 ms for group II

Parameter	df	F value	p value
Inflectional at 60 ms	(2, 38)	6.580	0.004 *

('*' indicates statistical significant difference at 0.05 level)

It can be observed from Table 4.14 that there is a significant difference in performance in the older age group [F (2, 38) = 6.580, p < 0.05] within the experiment 1 (inflectional at 60 ms).

Further, Pair-wise comparisons were made between the identity, test and unrelated conditions for the first experiment using the Bonferroni test for adjustment for multiple comparisons, based on estimated marginal means the mean difference was significant at the 0.05 level between all the three criteria. There was significant difference between identity- unrelated conditions only as shown in Table 4.15. There was no statistically significant difference between the identity- test, and test- unrelated.

Table 4.15
Results of Bonferroni test for inflectional form at 60 ms SOA for the older age group

Criteria pairs	Mean difference	Significance level
Identity- Test	-39.610	0.108
Identity- Unrelated	-60.956 *	0.007
Test- Unrelated	-21.346	0.619

('*' indicates a statistically significant difference at 0.05 level)

2. Inflectional at 30 ms

a) Younger group

Tests of Within- Subjects effects revealed the following findings for Group I (younger adult participants)

Table 4.16
Results of Tests of Within- Subjects effect for inflectional forms at 30 ms in group I

Parameter	df	F value	p value
Inflectional at 30 ms	(2, 38)	22.466	0.000 *

('*' indicates statistical significant difference at 0.05 level)

As it can be observed from Table 4.16, there is a significant difference in performance in the younger age group [$F (2, 38) = 22.466$, $p < 0.05$] within the experiment 2 (inflectional at 30 ms) among the three conditions. Further, Pairwise comparisons were made between the identity, test and unrelated conditions for the second experiment (inflectional at 60 ms SOA) using the Bonferroni test for adjustment for multiple comparisons, based on estimated marginal means the mean difference was significant at the 0.05 level between the three criteria. Results revealed that there was significant difference between identity- test, identity- unrelated, test- identity, test- unrelated, unrelated- identity, and unrelated- test conditions.

Table 4.17
Results of Bonferroni test for inflectional form at 30 ms for young groups

Criteria pairs	Mean difference	Significance level
Identity- Test	-28.854 *	0.010
Identity- Unrelated	-60.008 *	0.000
Test- Unrelated	-31.154	0.006

('*' indicates a statistically significant difference at 0.05 level)

b) *Older group*

Tests of Within- Subjects effects revealed the following findings for Group II (older adult participants).

Table 4.18

Results of Tests of Within- Subjects effect for inflectional forms at 30 ms in group II

Parameter	Df	F value	p value
Inflectional at 30 ms	(2, 38)	4.260	0.021 *

It can be observed from Table 4.18 that there is a significant difference in performance in the older age group [F (2, 38) = 4.260, p < 0.05] within the experiment 2 (inflectional at 30 ms) between these conditions.

Further, Pairwise comparisons were made between the identity, test and unrelated conditions for the second experiment using Bonferroni test for adjustment for multiple comparisons, based on estimated marginal means the mean difference was significant at the 0.05 level between the three criteria. There was significant difference observed between identity- unrelated, and unrelated- identity conditions only. There was no statistically significant observed difference between the identity- test, test- identity, test- unrelated, and unrelated- test conditions.

Table 4.19
Results of Bonferroni test for inflectional forms at 30 ms SOA for the older age groups

Criteria pairs	Mean difference	Significance level
Identity- Test	-11.529	1.000
Identity- Unrelated	-40.285 *	0.028
Test- Unrelated	-28.756	0.237

('*' indicates a statistically significant difference at 0.05 level)

3. Processing of derivational form at 60 ms

a) Younger group

Tests of Within- Subjects effects revealed the following findings for Group I (younger adult participants)

Table 4.20
Results of Tests of Within- Subjects effect for derivational forms at 60 ms

Parameter	df	F value	p value
Derivational at 60 ms	(2, 38)	11.714	0.000 *

('*' indicates a statistically significant difference at 0.05 level)

As it can be observed from Table 4.20, there is a significant difference in performance in the younger age group [$F(2, 38) = 11.714$, $p < 0.05$] within the experiment 3 (derivational at 60 ms). Further, Pair-wise Comparisons were made between the identity, test and unrelated conditions for the third experiment using the Bonferroni test for adjustment for multiple comparisons, based on estimated marginal means the mean difference was significant at the 0.05 level between identity- unrelated and unrelated- test conditions.

Table 4.21
Results of Bonferroni test for derivational form at 60 ms SOA for the young group

Criteria pairs	Mean difference	Significance level
Identity- Test	-13.697	0.969
Identity- Unrelated	-61.008 *	0.003
Unrelated- Test	47.310 *	0.000

('*' indicates a statistically significant difference at 0.05 level)

b) Older group

Tests of Within- Subjects effects revealed the following findings for Group II (older adult participants)

Table 4.22
Results of Tests of Within- Subjects effect for derivational forms at 60 ms SOA in group II

Parameter	df	F value	p value
Derivational at 60 ms	(2, 38)	0.610	0.549

Table 4.22 indicates that there is no significant difference in performance in the older age group [F (2, 38) = 0.610, p > 0.05] between the three conditions in experiment 3.

4. Processing of derivational form at 30 ms SOA

a) Younger group

Tests of Within- Subjects effects revealed the following findings for Group I (younger adult participants)

Table 4.23
Results of Tests of Within- Subjects effect for inflectional forms at 60 ms

Parameter	df	F value	p value
Derivational at 30 ms	(2, 38)	15.371	0.000 *

('*' indicates a statistically significant difference at 0.05 level)

Table 4.23 shows that there is a significant difference in performance in the younger age group [F (2, 38) = 15.371, p < 0.05] between the three conditions in experiment 4 (derivational at 30 ms). Further, Pair-wise comparisons were made between the identity, test and unrelated conditions for the fourth experiment using Bonferroni test for adjustment for multiple comparisons, based on estimated marginal means the mean difference was significant at the 0.05 level between the three criteria. Results showed that significant difference was found between identity- test, identity- unrelated, test- identity, and unrelated- identity conditions as seen in Table 4.24.

Table 4.24
Results of Bonferroni test for derivational from at 30 ms SOA for the younger group of adults

Criteria pairs	Mean difference	Significance level
Identity- Test	-25.137 *	0.011
Identity- Unrelated	-49.283 *	0.000
Test- Unrelated	-24.146	0.060

('*' indicates a statistically significant difference at 0.05 level)

b) Older group

Tests of Within- Subjects effects revealed the following findings for Group II

Table 4.25
Results of Tests of Within- Subjects effect for derivational forms at 30 ms SOA in older group

Parameter	df	F value	p value
Derivational at 30 ms	(2, 38)	3.236	0.050

It can be observed from Table 4.25 that there is a significant difference in performance in the older age group [F (2, 38) = 3.236, p = 0.05] between the three conditions. Further, Pairwise comparisons were made between the identity, test and unrelated conditions for the fourth experiment using Bonferroni test for adjustment for multiple comparisons, based on estimated marginal means the mean difference was significant at the 0.05 level between the three criteria. There was significant difference between identity- unrelated, and unrelated- identity conditions only. There was no statistically significant difference between the identity- test, test- identity, test- unrelated, and unrelated- test conditions.

Table 4.26
Results of Bonferroni test for derivational form at 30 ms for the older groups

Criteria pairs	Mean difference	Significance level
Identity- Test	-49.399	0.084
Identity- Unrelated	-34.830 *	0.043
Test- Unrelated	14.570	1.000

('*' indicates a statistically significant difference at 0.05 level)

The current study investigated the processing of inflectional form 'ed' and the derivational form 'ness'. The prime durations were as low as 60 ms and 30 ms. According to Lavric, Clapp and Rastle (2007), when the SOA is 60 ms, there is a possibility that the semantic features of the prime become accessible partially. To avoid this, the SOA was reduced to 30 ms as there are no studies so far to say that there is accessibility to the semantic features of the prime at such a low SOA. The reaction times were calculated for the inflectional and the derivational forms at 60 ms and 30 ms. The results showed a difference in the reaction times for the younger and the older adults. The younger adults performed better than the older adults for both the inflectional and derivational forms. There was a difference between the inflectional and derivational processing in the participants of the present study. The performance was better for the inflectional forms in comparison to the derivational forms. The reaction times were shorter for the inflectional forms at an SOA of 60 ms in the older males compared to the reaction times for the inflectional forms at 30 ms. This could be due to the excessively short duration for which the prime was presented that can increase the cognitive load in the individual. This was evident in the older group of adults, which could indicate that changes might happen in the processing of complex morphological forms as a result of aging. Both the young and older group of individuals had shortest reaction times for the identity condition, followed by the test condition and the longest reaction times were found in the unrelated condition. All the participants showed a repetition priming effect, which is, exhibiting shorter reaction times in comparison to the condition in which unrelated primes were used in both the experiments of inflectional forms at 60 ms and 30 ms SOA.

The study was also aimed at observing whether there were any differences in the reaction times or accuracy for both the genders. In the current study, females performed better than males in the experiments and also had fewer errors than men. This contradicts the findings by Thornson et al. (2011) that women performed worse than men on reaction time and made more errors.

(ii) Priming effect

The priming effect was described by Silva and Clahsen (2008) in their study on morphologically complex words processing in L1 and L2 processing. For measuring priming, the difference between the 'identity- test' conditions and 'test- unrelated' conditions has to be considered. If the reaction times are shorter in the *'identity'* and *'test'* conditions than those in the unrelated condition, but there are no differences between the '*identity'* and '*test'* conditions with respect to their reaction times, it is known as 'Full Priming'. This means that the test condition items are equally efficient in priming like the identity primes. If the reaction times for the *'test'* condition are longer than the reaction times for the *'identity'* condition, but are shorter than the '*unrelated'* condition, it is known as 'Partial Priming'. On the other hand, if the reaction times for the 'test' and 'unrelated' conditions are almost similar, without much difference in their values, it is said that it is a 'No priming' state.

With respect to the current study, the mean reaction times were calculated for the participants for the three criteria of identity, test, and unrelated within each of the four experiments which included, inflectional at 60 ms SOA, inflectional at 30 ms SOA, derivational at 60 ms SOA, and derivational at 30 ms SOA. A comparison of the priming effect was made between the younger group (20 to 30 years) and the older group (50 to 60 years) of participants. The result is discussed for each experiment separately.

Experiment 1 (Inflectional at 60 ms)

For Group I (younger adults), there was *partial priming* noticed as the mean difference in reaction times for the identity and test conditions were significantly different with a value of -30.308 ms and the unrelated condition, but there was a significant difference that was noticed between the identity and the test conditions also by -22.376 ms.

The older group of adults exhibited no significant difference between the identity and test conditions and also between the test and unrelated conditions, which led to a 'no priming effect'.

Experiment 2 (Inflectional at 60 ms)

For Group I, there was *partial priming* noticed as the mean difference in reaction times for the identity and test conditions were significantly different with a value of -28.854 ms and the unrelated condition, but there was a significant difference that was noticed between the identity and the test conditions also by -31.154 ms.

There was no significant difference between the identity and test conditions and also between the test and unrelated conditions, in the older group of individuals, which led to a 'no priming effect'.

Experiment 3 (Derivational at 60 ms)

For the young participants, there was *full priming* noticed as the mean difference in reaction times for the identity and test conditions was not significantly different with a value of 13.697 ms, but there was a significant difference that was noticed between the test and the unrelated conditions by 47.310 ms.

The older adults showed a 'no priming effect' as the difference between the identity and test conditions and also between the test and unrelated conditions, were significantly high.

Experiment 4 (Derivational at 30 ms)

The group 1 participants had a *partial priming effect* as the mean difference in reaction times for the identity and test conditions and between the test and the unrelated conditions also were significant.

The older group of participants showed no significant difference between the identity and test conditions and between the test and unrelated conditions. This was a 'no priming effect'.

Therefore, the findings reveal the difference in the priming effect in both the age groups for the four experiments. There was partial priming effect for the inflectional form at SOAs 60 ms and 30 ms, derivational form at 30 ms SOA and full priming for the derivational form at 60 ms in the younger adults during processing. The older age group showed no priming effect for all the four experiments.

Table 4.27 Comparison of priming effect in younger adults in the four experiments

SI. No.	Morphological forms at different SOAs	Full Priming	Partial Priming	No Priming
1	Inflectional form at 60 msec SOA		Present	
2	Inflectional form at 30 msec SOA		Present	
3	Derivational form at 60 msec SOA	Present		
4	Derivational form at 30 msec SOA		Present	

Table 4.28 Comparison of priming effect in older adults in the four experiments

SI. No.	Morphological forms at different SOAs	Full Priming	Partial Priming	No Priming
1	Inflectional form at 60 msec SOA			Present
2	Inflectional form at 30 msec SOA			Present
3	Derivational form at 60 msec SOA			Present
4	Derivational form at 30 msec SOA			Present

In the current study, the results for priming effect were different between the age groups and also for the four experiments. There was partial priming for the young adults for the inflectional form at 60 ms, 30 ms SOA and for the derivational form at 30 ms SOA. For the derivational form, at 60 ms

SOA, there was full priming in the younger adults. The older group of adults did not show any priming effects for any of the experiments.

There have been several studies that compared between the priming effects for the inflectional and derivational forms and the results revealed that the priming effect is stronger for the regular inflectional forms than for the derivational forms (Clahsen, Sonnenstuhl and Blevins (2003). There has been a priming effect noticed for the derivational forms also in the literature. The findings of the present study are consistent with the findings of many studies that there is a priming effect for words that are morphologically complex. (Stanners, Neiser, Hermon, & Hall, 1979). A 'partial priming effect' is said to occur when there is difference in the reaction time values between test and unrelated conditions and also between the identity and test conditions. This indicates that the effect of priming is not similar when the prime is just the root word as seen in the identity condition to the test condition when the prime is a complex morphological form, like the primes having the 'ed' for attached to the root word or the 'ness' form attached to the root word. In a study done by Silva and Clahsen (2008), there was 'full priming' for the native speakers of English for the inflectional regular past- tense 'ed' form, but 'no priming effect' was observed for the L2 learners of English (who were native speakers of Chinese, German, and Japanese) due to the 'ed' forms on the root word at an SOA of 60 ms as their reaction time values were almost similar for both the test and unrelated conditions. They say that this is because the L2 learners were not using the structure of the morphology to recognize the past- tense verb forms. This shows that 'partial priming' had taken place as against the 'no priming effect' seen for L2 speakers of Chinese and German who were also between 21 to 30 years of age. The findings in the study done by Silva and Clahsen (2008) for the inflectional past- tense form at an SOA of 30 ms showed similar results like in the experiment where the SOA was 60 ms. There was full priming for the native speakers of English, while there was 'no priming effect' for the L2 speakers of English. The results of the present study were not in harmony with these findings. The younger group of adults showed a 'partial priming effect' as the reaction times differences between the identity and test conditions and the test and unrelated conditions were significantly different. The older group of individuals showed 'no priming' as the reaction times of test and unrelated were not significantly different. Studies by Diependale, Dunabeitia, Morris and Keuleers (2011) found facilitation effect for the derivationally- related prime and pairs even in L2 learners of English. A study by Silva and Clahsen (2008) showed that for the derivational form 'ness', there was 'full priming' for the native speakers of English and a 'partial priming effect' for the L2 learners of English. The present study was also in accordance with the previous study as a 'full priming effect' was noticed for the younger adults, while the older adults demonstrated a 'no priming effect'. However, at 30 ms SOA, the adults between 20 to 30 years showed a 'partial priming effect', while the adults between 50 to 60 years did not show any priming effects.

(iii) Accuracy

a) Experiment 1 (Inflectional at 60 ms SOA)

Males

Table 4.29 shows that the younger males (20 to 30 years) had 100 % mean accuracy rates across all the three criteria of identity, test, and unrelated.

The older group of males performed with > 95% mean accuracy in all the three conditions. It was found that the mean accuracy was higher in young males in comparison to the older males. The unrelated condition had more errors when compared to the other two conditions.

Table 4.29
Mean accuracy percentage and standard deviation for younger and older group of males and females

Criteria	Age group	Mean (SD) Males	Mean (SD) Females
Identity Condition	Younger group	100.00 (0.00)	100.00 (0.00)
	Older group	96.00 (7.74)	99.50 (1.58)
Test Condition	Younger group	100.00 (0.00)	100.00 (0.00)
	Older group	94.00 (8.43)	98.50 (8.43)
Unrelated Condition	Younger group	100.00 (0.00)	100.00 (0.00)
	Older group	92.50 (12.07)	99.00 (2.10)

Females

The younger females (20 to 30 years) had 100 % mean accuracy rates for all the three criteria of identity, test, and unrelated. The mean accuracy rates for the older group of females were > 98% for the identity, test, and unrelated conditions respectively. It was found that younger females achieved 100% accuracy as young males. The older group of females made more errors in the processing of inflectional forms at 60 ms SOA.

b) Experiment 2 (Inflectional at 30 ms)

Males

The younger age group scored > 99%, and 99.5% in all the three criteria, while, the older age group participants did not have 100% accuracy.

Table 4.30
Mean accuracy percentage and standard deviation for younger and older groups of participants

Criteria	Age group	Mean (SD) Males	Mean (SD) Females
Identity Condition	Younger group	100.00 (0.00)	100.00 (0.00)
	Older group	97.00 (7.88)	99.50 (1.58)
Test Condition	Younger group	99.00 (2.10)	100.00 (0.00)
	Older group	96.50 (7.83)	99.00 (1.58)
Unrelated Condition	Younger group	99.50 (1.58)	99.00 (2.10)
	Older group	95.50 (6.43)	98.00 (4.83)

Females

The younger females performed with higher percentage of accuracy than the older group of females. The older females made more errors in the unrelated condition.

c) Experiment 3 (Derivational at 60 ms)

Males

Participants of the younger age group performed better than those belonging to the older age group. However, there was not a significant difference that was noticed.

Table 4.31
Mean accuracy percentage and standard deviation for younger and older adults

Criteria	Age group	Mean (SD) Males	Mean (SD) Females
Identity condition	Younger group	100.00 (0.00)	99.00 (2.10)
	Older group	97.00 (7.88)	97.50 (5.40)
Test condition	Younger group	100.00 (0.00)	97.50 (4.85)
	Older group	96.00 (7.74)	96.50 (7.83)
Unrelated condition	Younger group	98.50 (3.37)	97.50 (6.34)
	Older group	95.50 (6.43)	96.50 (7.47)

Females

The younger females had mean accuracy rates of above 97% for all the three criteria of identity, test, and unrelated. The mean accuracy rates for the older group of females were 97.50 %, 96.50 %, and 96.50 % for the identity, test, and unrelated conditions respectively.

d) Experiment 4 (Derivational at 30 ms)

Males

Table 4.32 indicates that the younger males (20 to 30 years) had > 98% accuracy rates for all the three criteria, whereas, the older group of males performed with > 95% of accuracy in all the three criteria. The performance was poorest for both the age groups in the unrelated condition.

Table 4.32
Mean accuracy percentage and standard deviation for younger and older participants

Criteria	Age group	Mean (SD) Males	Mean (SD) Females
Identity condition	Younger group	99.50 (1.58)	99.00 (2.10)
	Older group	97.50 (4.85)	97.50 (5.40)
Test condition	Younger group	99.00 (2.10)	98.00 (2.58)
	Older group	96.50 (4.74)	98.50 (3.37)
Unrelated condition	Younger group	98.00 (3.49)	95.50 (3.68)
	Older group	95.50 (6.43)	96.50 (7.47)

Females

There was no difference noticed for the younger and older females in terms of their mean accuracy rates.

Table 4.33
Overall mean accuracy percentage and standard deviation for younger and older groups

Experiment	Condition	Age group	Mean	SD
Inflectional at 60 ms	Identity	Young	100.00	0.00
		Old	97.75	5.72
	Test	Young	100.00	0.00
		Old	96.25	6.46
	Unrelated	Young	100.00	0.00
		Old	95.75	9.07

Inflectional at 30 ms	Identity	Young	100.00	0.00
		Old	98.25	5.68
	Test	Young	97.25	6.58
		Old	98.25	5.68
	Unrelated	Young	99.50	1.53
		Old	96.75	5.68
Derivational at 60 ms	Identity	Young	99.50	1.53
		Old	97.25	6.58
	Test	Young	98.75	3.58
		Old	96.25	7.58
	Unrelated	Young	97.50	3.44
		Old	94.25	10.16
Derivational at 30 ms	Identity	Young	99.25	1.83
		Old	97.50	5.50
	Test	Young	98.50	4.13
		Old	97.50	4.13
	Unrelated	Young	96.75	3.72
		Old	95.00	7.60

b

Table 4.32 indicates that there is a difference in mean accuracy across the criteria, that is, the identity condition has the best score, followed by the test condition. The unrelated condition had the least scores. Mixed ANOVA was done for the mean accuracy rates obtained during the experiments with morphological form (inflectional and derivational), prime duration (60 ms and 30 ms), and the criteria (identity, test, unrelated) as within- subject factors and age group (younger and older adults) and gender (males and females) as between- subject factors.

Table 4.34
Tests of Within- Subjects Effects results

Parameters	df	F value	p value
Form	(1,36)	4.369	0.044 *
Criteria	(2,72)	15.054	0.000 *
Formx gender	(1,36)	5.053	0.031*
Formx criteria	(2,72)	4.751	0.012 *

('*' means that there is a statistically significant difference at 0.05 level)

From the Table 4.34, Mixed ANOVA revealed a significant main effect for Form [F (1, 36) = 4.369, p < 0.05] and Criteria [F (2, 72) = 15.054, p < 0.05]. There was no main effect for duration [F (1, 36) = 0.506, p > 0.05]. There was a two- way interaction noticed between Form x Gender [F (1, 36) = 5.053, p < 0.05], Form x Criteria [F (2, 72) = 4.751, p < 0.05].

Tests of Between- Subjects Effects

The Table 4.35 gives the results for between- subject variables like Group, Gender and Group x Gender interaction.

Table 4.35
Tests of Between- Subjects Effects Results

Variable	Df	F value	p value
Group	(1,36)	3.513	0.069
Gender	(1,36)	0.289	0.594
Group x Gender	(1,36)	1.265	0.268

There was no significant main effect observed for the Group variable [F (1, 36) = 3.513, p > 0.05], Gender [F (1, 36) = 0.289, p > 0.05] and no interaction effect was noticed between Group x Gender [F (1, 36) = 1.265, p > 0.05]. Therefore, repeated measures ANOVA was performed for comparison of criteria (identity, test, and unrelated) for both the younger and older adults.

(i) Inflectional processing at 60 ms (Experiment 1)

a) Younger groups

Tests of Within- Subjects effects revealed the following findings

Table 4.36
Results of Tests of Within- Subjects effect for inflectional forms at 60 ms SOA

Parameter	df	F value	p value
Inflectional at 60 ms	(2,78)	1.899	0.157

As it can be observed from Table 4.36, there is no significant difference in performance between the three criteria [F (2, 78) = 1.899, p > 0.05] in experiment 1.

Experiment 2 (Inflectional at 30 ms)

Tests of Within- Subjects effects revealed the following findings

Table 4.37
Results for Tests of Within- Subjects effect for inflectional forms at 30 ms

Parameter	df	F value	p value
Inflectional at 30 ms	(2, 78)	4.109	0.06

As it can be observed from Table 4.37, there is no significant difference in performance in the younger age group [F (2, 78) = 4.109, p > 0.05] within the experiment.

Experiment 3 (Derivational at 60 ms)

Tests of Within- Subjects effects revealed the following findings

Table 4.38
Results of Tests of Within- Subjects effect for derivational forms at 60 ms SOA

Parameter	df	F value	p value
Derivational at 60 ms	(2, 78)	6.654	0.002 *

The Table 4.38 shows that there is a significant difference in performance [F (2, 78) = 6.654, p < 0.05] between the three criteria. Further, Pairwise comparisons were made between the identity, test and unrelated conditions for the third experiment using Bonferroni test for adjustment for multiple comparisons, based on estimated marginal means the mean difference was significant at the 0.05 level between all the three criteria. There was significant difference between identity- unrelated and unrelated- identity conditions.

Table 4.39
Pair-wise comparisons of the differences for the three criteria (identity, test, and unrelated) in experiment 3 (derivational at 60 ms)

Criteria pairs	Mean difference	Significance level
Identity- Test	0.875	0.327
Identity- Unrelated	2.500 *	0.012
Test- Unrelated	1.625	0.078

(‘*’ indicates statistical significant difference at 0.05 level)

Experiment 4 (Derivational at 30 ms)

Tests of Within- Subjects effects revealed the following findings

Table 4.40
Results for Tests of Within- Subjects effect for derivational forms at 30 ms

Parameter	df	F value	p value
Derivational at 30 ms	(2,78)	10.226	0.000 *

Table 4.40 shows that there is a significant difference in performance in the experiment for the three criteria [F (2, 78) = 10.226, $p < 0.05$]. Further, Pairwise comparisons were made between the identity, test and unrelated conditions for the fourth experiment using Bonferroni test for adjustment for multiple comparisons, based on estimated marginal means the mean difference was significant at the 0.05 level between the three criteria. Results revealed that significant difference was observed between identity- unrelated, test- unrelated and not for identity and test conditions.

Table 4.41
Pair-wise comparisons of the differences for the three criteria (identity, test, and unrelated) in experiment 4 (derivational at 30 ms)

Criteria pairs	Mean difference	Significance level
Identity- Test	0.875	0.327
Identity- Unrelated	2.500 *	0.012
Test- Unrelated	1.625	0.078

('*' indicates statistical significant difference at 0.05 level)

The table 4.41 reveals a significant difference between the identity and unrelated pairs and not between identity- test and test- unrelated.

In this study, accuracy rates in the priming experiment were higher for the younger age group of participants. The number of errors made by the two groups of participants was not very different. The number of errors was more in the unrelated condition and for the processing of derivational forms in the participants. The males made more errors than females which contradicts Thornson et al. (2011) study that the number of errors was more in females in reaction time measures. In the current study, the performance was poorer at 30 ms SOA for both inflectional and derivational forms as there is no possibility for semantic priming to occur at this SOA and that the very short duration of the prime increases the cognitive load in the individuals. The processing of derivational form at 60 ms SOA in younger group showed a full priming effect, that is, even the primes were as effective as the root primes in priming. This supports the supralexical hypothesis. The findings also find support in the Dual-mechanism models, where the morphological forms are parsed first before accessed from the mental lexicon.

CHAPTER 5 - SUMMARY AND CONCLUSION

Priming

Priming is defined as a memory form that is not conscious that brings about a change in the ability of the person in classifying, or identifying a particular item due to a previous exposure to that item or an item that is related to it.

Priming experiments are of importance to investigate whether the presentation of a '*prime*' before the '*target'* can increase the accuracy of performance and reduce the reaction time (facilitation), or reduces the accuracy of performance or increases the reaction time. Priming involves presenting material before the word to which a response has to be made. One of the most common paradigms involves presenting one word prior to the target word to which a response has to be given. The first word is called the *prime* and the word to which a response has to be made is called the *target*. The time between the onset of the prime to the onset of the target is called the *Stimulus- Onset Asynchrony* (SOA).

In masked priming experiments, if the mask appears before the prime, it is known as forward masking. Masking the prime stimulus prevents the visual system from taking up additional information about the prime word once the mask is displayed. At very short prime exposure durations, semantic priming (doctor – nurse) does not occur. However, very strong priming happens for morphological primes, which might disappear at longer SOAs.

Studies conducted previously related to the morphological priming experiments were conducted in languages like English, Hebrew, German, French, and others, but the findings from these studies are not to be generalized to the Indian languages as the language structure in the Indian languages is different from the language structure of the other non- Indian languages. The processing of morphological forms in Kannada- English bilinguals could be different as the morphological structure is different in Kannada and English. In Kannada, there are separate morphological markers for the masculine and feminine genders, whereas in English, there are no differences in the morphological markers for the genders. Therefore, the present study was aimed at understanding how the processing of two morphological forms, that is, the English inflectional ‘ed’ and derivational ‘ness’ forms occurs in normal native speakers of Kannada with English as the L2.

In the current study, the effect of Stimulus Onset Asynchrony and age were investigated in Kannada- speaking adults for four experimental conditions like the inflectional form at 60 ms SOA, inflectional form at 30 ms SOA, derivational form at 60 ms SOA, and derivational form at 30 ms SOA for three criteria within each experiment, like the identity, test, and unrelated conditions. Since there have been no studies done in the Indian population based on these parameters, this study was taken up to investigate these issues.

The total number of participants in the study were 40 normal adults, who were divided into two groups: Group I, consisting of 20 younger Kannada- English bilingual adults in the age range of 20- 30 years and Group II, consisting of 20 older Kannada- English bilingual adults in the age range of 50- 60 years. Equal number of males and females were considered for the study in each group.

All the participants were native speakers of Kannada, they had 12 years of formal education in Kannada and English, they had native- like proficiency in English, and they had normal or corrected- to- normal vision. The participants had normal speech, language, hearing, and communication skills at the time of the study (with no past history of any neurological or psychological problems). A total of 120 English word pairs were used. These 120 critical items were divided into one set of 60 prime- target pairs that were used for the experiments involving inflectional morpheme '-ed' in which the prime durations or the Stimulus Onset Asynchronies (SOAs) were 60 ms and 30 ms and another set consisting of 60 prime- target pairs having the derivational morphological marker '-ness' for SOAs of 60 ms and 30 ms. A total of 108 filler items were also prepared and divided into two sets, with each set consisting of 54 items. One of these sets was used for the inflectional form processing at 60 ms SOA and inflectional form processing at 30 ms SOA. Another set of these fillers was used for the experiments derivational at 60 ms SOA and derivational at 30 ms SOA. The fillers had prime- target pairs that fulfilled four criteria such as semantically unrelated pairs, nonword- word pairs, word- nonword pairs, and nonword- nonword pairs. Therefore, each experiment consisted of 114 prime- target pairs, that is, 60 critical item pairs and 54 filler items. DMDX software was used for the stimuli presentation and for the computation of the reaction time and accuracy. A DELL 15 inches laptop was used for presentation of the visual stimuli.

The reaction time and the accuracy rates were measured and the statistical analysis was done using the SPSS software. The statistical tests performed to compare between the inflectional and derivational form processing, identity, test and unrelated conditions, the two SOAs, genders, and age groups were mixed ANOVA and repeated measures of ANOVA.

The following are the findings of the present study

(i) When the analysis of the reaction time data was done, there was a more significant difference in values between the two age groups. The younger adult participants had shorter reaction times compared to the older group in both the gender groups.

(ii)There was a gender difference in reaction time. Though the females had shorter reaction times than males, there was no statistical significant difference between them.

(iii) The reaction times were shorter for the processing of inflectional forms compared to the derivational forms.

(iv) Amongst the three criteria, the identity condition had the fastest reaction times, next in order was the test condition and it was highest for the unrelated condition. There was also an increasing trend in the mean of the reaction time values from identity- to - test - to - unrelated conditions for both the gender groups across all the four experiments (inflectional at 60 ms, inflectional at 30 ms, derivational at 60 ms, and derivational at 30 ms).

(v) The mean RT values were higher at an SOA of 30 ms in comparison to those at an SOA of 60 ms for both the inflectional and derivational forms between the two groups- young and old.

(vi) The priming effect was better for the derivational form processing compared to the inflectional form processing. A full priming effect was seen for the younger adults at 60 ms SOA and partial priming for the older age group.

(vii) The accuracy percentage was higher in the younger individuals compared to the older individuals. However, there was no significant age effect on accuracy.

Clinical Implications

1. The results of the present study will enhance the knowledge of the Speech Language Pathologists (SLPs) and will help in understanding how normal L2 learner of English processes the complex morphological forms such as inflectional and derivational words.

2. In the present study, since SOA as low as 30 ms was taken, it hinted at the possibility of detrimental effects of age on the morphological processing as the cognitive load or demand increases at lower SOAs.

3. The results of the present study will help the SLPs while planning or formulating the treatment goals for individuals with brain damage regarding which morphological form is easier to process, so that, it can be incorporated into the treatment activities.

Limitations of the study

1.) The study had only two age groups of individuals, one between 20 to 30 years and another between 50 to 60 years. More age groups could have been considered for a better picture of effect of age on the processing of words that are morphologically complex.

2.) The reaction times and accuracy percentage obtained in the present study may be applicable only to Kannada- English bilinguals.

3.) Only two complex morphological forms, that is ‘ed’ and ‘ness’ form were considered in the study.

4.) The stimuli or prime- target pairs under each of the conditions (identity, test, unrelated) were relatively less. There were only 20 items under each condition.

Future Directions

1.) The present study may be conducted in other Indian languages to observe for differences in the outcomes between the languages, that is processing differences between L1 and L2.

2.) More number of age groups could be considered to check for the effect of age on the performance of individuals in processing morphologically complex forms.

3.) There could be possibility of taking up more inflectional and derivational forms and investigating for any differences in their processing.

4.) The priming paradigm may be used to investigate the processing of the words that are morphologically complex in individuals following brain damage or in other language disorders.

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APPENDIX A

Stimuli for Inflectional form experiments

Stimuli for Identity Condition of Experiments 1 and 2 (Inflectional at 60 ms and Inflectional at 30 ms)

S. No.	PRIME	TARGET
1.	BOIL	BOIL
2.	CURE	CURE
3.	WALK	WALK
4.	FADE	FADE
5.	FOLD	FOLD
6.	HEAT	HEAT
7.	FREE	FREE
8.	CALL	CALL
9.	FAIL	FAIL
10.	LACK	LACK
11.	CLAIM	CLAIM
12.	JOIN	JOIN
13.	GREET	GREET
14.	JUMP	JUMP
15.	PINCH	PINCH
16.	CLIMB	CLIMB
17.	WATCH	WATCH
18.	BUNK	BUNK
19.	GUIDE	GUIDE
20.	WASH	WASH

Stimuli for Test Condition of Experiments 1 and 2 (Inflectional at 60 ms and Inflectional at 30 ms)

S. No.	PRIME	TARGET
1.	LINKED	LINK
2.	LOCKED	LOCK
3.	MELTED	MELT
4.	PACKED	PACK
5.	PRAYED	PRAY
6.	RESTED	REST
7.	SOAKED	SOAK
8.	WARMED	WARM
9.	WIPED	WIPE
10.	PASTED	PASTE
11.	BLINKED	BLINK
12.	CHEATED	CHEAT

13.	COUNTED	COUNT
14.	WORKED	WORK
15.	TOSSED	TOSS
16.	SHAVED	SHAVE
17.	BAKED	BAKE
18.	BLOCKED	BLOCK
19.	WISHED	WISH
20.	LIKED	LIKE

Stimuli for Unrelated Condition of Experiments 1 and 2 (Inflectional at 60 ms and Inflectional at 30 ms)

S. No.	PRIME	TARGET
1.	TURN	KILL
2.	GRANT	LICK
3.	DRAW	COOK
4.	SWAY	LOOK
5.	PASS	STARE
6.	STIR	DANCE
7.	ROOT	CHASE
8.	START	PLAY
9.	KNOCK	POKE
10.	FETCH	DRIFT
11.	CHECK	FILL
12.	FLAP	POUR
13.	LEND	CLOSE
14.	HANG	OPEN
15.	STAY	FOOL
16.	GRIP	CLEAN
17.	REAP	POINT
18.	GAIN	TREAT
19.	WARM	SHARE
20.	RAISE	CRAWL

APPENDIX B

Stimuli for the Derivational form experiments

Stimuli for Identity Condition of Experiments 3 and 4 (Derivational at 60 ms and Derivational at 30 ms)

S. No.	PRIME	TARGET
1.	BOLD	BOLD
2.	COOL	COOL
3.	DULL	DULL
4.	DUMB	DUMB
5.	FIRM	FIRM
6.	FLAT	FLAT
7.	TASTY	TASTY
8.	LOUD	LOUD
9.	MEAN	MEAN
10.	NEAR	NEAR
11.	TIRED	TIRED
12.	HAPPY	HAPPY
13.	ROUGH	ROUGH
14.	RASH	RASH
15.	DEAF	DEAF
16.	CALM	CALM
17.	DEAR	DEAR
18.	GLAD	GLAD
19.	SLIM	SLIM
20.	POOR	POOR

Stimuli for Test Condition of Experiments 3 and 4 (Derivational at 60 ms and Derivational at 30 ms)

S. No.	PRIME	TARGET
1.	NEATNESS	NEAT
2.	SHAKINESS	SHAKY
3.	RIPENESS	RIPE
4.	RUDENESS	RUDE
5.	NUMBNESS	NUMB
6.	WEAKNESS	WEAK
7.	BRIGHTNESS	BRIGHT
8.	DARKNESS	DARK
9.	FAIRNESS	FAIR
10.	KINDNESS	KIND
11.	MILDNESS	MILD
12.	STILLNESS	STILL

13.	BUSYNESS	BUSY
14.	BRAVENESS	BRAVE
15.	BLINDNESS	BLIND
16.	MEEKNESS	MEEK
17.	LARGENESS	LARGE
18.	CUTENESS	CUTE
19.	SHININESS	SHINY
20.	FRESHNESS	FRESH

Stimuli for Unrelated Condition of Experiments 3 and 4 (Derivational at 60 ms and Derivational at 30 ms)

S. No.	PRIME	TARGET
1.	LOW	GOOD
2.	HAZY	SCARY
3.	MUTE	HIGH
4.	LUMPY	QUICK
5.	HUGE	CRAZY
6.	ILL	WAVY
7.	LOVELY	FAST
8.	DUSKY	AWARE
9.	CLEAR	GREAT
10.	DUSTY	TRIM
11.	AGED	ACUTE
12.	MATCH	QUIET
13.	BLACK	LEAN
14.	HARSH	IDLE
15.	BUMPY	GREY
16.	DEWY	FRANK
17.	CRISP	EXACT
18.	FROWN	EAGER
19.	RUSTY	DENSE
20.	FATE	HALF

APPENDIX C

List of filler items

Filler items for experiments 1 and 2 (Inflectional at 60 ms and 30 ms)

S. No.	PRIME	TARGET
1.	BURY	LACK
2.	ADAPT	REACH
3.	CURED	PACK
4.	WRAPPED	HIRE
5.	TOOK	BOOK
6.	SICK	KICK
7.	ROIL	SOIL
8.	FURE	CURE
9.	POCK	SING
10.	PASE	WRAP
11.	TRAG	BRAG
12.	RIST	BARE
13.	LUMP	TUMP
14.	DULL	CULL
15.	FLAT	NIMP
16.	LIMP	SOUD
17.	TRIM	PELL
18.	TOSE	TASE
19.	BROD	BRUD
20.	POCK	TREOT
21.	FOND	TOND
22.	JAMP	POCE
23.	SATE	BATE
24.	BELD	MELD
25.	LASE	LISE
26.	BROD	BRUD
27.	PENCH	CLITH
28.	HORD	MASH
29.	WORK	SOAK
30.	FADE	DREAM
31.	PALE	MALE
32.	NEAR	NEAT
33.	BUNKED	SLEEP
34.	COPIED	BLINK
35.	SADE	FADE
36.	ROLD	FOLD
37.	CREE	FREE
38.	WURN	BOLD
39.	BURE	BUMP
40.	DOMP	SELL
41.	FIRM	BIRM

42.	MEAN	SEAN
43.	MILD	BILD
44.	SALE	GUUD
45.	READ	BICK
46.	SORE	WODE
47.	TINK	BINK
48.	BOLL	MOLL
49.	GRAN	GRUN
50.	FRIT	FRAT
51.	JAMP	POCE
52.	MUCK	TRIT
53.	TOOK	BOOK
54.	SICK	KICK

Filler items for experiments 3 and 4 (Derivational at 60 ms and 30 ms)

S. No.	PRIME	TARGET
1.	HAME	DAME
2.	DROT	PROT
3.	GOZE	PRIY
4.	FOTCH	BOKE
5.	SLAT	SLUT
6.	FULLNESS	LIMP
7.	SLIMNESS	FIRM
8.	FIND	MUST
9.	TRIM	DEAF
10.	BOAT	COAT
11.	FEEL	PEAL
12.	FACK	LACK
13.	DINK	SINK
14.	BOCK	LOCK
15.	WULL	WELL
16.	HOLP	POSE
17.	GEIN	SLIM
18.	COLD	SOLD
19.	DARK	LARK
20.	BAKE	NAKE
21.	BEND	MERD
22.	RAMP	RISN
23.	PICK	PENCH
24.	TARE	PARE
25.	DORK	LORK
26.	TOSE	TASE
27.	WRUP	WREP
28.	POLT	LECK
29.	BIRN	SEINT
30.	BILL	SKILL
31.	FAST	BEND

32.	VAGUE	FAKE
33.	MILDNESS	ALIKE
34.	TIREDNESS	FOLD
35.	BORE	MORE
36.	LEAT	HEAT
37.	BIRE	FIRE
38.	MICK	KICK
39.	SNUP	SNAP
40.	BILD	WARN
41.	GROOD	TRAY
42.	FEAR	KEAR
43.	BEAT	REAT
44.	SALE	FALE
45.	WEAK	LIRE
46.	STALE	REDE
47.	HARD	THON
48.	KAME	RAME
49.	PINT	PUNT
50.	BLICK	POSS
51.	CULL	KOCK
52.	WINK	SHEVE
53.	OPIN	HEAT
54.	COOK	MIVE

APPENDIX D

Language Proficiency Questionnaire

Name:

Age:

Gender:

Instructions: Please read the questions carefully and choose the most appropriate choice whenever applicable.

1. Name all the languages you know beginning with the language 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 the following parameters:

Language	Understanding	Speaking	Reading	Writing
L1				
L2				
L3				

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

Language	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 teacher with you?	1	2	3	4
Which language was spoken by your classmate with you?	1	2	3	4
Did you change your medium of instruction?	Yes		No	
If yes, specify the changed medium of instruction. At what age did you change your medium of instruction?	1	2	3	4
Have you changed your state? If yes, then which language do you use to communicate?	1	2	3	4

9. On a scale from one to four, 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				

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

L1-

L2-

L3-

11.On a scale of one to four, mark your level of proficiency in each of the skill of the dialects 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									

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

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

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

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

Interaction with family	1	2	3	4
Education/Work	1	2	3	4
Listening to instruction	1	2	3	4

tapes at school				
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 radio	1	2	3	4
Market places	1	2	3	4

14.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		

15.Mention the number of years you have spent in each language environment

	Family	School	State	Work place
L1				
L2				
L3				

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

(1-Never, 2-Sometime, 3-Most of the time, 4- Always)

Interaction with family	1	2	3	4
Schooling/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 television	1	2	3	4
Listening to the radio	1	2	3	4
Market places	1	2	3	4

17.Rate how frequently others identify you as a native speaker based on your accent or pronunciation in the language

(1-Never, 2-Sometime, 3-Most of the time, 4- Always)

L1

L2

L3