BILINGUAL LEXICAL DECISION: EFFECT OF LANGUAGE PROFICIENCY AND PRIMES

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Abstract

Bilinguals may have varying degrees of proficiency over their two languages. Assessment of bilingual proficiency by employing tools developed for non-Indian population is not suitable to the bilingual population in India. Tools developed indigenously for quick and objective assessment of language proficiency is warranted. Therefore, the present study assessed performance of 30 Kannada-English bilinguals in primed lexical decision task (LDT) with three different prime types- translation equivalent, semantically related and semantically unrelated primes along with self-rating questionnaire, LEAP-Q. Good correlation of scores on questionnaires and reaction time for LDT suggest that primed LDT serves as a test for bilingual proficiency. Among the prime types, the translation equivalent prime indicated proficiency better than the semantically related and semantically unrelated stimuli. Results of the study suggest that primed lexical decision task can be used as a tool for assessing proficiency based on the performance of individuals as against only competence assessed through questionnaires.

Key words: *Bilingual proficiency. Lexical Decision Task, Prime type*

Bilingualism refers to 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. India being a multilingual and multicultural nation, presents a linguistic landscape of coexistence of more than one and often more than two or three languages almost throughout the country. Hence bilingualism/multilingualism is a common phenomenon prevalent throughout the country which poses innumerable challenges to speech and hearing specialists and educators in terms of language assessment, management and teaching.

The nature of bilingual lexical organization and type of bilingualism in individuals has raised number of questions to be addressed by researchers. Commonly asked question among those is whether the bilinguals store their two languages in discrete or common memory systems. Studies have also focused on understanding the bilingual organization by proposing numerous models to explain the same. These models have been proposed to support or refute either of two hypotheses i.e., language specific (Costa, Miozzo, & Caramazza, 1999) or language independent hypothesis (De Bot, 1992; Green, 1986; Poulisse & Bongaerts, 1994). The models of bilingual lexical organization describe two types of representation a lexical level of representation with two language specific stores or a conceptual representation, comprising a single lexical store. According to Kroll and DeGroot (1997) word representation in bilinguals is decomposed into form and meaning, the former represented at the lexical level and latter at the conceptual level. Various models have been proposed varying the connections among lexical and conceptual level of representation.

Word association model: This model (Fig.1A) assumes that the first language (L1) mediation is essential to gain access to concepts through second language (L2). 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 (as in Edmonds & Kiran, 2004). Thus according to this model cross language processing explores the links at lexical level (Potter, 1984).

i) *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).

ii) *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,

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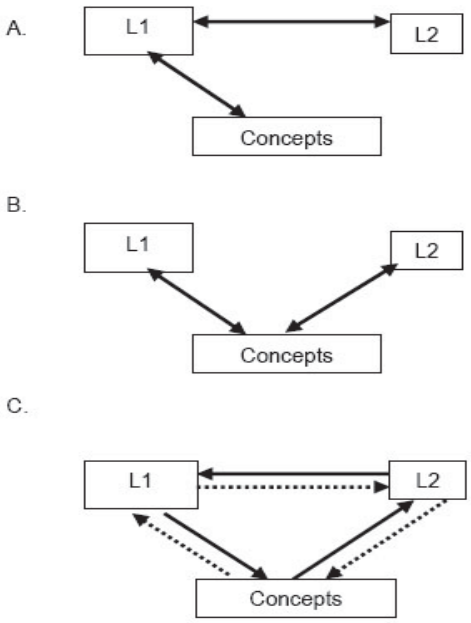
with direct access from L2 to concepts (Kroll and Stewart, 1994).

iii) *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).



A: Word Association Model; B: Concept Mediation Model; C: Revised Hierarchical Model (Source: Potter and Mc Cormack, 1984)

Figure 1: The hierarchical models

However de Groot (1992) theory holds good for forward translation (L1to L2 only) in participants dominant in their L1. De Groot, Dannenberg & Hell (1994) extended their study on two Dutch – English bilingual groups with varied L2 proficiency in order to include backward (L2 to L1) translation in addition to forward translation (L1 to L2). They analyzed six parameters (imageability, context availability, definition accuracy, familiarity, word frequency and length) and results revealed the parameter imageability to have a significant effect of on backward translation. Hence their study provides evidence for weak version of the asymmetrical model. The mixed model thus emphasises on the link between L2 and conceptual level for backward translation, however the strength of the link from L2 to conceptual memory is relatively weaker than the link between L1 to conceptual memory.

Bilinguals may also have varying degrees of proficiency over their two languages which might contribute to their differences in lexical organization. Hence tests of language proficiency may shed more light in understanding the processes involved in organization of languages. However, testing language proficiency is a complex undertaking that continues to stir much debate among language researchers and test developers.

The bilingual ability tests have been grouped into four types namely rating scales, fluency tests, flexibility tests and dominance tests (Mac Namara, 1967). Rating scales and Questionnaires are the commonly used tools in the assessment of language proficiency which involves self assessment and reporting of language measures. The most common fluency tests used are picture naming, word completion, oral reading, and following instructions. Tasks such as synonym production, word associations and word frequency estimations have also been employed. Dominance tests assess relative dominance between two languages in various domains. These tests for dominance are generally designed with experimental tasks 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.,

Some of the popularly used self assessment/rating scales are the International Second Language Proficiency Ratings (ISLPR-Ingram, 1985), Language Experience and Proficiency Questionnaire (LEAP – Q, Marian, Blumenfeld & Kaushanskaya, 2007), Language Assessment scales (De Avila & Duncan 1990), IDEA Proficiency Test designed by Ballard and Tighe (2005), Test of Language Proficiency (TLP) developed by Shivshankar, Shyamal, Vasantha, Bhoomika Kar and Narang (2011) to name a few.

Several test batteries have been developed and used for assessing proficiency in English acquired as a second language. The Language Proficiency Index (LPI) is a Canadian standardized test for English proficiency, 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 (http://www.g-telp.jp/english/). Michener English Language Assessment (MELA) describes language proficiency in terms of scores using Canadian Language Benchmarks (CLB) which are a national Canadian standard of English language proficiency. Canadian English Language Proficiency Index Program, (CELIP) is a set of computer-delivered English language proficiency tests used to assess an individual's functional skills in English for listening, speaking, reading, and writing (http: // www. paragontesting.ca /english -language-tests/celpip/).

Language proficiency tools have also been developed and routinely used in other European languages. The Minnesota Language Proficiency Assessments (MLPA) includes battery of instruments to measure proficiency in reading, writing, speaking, and listening in French, German, and Spanish (http://www.carla.umn.edu/assessment/MLPA.html). An online version of the reading, writing, and listening MLPA is also available. The Defense Language Proficiency Test (or DLPT) is another language test battery developed by the Defense Language Institute for the use of the Department of Defense (DoD) United States. The test assesses the general language proficiency of native English speakers in a foreign language, in the domains of reading and listening. DIALANG is an online diagnostic language assessment system designed to assess language proficiency in 14 European languages.

Many of the assessment tools mentioned above are subjective in nature, prone to bias as the subject himself/herself rates his/her proficiency, besides being time intensive in nature. To overcome this limitation the online tools have been developed in the recent years which measure effects occurring at various temporal points during ongoing process and are often sensitive to fast acting, automatic processes that rely on integration and interaction of several types of information (Shapiro, Swinney & Borsky 1998). The online tasks also provides insights about normal operation of language processing and allow us to learn about deficits, fundamental sparing and loss, and hence could help us to devise focused and efficacious treatment programs (Shapiro, Swinney & Borsky 1998).

Among the online tasks primed lexical decision tasks and lexical naming tasks (Meyer and Schvaneveldt, 1971) have been frequently used to study bilingual lexical organization. Priming refers to an increased sensitivity to certain stimuli due to prior experience. Priming relies on implicit memory rather than explicit memory utilized during direct retrieval processes. Research has also shown that the effects of priming can impact the decision-making process (Jacoby, 1983).

Priming can be perceptual or conceptual. Perceptual priming is based on the form of the stimulus and is enhanced by the match in terms of modality and exact format between the early and later stimuli whereas for conceptual priming, it is necessary to cue the meaning of a stimulus by providing semantic related tasks. Several studies have been reported where investigators have studied primed lexical decision task performance in individuals with varying degrees of language proficiency.

Kroll and Borning (1987) studied 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 in the L1-L2 direction but the reverse was not significant 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) studied French-English bilinguals second language autonomy of at two levels of proficiency. Results of their study showed individuals could access semantic and conceptual information in L2 autonomously even with limited fluency. This effect was seen even in a lexical decision task with rapid presentation conditions designed to tap automatic processing.

Literature thus reveals many studies investigating priming effects as an indicator of language proficiency for English and other foreign languages but very few studies have been reported regarding this preview in the Indian context. Bilingualism in India is different from that prevalent in the countries such as Europe and United States of America. Therefore, generalization of findings from those countries to the Indian context does not seem to be appropriate. Thus, there arises a need for the development of a quick and efficient online tool for the assessment of proficiency in Indian perspective.

The present study was undertaken as a part of main study which focused on developing a digitized test for quick, online assessment of language proficiency in Kannada English bilinguals 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, diplomat from different countries or the second language learners to know their success in language learning. Hence the present study was conducted to analyse the performance of Kannada- English bilinguals in primed lexical decision task in different prime conditions. The

performance on LDT was also correlated with the self rated proficiency levels of individuals.

Method

Objective of the study was to analyse the performance of Kannada- English bilingual adults in primed Lexical Decision Task (LDT). Thirty adults in the age range of 18-30 years with Kannada as their native language (L1 acquired first) and English as their L2 (acquired later), with a minimum educational qualification of 10 years in L2 served as participants for the study. The study was carried out in two phases.

In the first phase the participants self rated their language proficiency using LEAP-Q (Language Experience and Proficiency questionnaire). LEAP-Q (Marian, Blumenfeld & Kaushanskaya, 2007) was selected for the present study as it 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, & Goswami, 2009).

In the second phase participants performed a Lexical Decision Task (LDT). For which a total six hundred target items and ten trial items were selected. Out of six hundred items, three hundred each were from Kannada and English language. Three different types of primes were prepared for selected target words, the types being semantically related primes, translation equivalents primes and semantically unrelated primes. The sets were formed based on the relation of prime with that of target word, the three sets being semantically related (SR), translation equivalents (TE) and semantically unrelated (SUR) conditions. For each language 99 non words were also selected in order to achieve word to non word ratio of 0.3. The stimulus presentation for the lexical decision and the response recording were controlled using DMDX, a computer based software. Mean reaction time was computed in each of the prime categories. The mean reaction time measures were compared and correlated with proficiency levels on LEAP –Q.

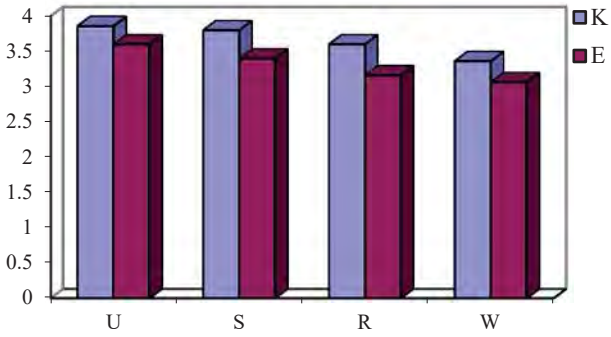
Results

In the first phase of study the participants self rated their language proficiency using 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 rated their proficiency employing four point rating scale (4 - Native like proficiency; 3 - Good proficiency; 2 - Low proficiency; 1 - Zero proficiency).

Table 1: Comparison of performance in LEAP Q for Kannada and English languages

Participants	MEAN	N	S D
KU	3.86	30	0.34
EU	3.60	30	0.62
KS	3.80	30	0.40
ES	3.40	30	0.67
KR	3.60	30	0.67
ER	3.16	30	0.53
KW	3.36	30	0.71
EW	3.06	30	0.58

KU- Kannada Understanding; KS- Kannada Speaking; KR- Kannada Reading; KW- Kannada Writing. EU- English Understanding; ES- English Speaking; ER- English Reading; EW- English Writing.



U- Understanding; S- Speaking; R- Reading; W- Writing.

Figure 1: Comparison of performance in LEAP Q for Kannada and English language

As shown in Table 1 and Figure 1, the mean and standard deviation of self ratings of the participants for the domain 'Understanding' in Kannada and English were 3.86; 0.34 and 3.60; 0.62 respectively similarly mean and standard deviation values for the domain 'Speaking' in Kannada and English were 3.80; 0.40 and 3.40; 0.67. For the domain 'Reading' in Kannada and English mean and standard deviation were 3.60; 0.67 and 3.16; 0.53 respectively and for the domain 'Writing' mean and standard deviation values of self ratings for Kannada and English were 3.36; 0.71 and 3.06; 0.58.

Further Paired sample t test was done to compare the difference in performance in Kannada and English languages in all the four domains. Results revealed that the difference was statistically significant in all the domains viz., 'Understanding' (p value 0.043, $p<0.05$), 'Speaking'(p value 0.008, $p<0.05$) and 'Reading' (p value 0.003, $p<0.05$) and 'Writing' (p value 0.048, $p<0.05$) in the two languages compared. The results thus revealed mean self ratings scores in English language to be significantly less than Kannada language.

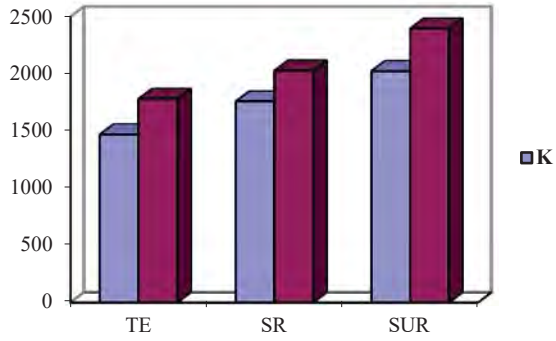
To evaluate the performance of participants in lexical decision task, their reaction times for the task were compared for Kannada and English languages. The mean and standard deviation values of R.T. for the three types of primes (translation equivalents, semantically related and semantically unrelated) between the two languages of the bilinguals (Kannada and English) are shown in Table 2 and Figure 2.

Table 2: Mean R.T. and SD values of LDT for Kannada and English languages

Type of stimuli	MEAN (range: 200-4000ms)	N	SD
KMTE	1468.36	30	405.97
EMTE	1780.45	30	508.99
KMSR	1757.95	30	361.50
EMSR	2028.67	30	439.61
KMSU	2024.51	30	454.54
EMSU	2396.40	30	356.51

KM-Kannada mean; EM- English mean; TE-Translation Equivalent; SR-Semantically Related; SUR-Semantically Unrelated

Results followed the trend of better performance in Kannada (L1) in comparison to English (L2). However shorter R.T. was observed on TE prime type compared to the other two types (SR and SUR) in both L1-L2 and L2-L1 conditions. Further statistical analysis was carried out employing Paired samples T- test to test for statistical differences in the R.T. between three prime types in Kannada and English language. The p value obtained were 0.004, 0.001, 0.002 ($p<0.05$) for translation equivalents (TE), semantically related (SR) and semantically unrelated (SUR) primes respectively, suggesting significant difference between the two languages.



K-Kannada; E English; TE-Translation Equivalent; SR-Semantically related; SUR-Semantically unrelated

Figure 2: Mean reaction times for Kannada and English languages

To validate the performance of participants in the primed LDT, correlation measures were obtained for the scores on the questionnaire with that of LDT. Spearman's rank correlation test was employed to derive the correlation coefficient. The mean scores of the three prime types were tested for their correlation with the four domains of LEAP Q in each language.

The results obtained for Kannada language revealed significant negative correlation for domains Understanding, Speaking, Reading and Writing with the prime type translation equivalent. Similar trend was also seen for semantically related prime type, depicting strong negative correlation for the domains Understanding, Speaking, however no correlation was observed for Reading and Writing domains. Also, no such trend was observed for the semantically unrelated prime type as the correlation failed to reach statistical significance in all the four domains.

Table 3: Correlation coefficients and Significance levels in Kannada language

	KU		KS		KR		KW	
	Correlation Coefficient	Sig.	Correlation Coefficient	Sig.	Correlation Coefficient	Sig.	Correlation Coefficient	Sig.
TE	-0.97	0.001	-0.89	0.00	-0.48	0.009	-0.16	0.043
SR	-0.86	0.02	-0.824	0.021	0.58	0.72	0.476	0.69
SUR	0.38	0.66	0.269	0.59	-0.16	0.73	0.19	0.66

TE-Translation Equivalent; SR-Semantically related; SUR-Semantically unrelated KU-Kannada Understanding; KS-Kannada Speaking; KR- Kannada Reading; KW- Kannada Writing.

Table 4: Correlation coefficients and Significance levels in English language

	EU		ES		ER		EW	
	Correlation Coefficient	Sig.	Correlation Coefficient	Sig.	Correlation Coefficient	Sig.	Correlation Coefficient	Sig.
TE	-0.906	0.00	-0.864	0.012	-0.816	0.00	0.24	0.08
SR	-0.79	0.00	-0.67	0.04	-0.514	0.07	-0.43	0.92
SUR	-0.58	0.051	-0.26	0.08	0.05	0.27	0.16	0.36

TE-Translation Equivalent; SR-Semantically related; SUR-Semantically unrelated EU- English Understanding; ES- English Speaking; ER-English Reading; EW- English Writing

The mean scores of the three prime types, tested for their correlation with the four domains of LEAP Q in English language is shown above.

The results obtained for English language revealed strong negative correlation for domains Understanding, Speaking and Reading but weak correlation for Writing, with the prime type translation equivalent. For semantically related prime type strong negative correlation was seen for Understanding, Speaking and Reading but not for writing domain. However no such trend was observed for the semantically unrelated prime type as the correlation failed to reach statistical significance similar to that observed for Kannada language.

In summary, the participants' performance on LDT correlated with that of their self rating of proficiency on LEAP-Q questionnaire with highly significant correlation in the domains of Understanding and Speaking. Among the three types of primes studied, for the TE prime R.T. were least compared to SR and SUR. Also, SUR prime type showed highest reaction time in both the languages. It is also noteworthy that the performance on LDT in Kannada language was significantly better by most of the participants than in English language.

Discussion

The objective of the study was to analyse the performance of Kannada- English bilingual adults in primed Lexical Decision Task (LDT) employing three different prime types and also to correlate their LDT performance with the self ratings of proficiency.

The participants in the first phase self rated their proficiency using LEAP-Q. The analysis of self ratings revealed mean self ratings scores in English language to be significantly less than Kannada language. This finding may be explained by the fact that 75% of the participants in our study had acquired Kannada language first, thus Kannada being their native language, participants considered themselves more competent in it compared to the second language, English. One possible reason for better self ratings in Kannada language may also be because of it being Native language, participants received either little or no feedback about their skills which might have lead to over estimation of competence. English being second language and as it is learnt formally most of the time, receiving more feedback, participants were critical in estimating their competence which might have resulted in overall lower scores (Ramya & Goswami, 2009). However these results are in congruence with the results obtained on LDT task wherein in both the tasks, participants had better scores in Kannada language than English. LDT being a task which assesses performance rather than competence as assessed by questionnaires further supports the questionnaire findings.

The participants in second phase of study performed a lexical decision task for three prime types in both languages. The reaction time (RT) scores on LDT task for Kannada language ranged from 1400 milliseconds to 2100 milliseconds and in English from 1700 milliseconds to 2400 milliseconds for the three types of primes- TE, SR and SUR (Table 2). The results revealed better performance in Kannada language (L1) relative to English for all the three prime types showing statistically significant difference between the two languages under study. This finding may be because, as 75% of the participants in our study had acquired Kannada first being their native language, and at a very young age which might have facilitated the access compared to the second language, English was acquired formally through instructions. Similar findings were reported for SR primes by Nas and deGroot (1984) who observed the effect of SR primes in L1 and L2 separately.

For TE primes, the RT was lesser in L2-L1 direction compared to L1-L2. This contradicts the previous studies on Asymmetrical Cross Language Priming phenomenon which report greater facilitation in L1-L2 direction vowing to stronger links from L1 to L2 than from L2 –L1. In our study the lesser RT for TE primes in Kannada language may be attributed to faster language processing in L1 which may be a result of richer and stronger representation in L1 memory system compared to L2. 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. Hence the stronger representation would have facilitated the subjects to translate the prime before the presentation of target as assumed in the Prediction hypothesis (DeGroot, Nas & Nelly1997).

There was also significant difference in RT scores observed for SUR primes between two languages. In a condition using semantically unrelated prime, the time taken for the decision making is entirely attributed to the lexicalization process without the facilitatory effect of primes. The differences observed with SUR primes further supports that processing in L1 in these participants is faster than in L2.

Hence Kannada language that is acquired first and processed better may have influenced the processing of English language resulting in activation of conceptual representations irrespective of the language order. This hypothesis is supported by Frenck-Mestre and Prince (1997) study which revealed that individuals could access semantic and conceptual information in L2 autonomously even with limited fluency. This effect was seen in a lexical decision task with rapid presentation conditions designed to tap automatic processing. Hence the connections being stronger for lexical and conceptual links in Kannada language have yielded faster R.T. in the participants. However this speculation needs further research evidence and support.

A possible explanation for the results of TE stimuli in both the languages with least R.T. compared to SR stimuli could be that though the SR primes presented before targets had conceptual overlap with the target depending on the degree of relatedness of prime with the target, the TE primes being directly linked to the concepts in both languages may have advantage of greater degree of overlap at the conceptual level (de Groot & Nas, 1991; Basnight, Brown & Altarriba, 2005). This enhanced semantic overlap that TE words have over SR words. This overlap could have led to larger priming effects leading to reduced R.T. for lexical decision in this stimuli type.

Comparison of Reaction time scores of LDT with LEAP-Q indicated significant negative correlation for Understanding and Speaking domain, weak correlation for Reading and Writing in both languages across translation equivalent and semantically related stimuli types. However no such trend was observed for the semantically unrelated stimuli type in both the languages as the correlation failed to reach statistical significance. The correlation is in the negative direction indicating increase in the self rating of individuals has led to decrease in reaction times. This in turn implies that individuals with higher level of proficiency in a language demonstrate shorter R.T. on LDT.

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. These studies have explained the difference in performance based on the word association model. According to this model, the second language accesses concepts via words in first language (L1). This model states that 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. The developmental hypothesis put forth by this model argues that with increasing expertise in L2, processing shifts from lexical to conceptual mediation.

Results from various Stroop studies, examining interference within and across language, also support this view (Cheng & 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).

Thus the present study offers support to the premise that digitized LDT could be employed 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. The TE prime type was observed to provide least RT and good correlation with self rating scores which can be employed for developing proficiency tests. Results of the study thus suggest that primed lexical decision can be used as a task for assessing proficiency based on the performance of individuals as against only competence assessed through questionnaire. The primed lexical decision can be applied to test proficiency even in clinical population such as stuttering and aphasia.

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