Development of Test for Assessment of Bilingual Proficiency through Lexical Priming Task for Hindi-English Bilinguals

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CHAPTER I

INTRODUCTION AND REVIEW

Bilingualism more generally, multilingualism is a widely prevalent phenomenon across several countries. There are very few persons in the world who do not know at least a few words in language(s) other than their native language. The process of globalization has contributed to the increased prevalence of bilingualism. In the past decades, the general notion was that bilingual individuals behave like two monolingual persons represented in a single brain. However, there are disagreements about this concept (Grosjean, 1989). Consequently, generalization of results elicited from monolingual studies to bilingual population is also questioned. Therefore, the issue of bilingualism has opened up new vistas for research. Further, in India that is well known for its linguistic diversity and richness, bilingualism becomes a very crucial issue for understanding language representation in bilingual brain, language flexibility in bilinguals as well as language proficiency in bi/multilingual individuals.

I. Linguistic status of India

India is a multilingual and multicultural nation with a population of over a billion people. The Indian linguistic landscape presents a picture of coexistence of more than one and often more than two or three languages almost throughout the country. It has 1576 rationalized mother tongues grouped into 114 languages. The 114 language groups of modern India genetically belong to five different language families. Among these, 22 languages (Assamese, Bengali, Bodo, Dogri, Gujarati, Hindi, Kannada, Kashmiri, Konkani, Maithili, Malayalam, Manipuri, Marathi, Nepali, Oriya, Punjabi, Sanskrit, Santhali, Sindhi, Tamil, Telugu, and Urdu) are included in the Constitution of India (http://en.wikepedia.org). 18 Indian languages are spoken by 96.29% of the population of the country and the remaining 96 languages by 3.71% of the population. As per the Third All India Education Survey (Sharma, 2001), 58 languages find a place in the school curricula and 47 are used in public administration at various levels. Newspapers are published in 87 languages and there are radio broadcasts in 91 languages. Being one of the most diverse linguistic and cultural nations in the world, the country poses innumerable challenges to both speech and hearing specialists and educators in their sphere of activities.

Spread of bilingualism in English is more than in Hindi, (the National language) i.e., 8% as second language, 3.15%, as third language where as the same in Hindi is 6.15% and 2.16%. Further, among the bilinguals reported in census 1991, 70% are forced bilinguals in groups of people who speak languages that do not have script of its own (Census, 1991). The Census India also reports a gradual increase in the population of bilinguals from 9.70% in 1961, 13.04% in 1971, 13.34% in 1981 and 19.44% in 1991. As bilingualism is very common a thorough understanding of it is of paramount importance.

Bilingualism refers to the knowledge and use of two languages and an ability to make a meaningful utterance in another language (Harding, Ruth and Riley, 1986). It is a sociolinguistic phenomenon that has received much scholarly attention. Many researchers have attempted to define bilingualism in their own ways and some of it is quoted below. Bloomfield (1933) defines bilingualism as “native-like control of two languages”. Haugen (1953 a) had suggested a more neutral definition in which bilingualism was viewed as learning “at the point where the speaker of one language can produce complete meaningful utterances in the other language”. Oestreicher (1974) suggested that bilingualism involves complete mastery of different languages without interference between the two linguistic processes.

Bilingualism is classified on the basis of various parameters like the age of acquisition, mastery of one language over the other language and other related factors. Thirumalai and Chengappa (1986) characterized bilingualism in different ways on the basis of how the languages of bilingual context are kept separate or fused together, sequence of learning, whether the languages of bilingual context are acquired under formal, instructional conditions or informal, non instructional set up and an appreciation as to which of the languages of a bilingual context is dominant in the individual use of languages. Weinrich (1953) proposed three types of bilingualism depending on the way in which the two languages are learned namely, compound, coordinate, and sub-coordinate.

a) A compound bilingual is an individual who learns two languages in the same environment so that he/she acquires one notion with two verbal expressions.
b) A coordinate bilingual acquires the two languages in different contexts (e.g., home and school), so the words of the two languages belong to separate and independent systems.
c) In a sub-ordinate bilingual, one language dominates the other.

By convention the language learned first is called L1 and the language learned second is called L2. This is not a perfect nomenclature because sometimes L1 and L2 are learnt simultaneously, and sometimes the language that is learnt first turns out to be the secondary language of use in later life. Bialystok & Hakuta (1994) made a distinction between simultaneous (L1 and L2 learned about the same time), early sequential (L1 learned first and L2 relatively early in childhood) and late (from adolescence onwards) bilingualism. Early sequential bilinguals form the largest group and the number is increasing worldwide, more so in our country.

Bilingualism is classified with respect to the age of acquisition. According to Cohen (1976), two types of bilingualism exist- early and late bilingualism where early bilingualism is further subdivided into simultaneous and sequential bilingualism and simultaneous type of bilingualism where L2 is acquired in consonance with L1. In sequential type of bilingualism L2 is acquired immediately after L1. Common to both of these subtypes is the age of acquisition in early childhood.

Bilinguals are also classified on the basis of mastery of each language. Passive bilinguals are those classes of bilinguals who can understand L2 but are not capable of producing any utterances in it where as dominant bilinguals are those who are proficient in one of the two languages. Balanced bilinguals, on the other hand, are those who are more or less equally proficient in both the languages, but will not necessarily pass for a native speaker in both languages; Equivalent bilinguals are those where the individuals pass in any situation in both the languages for a native speaker, i.e. he or she is indistinguishable from a native speaker.

The nature and type of bilingualism in individuals have raised number of questions to be addressed by researchers. Commonly asked question among those is whether the bilingual stores his or her two languages in separate or common memory systems. In other words, how many lexicons does a bilingual possess? Is there a separate store of lexicon for each language, or just one common store? Since 1960s, this question has been the focus of many researchers interested in bilingualism. Accordingly, three hypotheses are put forth in order to answer this question.

i) *The Common-store Hypothesis*

The common-store hypothesis or the interdependence hypothesis proposes that there is just one lexicon and one semantic memory system with words from both languages stored in it (McCormack, 1977). In daily life, we may notice that a bilingual can translate from one language to the other at his/her own will. This phenomenon may be considered as a support for the common-store hypothesis.

Altarriba (1974) cited an experiment in which language representation in bilinguals was investigated by examining transfer effects for translation equivalents. Subjects were familiarized with a list of either Spanish words or English words, and then placed in one of three conditions. They learned either the same list they had studied, a list containing translation equivalents of the words they had originally studied, or a new list of words. In the learning phase, the word list was presented auditorily and the subjects then participated in free recall. It is found that facilitation was equal in the Spanish to English and the English to Spanish conditions. Evidence in favor of this hypothesis was stated by Green in 1986, who conducted an experiment and found that when a person had a reasonable command of two languages, lexical items were subconsciously activated in both the languages, those in the language not required was suppressed when the subjects participated in free recall. It is found that facilitation was equal in the Spanish to English and the English to Spanish conditions. Singleton (1984) found that the presentation of a stimulus in one of a bilingual subject's language primed his or her response to a corresponding stimulus in his or her other language. He cited the findings as classical evidence in favor of L1 and L2 integration.

ii) *The Separate-store Hypothesis*

The separate-store hypothesis (or the independence hypothesis) holds that there are distinct memories for each language so that information processing in one language does not automatically affect processing in the other language (Kolers, 1963). A bilingual can function independently in one of his or her two languages with little interference from the other language. This may be taken as a support for this hypothesis. However, this hypothesis found more persuasive evidence from laboratories.

First evidence is from Smith (1997) who offered support for the above hypothesis from neuropsychological data with studies on bilinguals who have suffered brain damage resulting in aphasia. He reported that for some bilinguals, there was a reported loss of one language, with no impairment in functioning in the second language and also that different types of aphasia were found to occur in the two languages of a bilingual. The recovery patterns in those persons with aphasia also often differed for each of the several languages known to the patient. One example reported by Grosjean (1982) involved a native speaker of Swiss German who had received a serious head injury. The first language he recovered was French, a language he had learned as an adult and of which his knowledge was imperfect but which had pleasant associations for him. He subsequently recovered High German, but never recovered in his first language. The best conclusion from the reported case studies of individual bilingual aphasics was that each language had its own separate representation.

Second evidence is derived from Repetition Priming studies. In Repetition Priming, a prime (the word used as a stimulus) simply repeats or does not repeat a target word. Studies concerned with bilingual representation have investigated whether the processing of a word in one language can facilitate the processing of the translation of that word. The occurrence of repetition priming across languages means that a word and its translation share some of the same underlying representations in the cognitive network. Under certain special conditions facilitation of lexical decision has been found across languages when time interval between presentation of a word and its translation is extremely short (De Groot & Nas, 1991; Schwanenflugel & Rey, 1986).

iii) *The Hierarchical Hypothesis*

Despite sufficient evidence to support either common-store or separate-store hypothesis, it is argued that either of the two does not describe bilingual lexical representation because various experimental tasks emphasize different processes (Gerard & Scarborough, 1989). In general, findings with tasks that emphasize surface attributes support the independence or separate-store hypothesis while findings with tasks that emphasize semantic or conceptual attributes support the interdependence or common-store hypothesis (Durgunoglu & Roediger, 1987). Taylor and Taylor (1990) also hold that tasks that emphasize processing of words for their meaning rather than for their forms seem to obtain results that support the common-store hypothesis while tasks that tap the forms of words or associative links between words seem to favor the separate-store hypothesis. In order to further substantiate the proposed hypotheses, models of lexical organization have been proposed by researchers and are described below.

II. Models of lexical organization

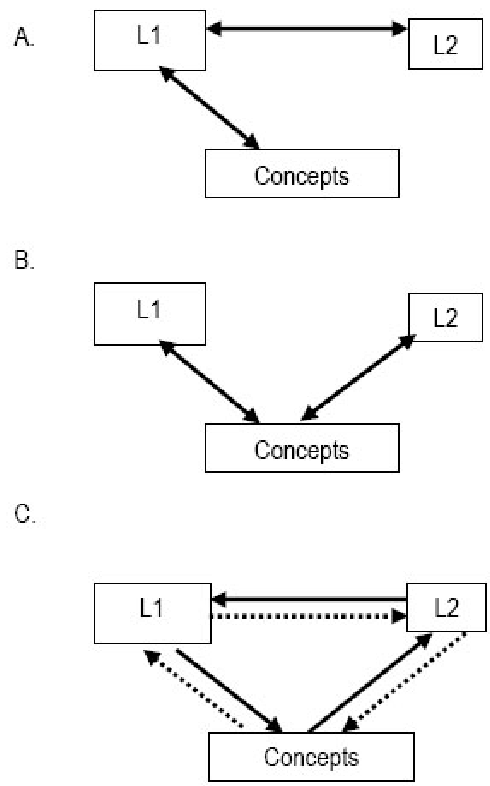
The nature of bilingual lexical organization is an enduring question in bilingual research (Snodgrass, 1984). Over the past couple of decades, much of the research conducted in bilingual domain has been concerned with the organization of the bilingual's two languages. Numerous models have been proposed to support or refute either of two hypotheses i.e., language specific or language independent hypothesis. All models distinguish two levels of representation–one lexical, with two language specific stores and one conceptual, comprising a single store. .According to Kroll and DeGroot (1997) word representation in bilingual literature is decomposed into form and meaning, the former represented at the lexical level and latter at the conceptual level. Various models have been proposed on the basis of connections within and between lexical and conceptual level of representation.

i) ***Word association model***: This model (Fig.1A) assumes that second language words (L2) gain access to concepts only through the first language mediation. The links between L1 and L2 are the lexical links and the links between L1 and the concepts are denoted as conceptual links. This model predicts that translation relies on lexical links and can thus bypass conceptual access. Thus according to this model cross language processing explores the links at lexical level (Potter, 1984).

ii) ***The concept mediation model***: This model (Fig.1B) proposes that L1 and L2 word forms are both directly connected to their corresponding concept. Access from L2 to L1 word forms occurs through access to the concept (Potter, 1984).

iii) ***Revised hierarchical model:*** This model (Fig. 1C) assumes that words in a bilingual's languages have separate word form representations but shared conceptual representations. Two routes lead from an L2 word form to its conceptual representation-the word association route, where concepts are accessed through the corresponding L1 word form, and the concept mediation route, with direct access from L2 to concepts (Kroll and Stewart, 1994).

iv) ***Mixed model:*** This model combines the word association model and concept mediation models. This model argues that the lexicons of a bilingual are directly connected to each other as well as indirectly connected by way of shared semantic representation (de Groot, 1992).



The hierarchical models
A: Word Association Model; B: Concept Mediation Model; C: Revised Hierarchical Model

(Source: Potter and Mc Cormack, 1984)

However de Groot (1992) based her theory on forward translation (L1to L2 only) in L1 dominant subjects. Therefore in a follow up study de Groot, Dannenberg & Hell (1994) examined forward (L1to L2) and backward (L2 to L1) translation with six variables (imageability, context availability, definition accuracy, familiarity, word frequency and length) in two Dutch–English bilingual groups that differed in L2 proficiency. Results revealed a significant effect of imageability on backward translation. Therefore, de Groot agrees that the data support a weak version of the asymmetrical model (direct and strong L2 to L1 link in backward translation without concept mediation). However, the mixed model predicts concept mediated backward translation, but with less strength in the link from L2 to conceptual memory than L1 to conceptual memory.

III. Language representation in Bilinguals

Cognitive experiments with bilinguals strongly support the position that the two languages of a bilingual access a common semantic network (Francis, 1999b). Three main sources of experimental evidence support this view. First, semantic comparisons between words from different languages have been shown to take no longer than comparisons between words in the same language, suggesting the integration of semantic information between languages (Caramazza & Brones, 1980; Dufour & Kroll, 1995; Potter, So, Von Eckhardt, & Feldman, 1984; Popiel, 1987). Second, primed lexical decision tasks have revealed that processing of a word is facilitated about 75% as much when immediately preceded by a semantic associate in the other language as when preceded by a semantic associate in the same language (e.g., Chen & Ng, 1989; de Groot & Nas, 1991; Grainger & Beauvillain, 1988; Keatley et al., 1994; Keatley & de Gelder, 1992; Kirsner et al., 1984; Schwanenflugel & Rey, 1986; Tzelgov & Eben-Ezra, 1992). Third, studies of interference effects, such as the Stroop and Stroop-like interferences (e.g., Preston & Lambert, 1969; Ehri & Ryan, 1980), or of part-set cueing during category exemplar generation (Peynircioglu & Goksen-Erelcin, 1988) have shown that processing in one language can automatically interfere with processing of another, and these interference effects also tend to be about 75% of the magnitude of the corresponding within-language effects (Francis, 1999b; MacLeod, 1991). Additionally, several studies of bilingual memory have shown a high degree of transfer across languages for tasks that involve primarily semantic processing (e.g., Francis, 1999a; Francis & Bjork, 1992; MacKay & Bowman, 1969; MacLeod, 1976; Seger et al., in press; Smith, 1991). The attenuation of some of the between-language relative to within language effects have been cause for debate, but are mostly attributed to non semantic contributions to the within-language priming and interference effects. Neuropsychological studies of bilingualism have attempted to clarify whether the two languages of a bilingual have shared or separate representations in the brain. Behavioral hemispheric lateralization studies have given mixed results (for reviews and critiques of this literature, see Paradis, 1990, 1992; Mendelsohn, 1988; Vaid, 1983). Compelling clinical case studies of differential language recovery after stroke-induced aphasia in multilinguals (e.g., Lecours et al., 1983; Solin, 1989; Vaid & Genesee, 1980; Paradis, 1977) have been used as evidence for separate cortical representations for each language. However, this interpretation depends critically on reports of language use prior to the stroke and these studies are not able to discriminate among the particular aspects of language that might underlie these impairments. From the neurosurgical literature, first and second language naming were selectively or simultaneously disrupted in cortical stimulation studies of presurgical patients (Ojemann, 1983; Ojemann & Whitaker, 1978), which suggests some shared and some separate regions for processing of the two languages. However, the specific components of language that are shared or separate are not clear.

IV. Nature of Semantic representations in Bilinguals

A prominent issue in cognitive research on bilingualism has been the degree of functional integration or separation of the two languages in a bilingual brain. At one end of the spectrum, the mental representations of two languages are viewed as being shared; at the other, each language has its own separate representation. In studying bilingualism, cognitive research has focused mainly on semantic representations.

Theories of how knowledge is stored and processed in the brain generally fall into either a-modal or multiple semantic systems. The first proposes that all meanings for objects, events, and concepts are stored and processed by a common a-modal semantic system (e.g., Caramazza, Hillis, Rapp, & Romani, 1990; Gernsbacher, 1985; Kroll & Potter, 1984; Pylyshyn, 1984). Conversely, the second class of theories posits that multiple semantic systems independently store and process semantic information, often redundantly (e.g., Paivio, 1971, 1986, 1991; Shallice, 1988, 1993). A salient example of this distinction has been the debate over the origin of *concreteness effects*, which is the observation that words representing concrete concepts (e.g., ‘table’) are processed more quickly and accurately than words representing comparatively abstract concepts (e.g., ‘aptitude’). Concrete words (words that refer to specific objects or events, e.g., *bicycle*) have been found to have many cognitive processing advantages over abstract words (words that refer to more general and/or complex concepts, e.g., *honesty*). In general, subjects encode and retrieve concrete words faster and more completely than abstract words. This has been demonstrated with recognition, free and cued recall, and paired associate learning (e.g., Paivio, Walsh, & Bons, 1994; Nelson & Schreiber, 1992; Marschark & Paivio, 1977). In addition, the time to comprehend a sentence is generally shorter when the sentence is concrete rather than abstract (Haberlandt & Graesser, 1985; Schwanenflugel & Shoben, 1983). Subjects also respond faster to concrete than to abstract sentences in meaningfulness judgment (Holmes & Langford, 1976; Klee & Eysenck, 1973) and truthfulness judgment (Belmore, Yates, Bellack, Jones, & Rosenquist, 1982) tasks. Unfortunately, in spite of the relative consistency of the experimental findings, there has been considerable disagreement concerning the source of concreteness effects, the two major theoretical contenders being *dual coding theory (*Paivio, 1991) and the *context-availability model* (Schwanenflugel, 1991).

i) Dual-coding theory

Dual-coding theory (Paivio, 1986, 1991) explains concreteness effects by recourse to modality-specific systems for representation and processing. According to this theory which is a variant of the multiple semantic-systems view, concrete words are associated with information stored in both a verbal "linguist" semantic system as well as a nonverbal "imagistic" semantic system. Abstract words, however, are associated primarily with information stored in the linguistic system. When one encounters a concrete word it initially activates linguistic information, but shortly thereafter it also begins to activate imagistic information via referential links that interconnect the linguistic and image systems. Abstract words, on the other hand, lack or have many fewer referential connections between systems and predominantly activate linguistic representations. Concrete words have distinct processing advantages over abstract words because they have access to information from multiple systems. So, for example, in a lexical decision task participants can classify "hand" as a word faster than "idea" because "hand" is processed and represented in both systems while "idea" is processed / represented only in the linguistic system. This additional semantic activity from dual systems allows participants to quickly differentiate concrete words from pseudowords (pseudowords presumably generate little semantic activation). The relatively lower semantic activity from a single system makes abstract words more difficult to differentiate from pseudowords resulting in relatively slower reaction times (RT).

Support for this model comes from divided visual field studies of word recognition (Chiarello, Senehi, & Nuding, 1987; Deloche, Seron, Scius, & Segui, 1987; Day, 1979), studies of ‘‘split-brain’’ and other brain lesioned patients (Coslett & Monsul, 1994; Coslett & Saffran, 1989; Coltheart et al., 1980; Zaidel, 1978), and electrophysiological experiments (Nittono, Suehiro, & Hori, 2002; Holcomb, Kounios, Anderson, & West, 1999; Kounios & Holcomb, 1994). These data all suggest that the right hemisphere is much better at processing concrete than abstract words, whereas the left hemisphere shows equivalent responses to both. There is, however, contradictory physiological evidence (Martin-Loeches, Hinojosa, Ferna´ndez-Frias, & Rubia, 2001; Howell & Bryden, 1987; Lambert & Beaumont, 1983), and the status of the dual coding model remains in dispute. In particular, several functional imaging experiments failed to provide evidence for the right hemisphere involvement in concrete word processing that is predicted by dual code theory (Noppeney & Price, 2004; Fiebach & Friederici, 2003; Grossman et al., 2002; Friederici, Opitz, & von Cramon, 2000; Kiehl et al., 1999; Perani et al., 1999). A study conducted by Binder, McKiernan, et al (2003) examined this issue using functional magnetic resonance imaging (fMRI) during a lexical decision task designed to encourage specific word identification. The results showed a bilateral network of association and posterior multimodal cortices activated during processing of concrete concepts, and a strongly left-lateralized network activated during processing of abstract nouns. These results thus provide firm evidence for a dual coding model of concrete and abstract concepts.

ii) Context-availability model

The fact that concrete word advantages are not always seen in all tasks (van Hell & de Groot, 1998; Schwanenflugel & Stowe, 1989) has been used to buttress a competing account known as context availability theory (Schwanenf lugel, 1991; Schwanenf lugel & Stowe, 1989). The context-availability model (Bransford & McCarrell, 1974; Kieras, 1978) denies the existence of different types of informational codes or processing systems as determinants of concreteness effects. This theory, a variation of the single semantic-system view, argues that comprehension is heavily reliant on context supplied by either the preceding discourse or the comprehender’s own mental knowledge base (semantic memory). Concrete words are thought to be more closely associated to relevant “contextual” knowledge in semantic memory than are abstract words, because concrete words exhibit stronger or more extensive associative links to this stored material. However, the underlying nature of the representations for the two word types and the processes that operate on these representations do not differ according to this account. So, participants can classify “hand” as a word faster than “idea” because “hand” activates more semantic information. Where context-availability differs from dual-coding is in how and where this additional information is stored and processed. Context availability argues for a simpler quantitative difference between word types within a single system, while dual-coding argues for a qualitative difference based on activity in different systems.

Holcomb and colleagues examined concreteness effects using event-related brain potentials (ERPs) and proposed a modified version of the dual coding theory that can best account for the resulting ERP differences between concrete and abstract words. In one study, Kounios and Holcomb (1994) examined the effect of concreteness on ERPs using both a lexical decision task and a concreteness judgment task in a repetition-priming paradigm. Concrete words elicited a more negative ERP than abstract words between 300 and 500 msec after stimulus onset. Interestingly, this difference was larger in the concreteness judgment task (which requires deeper semantic processing) than in the lexical decision task. This negativity coincided temporally with the classic N400 component (e.g., Kutas & Van Petten, 1988), which has been suggested to reflect the process whereby semantic information is integrated with the preceding context (e.g., Rugg, Doyle, & Holdstock, 1994; Brown & Hagoort, 1993; Holcomb, 1993). The concreteness N400 effect was also largest over the anterior right hemisphere scalp sites. This interaction between concreteness and scalp distribution indicates that concrete words were accessing a non identical set of cognitive and neural processing resources than abstract words and *not* simply more of the same resource (although they may access more of this resource as well) and is inconsistent with the single code context-availability model, which would predict a difference only in the amplitude and not in the scalp distribution of ERPs for concrete and abstract words. In a subsequent study utilizing an anomalous sentence task, Holcomb, Kounios, Anderson, and West (1999) found evidence that concreteness and context are separate independent factors that each influence N400 amplitude. Final words that were incongruous with the sentence context (e.g., ‘‘Armed robbery implies that the thief used a *rose*.’’) produced a more negative ERP (N400), which was most robust over centro-parietal scalp sites, than final words that were congruous with the sentence context (e.g., ‘‘Armed robbery implies that the thief used a *weapon*.’’) (Kutas & Hillyard, 1984),. Incongruous concrete final words also elicited more negative ERPs than incongruous abstract final words during the temporal region of the N400, but this effect extended to 800 msec or beyond and had a maximum amplitude focused over anterior scalp sites. Clearly, these findings are supportive of a role for contextual factors in the facilitation of semantic processing. However, single-code models cannot account for the prominent differences in spatial distribution found for concrete and abstract words. Thus, extended dual-coding theory proposed by Holcomb et al. (1999) accounts for both the contextual and the concreteness ERP effects.

V. Language representation and proficiency

One factor that likely influences the mental and neural organization of bilingual language is the degree of proficiency in a second language acquired after the first language has been mastered. Several cognitive studies indicate that the organization of the second language changes during the acquisition process. For example, in early stages of learning, second language (L2) vocabulary items are processed primarily through association with their translation equivalents in the first language (L1), whereas in later stages of learning they are more directly concept-mediated, i.e., associated with their meanings (Chen & Leung, 1989; Chen, 1990; Dufour & Kroll, 1995; Kroll & Stewart,1994; Potter, So, von Eckhardt, & Feldman, 1984). In these studies, L1 and L2 vocabulary are thought to access a common semantic system as a person becomes proficient in L2. The age at which a second language is acquired has been shown to influence the rate of learning and degree of proficiency attained (e.g., Johnson & Newport, 1989; Krashen, Long, & Scarcella, 1982). In general, the younger the learner, the more similar second language learning is to first language learning. The causes of these age effects on proficiency are highly controversial, with explanations ranging from biologically based critical periods to differences between child and adult learning contexts. Because studies that address age of the learner generally do not address cognitive processes, it is unknown at present whether mental representations of the second language or cognitive processes in the second language differ qualitatively for early and late learners. Although research in this area has provided no evidence that semantic processing differs for languages learned early or late, it suggests that any cognitive or neural differences between L1 and L2 should be greater for late than for early learners. There are numerous neuroimaging studies of bilingualism using positron emission tomography (PET) and fMRI. for L1 and L2 in word repetition and synonym-generation tasks (Klein et al., 1994, 1995). A PET study of whole-language comprehension in highly fluent Italian–English and Spanish–Catalan bilinguals also showed nearly identical activation patterns for L1 and L2 (Perani et al., 1998). These studies indicate that there is a shared cortical system for semantic knowledge in two languages. These PET studies, however, analyzed group averages. It remains possible, therefore, that adjacent cortical representations of semantic knowledge would not be resolved, especially if the topographical relation between the adjacent representations varied across individuals. In such a case, across subject averaging could blend two distinct semantic activations. fMRI may be better suited to resolve such adjacent activations because it has superior spatial resolution and because it is more common to visualize individual participant's activations. Two fMRI studies have revealed not only common activations for L1 and L2, but also separate activations for L1 and L2. Both fMRI studies, however, used whole-language comprehension or covert production tasks (Dehaene et al., 1997; Kim et al., 1997). Therefore, it is unclear whether the differences between L1 and L2 activations were based on semantic processes per se or, alternatively, based on other linguistic processes, such as phonological or syntactic processes. In the one previously published fMRI study of single-word processing in 24 Mandarin–English bilinguals, no differences were found between L1 and L2 activation patterns for word stem completion in either early or late learners of English (Chee et al., 1999). In general, there appears no consensus in the literature on proficiency and language representation. Yet, advantages that accrue because of bilingual status of an individual have been fairly well agreed upon across several studies.

VI. Advantages of bilingualism

Bilinguals derive a number of advantages in various aspects such as cognitive, curricular, socio-cultural, employment, communication and tolerance for other languages and cultures.

a) Cognitive advantages: The bilingual people can have some specific advantages in thinking. They have two or more words for each idea and object. Hence, a bilingual person can develop a creative thinking and an ability to think more flexibly. The bilinguals are aware about the language that should be spoken with persons in a particular situation. Therefore, they are more sensitive to the needs of the listener than the monolingual person. Being bilingual has a positive effect on intellectual growth. It enhances and enriches a person’s mental development.

b) *Socio-cultural advantages*: The bilinguals are able to switch between their languages and talk to different people in various languages. It increases a sense of self-esteem. Being bilingual creates a powerful link between people from different countries. Bilingualism also offers an access and exposure to different cultures. Knowledge of different languages offers a treasure of traditional and contemporary sayings, idioms, history and folk stories, music, literature and poetry in different cultures. Due to a wider cultural experience, there is a greater tolerance of differences in creeds and customs.

c) *Curricular advantages*: Bilingual education leads to better curricular results. The bilinguals tend to show a higher performance in examinations and tests. It is associated with the advantages of thinking linked to bilingualism. The bilinguals find it quite easy to learn and speak three, four or more languages.

d) *Communication advantages*: The bilinguals enjoy reading and writing in different languages. They can understand and appreciate literature in various languages. It gives a deeper knowledge of different ideas and traditions. It helps to improve the ways of thinking and behaving. The pleasures of reading poetry, novels and magazines as well as the enjoyment of writing to family and friends are doubled for bilinguals.

e) *Employment advantages:* Being bilingual offers potential employment benefits. It offers a wider choice of jobs in various fields. The bilinguals can get prosperous career opportunities in the retail sector, transport, tourism, administration, secretarial work, public relations, marketing and sales, banking and accountancy, translation, law and teaching. The above advantages are enjoyed by people of India since India is known for its bi/multilingual nature in most of the states.

VII. Communication behavior of bilinguals

Communication behavior of bilinguals often presents as an interesting plane of study since they are known to show some of the following dominant traits, which are themselves subject to different interpretations.

i) *Interference*: This occurs in a case where a speaker consciously or inadvertently brings in pronunciation, sentence formation and vocabulary of the source language while using a target language. Ruke and Dravina (1989) argued that interference is always present in persons with bilingualism, especially when the two languages are closer in their phonological, syntactic and morphological features.

ii) *Code-switching*: This occurs when a speaker drops into his target language a word or phrase from his source language. This sometimes makes up for inadequacies, especially stylistic, in the first language. This can be seen when the Franco-English bilingual wishes his guests " Bon appetit", an expression considered absurd by users of English. Code-switching may result more often than not from language group influence or occasional lapses which speakers want to fill. It may also be prompted by the bureaucratic influence of the dominant language.

iii) *Translation:* When a bilingual person masters two mutually incomprehensible languages, he becomes a translator. The problem with translation is that any translated version might lose something of the author's original intent. Especially in poetry, the translation is sometimes said to be a better work than the original and, in such cases, one is actually dealing with a new, though derived, work and not just a translation.

As the ability to speak more than one language becomes more important, so does the need to assess the language abilities of second language learners. Among the tools used for assessment commonly are self-assessment questionnaires and tests.

VIII. Tools for assessment of bilingualism

Traditionally tests for assessment of bilingualism are most widely used either for placement in colleges and universities or for recruitment in jobs such as translators or bilingual teachers in schools and universities. In such situations, depending on the purpose of testing, consideration is given to the choice of selection of skills that need to be tested, (for example, speaking, listening, reading, and writing). Therefore, it is likely that a test which is appropriate in one situation may not be appropriate in another. For example, a test designed to measure the reading abilities of elementary school learners will not be appropriate for college placement.

Thus, when choosing a test, it is important to define the purpose of testing, and then to find or develop a test that fits the said purpose. Further, it is also important to know the reliability and validity of the test, especially if the test is to be used for high-stakes purposes, such as entrance into a college or university. Large scale standardized tests generally have more reliability and validity requirements than classroom tests.

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

a) Rating scales
b) Fluency tests
c) Flexibility tests, and
d) Dominance tests

Rating scales include various instruments such as interviews, language usage scales, and self-rating scales. International Second Language Proficiency Rating Scale (ISLPR), previously referred to as ASLPR (Ingram 1985), is a widely accepted rating scale to assess second language proficiency.

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

Despite the intense requirement for assessment of bilingual proficiency, there are very few tools developed in our country (Shanbal & Prema, 2007 for children; Ramya, 2009 for adults). These tools are in the form of questionnaires that are developed with specific purpose and/ or that which is adopted from other countries to our population, but not standardized. A few of these are, however, employed in studies that examined language skills in persons with aphasia to decide the language of assessment and intervention; bilingual and biliterate children for assessment of reading and writing skills or to check for adequacy of second language learning in adult second language learners.

Dominance tests use any of the above tests to assess the relative dominance of one language over another in particular areas. The outcome has been greater precision in defining different types and degrees of bilingualism at the expense of more qualitative differences in language proficiency that are hard to measure through questionnaire or rating scales. The tests for dominance are generally designed with experimental tasks used to study bilinguals that range from production tasks that employ reading lists, retelling stories, picture naming, giving word associations to perception and comprehension tasks such as free recall, Stroop tests, translation, hemispheric lateralization studies, dichotic listening, hemi-field presentation, concurrent activity tasks etc., The tasks can be generally categorized under two broad categories - the Online tasks and the Offline tasks.

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

ii) Offline tasks: These require a patient to consciously reflect on a decision and most often includes problems solving (e.g. what does this sentence mean, "is an ostrich a bird"?). These tasks are affected by memory and attention demands. They measure effects observed at end points of perhaps several processes. Offline tasks thus mask a patient's strengths and weakness in any single area involving sub components of language domain. For example, sentence-picture matching, categorization tasks, word generation etc. Owing to the strength of online tasks, they are generally preferred over the offline tasks in understanding language processing, more so in bilinguals. Among the online tasks, the primed lexical decision task (LDT) and Lexical naming tasks (Meyer and Schvaneveldt, 1971) have been frequently used to study bilingual lexical organization to understand the dominance of one language over the other in a bilingual individual. The online tasks are generally designed on the principles of priming.

Research suggests that self-reported language measures are indicative of linguistic ability Bachman & Palmar, 1985; MacIntyre, Noels, & Clement, 1997, Ross, 1998; Shameem, 1998;

Stefani, 1994). Existing self-assessment tools for studying bilinguals' proficiency assesses both domain-general and domain-specific proficiency i.e reading writing comprehension and expression whereas dominance tests assesses for domain general modalities. In the dominance tests the focus is to interpret which of the language/s is dominant in usage and employs some general question irrespective of the four domains mentioned above. Bahrick (1984) found that language dominance ratings correlated highly with performance on some tasks (e.g., category generation and vocabulary recognition) but correlated less with performance on other tasks (e.g., oral comprehension). Together, studies of domain-general self-assessment in bilinguals suggest that the relationship between self-reported and behavioral measures of language performance varies across languages and tasks.

Studies of domain-specific proficiency assessment in bilinguals have focused on grammatical ability (Jia uan ,Zhang, Jian , Xu, Bo, 2002), the degree of foreign accent (Flege , Mc kay and Meador,(1999), and computational language use. Jiang used a 32-item questionnaire that assessed the following four areas. (a) Age/time variables associated with L2 acquisition. (b) Environmental variables (e.g., number of L2 speakers at home; frequency with which L2 is spoken at home and in the workplace and father's, mother's, and siblings' proficiency in speaking, reading, and writing L2**)** (c) affective variables (e.g., self-consiousness, cultural preference and identity, and motivation); and (d) self-evaluated L1 and L2 proficiency in speaking, reading, and writing. Jia et al., found that self-reported ratings of language proficiency were positively correlated with behavioral performance. Similarly, in a series of studies on how language dominance affects the degree of foreign accent and grammatical ability, Flege, Mc Kay and Meador (1999) used a language history questionnaire that targeted participants self-reported age of arrival in the L2-speaking country/initial L2 learning; age at which L2 proficiency was attained, duration of L2 immersion; number of years of L2 schooling; percentage use of L1/L2; frequency of exposure to L2 TV, movies/videos, and radio; frequency of use of L1/L2 in a working environment; and ability to imitate foreign accents. The researchers found significant correlations between language history and degree of foreign accent in L2 and between language history and performance on a grammaticality judgment task. In a study of computational language use, Vaid and Menon (2000) used a questionnaire that focused on language preference for mental arithmetic (e.g., counting, noting the time, and remembering a telephone number). The questionnaire also yielded self-reported ratings of language proficiency speaking, comprehending, reading, and writing, as well as participants' age of arrival in the L2-speaking country/initial L2 learning; the setting of language acquisition (home, school, other); duration of L2 immersion; the language of instruction in elementary and secondary school; and frequency of use of L1/L2 at work, with parents, and with siblings, while thinking to self, and while dreaming. Language preference for mental arithmetic was found to correlate with variables in the bilinguals' language history, with the strongest predictor being the language of early formal instruction followed by length of residence in the L2 country, onset of bilingualism, and relative language dominance.

A consistent aspect of the above studies was the focus on proficiency and history-related variables. However, the studies diverged in three notable ways: (a) The distinction among language proficiency, dominance, and preference remained largely unexplored, (b) behavioral tasks used to validate the questionnaires were limited, and (c) questions and scales were not consistent across studies. There is currently no uniform procedure for determining bilingual language dominance and proficiency. Researchers frequently use distinct aspects of language status and performance to delineate the two, or they use the same measure (e.g., L1:L2 proficiency ratio) to define both dominance (Flege et al., 2002) and proficiency (Vaid & Menon, 2000).

The second point of divergence among previous studies stems from ratings of language proficiency that were often compared to bilinguals' performance on only one or two behavioral tasks such as degree of foreign accent (Flege, Mc Kay and Meador 1999) or grammaticality judgment rather than on a range of behavioral tasks. There is considerable evidence that various language history variables apply differently across performance domains. For example, age of acquisition applies more to phonology but less to morphosyntax (Snow & Hoefnagel-Höhle, 1979). Therefore, an accurate picture of the relationship between bilinguals' self-reports and performance can be gained only from a comprehensive assessment of behavioral language performance.

. Previous studies suggest that bilinguals' language profiles are best captured by assessing language experience and proficiency across multiple linguistic domains. It appears that bilinguals are able to assess their language proficiency and report their language history in a way that is consistent with behavioral performance (Chincotta & Underwood, 1998, Flege et al., 1999, 2002; Jia et al., 2002). However, the absence of a valid and uniformly used assessment measure makes it difficult to interpret existing findings and to make generalizations across studies and populations. Some of the popularly used self assessment/rating scales are the International Second Language Proficiency Ratings (ISLPR-Ingram, 1985) and the Language Experience and Proficiency Questionnaire (LEAP – Q, Blumenfeld & Kaushanskaya, 2007) .

The ISLPR was previously called the Australian Second Language Proficiency Ratings (ASLPR). The name of it has been changed in 1997 in an effort to acknowledge the growing international use of the scales. ISLPR is a scale that rates the proficiency of bilinguals in all four language skills, namely, Speaking(S), Listening (L), Writing (W) and Reading(R) on a nine point scale. The authors have reported a high level of validity and reliability and that it can be confidently used to assess a bilingual person's practical skills in the second language.

LEAP- Q was constructed within the context of bilingualism theories that view L2 acquisition as an interplay between proficiency and experience variables (Hyltenstam & Abrahamsson, 2003). Given a theoretical framework that incorporates both language proficiency and language history, the LEAP-Q aims to capture factors that previously have been identified as important contributors to bilingual status: language competence (including proficiency, dominance, and preference ratings); age of language acquisition; modes of language acquisition; prior language exposure; and current language use. The LEAP-Q is based on question types previously used in questionnaires assessing bilinguals (Flege et al., 1999), LEAP Q basically focuses on language competence, language acquisition and language exposure.

The target population for the LEAP-Q consists of adult and adolescent bilinguals and multilinguals with a variety of language experiences and proficiency levels. It includes simultaneous bilinguals (who learned their L1 and L2 early on and in parallel), late bilinguals (who learned their L2 later in life), balanced bilinguals (who are equally proficient across their languages), and unbalanced bilinguals (who are more proficient in one language than the other). In its current form, the LEAP-Q has been validated for use with individuals who have attained literacy skills equivalent to a high school education level or higher in at least one of their languages. Although previous studies suggest that similar questions about proficiency and language history can be successfully used to capture language profiles in bilingual children by means of parent reports (Chincotta & Underwood, 1998; Flege et al., 2002; Vaid & Menon, 2000), the questionnaire has not yet been validated for use with children or with clinical populations. Finally, unlike language testing instruments in which the primary objective is to place students in English-as-a-second language and foreign language programs (e.g., those offered by the Center for Advanced Research on Language Acquisition and the American Council on the Teaching of Foreign Languages, as well as the University of Ontario's French Immersion Program Assessment Tool).

The target settings for the LEAP-Q are primarily research oriented (i.e., for assessment of research participants). Although novice language-learners may complete the questionnaire, only self-reports of bilinguals with proficiency levels sufficient to complete standardized assessment tools (i.e., for self-reports to be meaningful, individuals should claim basic functionality within their L2) have been employed in the study. This target population was chosen for five reasons: (a) to be representative of bilingual and multilingual groups most often studied in research settings; (b) to accommodate the widest and most diverse sample of bilingual and multilingual speakers (with respect to specific languages, language history, and language use); (c) to allow the questionnaire to be completed independently and with minimal support while still providing meaningful data; (d) to span the variables documented as most relevant in surveys of practicing speech-language pathologists (Kohnert, Kennedy, Glaze, Kan & Carney, 2003; Roseberry-McKibbin et al., 2005).

The other self assessment tools include Language Assessment scales formulated by De Avila and Duncan (1990). It is designed to measure proficiency in English and language skills necessary for functioning in mainstream academic environment. It tests for oral and reading /writing skills in children from grade 1 to 6 oral tests assesses for vocabulary, listening comprehension, story-retelling while the reading/writing tests assesses for mechanics and usage, vocabulary, fluency, reading comprehension, sentence completion, essay writing.

The IDEA Proficiency Test was designed by Ballard and Tighe (2005) and is designed to evaluate proficiency in English for children from the age of 3 years through the 12th grade. It also tests for Oral and Reading / Writing skills. The Reading/Writing test may be given independently of the Oral test, but both tests would be needed for an overall assessment of language ability. The Oral Proficiency tests of English are designed to determine the proficiency level of students who are native speakers of other languages and who are being considered for placement in Limited English Proficient programs. These tests are administered individually using an easel-style book with pictures which correspond to test questions. The domains tested are Syntax, Morphological Structure, Lexical Items, Phonological Structure, Comprehension, and Oral Production. Examinees continue progressing through levels of difficulty until they reach their proficiency ceiling. The resulting classifications are Non-English-Speaking, Limited English-Speaking, or Fluent English-Speaking. There are three levels of the Oral tests: The Pre-IPT (ages 3-5); The IPT 1 (K-6); and the IPT 2 (grades 7-12).

Woodcock-Muñoz Language Survey–Revised (WMLS-R) was formulated by Woodcock and Munnoz in the year 1993. It is a Norm reference measure of reading, writing, listening and comprehension. It is employed for the assessment of proficiency in English-Spanish bilinguals. It can test a wide population between age groups of 2 and 90. The overall duration required for administration of full test according to authors is about 55 minutes and about 25 minutes for administration of the screening version. The WMLS –R scoring and reporting program quickly and accurately converts all raw scores into derived scores and provides an index of proficiency in English and Spanish separately.

Test of Language Proficiency (TLP) has been developed by Shivshankar, Shyamala, Vasantha, Bhoomika Kar and Vaishna Narang (2011). The TLP has two parts, proforma and quantitative proficiency tests. Proforma includes general information, participants profile, participant's language use choice and language proficiency in different contexts. Quantitative proficiency test includes picture narration task, verbal comprehension, reading and writing tasks. In picture narration task, the subject has to describe the given picture in L1, L2 and L3, subject will be asked to write five sentences about the picture and read aloud the same sentences. In verbal comprehension task, passages will be read to the subject and he/she has to answer six direct questions related to the read passages.

The Language Proficiency Index or LPI is a Canadian standardized for English proficiency written and administered by the University of British Columbia Applied Research and Evaluation Services. The results of this test are used mostly by post secondary institutions and professional organizations within the Province of British Columbia and in the territory of Yukon. The test is 2.5 hours long and consists of five components; Parts I and II are multiple choice and deal with catching various grammar related mistakes. Part III is a reading comprehension section, also in multiple choices. Part IV deals with writing brief summaries of a short piece of writing and Part V is a 300-500 word essay.

The Minnesota Language Proficiency Assessments (MLPA) is a battery of instruments designed to measure learners' proficiency in reading, writing, speaking, and listening at two intermediate levels on the ACTFL scale in French, German, and Spanish. An online version of the reading, writing, and listening MLPA is now available. CARLA is currently recruiting teachers of French, German and Spanish to help pilot the speaking assessment.

CELIP is the Canadian English Language Proficiency Index Program. Developed at the University of British Columbia (UBC), CELPIP is a complete set of computer-delivered English language proficiency tests used to assess an individual's functional skills in English for listening, speaking, reading, and writing. It has two parts: general and academic. The Canadian English Language Proficiency Index Test-General assesses proficiency levels of general reading and writing skills. The test consists of five parts based on everyday general reading and writing tasks. It is accepted by Citizenship and Immigration Canada (CIC) for immigration points. Also suitable for certain post-secondary and employment training programs in which functional reading and writing skills are required.

The Canadian English Language Proficiency Index Test-Academic assesses proficiency of beginning college or university-level reading and writing. The test consists of four subtests: sentence structure, reading comprehension, English usage, and essay writing. It is suitable for university or college programs where a higher level of English communication and composition skills is required.

The Defense Language Proficiency Test (or DLPT) is a battery of foreign language tests produced by the Defense Language Institute and used by the United States Department of

Defense (DoD). They are intended to assess the general language proficiency of native English speakers in a specific foreign language, in the skills of reading and listening.

DIALONG is an online diagnostic language assessment system designed to assess language proficiency in 14 European languages. It was funded by the European Commission and by some 25 institutions, largely universities, throughout the European Union. According to the DIALANG website, it was designed primarily for European citizens to assess their language abilities in adherence to Europe's Common European Framework of Reference – CEFR – as a basis for determining language proficiency. The CEFR is a widely recognized framework used to describe and measure the language proficiency level of a learner in a particular language. The current version provides test in Danish, English, Finnish, French, German, Greek, Italian, Portugese, Spanish, Swedish, Irish, Icelandic, and Norwegian. DIALANG offers separate test for reading, writing, listening, grammatical structures and vocabulary. These tests enable the users to become aware of their strengths and weaknesses. The tests are offered across a wide range of proficiency levels from beginners to advanced. Due to the limitations of the test design, DIALANG has not yet developed effective methods to test speaking and writing. DIALANG uses an indirect approach to assess written tasks: many writing tasks in DIALANG resemble reading, vocabulary or grammar tasks. Users are given the opportunity to write to complete some tasks; however, they may be limited to just a few words. The purpose of DIALANG is to offer information regarding the strengths and weaknesses of a language. DIALANG suggest that its system will be most valuable to teachers, language teaching institutions, institutions running independent language learning schemes, and in institutions interest in promoting language proficiency among their staff. DIALANG is intended for any foreign language learner. DIALANG can assess language proficiency of those formally trained in language classes and those trained informally. DIALANG suggests that its unique feature of offering test in 14 languages could be particularly suitable to the diverse L2 learners in Canada.

The General Tests of English Language Proficiency (G-TELP) comprise a testing system designed to assess the English Language ability of non-native speakers in task oriented, real-world situations. Evaluation of test-taker performance is based on well defined, functional language tasks. The G-TELP system offers assessment at five levels of proficiency. G-TELP is the most well-known English speaking test in Korea and chosen as the English speaking proficiency test for admission and promotion exams for corporations, administrative exams for government organizations, and certification exams for pilots. G-TELP's client list includes: The Ministry of Foreign Affairs, The Civil Aviation Safety Authority of the Ministry Construction & Transportation, Hyundai Motor Company, Kia Motors, Korean Airlines, Asiana Airlines, Korea Airport Service, Oracle Korea Corporation, Hanjin Co., Ltd., Hewlett-Packard, J&J and P&G etc.

Michener English Language Assessment (MELA) is set in the context of health care. It describes language proficiency in four skill areas: Speaking, Listening, Reading and Writing. MELA test scores are reported using Canadian Language Benchmarks (CLB) which are a national Canadian standard of English language proficiency. MELA is used to determine communicative readiness to join health care educational programs and assist program consultants to advise applicants about strong and weak areas in their language proficiency and provide options for skill development.

IX. Priming and Bilingual Proficiency

Priming refers to an increased sensitivity to certain stimuli due to prior experience. Because priming is believed to occur outside of conscious awareness, it is different from memory that relies on the direct retrieval of information. Direct retrieval utilizes explicit memory, while priming relies on implicit memory. Research has also shown that the effects of priming can impact the decision-making process (Jacoby, 1983).

Priming occurs when an earlier stimulus influences response to a later stimulus. For example, when a person reads a list of words including the word *table*, and is later asked to complete a word starting with *tab*, the probability that subject answers *table* is higher than for non-primed people. Priming works best when the two stimuli are in the same modality. For example visual priming works best with visual cues and verbal priming works best with verbal cues. But priming also occurs between modalities or between semantically related words such as ‘doctor’ and ‘nurse’.

Priming can be perceptual or conceptual. Perceptual priming is based on the form of the stimulus and is enhanced by the match between the early and later stimuli. Perceptual priming is sensitive to the modality and exact format of the stimulus. For example, when an individual is shown an incomplete sketch to identify but is unable to do so, but when shown additional related sketches to enhance perceptual cues, identification of the sketch is likely to be much earlier in subsequent attempts. Whereas for conceptual priming, it is necessary to cue the meaning of a stimulus by providing semantic related tasks. For example, *table*, will show priming effects on *chair*, because *table* and *chair* have similar conceptual base as they belong to the same category of furniture.

A distinction is also made between semantic priming and associative priming. In semantic priming, the prime and the target are from the same semantic category and share features; in associative priming, on the other hand, the target is a word that has a high probability of appearing with the prime, and is "associated" with it but not necessarily related in semantic features. For example, the word *dog* is a semantic prime for *wolf*, because the two are both animals, but *dog* is not an associative prime for *wolf* because the words don't frequently occur together. On the other hand, *dog* is an associative prime for *bone*, since the words are closely associated and frequently appear together

Priming results in an increase in the accuracy, probability or speed of response to stimulus as a consequence of a prior exposure to another stimulus. Priming occurs when the processing of a word (the target) is facilitated by a preceding stimulus (the prime). The first word is called the prime and the word to which a response (lexical decision or naming) has to be made is called the target. The time between the presentation of a prime (its onset) and the start of the target is called Stimulus Onset Asynchrony (SOA). The most common interpretation of priming is that the cortical representation of the prime and target are interconnected or overlap in some way such that activating the representation of the prime automatically activates the representation of the target word.

Majority of the studies employing priming principles reported in the literature have investigated the models of bilingual lexical organization employing tasks such as translation production, translation recognition, Stroop tasks, picture naming etc. For example, in the Revised

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

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

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

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

Keatley, Chapman, Newstrom, Mac Dade and Morellato, (1994) demonstrated priming asymmetries even in highly fluent Dutch-English bilinguals; priming was significant only in the L1-L2 direction and not in the reverse for semantically related prime-target pairs. Similar results have been reported by Grainger and Frenck-Mestre (1998) for translation primes in highly proficient French-English bilinguals.

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

a) Cross-language Priming

Cross-language priming experiments give an insight into the bilingual's architecture. There are different types of priming strategies: Semantic Priming/Associative Priming; Phonological Priming; Repetition Priming or Translation Priming; Orthographic Priming / Form Based Priming; and Syntactic Priming. Researchers have frequently used the translation priming and semantic priming paradigms using Lexical Decision Task (LDT) to assess lexical organization/dominance in bilinguals.

The LDT can be of four different types:

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

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

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

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

The present study employs the visual pair wise LDT in a cross-language translation and semantic priming paradigm. The semantic priming effects obtained with the lexical decision task may be attributed to Posner and Snyder's (1975) dual process theory of priming. According to this, priming effects may be either due to fast acting, inhibition less automatic priming component or induced via attentional processes, reflecting subjects awareness of contextual factors that extend beyond the prime-target relationship, i.e., strategic priming.

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

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

In studies investigating cross-language priming it has been reported that cross language priming occurs with SOAs of 300 milliseconds or less (Chen & Ng, 1989; Keatley et al., 1994). With longer SOAs it is assumed that strategic factors play a role in producing priming effects. In strategic priming or priming induced via attentional process, two types of mechanisms have been proposed to explain these strategic priming effects - *Expectancy and Post lexical checking*. Expectancy accounts posit that subjects use the prime to generate a set of expectations about the forthcoming target (Becker 1980, Posner and Snyder 1975a). If the subsequent target is indeed in this expectancy set, reaction times are facilitated. If not, reaction times are inhibited because subjects must devote more attentional resources to activate the node for a word not present in the expectancy set.

Post lexical processing involves the accession of expected and unexpected targets at the same rate, but the subsequent decision to accept or reject the target as a word is influenced by subject expectations. Thus, strategic priming can be because of post lexical integration mechanism or allocation of attention to the memory area containing the representation of the target word prior to its occurrence. In either case, strategic effects (controlled, conscious), may be facilitatory or inhibitory where as automatic priming effects are always facilitatory. Hence, in order to measure the relative contribution of facilitatory and inhibitory effects to the overall semantic priming effect, a neutral priming condition must be used. The purpose of using a neutral prime is to provide a baseline priming condition that is semantically neutral in comparison to the related and unrelated word prime conditions. Facilitatory effects refer to faster and/or more accurate response in related word condition as compared to the neutral priming condition. Inhibitory effects refer to slower and/or less accurate responses in the unrelated word condition as compared to the neutral priming condition.

During the past three decades, there has been a plethora of studies from other countries on bilinguals which have used semantic priming paradigm with between language stimuli (Chen and Ng, 1989; Frenck and Pynte, 1987; Grainger and Beauvillain, 1988; Keatley and de Gelder, 1992; Keatley, Spinks and de Gelder, 1994; Kirsner et al., 1984; Larsen, Fritsch, and Grava, 1994; Meyer and Ruddy, 1975; Schwanenflugel and Rey, 1986; Tzelgov and Eben-Ezra, 1992; Williams, 1994). But, there are no studies investigating priming effects as an indicator of language proficiency in India. Hence, the present study is proposed to examine the priming patterns across bilinguals. The patterns of priming in bilinguals will be further compared with the self-rating of proficiency in languages by bilinguals on a questionnaire. If the results on priming and self-rating are found to be congruent with each other, eventually, it may be proposed to adopt priming tasks as an efficient and quick method for assessment of proficiency in bilingual adults.

X. Need for the Study

Bilingualism in India is different from that prevalent in the countries such as Europe and United States of America. In the light of this situation, generalization of findings from the Western countries to the Indian context does not seem to be appropriate. Further, assessment of bilingual proficiency through offline tools such as questionnaires is reported to be subjected to bias as either the participant or the tester rates proficiency. Hence, studies employing primed lexical decision that would serve as online measure to derive an index of proficiency are much needed in the Indian context. With this perspective, the present study was proposed with the purpose of developing an online tool to measure proficiency in Hindi-English bilinguals.

XI. Objectives of the Study

1. To develop a language proficiency test for Hindi-English bilingual adults on the principle of primed LDT.
2. To compare the performance of primed lexical decision in each of the languages of the bilinguals (Hindi- English).
3. To compare the performance of bilinguals based on nature of words in each of the languages.
4. To compare the performance of bilinguals on LDT and self reporting proficiency questionnaire.
5. To develop a yardstick to classify bilingual adults based on their proficiency.

CHAPTER II

METHOD

Objective of the study is to develop a test for language proficiency in Hindi- English bilingual adults. Language proficiency is generally evaluated with the help of questionnaire developed for specific purpose of the study in question. Hence, such questionnaires, most often are in- applicable for other purposes besides being time intensive on the part of the investigator as well as participant. Hence, the present study is undertaken with the aim of developing a computer based test for quick, online assessment of language proficiency that serves a wide range of purposes for professionals such as speech language clinicians, researchers, educational administrators involved in assessing the proficiency of languages in teachers, or the second language learners to know their success in language learning. The test is designed by employing the principle of priming using Lexical Decision Task (LDT).

a) ***Design of the study***: Single group design was adapted with the objective of comparing the performance on two tasks- questionnaire and LDT. The study was conducted in two phases. First phase involved administration of LEAP-Q[1], a self rating tool for language proficiency and language usage. Second phase involved administration of lexical decision task in both Hindi-English and Kannada- English languages using DMDX software[2] for the same group of participants.

i) *Participants**:*** Sixty participants (30 males and 30 females) who are Hindi-English bilinguals among whom 15 Speech Language Pathologists and 15 non Speech Language Pathologists were included in the study based on the inclusionary criteria mentioned below.

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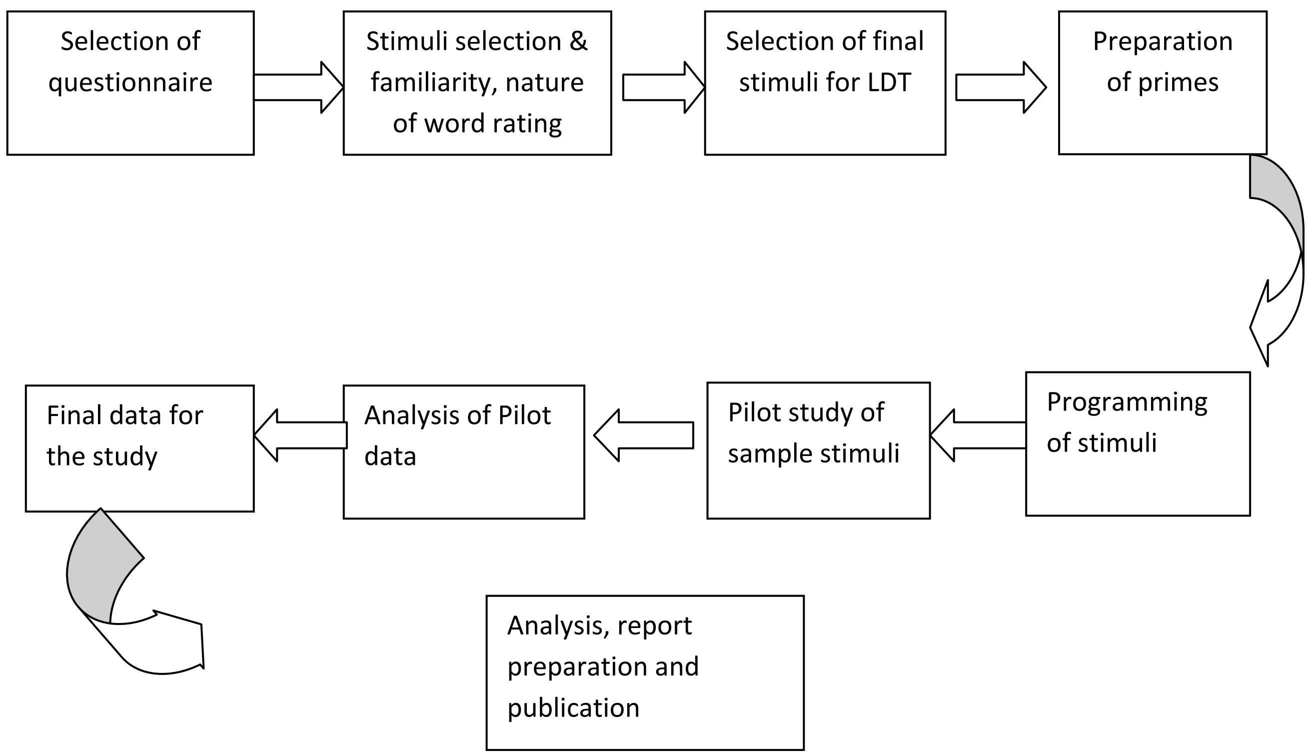
[1] LEAP-Q refers to the language experience and proficiency questionnaire, used for assessment of proficiency in bilinguals developed by Marian.V, Blumenfield.H in the year 2007.

[2] DMDX software was developed by Kenneth Foster and Jonathan Forster at the university of Arizona. DMDX is a WIN32 based display system used to measure reaction time for visual and auditory stimulus. Detail information regarding this software is available at the following website: www.u.arizona.edu.dmdx

- Age (18-30years)
- Native speakers of Hindi and Kannada language with exposure to English as a second language.
- Minimum of 10 years of educational experience in the two languages under study.
- No history of sensory, motor and/or psychological problems.

The following steps were conceived for the conduct of the study.



ii) Selection of questionnaire

Various questionnaires used for assessment of language proficiency were reviewed. Some of the questionnaires considered were Language Assessment Scales (De Avila & Duncan, 1990), Idea Language Proficiency Test (Dalton & Barret,1991) and Woodcock Munnoz Language Survey (Woodcock Munnoz – Sandoval, 1993), International Second Language Proficiency Rating scale (Ingram & Wylie 1997) and LEAP-Q (Marian, Blumenfeld & Kaushanskaya, 2007). Although these scales are useful in measuring language proficiency, there are a few shortcomings as listed below:

- Many of the test items are not valid (Haber, 1985; Carpenter, 1994; Hedberg, 1995, Kao,1998)
- Inter rater reliability is low (Crocker, 1998)
- Norms are not available on Indian population and few do not provide clear distinction among language proficiency, dominance and preference.

However LEAP-Q (Marian, Blumenfeld & Kaushanskaya, 2007) provides elaborate information about bilingual proficiency with respect to language acquisition, language use in different language environments, along with self rating of proficiency. This tool has been constructed within the context of bilingualism theories. They have considered both language proficiency and language history variables to specify the type of bilingualism. Language competence is evaluated using proficiency, dominance and preference ratings. Hence LEAP-Q was selected and also because of the reason that it has norms for Indian languages (Ramya, 2009).

iii) Familiarity rating and nature of word judgment of stimuli

Eight hundred words- four hundred each in Hindi and English were collected. These words were subjected to familiarity ratings and concreteness and abstractness judgment by 3 experienced professionals (one special educator, one SLP, and one linguist). The three experts adapted a 3-point rating scale where 2 - very familiar 1-familiar and 0- least for familiarity rating and 'C', 'A' representation for concrete and abstractness judgment respectively.

iv) *Selection of Stimuli for LDT*

a) ***Words:*** The words rated by the experts as '2' (very familiar) and '1' (familiar) were selected for the final set of stimuli, where as the words which were rated as 'zero' (less familiar) were excluded from the list of words. The target words thus selected were familiar, concrete or abstract words. The concrete words were nouns and abstract words were adjectives and nouns.

b) ***Non words:*** Non words were prepared in order to counterbalance the word stimuli sets. They were prepared by transposing letters in the word stimuli. The non words were prepared in conformation with the phonological rules of respective target languages.

The total number of stimuli selected for the study was eight hundred target items and ten trial items. Out of twelve hundred items, four hundred each were selected from Hindi, Kannada and English language. In each of the languages the items were further divided into three sets consisting of hundred in individual set. The sets were formed based on the relation of prime with that of target word, the three sets being semantically related, translation equivalents and semantically unrelated conditions. For each language 99 non words were selected in order to achieve word to non word ratio of 0.3.

V) Preparation of primes

Three different types of primes were prepared for selected target words, the types being semantically related primes, translation equivalents primes and semantically unrelated primes. Semantically related primes consisted of words which belonged to the same semantic category as that of the target, and also synonyms, antonyms and derivatives of the target words. The translation equivalent primes were the exact translation of the stimulus in the non target language and the semantically unrelated primes comprised of words that did not have syntagmatic relationship with target words and were of different semantic category. Among 300 target words, 100 words were preceded by semantically related primes, 100 by translation equivalent primes and 100 by semantically unrelated primes in each language. Non words were also preceded by 3 sets of primes similar to target words. It was ensured that most of the primes were simple and its frequency of occurrence in spoken language is high.

vi) Programming of stimuli, primes and non words

The programming of stimulus was done using DMDX software version 4.0. The target words, non words and their primes were programmed for presentation. Primes were displayed in the center line of computer monitor where as target stimulus appeared 5 centimeters above the center line to ensure that the participants distinguished the prime and the target. Words were displayed in bold black letters on a white background. Each prime displayed lasted for 500 millisecond. This was followed by an inter stimulus duration of 250 millisecond following which target stimuli was displayed for 2000 millisecond. The maximum duration available for the participants to respond was 4000 millisecond. The reaction time was measured as the time taken from the start of stimuli until the subject responds or until 4000 millisecond, whichever occurred first. If the subject failed to respond to the target within this 4000 millisecond, the response was recorded as error, and inter trial interval was initiated followed by presentation of subsequent prime. The '1' key on keyboard was used to indicate "yes" response and '0' key for "no" response.

vii) *Procedure*

Participants were enrolled after they signed in the consent letter indicating their willingness to be a part of the study. All the participants were given a copy of LEAP-Q to rate their bilingual proficiency. On an average, 40-45 minutes were taken by the participants to fill-up the questionnaire. Consequent to self rating, they were given the lexical decision task programmed on the DMDX using Compaq laptop (Window-based) with 14" color monitor.

The stimulus presentation for the lexical decision and the response recording were controlled using DMDX, a computer based software. The experiment was conducted in a silent environment with subjects seated comfortably on a chair. The monitor distance from participant's eyes was maintained at about 50 centimeters. The participants were familiarized with the test procedure through five trial stimuli. Subsequent to this, the participants were instructed as - "You will be presented with several pairs of words as stimuli. In each pair, one of the stimuli will be aligned at the center and the other above the center of the monitor. You will have to concentrate on the stimulus appearing above the center of the monitor. Your task is to decide whether that stimulus (appearing above the center of the monitor) is a word, having meaning or non word, having no meaning. If it is a word press '1' key and if it is a non word press '0' key as soon as you decide."

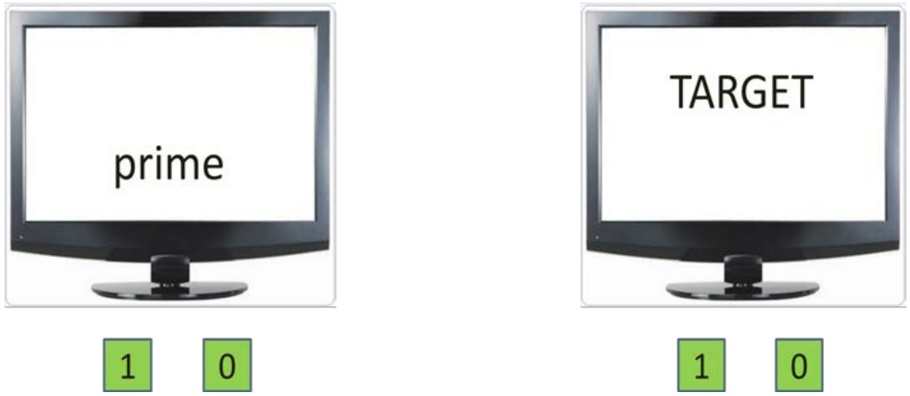


Figure 2
Schematic representation of presentation of prime and target

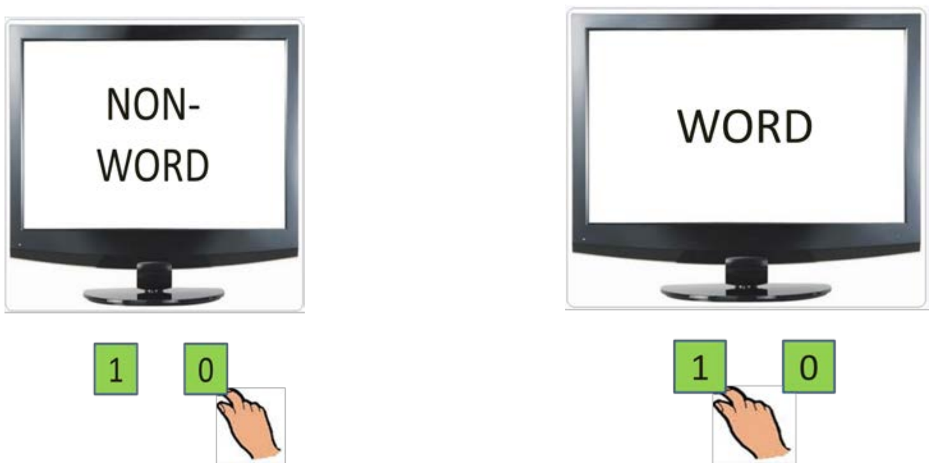


Figure 3
Schematic representation of response button to word and nonword

This was followed by presentation of test items. For 50% of the participants the task started with Hindi as target language and for the others, English was the target language at the start of the task. Within each language, the order of presentation of three sets of programs was counterbalanced between the language groups.

viii) *Pilot study*

To assess the efficacy of the configured program, a pilot study was carried out on six participants who met the inclusion criteria as mentioned above. Initially participants were asked to fill the LEAP-Q (Marian, Blumenfeld & Kaushanskaya 2007; Ramya 2009) which was followed by administration of the pilot test stimuli, employing the same procedure proposed for the main study. The results obtained on both the tasks i.e. self rating of proficiency with the questionnaire and the mean reaction times obtained on lexical decision task were analyzed. Analysis revealed that for 4 out of 6 participants the performance on these two tasks matched with each other i.e. for those subjects who had rated their proficiency to be high on the LEAP-Q had obtained less mean reaction time and vice versa. The parameters considered were found to be adequate through the pilot study. Hence, the main study was carried as designed. The participants were initially made to fill the questionnaire, LPQ and later were administered the primed LDT task Hindiand English following the procedure as mentioned earlier.

ix) Data compilation

As the primary objective of the present study was to develop a computerized tool for the assessment of proficiency in bilinguals, employing the lexical decision principle, the reaction time obtained on the lexical decision task by Hindi-English across the three stimulus sets/programs (translation equivalents, semantically related and semantically unrelated) were compared to their self rating score on LEAP-Q.

The self rating part (question number 10* in the LPQ) was extracted to estimate the participants rating of their proficiency in L1& L2 across the four domains of LEAP-Q i.e. speaking, understanding, reading and writing. The scores were tabulated and entered in Microsoft excel program. Similarly for the primed lexical decision task mean reaction time was extracted and tabulated for each language separately, for the three programs (translation equivalents, semantically related and semantically unrelated programs) and entered in Microsoft excel program.

The scores obtained from the LEAP-Q ranged from 4 to 1, a score of 4 represented perfect or native like proficiency, 3 indicated good, 2 indicated low and 1 indicated no proficiency. The reaction time obtained from the lexical decision task was in milliseconds. The reaction time for incorrect responses was also not considered and was rounded of to ‘0’ at the time of tabulation. However the incorrect responses were considered for qualitative analysis. The accuracy of correct responses, error responses specific to concrete, abstract and non words was obtained from the lexical decision task in Hindi-English bilinguals across the three stimulus sets/programs.

CHAPTER III
RESULTS AND DISCUSSION

The present study was carried out with the objective to develop a digitized online test for assessment of language proficiency in Hindi - English bilingual adults. For this purpose lexical decision task was employed. The lexical decision task involved three types of stimuli (semantically related, translation equivalents and semantically unrelated words) in each language. The reaction time for LDT was measured using DMDX program. The reaction time was compared for the two languages across each of the stimuli type. The performance of participants in this task was compared with self ratings of LEAP-Q for validation.

For all the three types of stimuli mean and standard deviation values for reaction time were extracted. All values below 200 milliseconds and above 3000 milliseconds were considered as outliers and eliminated from analysis as discussed earlier. The reaction time (R.T.) for incorrect responses was also eliminated from analysis. This elimination did not change the general pattern of results as this accounted for only 2% of total data. The values that were obtained were subjected to further statistical analysis using SPSS (version 17.0). t-test and ANOVA were employed to find out if there were statistically significant differences in the reaction time between the two languages (Hindi and English) and the three types of stimuli (semantically related, semantically unrelated and translation equivalent words).

i) Mean and SD scores on LDT

One of the main objectives of the study was to develop language proficiency test for Hindi -English bilingual adults on the principle of primed LDT. Hence, the results obtained in this task are analyzed and discussed with reference to this objective. The performance of both SLP and non-SLP participants in the LDT was compared for Hindi and English languages. The mean and standard deviation values of R.T. for the three types of stimuli (translation equivalents, semantically related and semantically unrelated) and two languages of the bilinguals (Hindi and English) are shown in Table 1 and Figure 1.

Table 1

Mean R.T. and SD for LDT for Hindi and English

Descriptive Statistics

	group	Mean	Std. Deviation	N
SRENG	SLP	826.2383	186.16034	30
	Non-SLP	797.7294	201.17636	30
	Total	811.9839	192.70122	60
SURENG	SLP	827.3700	175.71934	30
	Non-SLP	859.6490	231.66918	30
	Total	843.5095	204.50511	60
TEENG	SLP	766.3173	172.89889	30
	Non-SLP	785.5272	227.60727	30
	Total	775.9223	200.62652	60
SRHIN	SLP	977.6149	276.68484	30
	Non-SLP	948.9642	231.88204	30
	Total	963.2895	253.50768	60
SURHIN	SLP	969.6553	318.17153	30
	Non-SLP	1003.4292	274.28037	30
	Total	986.5423	295.00165	60
TEHIN	SLP	857.6513	252.37264	30
	Non-SLP	876.9390	234.05152	30
	Total	867.2952	241.50903	60

(SRENG=Semantically Related English stimuli; SURENG= Semantically Unrelated English stimuli; TEENG=Translation Equivalent English stimuli; SRHIN= Semantically Related Hindi stimuli; SURHIN=Semantically Unrelated Hindi stimuli; TEHIN= Translation Equivalent Hindi stimuli)

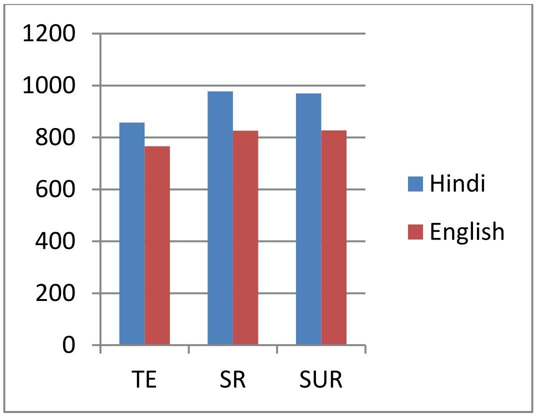


Figure 1

Mean reaction times for Hindi and English languages (SLP) H-Hindi; E English; TE-Translation Equivalent; SR-Semantically related; SUR-Semantically unrelated.

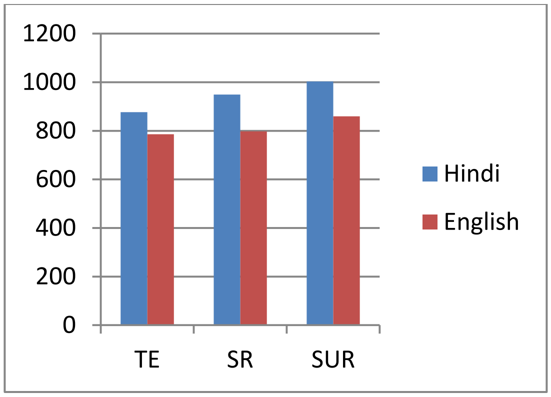


Figure 2

Mean reaction times for Hindi and English languages (Non-SLP) H-Hindi; E English; TE-Translation Equivalent; SR-Semantically related; SUR-Semantically unrelated.

As shown in Table 1 and Figure 1 and Figure 2, for translation equivalent stimuli type in Hindi, the mean and standard deviation values were 857.65 milliseconds and 252.37 milliseconds for SLP's and 876.93 and 234.05 milliseconds for Non-SLP's. The mean and standard deviation for translation equivalent stimuli type in English were 766.31 milliseconds and 172.89 milliseconds for SLP's and 785.52 and 227.60 milliseconds for Non-SLP's respectively.

Further statistical analysis was carried out employing Paired samples T- test to test for statistical differences in the R.T. between Translation Equivalent (TE) stimuli types in Hindi and English language (SLP's). The p value was 0.066 ($p>0.05$) suggesting no significant difference on TE words between the two languages. Whereas p value for Non SLP's was 0.049 suggesting significant difference on TE words between the two languages ($p<0.05$).

Similarly, the mean and standard deviation scores for semantically related (SR) Hindi stimuli and semantically related English stimuli were 977.61 milliseconds; 276.68 milliseconds for SLP's and 948.96 and 231.88 milliseconds for Non SLP's. The mean and standard deviation for semantically related stimuli type in English were 826.23 milliseconds and 186.16 milliseconds respectively for SLP's and 797.72 and 201.17 milliseconds respectively for Non

SLP's. Paired sample T- test was done to analyze if difference between these two stimuli. The p value was 0. 008 and 0.003 ($p<0.05$) again suggesting significant difference between the two languages for the SR stimuli for both SLP and Non SLP's.

The mean and standard deviation scores for the semantically unrelated (SUR) stimuli type in both the languages are also depicted in Table.1 The mean and standard deviation values for Hindi SUR stimuli type were 969.65 milliseconds; 318.17 milliseconds for SLP's and 1003.42 and 274.28 milliseconds for Non SLP's. The mean and standard deviation for semantically unrelated stimuli type in English were 827.37 milliseconds and 175.71 milliseconds respectively for SLP's and 859.64 and 231.66 milliseconds respectively for Non SLP's. Paired sample T- test was done to analyze if difference between these two stimuli. The p value was 0.030 and 0.019 ($p<0.05$) again suggesting significant difference between the two languages for the SR stimuli for both SLP and Non SLP's.

Table 2
Paired sample test for Hindi and English languages (SLP)

		t	df	Sig. (2-tailed)
Pair 1	SRENG – SRHIN	-2.851	29	.008
Pair 2	SURENG – SURHIN	-2.275	29	.030
Pair 3	TEENG – TEHIN	-1.908	29	.066

(TE-Translation Equivalent; SR- Semantically related; SUR-Semantically unrelated)

Table 3
Paired sample test for Hindi and English languages (Non-SLP)

		t	df	Sig. (2-tailed)
Pair 1	SRENG - SRHIN	-3.274	29	.003
Pair 2	SURENG - SURHIN	-2.480	29	.019
Pair 3	TEENG - TEHIN	-2.056	29	.049

(TE-Translation Equivalent; SR- Semantically related; SUR-Semantically unrelated)

ii) ***Mean and SD scores on LEAP-Q***

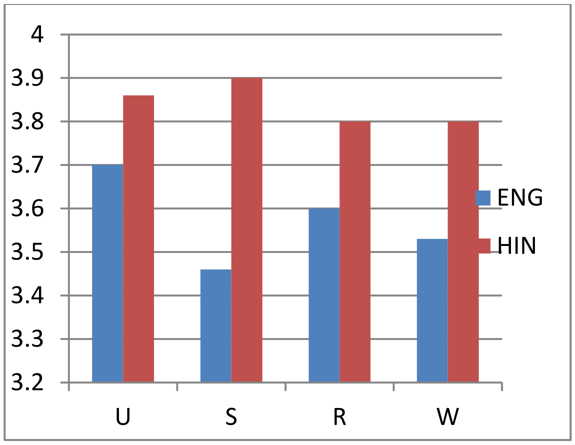
For the purpose of comparison of performance in LEAP-Q with LDT and also between the two languages, the self rating scores of the participants of their proficiency in the questionnaire under four domains namely, Understanding, Speaking, Reading and Writing in both Kannada and English languages were considered. In the questionnaire the participants were required to rate their proficiency employing four point rating scale with the denotations: 4 - Native like proficiency; 3 - Good proficiency; 2 - Low proficiency; 1 - Zero proficiency. The mean and standard deviation were computed for all the four domains in both the languages.

Table 4
Comparison of performance in LEAP-Q for Hindi and English

Participants	MEAN (SLP group) (Max score=5)	MEAN (Non-SLP Group) (Max score=5)
EU	3.7 (0.46)	3.7 (0.44)
HU	3.86 (0.34)	3.9 (0.18)
ES	3.46 (0.50)	3.3 (0.66)
HS	3.9 (0.30)	3.8 (0.48)
ER	3.6 (0.56)	3.7 (0.44)
HR	3.8 (0.40)	3.8 (0.37)
EW	3.53 (0.68)	3.6 (0.47)
HW	3.8 (0.40)	3.7 (0.50)

(N=30)

HU- Hindi Understanding; HS- Hindi Speaking; HR- Hindi Reading;
HW- Hindi Writing; EU- English Understanding; ES- English Speaking;
ER- English Reading; EW- English Writing



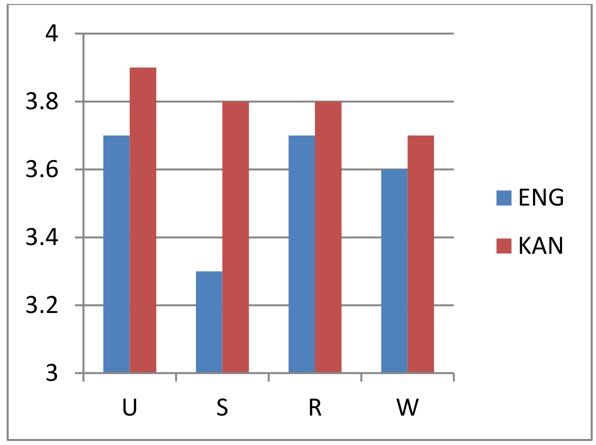


Figure 3

Comparison of performance in LEAP-Q for Hindi and English language (SLP)

(U- Understanding; S- Speaking; R- Reading; W-Writing)

Figure 4

Comparison of performance in LEAP-Q for Hindi and English language (Non-SLP)

(U- Understanding; S- Speaking; R- Reading; W-Writing)

As shown in Table 4 and Figure 4, the mean and standard deviation of self ratings of the participants for the domain 'Understanding' in English and Hindi SLP's were 3.7;0.46 and 3.86 ; 0.34 respectively. Similarly mean and standard deviation values for the domain 'Speaking' in English and Hindi were 3.46; 0.50 and 3.9 ;0.30. For the domain 'Reading' in English and Hindi mean and standard deviation were 3.60,0.56 and 3.8, 0.40 respectively and for the domain 'Writing' mean and standard deviation values of self ratings for English and Hindi were 3.53; 0.68 and 3.8 ; 0.40.

As shown in Table 5 and Figure 5, the mean and standard deviation of self ratings of the SLP's for the domain 'Understanding' in English and Hindi were 3.7;0.44 and 3.9 ; 0.18 respectively; for 'Speaking' were 3.3; 0.66 and 3.8 ;0.48; for 'Reading' were 3.70,0.44 and 3.8, 0.37 and for 'Writing' were 3.6; 0.47 and 3.7 ; 0.50.

iii) *Comparison of scores on LDT and LEAP-Q*

As the second objective of the study was to validate the performance of participants in the language proficiency test developed on the principle of primed LDT, correlation measures were obtained for the scores obtained on the LEAP-Q with LDT. Pearson rank correlation test was employed to derive the correlation coefficient. The mean scores of the three stimuli types were tested for their correlation with the four domains of in each language.

The results obtained in Hindi language (SLP) are discussed below. Results revealed significant negative correlation for domains Understanding, Speaking, Reading and Writing with the stimuli type translation equivalent. The results showed that there was significant negative correlation between the four domains (Understanding, Speaking, Reading and Writing) of LEAP Q with LDT suggesting that with the increase in the reaction time for the LDT, there was a decrease in the self ratings for these two domains. The correlation coefficients and the significance levels of the same are tabulated in Table 5.

Table 5
Correlation coefficients and significance level for TE , SR & SUR stimuli type in Hindi

Type of Stimuli	**H U**		**HS**		**HR**		**HW**	
TE	Correlation coefficient	**p**	Correlation coefficient	**p**	Correlation coefficient	**p**	Correlation coefficient	**p**
TE	-.651**	0.00	-.446*	.013	-.454*	0.012	-.404*	0.027
SR	-.739**	0.000	-.478**	0.008	-.449*	0.013	-.308	0.098
SUR	-.728**	0.000	-.474**	0.008	-.518**	0.003	-.411*	0.024

(N=30); (TE- Translation Equivalent stimuli type; HU- Hindi Understanding; HS- Hindi Speaking; HR- Hindi Reading; HW- Hindi Writing)

The results obtained for English language are as follows. Results revealed significant negative correlation for domains of Understanding, Speaking and Writing but weak correlation for Reading, with the stimuli type translation equivalent. For SR stimuli type in English language, strong negative correlation was seen for, Speaking but not for understanding, reading and writing domain. However no such trend was observed for the SUR stimuli type in English language. A strong negative correlation is seen for understanding, reading and writing but not for speaking domain. The correlation coefficients and significance levels of the same are shown in Table 6.

Table 6

Correlation coefficients and significance level for TE , SR & SUR stimuli type in English

Type of Stimuli	**E U**		**ES**		**ER**		**EW**	
	Correlation coefficient	**p**	Correlation coefficient	**p**	Correlation coefficient	**p**	Correlation coefficient	**p**
TE	-0.63	**0.00**	-.074	0.697	.074	0.697	-.115	0.545
SR	.223	.236	-.030	.877	.085	.657	.229	.224
SUR	-.400*	.029	.000	.997	-.009	.963	-.224	.235

(N=30); (TE- Translation Equivalent stimuli type; EU- English Understanding;ES- English Speaking; ER- English Reading; EW- English Writing)

Performance of Non-SLP group on Hindi language revealed significant negative correlation for domains Understanding and Writing but not with speaking and reading. Similar trend was not seen for SR stimuli type, depicting strong negative correlation for all the domains. For SUR stimuli type strong negative correlation for reading and writing was observed but a positive correlation seen for understanding and speaking domain. The correlation coefficients and the significance levels of the same are tabulated in Table 7.

Table 7

Correlation coefficients and significance level for TE , SR & SUR stimuli type in Hindi

Type of Stimuli	**H U**		**HS**		**HR**		**HW**	
	Correlation coefficient	**p**	Correlation coefficient	**p**	Correlation coefficient	**p**	Correlation coefficient	**p**
TE	-.380*	.038	.000	.998	.013	.944	-.092	.627
SR	.[a]	**.000**	-.071	.709	-.074	.696	-.315	.090
SUR	0.32	**0.00**	.028	.883	-.094	.621	-.372*	.043

(Non-SLP; N=30); (TE- Translation Equivalent stimuli type; HU- Hindi Understanding; HS- Hindi Speaking; HR- Hindi Reading; HW- Hindi Writing)

The results obtained for English language (Non-SLP) revealed strong negative correlation for domains Understanding, Speaking but weak correlation for Reading and Writing, with the stimuli type translation equivalent. For SR stimuli type in English language, strong negative correlation was seen for all the domains. However a similar trend was observed for the SUR stimuli type in English language. A strong negative correlation is seen for understanding, reading and writing but not for speaking domain. Table 7 depicts the correlation coefficients and significance levels obtained for this stimuli type.

Table 8
Correlation coefficients and significance level for TE, SR & SUR stimuli type in English

Type of Stimuli	**E U**		**ES**		**ER**		**EW**	
TE	Correlation coefficient	**p**	Correlation coefficient	**p**	Correlation coefficient	**p**	Correlation coefficient	**p**
TE	-.196	.299	-.135	.478	.069	.715	-.077	.685
SR	-.016	.934	-.131	.492	-.023	.905	-.079	.677
SUR	-.072	.707	-.071	.709	-.091	.631	-.015	.938

(Non-SLP; N=30); (TE- Translation Equivalent stimuli type; EU- English Understanding; ES- English Speaking; ER- English Reading; EW- English Writing)

iv) Performance on LDT in Hindi and English languages

The third objective of the study was to compare the performance of primed lexical decision for each type of stimuli (SR, SUR & TE) in two languages (Hindi and English) of the two groups of bilinguals (SLP and non-SLP group). One-way repeated measure ANOVA was carried out to find out if there was any significant difference in the R.T. between the three stimuli types in English. For the SLP group, the results did not indicate difference in the R.T.'s for three stimuli types {F (2, 58) =1.30 p < 0.28} in English. Whereas, for Hindi language there was a statistical difference {F (2,58)=19.88, p<0.00} between SR, SUR and TE with TE being significantly different from the other two conditions (p<0.00). For English language, the results revealed significant difference only between SR and SUR stimuli (p<0.00) for the non SLP group. Within subjects, however, no difference {F (2,58) =4.27 p<0.01} was observed. Table 9, 10 and 11 show the details.

Table 9
Tests of Within-Subjects Effects

⇨ Groups	SLP Group			Non-SLP Group		
Languages ⇩	df	F	Sig.	df	F	Sig.
English	2	1.30	.28	2	4.27	.01
Error (English)	58			58		
Hindi	2	19.88	**.00**	2	13.20	**.00**
Error (Hindi)	58			58		

P.S.: Sphericity assumed (N=60)

Table 10
Pairwise comparison of three types of stimuli

	English Condition (I)	English condition (J)	English-SLP group		Hindi-SLP group	
			Mean Difference (I-J)	Sig.[a]	Mean Difference (I-J)	Sig.[a]
Dimension 1	1	2	-61.920*	.004	7.960	1.000
		3	12.202	1.000	119.964*	.000
	2	1	61.920*	.004	-7.960	1.000
		3	74.122	.078	112.004*	.000
	3	1	-12.202	1.000	-119.964*	.000
		2	-74.122	.078	-112.004*	.000

Table 11
Pairwise comparison of the three types of stimuli

Hindi condition (I)		Hindi condition (J)	Mean Difference (I-J)	Sig.[a]
Dimen sion1	1	2	7.960	1.000
		3	119.964*	.000
	2	1	-7.960	1.000
		3	112.004*	.000
	3	1	-119.964*	.000
		2	-112.004*	.000

Table 12
Three stimuli showing significant differences (Hindi-Non SLP group)

Measure:MEASURE_1

Hindi Condition (I)		Hindi Condition (J)	Mean Difference (I-J)	Sig.[a]
Dimens ion 1	1	2	-54.465*	.017
		3	72.025*	.035
	2	1	54.465*	.017
		3	126.490*	.000
	3	1	-72.025*	.035
		2	-126.490*	.000

v) ***To develop a yardstick to classify bilingual adults based on their proficiency***

The data was subjected to cluster analysis to examine if bilingual adults could be classified based on proficiency. Table 13 and Table 14 show the cluster centers and the number of participants in each cluster center for SLP group and non-SLP groups for English and the three types of stimuli respectively. On closer examination of the R.T. and the number of participants in each of the cluster group, it was possible to speculate high and low proficiency of participants in English language.

SLP Group: Out of thirty participants in SLP group, 8 were grouped in the first cluster (RT=1074.17) and 22 in the second cluster (RT=736.0) for SR stimuli. On the basis of the results, it may be inferred that those with RT less than736.0 could be treated as high proficient and those with R.T. greater than 1074.17 as low proficient in English. Similarly 19 participants were grouped in the first cluster (RT=1089.59) and 11 in the second (RT=716.66) cluster for SUR stimuli which suggests that individuals with the RT less than716.66 could be treated as high proficient and those with RT greater than 1018.59 as low proficient. Whereas 21 were grouped in the first cluster (RT=983.85) and the other 09 in the second (RT=673.09) cluster for TE stimuli suggesting that those with RT less than 673.09 could be treated as high proficient and with RT greater than 983.85 as low proficient in English language.

Similar analysis was carried out to examine proficiency of bilinguals in Hindi language. Out of thirty participants, 3 were grouped in the first cluster (R.T.= 1608.95) and 27 in the second cluster (R.T.= 907. 47) for SR stimuli. It can be suggested that individuals with the RT less than 907.47 are high proficient and with RT greater than 1608.95 are less proficient. Similarly 3 (R.T.=1688.08) were grouped in first cluster and 27 (R.T.= 889.83) in the second cluster for SUR stimuli. Therefore, individuals with the RT less than 889.83 could be treated as are high proficient and those with RT greater than 1688.08 as less proficient. Whereas 7 (R.T. = 1218.12) were grouped in the first cluster and 23 (R.T. = 747.94) for TE stimuli suggesting that individuals with the RT less than 747.94 could be considered as high proficient and those with R.T. greater than 1218.12 as less proficient. Details are shown in Table 13

Non SLP group: Out of thirty participants in non-SLP group, 15 were grouped in the first cluster (RT=632.52) and 15 in the second cluster (RT=962.94) for SR stimuli. On the basis of the results, it may be inferred that individuals with RT less than 632.52 could be treated as high proficient and those with R.T. greater than 962.94 as low proficient in English. Similarly 21 (R.T.= 737.34) participants were grouped in the first cluster (RT=1089.59) and 09 in the second (R.T.= 1145.04) cluster for SUR stimuli which suggests that individuals with the R.T. less than737.34 could be treated as high proficient and those with R.T. greater than 1145.04 as low proficient. Whereas 23 were grouped in the first cluster (R.T.= 689.15) and the 07 in the second (R.T.= 1102.20) cluster for TE stimuli suggesting that those with RT less than 689.15 could be treated as high proficient and with RT greater than 1102.20 as low proficient in English language.

Similar analysis was carried out to examine proficiency of bilinguals in Hindi language. Out of thirty participants, 10 were grouped in the first cluster (R.T.= 1219.55) and 20 in the second cluster (R.T.= 813.67) for SR stimuli. It can be suggested that individuals with the RT less than 813.67 are high proficient and with RT greater than 1219.55 are less proficient. Similarly 12 (R.T.= 1271.53) were grouped in first cluster and 18 (R.T.= 824.69) in the second cluster for SUR stimuli. Therefore, individuals with the R.T. less than 824.69 could be treated as are high proficient and those with R.T. greater than 1271.53 as less proficient. Whereas 11 (R.T. = 1132.89) were grouped in the first cluster and 19 (R.T. = 728.76) for TE stimuli suggesting that individuals with the R.T. less than 728.76 could be considered as high proficient and those with R.T. greater than 1132.89 as less proficient. Details are shown in Table 14.

In view of high correlation observed between TE stimuli and understanding domain of LEAP-Q, it is suggested that among the three types of stimuli employed for proficiency measures, R.T.for TE stimuli obtained from SLP and non-SLP groups for English and Hindi could be used as a measure of proficiency. The derived measures of 673.09 for 21/30 participants; 747.94 for 23/30 participants for SLP group in English and Hindi respectively; 689.15 for 23/30 participants; 728.76 for 19/30 participants for non-SLP group in English and Hindi respectively could be used as yardstick to measure high proficiency. The results, however, need to be validated on a larger population

Table: 13

Cluster Analysis on SLP responses to SR, SUR and TE

(English Language)

Type of Stimuli	Cluster centers	
	1	2
SRENG	1074.17 (8/30)	736.08 (22/30)
SURENG	716.66 (19/30)	1018.59 (11/30)
TEENG	673.09 (21/30)	983.85 (09/30)
Cluster Analysis on SLP responses to SR, SUR and TE (Hindi Language)		
SRHIN	1608.95 (3/30)	907.47 (27/30)
SURHIN	1688.08 (3/30)	889.83 (27/30)
TEHIN	1218.12 (7/30)	747.94 (23/30)

Table: 14

Cluster Analysis on Non-SLP responses to SR, SUR and TE

(English Language)

Type of Stimuli	Cluster centers	
	1	2
SRENG	632.52 (15/30)	962.94 (15/30)
SURENG	737.34 (21/30)	1145.04 (9/30)
TEENG	689.15 (32/30)	1102.20 (07/30)
Cluster Analysis on Non-SLP responses to SR, SUR and TE (Hindi Language)		
SRHIN	1219.55 (10/30)	813.67 (20/30)
SURHIN	1271.53 (12/30)	824.69 (18/30)
TEHIN	1132.89 (11/30)	728.76 (19/30)

P.S.: Numbers in parentheses indicate the number of participants in each cluster w.r.t total number of participants.

*vi) **Comparison of performance on LDT for concrete & abstract stimuli in Hindi and English***

Repeated measure ANOVA was carried out to check for difference on LDT task between concrete and abstract words within SLP and Non-SLP's in both the languages for three types of stimuli.

Concrete words in English language: In English language for concrete words irrespective of type of stimuli in both SLP and non-SLP groups, significant difference was not observed. Table 15 shows the details of within- subjects effects for concrete words in English.

Table 15
Within-Subjects Effects for concrete words in English

SLP Group			
Source	df	F	Sig.
condition	2	3.037	.056
Error (condition)	58		
Non-SLP Group			
condition	2	3.177	.051
Error(condition)	58		

P.S.: Sphericity assumed

Abstract words in English language: Irrespective of the types of stimuli, in both SLP and non-SLP groups, again no significant difference was observed. Table 16 shows the details of within-subjects effect for abstract words in English.

Concrete words in Hindi language: SLP group showed significant difference ($p < 0.05$) for concrete words but no significant difference was observed for abstract words ($p>0.05$). Table 17 shows the details of within- subjects effects for concrete words in Hindi.

Abstract words in Hindi language: Both SLP and non-SLP groups showed a significant difference ($p < 0.01$) for abstract words. Table 18 shows the details of within- subjects effects for abstract words in Hindi.

Table 16
Within-Subjects Effects for abstract words in English

SLP Group			
Source	df	F	Sig.
condition	2	.029	.971
Error(condition)	58		
Non-SLP Group			
condition	2	.079	.924
Error(condition)	58		

P.S.: Sphericity assumed

Table 17

Within-Subjects Effects for concrete words in Hindi

SLP Group			
Source	df	F	Sig.
condition	2	4.793	.012
Error(condition)	58		
Non-SLP Group			
condition	2	3.020	.057
Error(condition)	58		

P.S.: Sphericity assumed

Table 18

Within-Subjects Effects for abstract words in Hindi

SLP Group			
Source	df	F	Sig.
condition	2	15.629	.000
Error (condition)	58		
Non-SLP Group			
condition	2	8.414	.001
Error (condition)	58		

P.S.: Sphericity assumed

Pair wise comparison of type of words (concrete vs. abstract) and type of stimuli (SR, SUR and TE) between the two languages (Hindi and English) and the two groups (SLP and non-SLP) indicated a significant difference between Hindi SR and Hindi TE; Hindi SUR and Hindi TE stimuli for SLP group. Whereas for non-SLP group, significant difference was observed between Hindi SR & Hindi SUR and Hindi SUR & Hindi TE stimuli. Also, paired t- test was carried out to compare between concrete and abstract words between SLP and non-SLP group for both English and Hindi language irrespective of type of stimuli. Results revealed significant difference between concrete and abstract words for Hindi SR and SUR stimuli. Whereas for non-SLP group, there is a significant difference between concrete and abstract words in only Hindi SUR stimuli and not for other types. Table 19 and Table 20 show the details.

Table 19
Paired t- test for English –Hindi SLP group

		t	df	Significance (2-tailed)
Pair 1	E-SR-Con Vs. E-SR-Abs	1.293	29	.206
Pair 2	E-SUR-Con Vs. E-SUR-Abs	-.372	29	.712
Pair 3	E-TE-Con Vs. E-TE-Abs	-.849	29	.403
Pair 4	H-SR-Con Vs. H-SR-Abs	2.454	29	.020
Pair 5	H-SUR-Con Vs. H-SUR-Abs	5.716	29	.000
Pair 6	H-TE-Con Vs. H-TE-Abs	.421	29	.677

Table 20
Paired t-test for English –Hindi Non-SLP group

		t	df	Significance (2-tailed)
Pair 1	E-SR-Con Vs. E-SR-Abs	.205	29	.839
Pair 2	E-SUR-Con Vs. E-SUR-Abs	-1.557	29	.130
Pair 3	E-TE-Con Vs. E-TE-Abs	.891	29	.380
Pair 4	H-SR-Con Vs. H-SR-Abs	.849	29	.403
Pair 5	H-SUR-Con Vs. H-SUR-Abs	2.854	29	.008
Pair 6	H-TE-Con Vs. H-TE-Abs	.812	29	.423

Paired t test was also carried out for the comparison of performance on LDT for concrete and abstract stimuli in the two languages of both SLP and non-SLP groups. When English and Hindi language was compared across all the three types of stimuli, significant difference was observed between English SR and Hindi SR stimuli for both concrete and abstract words, English SUR and Hindi SUR for abstract words. Table 21 shows the details for SLP group. However, for non-SLP group, statistical difference was observed only for English SUR and Hindi SUR stimuli for abstract words and that there was no significant difference for the other two types of stimuli. Table 22 shows the details for non-SLP group.

Table 21
Language- wise comparison of paired t- test for SLP group

		t	df	Sig. (2-tailed)
Pair 1	E-SR-Con Vs. H-SR-Con	2.827	29	**.008**
Pair 2	E-SR-Abs Vs. H-SR-Abs	2.982	29	**.006**
Pair 3	E-SUR-Con Vs. H-SUR-Con	-.724	29	.475
Pair 4	E-SUR-Abs Vs. H-SUR-Abs	4.901	29	**.000**
Pair 5	E-TE-Con Vs. H-TE-Con	-1.547	29	.133
Pair 6	E-TE-Abs Vs. H-TE-Abs	-.387	29	.702

Table 22
Language- wise comparison of paired t- test for Non-SLP group

		t	df	Significance (2-tailed)
Pair 1	E-SR-Con Vs. H-SR-Con	.961	29	.344
Pair 2	E-SR-Abs Vs. H-SR-Abs	1.352	29	.187
Pair 3	E-SUR-Con Vs. H-SUR-Con	-.423	29	.676
Pair 4	E-SUR-Abs Vs. H-SUR-Abs	3.268	29	.003
Pair 5	E-TE-Con Vs. H-TE-Con	-.902	29	.375
Pair 6	E-TE-Abs Vs. H-TE-Abs	-.551	29	.586

DISCUSSION

The main objective of the present study was to develop a language proficiency test for Hindi-English bilingual adults on the principle of primed LDT, to compare the results obtained on LDT with the results on LEAP-Q and to develop a yardstick to classify bilingual adults for proficiency based on their LDT performance.

The average R.T. on LDT task for the three types of stimuli- TE, SR and SUR for Hindi language ranged from 850 milliseconds to 1000 milliseconds and for English from 750 milliseconds to 850 milliseconds for both SLP and non SLP groups[3], and English from 600 to 700 milliseconds for SLP group and for non SLP group it ranged from and 750 to 900 milliseconds for English language. The results showed significant difference in the LDT

[3] For Kannada language the range was 650 milliseconds to 750 milliseconds and 850 to 1000 milliseconds (Prema, 2010)

performance between the two languages under study ($p<0.05$). However, better performance on LDT task in English language relative to Hindi (and Kannada, Prema, 2010) was observed for all the three stimuli types. This finding may be explained by the fact that all the participants in our study had English as medium of instruction throughout their education and also used English for their academic learning and social activities despite Hindi / Kannada language being their native language. As pointed out by Diller (1970), more and more studies suggest that the bilingual memory may be a conceptual artifact. For instance, bilinguals differ in their fluency in the second language (Kroll & Curley, 1988), or in their history of learning that language (Lambert, Havelka & Crosby, 1958), which may bring about different memory representations for difference in groups of bilinguals. These differences in fluency, history of learning language could have influenced the results of the study.

Primed lexical decision tasks have revealed that processing of a word is facilitated about 75% as much when immediately preceded by a semantic associate in the other language as when preceded by a semantic associate in the same language (Chen & Ng, 1989; de Groot & Nas, 1991; Grainger & Beauvillain, 1988; Keatley et al., 1994; Keatley & de Gelder, 1992; Kirsner et al., 1984; Schwanenflugel & Rey, 1986; Tzelgov & Eben-Ezra, 1992).Evidence from cross-language priming studies, in which a prime in one language is followed by a target in the other language, suggests that at least under certain circumstances bilinguals are able to access conceptual information that is shared between the two languages. This position has been the starting point of many studies in bilingual memory. The performance on TE stimuli may be explained based on cross language priming effects. Asymmetrical cross language priming effects is a phenomenon where in the effect of priming in one language may have stronger facilitation on the lexical decision than in the other. The asymmetry in lexical processing in bilinguals (directionality effect) refers to the fact that the backward processing (from L2 to L1) is performed faster than the forward processing (from L1 to L2). In support of previous research, the current study demonstrated a significant priming effect in L2-L1 direction. The present study showed difference in the R.T. between the two groups of bilinguals-Hindi-English (and also Kannada-English in an earlier study by the author) with stimuli in English language showing better R.T. Hence, the explanation of language processing taking place in one language faster than in the other language cannot be ruled out. Supporting this view, Posner (as cited in Keatley et al., 1994) suggest that R.T. in a LDT reflect that a representation is available to consciousness on the basis of its threshold and activation levels of the representation of the words in both the languages. Our participants may have lesser thresholds and higher activation levels for representation in English language which might have facilitated quicker detection and processing in that language.

Results from various experiments indicate that at least two factors contribute to the asymmetry, namely the choice of the processing route and the word type effect. Depending on the direction of processing (backward or forward) and the proficiency level of bilinguals either the conceptual or the lexical processing route applies. This, in turn, results in the asymmetry mentioned above. The interrelation between the direction of processing (L1 to L2; L2 to L1) and the application of one of the processing routes (backward or forward) can be explained within the framework of the asymmetrical model of the bilingual mental lexicon. Within the framework of the hierarchical model of the bilingual mental lexicon, the conceptual and the lexical processing routes can be differentiated. If processing occurs solely at the lexical level on the lexical connection between the L1 lexical store and the L2 lexical store then it occurs on the lexical processing route. If, on the other hand, processing occurs between the lexical level and the conceptual level and comprises conceptual access, then the processing route which is being used is referred to as conceptual. The application of either of the processing routes depends, for that matter, on whether the forward processing (from L1 to L2) or the backward processing (from L2 to L1) takes place (Kroll and Scholl, 1992). Generally, researchers agree that when the forward processing takes place then the conceptual route is being used and when the backward processing takes place the lexical route is being used (Kroll & Scholl, 1992; Kroll, 1993; Scholl et al. 1995). Thus, it can be said that backward processing i.e., the lexical route is being used by Hindi-English and Kannada-English bilinguals in this study.

Another possible explanation can be derived on the basis of Revised Hierarchical Memory Model (Kroll & Stewart 1990, 1994) which predicts that the presentation of a word is more likely to activate its corresponding conceptual representations in L2 than its lexical representation in L2. In contrast, presentation of an L2 word is more likely to activate the corresponding word in the L1 than the concept. In this condition the asymmetry is due to different kinds of connections between the two languages; when the language order is L1-L2, it is assumed to be conceptual and when the language order is L2-L1, the connection is assumed to be lexical. It has previously been mentioned that the lexical connection in the forward direction is weaker than in the backward direction. If the rule that the more frequently used connections are also the stronger ones is applied to the lexical connections then the stronger backward lexical connection is the one more frequently used.

One plausible explanation of this phenomenon is that at the beginning of the second language acquisition bilinguals try to learn words translating from L2 directly to L1 (Kroll, 1993: 70; de Groot, 1993: 44; Kroll & Stewart, 1994). As a result, the lexical connection in the backward direction becomes stronger and associations between translation equivalents are formed. During lexical processing beginner bilinguals rely more on the relatively strong lexical connection than on the L2 conceptual connection, which is still developing. However, with the development of proficiency the role of the backward lexical connection diminishes and is taken over by the L2 conceptual connection (de Groot et al., 1994). Nevertheless, the backward lexical connection can still be used even by highly fluent bilinguals, despite the fact that both conceptual connections are fully developed. The weakness of the lexical connection in the forward direction and the presence of the conceptual access, for that matter, results in longer R.Ts due to the fact that conceptual access is more time consuming than the lexical access. The RTs for the backward translation should, therefore, prove shorter in comparison with RTs for picture naming or any other task involving conceptual access (Kroll and Curley, 1988). The weakness of the lexical connection in the forward direction (from L1 to L2) led the researchers to stipulate that language processing from L1 to L2 cannot occur exclusively at the lexical level. It was stipulated that during lexical processing in the forward direction (from L1 to L2) the relatively strong L1 conceptual connection and the L2 conceptual connection are used instead of a weak lexical connection. As a result, in lexical processing from L1 to L2 the conceptual processing route is chosen rather than the lexical processing route. In conclusion, processing in the backward direction proceeds via the lexical route (is a lexical task) and processing in the forward direction proceeds via the conceptual route (is a conceptual task).

The present study supports these assumptions. The reasons for asymmetry could be the age at which a second language is acquired has been shown to influence the rate of learning and degree of proficiency attained (e.g., Johnson & Newport, 1989; Krashen, Long, & Scarcella, 1982). In general, the younger the learner, the more similar second language learning is to first language learning. Hence, English being the second language, the connections being stronger for lexical links in backward processing route have yielded faster R.T. in the participants. This is supported by the results of Kroll (1993) which suggests that even for highly proficient bilinguals the lexical connections stay active in later years. Moreover, de Groot et al., (1994) found that the variables of familiarity and frequency exert a more powerful influence on the backward translation. This was attributed to the finding that the variables are likely to require lexical processing. As all the words used in this study were selected on the basis of their familiarity only those which were most familiar were used could also shave also influenced backward processing route in bilinguals.

Further, the asymmetry in bilinguals could be the outcome of the divergences in processing of different types of words (concrete/abstract, frequent/infrequent etc.). As the stimuli was equally divided on concrete and abstract words and as only frequently occurring words were considered could have affected the results. The third objective of the study was to compare the performance of bilinguals based on nature of words in each of the languages. In this study lexical decision task was utilized because here the nonword trials provide an ideal common baseline against which both concrete and abstract conditions can be compared.

Typically, subjects show a processing advantage for concrete words (e.g. leaf, house, sword) over abstract words (e.g. pity, victory, deceit). This superiority has been attributed variously to: (i) abstract words lacking the direct sensory referents of concrete words (Paivio, 1986); (ii) greater availability of contextual information in the knowledge base for concrete words (Schwanenflugel and Shoben, 1983); and (iii) concrete words being supported by more semantic features than abstract words (Plaut and Shallice, 1991, 1993). In this study, the error responses in Hindi-English bilingual SLP and non SLP groups showed greater errors in abstract words compared to concrete. This result is in support with lexical decision tasks studies conducted by James (1975), Kroll and Merves (1986) which showed abstract words generated slower latencies and more errors than concrete words. This is also consistent with the behavioural data from the imaging study of Kiehl and colleagues which showed longer latencies for abstract compared with concrete words (Kiehl *et al*., 1999). In SR condition abstract words showed greater errors than concrete words. Particularly In Hindi language, in SUR condition abstract words showed more errors. But, this trend was not observed in English language. Thus, the results of this study support the extended dual coding model i.e in case of unrelated prime where a contextual clue is not available the concrete words were processed more accurately in

Hindi because of a image based advantage for concrete words thus, supporting the view that concrete words are using both contextual and image based information in processing.

Another reason to explain these results could be due to the word type effect. De Groot and her colleagues (de Groot, 1993; de Groot et al., 1994) distinguished between different types of words and conducted translation tasks proving that different types of words can slow down or speed up lexical processing. In scientific literature this phenomenon is called the word type effect. As most of the concrete words used in the study were nouns and abstract words were mostly adjectives, the selection of words could have led to difference in performance of bilinguals on the task. In general it is reported that nouns and verbs differ along various dimensions, including average frequency, age of acquisition, lexical neighborhood density, number of semantic associates, mutability of meanings and potential lexical competitors for a given word (Gentner, 1981; Szekely et al., 2005), and word class differences are apparent for many aspects of language processing, including children's lexical development (Gentner, 1982), aphasic patients' deficit patterns (Myerson & Goodglass, 1972), and healthy adults' memory for words (Reynolds & Flagg, 1976) and electrophysiological responses (Federmeier, Segal, Lombrozo, & Kutas, 2000; Lee & Federmeier, 2006), among others.

Most studies in the literature have used only nouns as stimuli, leaving open the question of whether the kind of concreteness effects that have typically been described generalize to other parts of speech. However, a few studies that included verbs in their stimulus sets have reported interactions of concreteness with word class. A study conducted by Tyler, Russel, Fadili, Moss (2001) showed that there was a reliable effect of word class in the lexical decision conditions, with nouns (mean = 510 ms) faster than verbs [mean = 541 ms; $F_2(1,236) = 22.0$, $P < 0.001$], a finding which is consistent with previous behavioural studies. In a lexical decision task using a visual half-field manipulation, Eviatar, Menn, and Zaidel (1990) found a similar pattern, with concreteness effects for nouns but not for verbs that wasobserved in both visual fields.Thus, Concreteness effects have been robustly demonstrated for nouns in behavioral studies (Hamilton & Rajaram, 2001; Paivio, Walsh, & Bons, 1994; Paivio, Yuille, & Madigan, 1968), hemodynamic imaging studies (Jessen et al., 2000; Sabsevitz, Medler, Seidenberg, & Binder, 2005), and electrophysiological studies (Holcomb et al., 1999; Kounios & Holcomb, 1994; West & Holcomb, 2000). However, the basis (or bases) of these effects, and their generalizability, has remained unclear. On the one hand, it is possible that concreteness effects arise from general properties of words, such as the richness of the semantic information they evoke, in which case such effects would be expected to hold across word class and other lexical variables. Thus, the effect of use of adjectives in the study provokes further research.

It has been claimed that the abstract–concrete difference reflects the manner in which these concepts are acquired and the roles they play in language (Breedin*et al*., 1994). A deeper understanding of abstract word semantics and their relationship to other aspects of the language system is long overdue, particularly bearing in mind the importance of an abstract vocabulary to our ability to communicate and produce fluent propositional speech (Crutch and Warrington, 2003*b*). Results from Stroop studies, examining interference within and across language, also support this view (Cheng & Ho,1986; Magiste,1984; Tzelgov, Henik & Leiser, 1990). Similar findings have also been reported in semantic priming studies which supports the hypothesis that fluent bilinguals are able to take advantage of the semantic context, even when it appears in the other language (Altarriba 1990; Chen & Ng,1989; de Groot & Nas,1991; Frenck & Pynte,1987; Krisner et al. 1984; Meyer & Ruddy, 1974; Schwanenflugel & Rey,1986; Tzelgov & Henik, 1989).

As the fourth objective of the study was to validate the performance of participants in this language proficiency test, developed on the principle of primed LDT, correlation measures were obtained for their questionnaire's self ratings with that of LDT. The overall findings obtained provide a picture of good correlation between LDT and self rating on LEAP-Q (Table 5 and Table 6). The correlation being in the negative direction indicates increase in reaction times will lead to decrease in the self rating of individuals which implies individuals with higher level of proficiency in a language demonstrate shorter R.T. on LDT. Hence our current result validates the use of LDT for determining language proficiency. Several previous researchers have also demonstrated that the magnitude of priming is greater for high proficient bilinguals than for low proficient bilinguals hence shorter R.T. for lexical decision in the former group than the latter. According to the word association model, the second language accesses concepts via words in first language (L1). Therefore, lexical mediation through L1 appears to characterize the performance of non fluent or low proficient bilinguals, where as concept mediation appears to characterize the performance of more fluent or high proficient bilinguals in whom with increasing expertise in L2, processing shifts from lexical to conceptual mediation.

CHAPTER IV

SUMMARY

The study was proposed in the direction of the development of a digitized test for assessment of proficiency in bilinguals. Though there are tools which can estimate the proficiency in languages in a bilingual (predominantly the rating scales in questionnaire) they are subjective in nature, prone to bias as the subject himself/herself rates his/her proficiency, and time consuming. Hence there arises a need for the development of a quick and efficient online tool for the assessment of proficiency. The digitized test was configured on the principles of primed lexical decision. The LDT task was developed in Hindi and English languages. Three stimulus sets, Translation Equivalents (TE), Semantically Related (SR) and Semantically Unrelated (SUR) divided on the basis of prime employed were used in each language.

Sixty adults in the age range of 18-30 years with Hindi as their native language (first acquired) and English as their L2 acquired later, with a minimum educational qualification of 10 years in L2 participated in the study. Each of the participants signed a consent letter for participation in the study. Each participant self-rated for proficiency on LEAP-Q initially and later performed on the LDT. The performance was observed to be better in English in comparison to Hindi. Short R.T. was observed on TE stimuli compared to the other two prime types (SR and SUR) in both L1-L2 and L2-L1 conditions. Comparison of LDT scores with the four domains of LEAP-Q (speaking, understanding, reading and writing) yielded positive correlation offering support to our premise that LDT can serve as a test for bilingual proficiency. This could also serve as either a substitute or an adjunct measure with LEAP-Q in determining proficiency in bilinguals.

Implications and future directions

Results of the present study can serve as reference value to estimate bilingual proficiency in adults in the age range of 18-30 years. This has further implications as the normative values can be developed and applied for comparisons with the population having language disorders such as persons with Aphasia. Insights obtained from the analysis suggest that primed lexical decision can be used as a tool for assessing proficiency based on the performance of individuals as against only competence assessed through questionnaires. The present study may be replicated to investigate other Indian languages from different language families.

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