LEXICAL ORGANIZATION IN KANNADA-ENGLISH AND MALAYALAM-ENGLISH BILINGUALS WITH AND WITHOUT APHASIA: AN INVESTIGATION THROUGH TRANSLATION

Project under AIISH Research Fund (ARF) 2011-2012

(Ref: SH/CDN/ARF/4.15/2011-12 with total funds of Rs. 5,82,000.00)

Department of Speech Language Pathology

All India Institute of Speech and Hearing

Manasagangothri, Mysore-570006

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October 2012

Acknowledgements

We thank Dr. S. R. Savithri, Director, All India Institute of Speech and Hearing, Mysore for sanctioning the project and for providing financial support from AIISH Research Fund.

We would like to thank all the participants of the study for their co-operation during the study.

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INTRODUCTION

Organization of languages in a bilingual brain is considered to be intricate and has to be examined comprehensively. The nature of bilingual lexical organization is an enduring question in bilingual research (Snodgrass, 1984). Significant information in this regard can be gleaned from the study of individuals with aphasia.

Aphasia is defined as "an acquired communication disorder caused by brain damage, characterized by impairment of language modalities like speaking, listening, reading, and writing" (Chapey, 2001). For individuals with aphasia, recovery is significant within the first 6 months post injury and the initial severity, lesion size, and time post onset are among the best predictors of degree of spontaneous recovery (Stemmer, 1998). Spontaneous recovery is defined as "the psychological changes that take place in the brain in the immediate period following the onset of aphasia" (Gil & Goral, 2004, p. 208).

It is widely assumed that at least half of the world's population is bilingual. To be defined as a bilingual one needs to be fluent speaker of two languages, that is, using these languages in everyday life (Grosjean, 1994). People who are fluent in even more languages are usually called polyglots. Some people may be exposed to two, referred to as L1 and L2 (or more) languages from the day they are born (i.e. early bilinguals), others, nevertheless, may become a native speaker of one language, referred to as L1, and acquire one, referred to as L2, (or more) later in life.

One of the central questions in the field of bilingual memory involves the lexical organization of bilinguals' two languages within the brain. Are these languages organized in an extremely independent, selectively accessed manner or rather in a greatly overlapping, distributed manner, much like monolingual memory with twice as many words? In short, are there two lexicons or one?

Bilingualism

A more operative definition of bilingualism pertains to a person who uses two or more languages or even dialects in everyday life (Grosjean, 1994; Fabbro, 2001a). According to traditional studies, bilingualism is generally classified as 'early coordinated' or 'late subordinate', depending on the age of L2 acquisition (Fabbro, 1996). The definition of "early coordinate" bilingualism means that both languages have been acquired before puberty, even though L2 is often acquired in an extra-familiar environment (frequently after the immigration into a new country). In the "subordinate" bilingualism, the two languages are rather in a hierarchical relation (one is always dominant upon the other).

Translation disorders in the 'bilingual' and 'polyglot' aphasia

Since at least the 19th century, bilingual and polyglot aphasia's clinical studies have provided a rich literature on certain pathological translation disorders, summarized in the following list:

- *Impossibility to translate*: both from L1 to L2, and from L2 to L1;
- *Spontaneous / incoercible translation*: inclination to translate everything the patient or interlocutors say;
- *Translation without comprehension*: patient does not understand what she is asked to translate, although she correctly performs it;
- *Paradoxical translation*: patient is able to translate only into the language that cannot be spoken spontaneously at that moment (not vice versa).

Such disorders seem to support the hypothesis that different bilingual abilities are processed by a network of neuro-functional components. The damage of one of them may not necessarily involve the damage of all the system. Moreover, recent data from neuro-imaging research on translation and switching processes seem to confirm even at the cerebral representation level (cortical and subcortical) the differences between switching and translation processes.

The pathological processes involving translation disorders allow assuming the existence and the importance of automatic mechanisms in the translation procedures. The forming and rising of these automatisms seem to depend not only on one's bilingual competence, but mainly on their switching practice.

Recovery patterns in bilingual aphasics

The patterns of recovery in bilingual aphasics challenge accounts of the representation and control of language in the brain. Paradis (1977) identified six basic recovery patterns. Languages can be affected equally, differentially or selectively.

- Parallel recovery occurs when both languages are impaired and restored at the same rate;
- Differential recovery occurs when languages recover differentially relative to their pre-morbid levels and
- Selective recovery occurs when at least one language is not recovered at all. A unique case of selective recovery, antagonistic recovery, occurs when as one language recovers a second language becomes impaired.
- In blended recovery, patients mix their languages inappropriately.
- In successive recovery two or more languages may eventually recover but the second language may only begin to recover when the first has (fully) recovered.

These basic patterns do not exhaust the set of possibilities. A language may be recovered in an antagonistic fashion or never recovered at all. Or, in the case of alternating antagonism, there may be a temporary inability to translate into the language that the patient can use spontaneously (Paradis, Goldblum & Abidi, 1982). There are also other rare, but essential, cases involving a selective deficit such as the loss of the ability to avoid switching between languages (patient S.J., Fabbro, Skrap, & Agliotti, 2000; Ansaldo & Joanette, 2002).

Two further patterns, alternating antagonism and selective aphasia may be considered variants of antagonistic and selective recovery, respectively (Paradis, 2001). In alternating antagonism, patients can access only one of their languages in spontaneous speech for alternating periods of time (Nilipour & Ashayeri, 1989; Paradis, Goldblum & Abidi, 1982). In the case of selective aphasia (Paradis & Goldblum, 1989), in contrast to selective recovery, there are aphasic problems in only one language with no obvious deficits in the other.

Pitres' law (1895) stated: 'In acquired aphasia with a multilingual patient, recovery comes first and most completely in the language most used just before the injury, whether or not it is the patient's mother tongue'. By contrast, Ribot's law stated: 'In a multilingual patient with aphasia, recovery comes first in the person's mother tongue ...' (Pearce, 2005)

The Bilingual Aphasia Test

The BAT, *Bilingual Aphasia Test* (Paradis & Libben, 1987; Paradis, 2001a, 2001b), provides objective criteria for the assessment of linguistic disorder in bilingual aphasics, in order to detect and classify patient's linguistic performances and recovery in both languages. It does not give clear cut classification of patient's syndromes or aphasia types but provides the data which can be analyzed in terms of the prevalent theory. Hence it specifies which aspects of language are deficient and in need of rehabilitation. In addition, because it covers a wide range of language tasks, the BAT has been found to discriminate between different types of aphasia (Peristeri & Tsapkini, 2011). Standardised instruments for assessing language performance in different languages (Eg., the Bilingual Aphasia test, Paradis, 2001) are vital to establishing valid data sets.

The BAT comprises of three parts: (a) a history of bilingualism questionnaire; (b) a language specific test; and (c) a specific language pair test. Part A provides an estimate of the degree of premorbid proficiency while taking into consideration factors such as age, context, and degree of motivation and frequency of code switching. It can be completed in either language by the client alone or with assistance. Part B examines language in four modalities which include: hearing, speaking, reading and writing, each at the level of the word, the sentence and the paragraph. Part C examines word recognition, translation of words and sentences and grammaticality judgment for each given language pair.

Language structure of Kannada and Malayalam

Kannada is an agglutinative language of the suffixing type, with a nominative syntax and subject, object, verb (SOV) constituent order. The word order is reasonably free, since noun phrases are marked for case and verbs (in most cases) for agreement with subject in number, gender and person, subjects and objects are often dropped. Malayalam is one of the Dravidian languages and as such has an agglutinative grammar. The word order is usually subject–object–verb, although other orders are often utilized for reasons such as emphasis. Nouns are inflected for case and number, while verbs are conjugated for tense, mood and causativity (and also in archaic language for person, gender, number and polarity).

Models of bilingual memory

Some of the major questions in bilingual research are whether bilingual speakers have two distinct lexicons, one for each language, or one large 'bilingual' lexicon, and about the mechanisms involved in lexical access and lexical selection. Early research in bilingualism was carried out by Uriel Weinreich (1953) and Ervin and Osgood (1954) and studies revolved around the more general question of whether bilinguals store their languages as a single large or two small stores (SLOTS). Experimental paradigms namely word association and naming, recognition and recall, and language transfer and interference were initially used to study knowledge organization in bilinguals. Also, data from bilingual patients with brain lesions have shed considerable light on bilingual memory organization.

Initially the three-node *'hierarchical models'* consisting of the word association, concept mediation, mixed and revised hierarchical models were the focus of bilingual research. All these models share a common architecture consisting of two separate lexical stores (one for each language) and one common conceptual store. The type of hierarchical model is decided by the location and weighting of the links between the L1 (first language) and L2 (second language) lexical nodes and the conceptual node.

The *word association model* (Potter, So, von Eckardt & Feldman, 1984) assumes that a L2 word is connected to its corresponding conceptual representation only through its L1 equivalent. Therefore, according to this model if a L2 speaker needs to access the meaning of a L2 word he or she will first activate the corresponding L1 word form and only then access the meaning of the word. The *concept mediation model* (Potter et al., 1984) 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. *Mixed memory model* (De Groot – Nas, 1991; De Groot, 1992 after De Groot, 1993) is in line with the hierarchical tradition, which suggests that the conceptual level is common for both languages of bilingual, and the lexical level is characterized by two separate stores. L1 and L2 conceptual links are assigned C1 and C2 abbreviations, respectively. The marking which is assigned to the lexical link is LL.

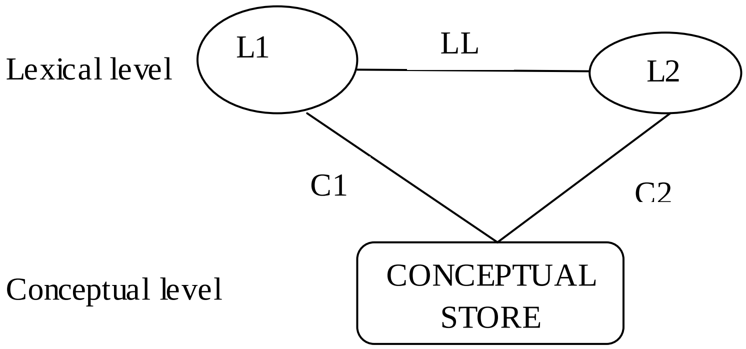

Figure 1: Mixed memory structure (adapted from De Groot et al., 1994, p. 601)

There are certain features which differentiate the mixed memory model from the asymmetrical model of the bilingual mental lexicon. First of all, the size of the L1 and L2 lexical stores noticeably differs. The difference in size between the circles depicting the L1 lexical store and the L2 lexical store is a graphic representation of the fact that the L1 lexical store is larger than the L2 lexical store, at least for unbalanced bilinguals. Another visible difference between the models is the lack of graphic representation of the various strength of connections. This fact by no means suggests that according to the mixed memory model all of the connections demonstrate the equal strength. Quite to the contrary, all of the connections differ in strength depending on the representations which they connect. For example, a lexical connection for frequent translation equivalents is supposed to be strong while a lexical connection for infrequent translation equivalents is supposed to be weak. Similarly, a conceptual connection between representations of frequent words would be stronger than a similar connection between representations of infrequent words. The strength of connection is therefore not dependent on the direction of processing but rather on the type of words being processed.

Kroll and Stewart (1994) posited that the lexical and conceptual connections between L1 and L2 might be asymmetric. This idea lies at the basis of the third hierarchical model, the revised hierarchical model (Kroll & Stewart, 1994). The *revised hierarchical model (RHM)* therefore has two main aspects. First, both lexical and conceptually mediated links between L1 and L2 exist. The lexical link is stronger in the L2-L1 direction than in the L1-L2 direction. The conceptual link on the other hand is stronger in the L1-L2 direction than in the L2-L1 direction. Second, the balance between lexical and conceptual links changes as proficiency increases. The more proficient a bilingual is the more conceptual mediation will occur.

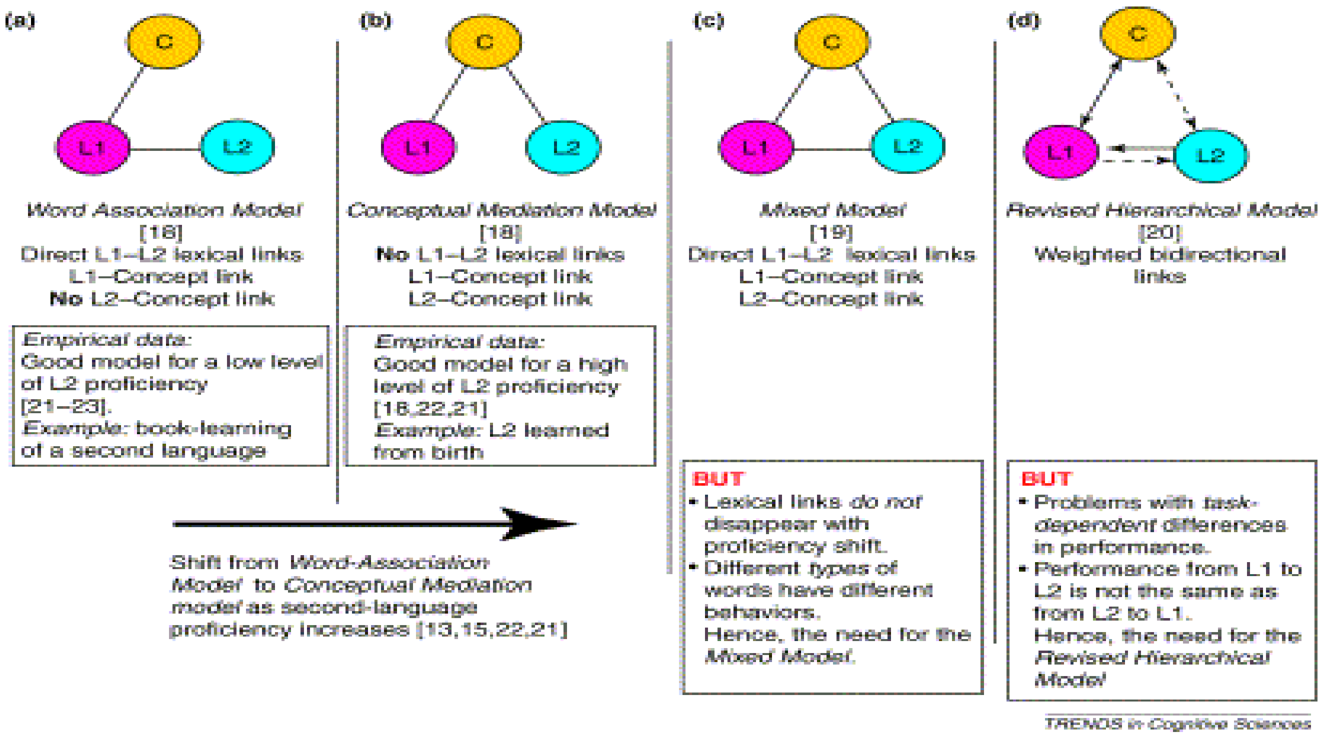

Figure 2: Types of bilingual model (cited in French, R., & Jacquet, M. (2004). Understanding bilingual memory: models and data. *Trends in Cognitive Sciences,* 8 (2), 87-93.)

Connectionist model and the emergence of organization

The findings that ushered in a period of change in bilingual memory research include connectionist models. Three distributed connectionist models have been developed. Bilingual simple recurrent network (BSRN) was designed by French which showed that, after sufficient exposure to both languages, the internal representations of the words of both languages cluster according to language, although the activation patterns of these representations remain highly overlapping. SOMBIP (Self organization of bilingual memory) is another recent connectionist architecture that relies on unsupervised learning to produce language separation. A third model was developed by Thomas (1997). This was a supervised, feed-forward connectionist architecture that included explicit language tags for each lexical item. The first two models, BSRN and SOMBIP, construct their organizational structure as an emergent product of their individual inputs, whereas the third model relies on ‘static’ tags to engender language organization. In both the SOMBIP model, which relies on a variety of phonological cues, and the BSRN model, which relies on the statistics of word associations, language separation emerges solely on the input to the models. In other words, regularities, either phonological or covariational, of the bilingual language input are adequate to cluster the two languages, which is markedly different from including an explicit language tag for each lexical item.

According to Thompson (2000) most individuals with aphasia show recovery of language function despite persisting damage to left hemisphere language zones (Holland et al., l996). Such recovery is a complex process that is dependent on neurophysiological processes, environmental factors, and other variables. Soon after damage to the neural networks that subserve language, reorganizational processes begin. In addition, most individuals with aphasia receive treatment to facilitate maximal language recovery (cited in Thompson, C. K. (2000). The Neurobiology of Language Recovery in Aphasia. *Brain and Language, 71*, 245–248.)

The following factors determine the particular type of recovery or the language that is preferentially recovered:

- The nature of language:

There are four linguistic means for communicating experience (Tomasello, 1995) – individual symbols (lexical items); markers on symbols (grammatical morphology), ordering patterns of symbols (word order) and prosodic variations of speech (e.g., stress, intonation, timing). Languages differ in the way they attach to these different means. In some languages, word order is fundamentally free and information on “who did what to whom” is conveyed by word endings, or by prosody in tone languages. By disparity, in English, such information is conveyed by word order and this is relatively rigid. These different linguistic means require different processes. A given lesion can hence give rise to different outcomes in different languages because one process is relatively more important in one language rather than another and so there can be more opportunities for errors of a certain type to reveal themselves in one language rather than another (Eg, Paradis, 2001). Damage to a device implementing that process will exert a greater effect in one language rather than another and so underlie differential recovery in one instance and selective recovery in another.

- Individual differences in recovery

A lesion at a given site and extent may yield different effects (e.g., parallel recovery versus differential recovery) because of more effective repair process in one individual compared to the other. A number of factors are known to affect the likelihood of recovery from a focal lesion. These factors include age, premorbid IQ /education level and the integrity of the frontal lobes (Robertson & Murre, 1999).

Thompson, C. K. (2000) raised questions such as what influence the extent to which undamaged portions of the left hemisphere or areas in the right hemisphere are recruited for processing language once the system is damaged? More specifically does the treatment provided influence reorganization of the language system or does it reorganize in a biologically predisposed manner, considering site and extent of lesion and other variables? And the author concluded that, given the results of animal studies as well as recovery studies of aphasia, it is highly likely that treatment plays a strong role.

Furthermore, Thompson, C. K. (2000) questioned whether the domain of language or the type of treatment provided influence recovery patterns? For example, does treatment focused on sentence production result in reorganizational processes that differ (at least in some respects) to that that results from treatment focused on naming or word retrieval? Does treatment for sentence production focused on lexical and syntactic properties known to influence normal language processing result in different neurophysiological outcomes than treatment aimed at teaching patients to produce sentences and phrases for communicating in certain functional contexts? It was concluded that indeed, it is arguable that treatment focused on a particular language domain would result in recruitment of different aspects of the language network. The treatment approach also might result in markedly different outcomes.

Thompson and colleagues have shown, for example, that linguistic specific treatment of sentence production deficits in agrammatic aphasia results in generalization to untrained sentences that are linguistically similar to those trained, indicating improved access to the structures and computations required to produce sentences (Ballard & Thompson, l999; Thompson & Shapiro, l995).

There is an increasing need in India to understand the lexical organization of languages in bilingual individuals with and without Aphasia for the following purposes:

1. To understand the interactions between L1 and L2 following Aphasia
2. To understand the differences and similarities between neurotypical individuals and individuals with Aphasia, specifically with reference to Kannada-English and Malayalam -English bilinguals
3. To aid in the selection of therapeutic strategies for bilingual individuals with aphasia, rehabilitation of bilingual persons with aphasia is confronted with several questions, like,

    Should only one language known by the patient be treated or all?

    Does rehabilitation one language have beneficial effects on untreated languages?

    Do potentially beneficial effects only occur between structurally related languages?

As research in this area is relatively young little is known about pre- and post-rehabilitation assessment of bilingual language disorders. Currently only one language is treated wherein patients often show mixing or switching problems. It would be confusing for them and a waste of time (Fabbro 2001a). Further, poor availability of bilingual speech-language services may just leave not many choices (Ansaldo et al., 2008)

REVIEW OF LITERATURE

Lexical organization in the bilingual brain has been a topic of both theoretical and clinical interest over the years. Several conceptualized models have been put forth to explain the organization of the bilingual mental lexicon having been supported by evidences from experiments on or profiles of typically developing bilingual children, neurotypical bilingual adults and bilingual individuals with Aphasia.

Bilingual individuals with Aphasia have been studied all over the world in various language pairs to address issues such as differences in the severity of impact on two languages, recovery patterns, language of intervention, transfer of skill from one language to the other etc. These investigations have provided insights in to the nature of bilingual language representation and in turn their lexical organization. This population forms a significant data base considering the numerous probabilities that exist in the manifestation of language.

There is indeed a great need of further understanding of aphasia in bilinguals to improve clinical intervention with bilingual patients and to shed light on the nature of bilingualism and of aphasia. Increasingly, there is recognition that the study of bilingual language is not a separate field of inquiry but is part of research which seeks to understand language per se (Caramazza & Brones, 1979; de Bot, 1992; Tzelgov, Henik, & Leiser, 1990). Researchers in bilingualism have recognized that one cannot assume the existence of a single lexical or conceptual system if performance in the two languages is comparable on a particular task or assume language-specific, separate systems if performance varies across languages (Diller, 1974; Durgunoglu & Roediger, 1987; Snodgrass, 1992).

Currently, two major but conflicting theories exist. The first theory states that the bilingual lexical system consists of two language specific lexical systems connected to a common semantic system (De Groot, 1992). According to this theory, the conceptual representations for words are stored in a common, non-language-specific system which is linked to separate, language-defined lexical systems. The next theory considers the similarities between bilinguals and monolinguals and suggests that the bilingual system is the same as the monolingual system. This theory gives importance to morphology of language in determining boundaries in the bilingual language system (Kirsner, Lalor, & Hird, 1993)

Tasks involving translation from one language to another is assumed to yield information regarding lexical organization in bilinguals. Wilss (1996) described translation as a knowledge-based activity where the linguistic knowledge of two language systems is an essential prerequisite but it alone would be inadequate. Insights from Green (1986), Price *et al.* (1999), Paradis (1982) and Fabbro (1999) suggest that translation should be considered as a cognitive task totally disassociate from understanding and speaking a bilingual's two languages.

Bilingual aphasics may also exhibit translation disorders (Fabbro & Gran, 1997). One of these phenomena is the *inability to translate,* which affects both directions of translation, that is, from L1 into L2 and vice versa. Another disorder is *spontaneous translation,* a compulsive ''need'' to translate all that is said by the patients themselves and/or by their interlocutors (DeVreese, Motta, & Toschi, 1988). Another disorder is *translation without comprehension,* which occurs when patients do not understand commands that are given to them but can nevertheless correctly translate the sentences (Veyrac, 1931; Fabbro & Paradis, 1995b). Finally, *paradoxical translation* occur when a patient can translate only into the language that he or she cannot speak spontaneously and not the reverse (Paradis et al., 1982). In a specific study Paradis (1984) analyzed the paradoxical translation phenomenon and the translation without comprehension deficit phenomenon and presumed the existence of a series of neurofunctionally separate and independent components as follows: (a) a component accounting for translation from language A into language B (A→B) and (b) a component accounting for translation from language B into A (B→A). Therefore, a cerebral lesion in a bilingual subject may for a certain period of time selectively inhibit only a component of the translation process, whereas the other component that is neurofunctionally independent may continue to perform translation without difficulty.

Studies on the bilingual brain

While clinical neurolinguistic studies primarily focused on the development of test methods for a complete and systematic assessment of language disorders and the description of the linguistic symptomatology in the different phases that follow a cerebral lesion, experimental studies in this field basically tried to answer the where and how the languages known by bilinguals are represented in the cerebral structures.

Electro-cortico-stimulation was one of the first methods in electrical stimulation studies which were used to assess the cerebral representation of linguistic functions during brain surgery (Ojemann & Whitaker, 1978; Rapport et al., 1989). In these studies, patients were administered naming tests in both languages while during neurosurgical interventions different cortical areas were stimulated in such a way as to produce their transient functional inhibition and prove whether these areas were involved in language processing. There were sites in which both languages were equally disrupted, one language was disrupted more than the other, and sites in which one language was disrupted and the other was not affected at all by electrical stimulation of the brain (EBS). Hence it was evident that specific cortical areas were shared by both languages, whereas other areas, when stimulated, selectively inhibited only one language. These studies were criticized because they could not be replicated on a larger population of a statistically sufficient size and because the spatial definition of such brain mapping lacked exactness.

A number of studies carried out by Helen Neville and associates (Neville et al., 1992; 1997; Weber-Fox & Neville, 1997) using electrophysiological techniques (event-related potentials, ERPs) revealed possible differences in the cerebral cortical organization of languages according to the age of acquisition and learning strategies. In early bilinguals, closed-class words of both languages tend to be represented in the left frontal lobe, whereas open-class words tend to occupy postrolandic cortical structures. On the other hand, in bilinguals who learned their second language after the ‘‘critical age’’ (about 7 years of age), closed-class words of L2 vs. L1 do not seem to be represented in left frontal areas but along with open-class words in postrolandic areas.

Studies on bilingual aphasia (Fabbro & Paradis, 1995; Fabbro, 1999) and neuroimaging studies (Dehaene *et al.*, 1997; Weber-Fox *et al.*, 1996) substantiate that the declarative learning of a L2 grammar and the lexico-semantic level of both L1 and L2 are mainly supported by the temporal neocortex and the parieto-temporal areas. All these data stress the importance of both implicit acquisition and explicit learning in every language fixing process.

Lucas, Mckhann, and Ojemann (2004) examined whether multiple languages are functionally separated within the bilingual brain; whether the languages are similarly organized; and whether language organization in bilinguals mirror that in monolinguals. The authors found both distinct language-specific sites and shared sites that support both languages. In terms of total cortical extent, L1 and L2 representations were found to be similar but were considerably different in anatomical distribution. The L2 sites were limited to the posterior temporal and parietal regions, whereas the L1 and shared sites was seen throughout the mapped areas. Bilinguals possessed seven perisylvian language zones, in which L2 sites were significantly underrepresented when compared with the distribution of language sites in monolinguals. The areas which restricted L2 overlapped the primary language areas found in monolingual children, indicating that these zones were dedicated to L1. These findings convey three conclusions. It is mandatory to map both languages in bilinguals because L1 and L2 areas are functionally different. There exist differences in the organization of L1 and L2 areas, with L2-specific sites located restricted to the posterior temporal and parietal lobes. Finally, language organization comparisons in bilingual and monolingual brains demonstrate the presence of L2-restricted zones, which are dedicated to L1.

Studies on different models of lexical organization

Potter et al. (1984) compared word association and concept mediation models in a study in which bilinguals performed picture and word naming in L1 and L2, and both L1-L2 (forward) and L2-L1 (backward) translation. The results were in accordance with the concept mediation model, as L2 picture naming was found to be as fast as forward translation. Potter et al. (1984) found this result to be strikingly similar in proficient and less proficient bilinguals. L2 processing was therefore assumed to occur through concept mediation at all levels of proficiency.

Kroll and Curley (1988) argued that connections between L1 and L2 need not always occur through concepts. They suggested that a stage in which L1-L2 word form links mediate the processing of L2 words might still be present, but that the non-proficient bilinguals in Potter et al.'s (1984) study might have passed that stage. In other words, these bilinguals were already too proficient. In an experiment replicating the Potter et al. (1984) study with a wider range of bilinguals, they found that bilinguals who had known their L2 for less than 2 years conformed to the word association model: translation into L2 was faster than picture naming in L2. For more proficient bilinguals the results replicated those of Potter et al. (1984).

Bilingual aphasics also show translation disorders that would support the revised hierarchical model. Breakdown of links in this model can explain the occurrence of various disorders. Evidence for a single conceptual store came from results of studies which indicate cross-language semantic priming and evidence for separate lexical stores came largely from the lack of any influential evidence of cross-language repetition priming. Hierarchical models have been criticized by several authors because the memory structure for an individual bilingual seemed to vary depending on numerous factors, including the concreteness or abstractness of a given word, it's part of speech and, especially, whether its translation was a cognate or not.

According to *Mixed memory model,* which was devised explicitly to account familiarity and word type effect (De Groot, 1993) the conceptual and lexical connections vary in strength and depends on magnitude of activation occurring on a particular connection and between particular representations. The more activation occurs on a connection the stronger it gets and the faster the processing on that connection. The phenomenon that concrete words are easier to process across languages has been elucidated by means of the decompositional conceptual representation in the bilingual memory (De Groot, 1993; De Groot – Comijs, 1995; van Hell et al., 1998).

Decompositional conceptual representation in bilingual memory

To account for the observable fact that concrete words are easier to process across languages the theory of the decompositional conceptual representation in the bilingual memory was used.

The figure 3 presents the notion of the decomposition of conceptual representations on the example of Dutch-English translation pairs differing in abstractness: *vader-father* (Eng. father-father) and *idee-idea* (Eng. idea-idea).

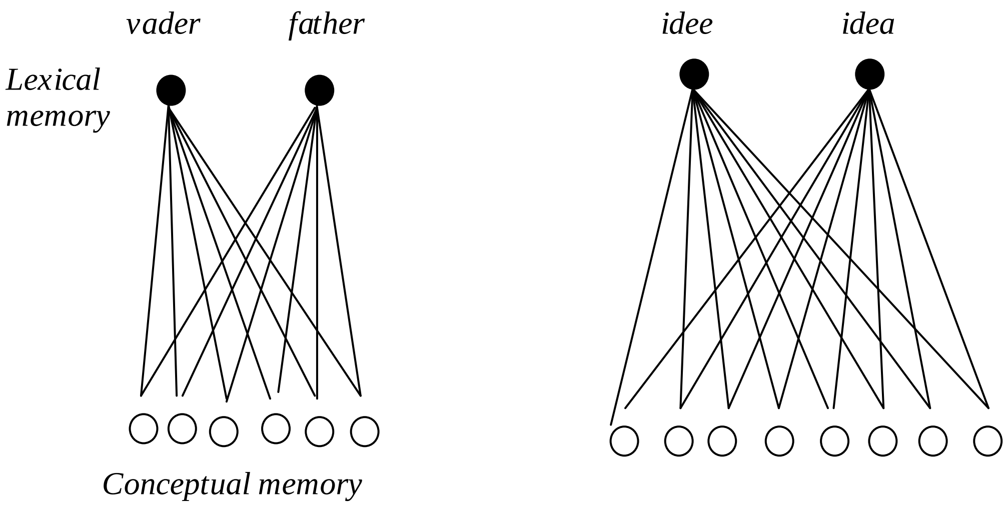

Figure 3: Decompositional conceptual representations in bilingual memory (De Groot, 1992a, 1992b)

According to this theory, the meaning of a word is a set of different semantic features forming the semantic representation of this word in the conceptual store. The semantic representations of words from a translation pair can to a lesser (*idee-idea*) or greater (*vader-father*) degree overlap in semantic features. The degree of overlap depends on the word type of the translation pair. For example, concrete words (*vader-father*) would share more semantic features across languages than abstract words (*idee-idea*) (De Groot, 1993). Thus, concrete words are easier to process across languages for the reason that they share more semantic features in the bilingual mental lexicon. The situation when abstract words share only some semantic features is said to be typical for proficient bilinguals (De Groot, 1993) who know all shades of meaning of a particular word in L2 and are able to determine to what extent the meanings of translation equivalents overlap.

The relation between translation equivalents in terms of overlap of a set of semantic features is represented in the distributed feature model. This model claims that concrete nouns and cognates are more likely to map onto virtually the same pool of semantic features across languages than the abstract nouns and non cognates. Hence the translation will be retrieved more quickly when the overlap between the semantic features are more.

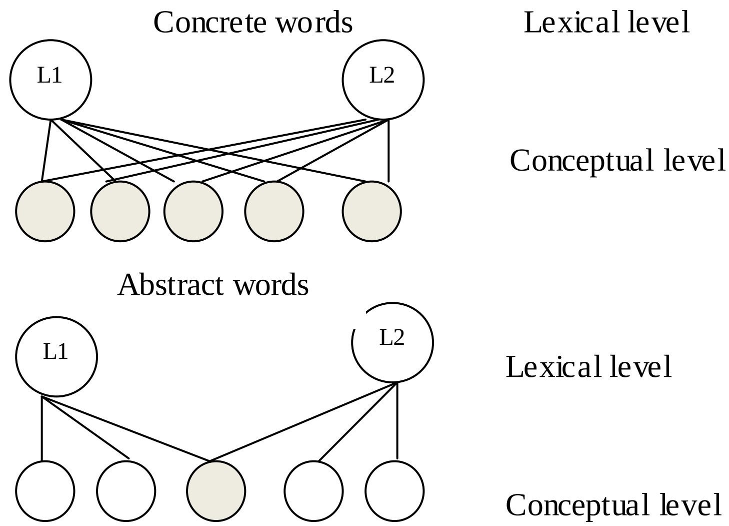

Figure 4: The distributed feature model (adapted from Van Hell and De Groot, 1998).

The structures of languages have been found to influence the representation of two or more languages. This interesting feature is yet to be discovered in many Indian languages, although some attempts have been made. Narang and Laskar (2010) studied individuals with left hemisphere damage, right hemisphere damage and both using the Assamese-English version of the 'Bilingual Aphasia Test' and found that the translation abilities in all the three groups were better from L1 (Assamese) to L2 (English) than vice-versa, when L1 proficiency was better than L2. Mohan, Mohan, Maria, Shanbal and Suting (2010) investigated a Kannada-English bilingual adult with Trans-cortical Sensory Aphasia on a lexical decision paradigm and found that the processing of the languages were parallel and not hierarchical, which is point towards a divided mental lexicon for the participant. Some studies on code-switching and code-mixing have shown mixed patterns of cross-language influences in Malayalam-English (Krupa & Chengappa, 2002) and Kannada-English (Bhat & Chengappa, 2004) bilingual individuals with Aphasia. The choice of language(s) for aphasia treatment, and the likelihood and mechanisms of generalization of treatment gains across languages, are examples of clinical questions, the answers to which may depend on the nature of bilingual linguistic organization.

Choice of language for intervention

Paradis (1993) listed the following questions as being of importance in the consideration of the choice of language/s for intervention in bi/multilingual aphasics:

(a) Is it enough to rehabilitate one language in bilingual aphasics or do all languages known by the patient have to be treated?

(b) If the decision is taken to rehabilitate one language only, what are the criteria behind this choice?

(c) Does rehabilitation in one language also have beneficial effects on the untreated languages?

(d) Do potentially beneficial effects transfer to structurally similar languages (Kannada and Malayalam) only or also to structurally distinct languages (Kannada /Malayalam and English)

Empirical research on language rehabilitation in bilingual aphasics

As accounted by Fabbro (1999), the empirical research on language rehabilitation in bilingual aphasics is still at an early stage. So far researchers have mainly analyzed individual cases and, generally, they have not carried out a proper pre- and post rehabilitation assessment of language disorders. In addition very few research studies assessed the patient's linguistic abilities before and after rehabilitation with a test equivalent in both languages. Conclusions drawn from these research studies are thus still speculative, and further studies are needed if more detailed information is to be acquired.

Among the many single case studies of the last decade several report cross language advantage when therapy is provided in any one of the languages, often the second language (Marangolo, Rizzi, Teran, Piras & Sabatini, 2009; Miertsch, Meisel & Isel, 2009), even when the languages are structurally different (Watamori & Sasanuma, 1976) and even when training is provided in the less dominant language (Edmonds & Kiran, 2006) or when different modes of therapy such as cognitive and cognate- based treatments are tried (Kohnert, 2004). Others report non parallel recovery (Goral, 2004) and emphasize the relative contribution of spontaneous recovery, therapeutic transfer, language proficiency, language use and structural relations between the two languages.

Kohnert (2009) reviewed twelve studies focusing on question of the possible transfer or generalization of positive effects from a treated to an untreated language in bilingual individuals with primary acquired aphasia. She points out that half of them did not account for spontaneous while among the remaining four reported cross – language generalization under some conditions while the remaining did not report any cross- language generalization of treatment effect to untreated language.

Two other studies have attempted to provide a comprehensive review on the scant literature on effects of therapeutic intervention for bilingual aphasics. Lorenzen and Murray (2008) present a theoretical and clinical summary of bilingual aphasia focusing on English - Spanish bilinguals in the United States. Considerations in the valuation of the bilingual aphasics included issues that will provide clues to the loci breakdown in the language systems, factors driving recovery patterns, the role of cognitive factors as well as client priorities that need to be considered in planning intervention are emphasized. They recommend that once the choice of language/s is made in consultation with the client and family treatment efficacy needs to be maximized by analyzing treatment languages for similarities of underlying structure to maximize outcome even if treatment is in one language. The need for further empirical investigations on issue of quantifying and qualifying bilingualism, the interaction between linguistic and cognitive factors, a better documentation and greater understanding of recovery patterns are stressed.

Shah, Frymark, Mullen, and Wang, (2010) undertook a systematic review to examine three critical questions faced by speech language pathologists during clinical decision making: outcomes when language therapy is provided in the secondary (less- dominant) language (L2), extent of cross- language transfer (CLT) and variables that influence CLT and outcomes when language therapy is mediated by a language broker (translator). Their review of data from 14 studies (N=45 aphasic individuals) indicate that treatment in L2 leads to positive outcomes (cognate to L1 treatment); CLT was found to occur in most studies, especially when L1 was the language of treatment. In general the following trends were identified by them: therapy provided in L2 yields positive receptive and expressive outcomes even in chronic bilingual aphasia, CLT does occur in over half the participant, and , or age of acquisition and language typology have little differential effect on outcomes. Interestingly studies addressing receptive language appeared to show more positive cross linguistic effects. However, they also pointed that several variables are confounded and emphasized the need for further research.

On the basis of their review, Shah et al. (2010) recommended that when an SLP is faced with decisions about choice of language for treatment, the L2 can be actively considered as a viable option when considered along with, factors such as client preference and language of the environment. Since they did not find any consistent effect of L2 acquisition age or proficiency level they suggest that SLPs may consider L2 therapy for early and late bilinguals with moderate to high L2 proficiency, until further data emerge suggesting otherwise. The implications for clinical decision making purposes then, are that the current state of evidence does not provide any basis for SLPS to predict if CLT will occur after unilingual treatment.

Selection criteria for choice of therapeutic language and factors that influence choice of language for therapy

As of date there are no clear- cut answers available on the issue of choice of language for therapy while some researchers claim that the mother tongue is preferable others claim that it is the least impaired language which should be treated, and still others claimed that the language that is worst impaired should be targeted. It is also not clear as to whether therapy should be provided in only one language of the bi/multilingual aphasic or whether more than one language should be targeted. As a rule however, for economic reasons and the difficulty in finding suitable bi/multilingual therapists language intervention by and large, continues to be provided in a single language.

The investigations on this issue have been done using both implicit (e.g., translation priming) and explicit (e.g., word translation) measures. Cross-language influences are sensitively tapped using translation based tasks. Hence, it is only appropriate that 'translation' be the central paradigm of the current investigation.

Hence the present study aims to examine the lexical connections between two languages, English and Kannada in Kannada-English bilingual individuals and English and Malayalam in Malayalam -English bilingual individuals with Aphasia and neurotypical individuals.

Objectives

The study has the following objectives:

1. To evaluate the responses of Kannada-English bilingual individuals and Malayalam - English bilingual individuals with and without Aphasia on the 'Word Recognition', 'Word Translation', 'Translation of sentences' and 'Grammaticality Judgment' sections of the English-Kannada and Malayalam -English version of the 'Bilingual Aphasia Test'.
2. To describe the nature of disruption of the two languages in bilingual individuals with aphasia and the nature of lexical organization in bilingual individuals.

METHOD

Participants

Two groups of participants were considered for the study. Ten Kannada-English and ten Malayalam – English bilingual individuals with Aphasia were included in Group 1. Table 1 depicts the demographic details of all the subjects in Group 1. Group 2 consisted of twenty age-matched neurotypical Kannada-English and Malayalam – English bilingual individuals. All the Kannada-English participants had 'Kannada' as their mother tongue (L1) and 'English' as their second language (L2) similarly all the Malayalam – English bilingual participants had 'Malayalam' as their mother tongue(L1) and 'English' as their second language (L2) .

The diagnosis of Aphasia was made on the basis of administration of the 'Western Aphasia Battery' (Kertesz, 1982). The 'International Second Language Proficiency Rating Scale' (Wylie & Ingram, 2006) was also administered on all the participants to rate their second language proficiency. All the participants who scored minimum vocational proficiency (able to communicate in English with all age groups) were included in the study. Consent was obtained from all the participants selected.

Criteria for inclusion included the following (a) aphasia subsequent to CVA (b) history of bilingualism (c) hearing sensitivity within normal limits (d) no history of neurological illness and dementia.

Table 1: Demographic details of subjects

Subjects	Age/ gender	Aphasia type	Languages known pre morbidly
1	36/M	Anomic	Kannada, English
2	66/M	Broca's	Kannada, English
3	49/F	Anomic	Kannada, English
4	76/M	Anomic	Kannada, English
5	57/M	Broca's	Kannada, English
6	38/M	Broca's	Kannada, English
7	48/M	Broca's	Kannada, English
8	59/M	Broca's	Kannada, English
9	62/M	Broca's	Kannada, English
10	71/M	Broca's	Kannada, English
11	62/M	Broca's	Malayalam, English
12	56/M	Broca's	Malayalam, English
13	57/M	Broca's	Malayalam, English
14	64/M	Broca's	Malayalam, English
15	58/M	Broca's	Malayalam, English
16	45/M	Anomic	Malayalam, English
17	55/M	Broca's	Malayalam, English
18	63/M	Broca's	Malayalam, English
19	54/M	Broca's	Malayalam, English
20	52/M	Anomic	Malayalam, English

Stimuli

In the present study Part C of 'Bilingual Aphasia Test' was administered to Kannada – English and Malayalam- English bilinguals with and without aphasia. 'Part C' of the English-Kannada (Paradis & Rangamani, 1989) version of the 'Bilingual Aphasia Test' was used for the Kannada- English bilinguals. The Malayalam version of the test was not available hence it was adapted to Malayalam and standardized for its use in the present study.

The Part C of 'Bilingual Aphasia Test' consists of four tasks in each direction – recognition of translation equivalents, production of translation equivalents, translation of sentences and grammaticality judgments. Within each task, the patient's performance in one language was compared with his or her performance in the other. The part C of the test consists of the following subsections: Word recognition, Word translation, Sentence translation and Grammaticality judgment.

The *word recognition task* requires the subject to recognize five L1 words within a list of 10 words in L2. Similarly five L2 words have to be recognized from a list of 10 L1 words. The words selected for this task were familiar concrete words.

Word translation task requires the subject to translate words from L1 to L2 and L2 toL1. The stimuli are arranged as follows:

Five concrete words of L1 to L2.

Five abstract words of L1 to L2.

Five concrete words of L2 to L1.

Five abstract words of L2 to L1.

Sentence translation task: In this task the subjects are asked to translate sentences from L1 to L2 and L2 to L1.

Grammaticality judgment task requires the subject to judge whether a sentence is grammatically correct in the given language. Sentences 482 – 496 are in L1 and sentences 498-512 are in L2 (refer Appendix A & B). The stimuli chosen for this task contained features which were acceptable in one language but not in the other.

Instruction and Scoring

The instruction for each of the subtest is different and is given in both languages. For every correct response the participant gets '1' score and '0' for each incorrect response. Under the grammaticality judgment task the participants are scored for both judging a sentence and for correcting the incorrect sentences. The sentence translation task is scored based on the number of correct word groups produced.

Procedure

The study was conducted in the following phases:

Phase 1: Adaptation of Part C of BAT to Malayalam – English language pair
Phase 2: Standardization of Part C Malayalam – English BAT

Phase 3: Administration of the Kannada – English and Malayalam English BAT on bilingual individuals with and without aphasia.

Adaptation of Part C of BAT to Malayalam – English language pair

Permission was sought from the original author before adapting the part C of the test to Malayalam- English language pair. The stimuli for the Malayalam – English version of the test were prepared by considering the semantic and syntactic rules of Malayalam language. In order to maintain equivalence in structural complexity, the stimuli selected were similar in complexity rather than for being actual translations from the original. The test was made in such a way that it is culturally compatible to the Malayalam speaking population. For example, the stimuli "Hat is on the table" was modified as "Cap is on the table" considering the linguistic and cultural context of Malayalam speaking population. Further, the stimuli were arranged in such a way that it followed the same pattern of the answer key provided for all languages.

Preparation of test stimuli

Two sets of five familiar words were selected for word recognition tasks in both Malayalam and English. All the words in this section were familiar concrete words. The stimuli for word translation tasks consisted of two sets of ten words. Each set consisted of both concrete and abstract words which were simple and familiar. Six sentences of varying complexity were developed for both languages in the sentence translation tasks. Sentence translation tasks began with simple sentences and gradually proceeded to more grammatically complex sentences. In the grammaticality judgment task, two sets of eight sentences were developed. Only two sentences were grammatically correct in each language. The sentences used in this task incorporated reversible contrastive features. For example, the stimuli 'Cap is on the table' is grammatically incorrect in English but its translation in Malayalam language is correct since the language rules of Malayalam does not necessitate the use of articles before a noun.

The adapted test was then given to five Speech Language Pathologists who has adequate experience in assessment and management of individuals with speech and language disorders for content validation and the necessary changes suggested were incorporated.

Standardization of Part C Malayalam – English BAT

The test was administered to 180 Malayalam English bilinguals in the age range of 20 to 80 years. Thirty subjects (15 females and 15 males) were included in each age group.

Administration of the test

The Kannada – English and Malayalam - English BAT was administered on 20 bilingual individuals with and without aphasia in each language group.

Analysis

The scores obtained under the four sections of 'Part C' of the 'Bilingual Aphasia Test' were compared across the two groups using suitable statistical measures and presented in the results and discussion section.

RESULTS AND DISCUSSION

In this study two groups of participants were considered. Ten each of Kannada-English and Malayalam – English bilingual individuals with Aphasia were the participants in Group 1. Ten age-matched neurotypical bilingual individuals were the participants of Group 2. Part C' of the 'Bilingual Aphasia Test' was the major stimulus of the study.

The objective of the study is to explain the nature of lexical organization of the two languages in Kannada-English (KE) and Malayalam – English (ME) bilinguals, provide significant information regarding the nature of disruption of the two languages in Kannada-English (KE) and Malayalam – English (ME) bilinguals with Aphasia and to provide evidence for the existing models of the bilingual mental lexicon.

The statistical analysis for Kannada-English (KE) and Malayalam – English (ME) bilingual individuals with and without aphasia were carried out using parametric and non- parametric tests respectively. The results of comparison of Kannada-English and Malayalam – English (ME) bilingual individuals with and without Aphasia will be discussed under 4 main headings, they are;

a) Between the groups
b) Across each tasks
c) Translation of English-Kannada Vs. Kannada-English and English-Malayalam vs. Malayalam-English
d) Overall comparison of tasks and translations

The mean and std. deviation for Kannada-English (KE) and Malayalam – English (ME) bilingual individuals with and without aphasia is as given below in table 2, 3 and figure 4, 5.

Table 2: *Mean and standard deviation for the two groups across tasks*

	aphasia		normal	
	Mean	SD	Mean	SD
t1ke	76.00	33.73	100.00	0.00
t1ek	86.00	16.46	100.00	0.00
t2ke	58.00	26.16	96.00	5.16
t2ek	61.00	21.83	97.00	4.83
t3ke	59.15	22.83	97.76	3.91
t3ek	58.84	20.30	98.32	2.70
t4ket	61.23	27.61	88.72	9.67
t4ekt	56.23	22.23	90.61	9.44

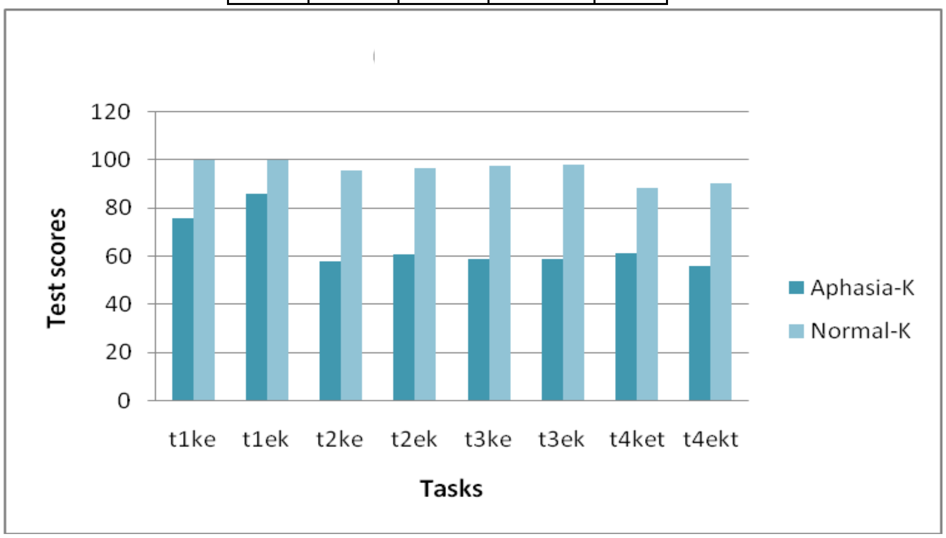

Figure 4: Mean scores for the Kannada group across tasks

Table 3: *Mean and standard deviation for the two groups across tasks*

	aphasic		normal	
	Mean	SD	Mean	SD
t1me	96.00	8.43	100.00	0.00
t1em	96.00	8.43	100.00	0.00
t2me	23.00	15.67	100.00	0.00
t2em	23.00	14.94	100.00	0.00
t3me	23.88	11.12	100.00	0.00
t3em	28.88	9.36	100.00	0.00
t4met	48.73	15.54	100.00	0.00
t4emt	33.11	14.73	96.86	4.43
tme	37.29	5.77	100.00	0.00
tem	35.86	7.65	98.96	1.46

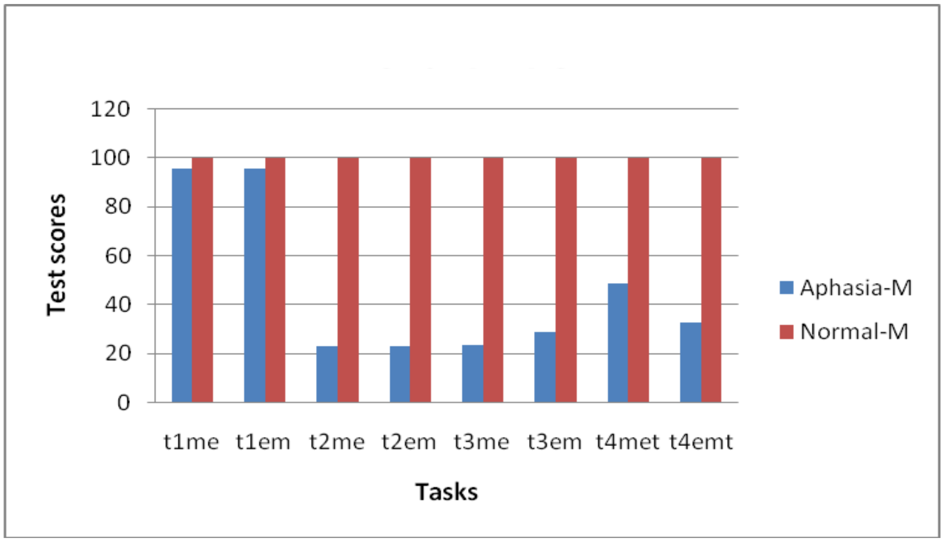

Figure 5: Mean scores for the Malayalam group across tasks

Between the groups comparison

In order to compare the performance of ***Kannada-English (KE)*** bilingual individuals with and without Aphasia for all tasks, MANOVA was used which revealed a significant difference between the two groups as shown in the table 4 below.

The Group I and II ***Malayalam- English (ME)*** bilinguals were compared using Mann Whitney U test and it can be observed from table 5 that there is a significant difference ($p<0.005$) for all the tasks between the groups except for task I (Word Recognition).

Table 4: *Between the group comparison across tasks*

Groups		
Tasks	F	Sig.
t1ke	5.063	.037*
t1ek	7.230	.015*
t2ke	20.306	.000*
t2ek	25.920	.000*
t3ke	27.769	.000*
t3ek	37.128	.000*
t4ket	8.823	.008*
t4ekt	20.256	.000*

Table 5: *Between the group comparison across tasks*

Groups		
Tasks	Z	Sig.
t1me	-1.453	.146
t1em	-1.453	.146
t2me	-4.065	.000*
t2em	-4.082	.000*
t3me	-4.047	.000*
t3em	-4.049	.000*
t4met	-4.044	.000*
t4emt	-3.841	.000*
tme	-4.042	.000*
tem	-3.839	.000*

Due to deficits in recognition, translation and grammaticality judgment, group I performed poorly ($p<0.005$) than group II in all the tasks in Kannada-English bilingual. In Malayalam- English similar results were found except for task I. This would be because of the relative simplicity of the task for both the groups. The results of the study indicate that the normal controls performed significantly better than the aphasic group.

Across each tasks

- Comparison was done separately for the two groups across the tasks using one-way repeated measure ANOVA. No significant difference ($p<0.005$) was seen between the tasks in the ***Kannada-English*** aphasia group while a significant difference was present between task I (word recognition) and task IV (grammaticality judgment) among bilinguals without aphasia as depicted in table 6 below. A significant difference ($p<0.005$) was present in group II may be because of the relative complexity of task IV than task I but for the participants in group I all the tasks were equally difficult hence no significant difference($p<0.005$) was seen between the tasks. The results are inconsistent with the data reported by Linebarger et al. (1983), where agrammatic aphasic subjects performed well on the grammaticality judgment task involving the manipulation of argument-structure properties.

  Table 6: *Across tasks comparison-KE*

task	Group	F	Sig.
KE	Aphasia	1.287	.299
	Normal	6.217	.002*

Normal group			
Task(KE)		Mean Difference	Sig.
1	2	4.000	.221
	3	2.240	.623
	4	11.280*	.030*
2	1	-4.000	.221
	3	-1.760	1.000
	4	7.280	.560
3	1	-2.240	.623
	2	1.760	1.000
	4	9.040	.265
4	1	-11.280*	.030*
	2	-7.280	.560
	3	-9.040	.265

- Each task was compared across the groups within ***Malayalam-English*** using Friedman test. There was no difference (p<0.005) in Group II while a significant difference (p<0.005) was observed in Group I. Hence pair wise task comparison using Wilcoxon Signed Ranks test [t (3) =0.000] was done for Group I and the results indicate that there is a significant difference between the tasks as seen in the table 7 below. This may be because of the difference in task complexity.

Table 7: *Across tasks comparison-ME*

ME	Aphasia
N	10
Df	3
Asymp. Sig.	.000*

ME	T2 - T1	T3 - T1	T4T - T1	T3 - T2	T4T - T2	T4T - T3
Z	-2.825	-2.807	-2.805	-.051	-2.701	-2.599
Sig.	.005*	.005*	.005*	.959	.007*	.009*

- The ***English-Kannada*** aphasia group showed significant difference (p<0.005) between task I and task IV, the difference was negligible among bilinguals without aphasia on doing one-way repeated measure ANOVA which is clear from table 8. Due to deficits in recognition, translation and grammaticality judgment which is more evident in L2 than L1and also because of the relative complexity of task IV than task I there was a significant difference in group I.

Table 8: *Across tasks comparison-EK*

task	Group	F	Sig.
EK	Aphasia	6.069	.003*
	Normal	6.261	.002#

\# negligible difference

Aphasia group				Normal group	
Task(EK)		Mean Difference	Sig.	Mean Difference	Sig.
1	2	25.000	.161	3.000	.487
	3	27.160	.092	1.680	.487
	4	29.770*	.013*	9.390	.071
2	1	-25.000	.161	-3.000	.487
	3	2.160	1.000	-1.320	1.000
	4	4.770	1.000	6.390	.286
3	1	-27.160	.092	-1.680	.487
	2	-2.160	1.000	1.320	1.000
	4	2.610	1.000	7.710	.262
4	1	-29.770*	.013*	-9.390	.071
	2	-4.770	1.000	-6.390	.286
	3	-2.610	1.000	-7.710	.262

- Also, in ***English-Malayalam*** bilinguals each task was compared across the groups within EM using Friedman test. There was significant difference ($p<0.005$) for both groups as observed in table 9 below. On performing Pair wise task comparison using Wilcoxon Signed Ranks test for both groups a significant difference [f(3)=0.000,0.007] was present for group I when task I was compared with the other three tasks, also when task IV was compared with task II. Whereas for task IV in group II the difference was negligible ($p<0.005$). It may be because the tasks were of varying complexity. Task II and task III had no significant difference ($p<0.005$) since both were translation tasks.

Table 9: *Across tasks comparison-EM*

EM	Aphasia	Normal

N	10	10
Df	3	3
Asymp. Sig.	.000*	.007#

negligible difference

	Aphasia group		Normal group	
	Z	Asymp. Sig.	Z	Asymp. Sig.
T2 - T1	-2.825	.005*	.000	1.000
T3 - T1	-2.812	.005*	.000	1.000
T4T - T1	-2.805	.005*	-1.890	.059
T3 - T2	-1.072	.284	.000	1.000
T4T - T2	-2.194	.028	-1.890	.059
T4T - T3	-.765	.444	-1.890	.059

Hence according to the study, while considering language therapy, therapy goals should be arranged in a hierarchical order by focussing on simpler tasks such as word recognition first and then gradually moving on to much complex tasks such as grammaticality judgment. This can be done in any of the languages of the client irrespective of L1 and L2.

According to Thompson et al.'s (1997) findings, it was seen that subjects would demonstrate a hierarchy of verb difficulty in verb naming and in categorizing verbs by type because both verb production and verb categorization require access to verbs and their lexical-syntactic entries from a production point of view. Based on the results of previous grammaticality judgment studies (Gardner, Denes, & Zurif, 1975; Linebarger, Schwartz, & Saffran, 1983), it was anticipated that subjects would perform the grammaticality judgment test with a high rate of success, indicating intact lexical-syntactic representation of and access to verb entry in the early stage of sentence processing.

Translation of EK vs. KE and EM vs. ME

Comparison of translation of ***EK vs. KE*** and ***EM vs. ME*** among all the four tasks was carried out using paired t-test and Wilcoxon Signed Ranks test respectively.

For ***EK vs. KE*** the results showed no significant difference ($p<0.005$) in all the four tasks between the two groups which is evident from the table 10. Since participants in group I was attending speech therapy for a minimum of 1 year their performance has improved overtime and they have obtained near normal scores.

For EM vs. ME there is no significant difference ($p<0.005$) present in all the four tasks for group I and II which is evident from the table 11.

Table 10: *Translation of EK vs. KE*

EK vs. KE	Aphasia		Normal group	
	t	Sig.	t	Sig.
t1ke - t1ek	-1.342	.213	-1.342	.213
t2ke - t2ek	-.394	.703	-.557	.591
t3ke - t3ek	.056	.957	-.429	.678
t4ket - t4ekt	.634	.542	-.715	.493

Table 11: *Translation of EM vs. ME*

EM vs ME	Aphasia		Normal	
	Z	Sig.	Z	Sig.
t1em - t1me	.000	1.000	.000	1.000
t2em - t2me	.000	1.000	.000	1.000
t3em - t3me	-1.620	.105	.000	1.000
t4emt - t4met	-2.552	.011	-1.890	.059
tem - tme	-1.084	.279	-1.890	.059

The recovery of both L1 and L2, after training in one language, can be attributed to cross-language transfer or generalization. Recent investigations of gains following language treatment in bilingual individuals with aphasia (e.g., Edmonds & Kiran, 2006) are steady with early reports (e.g., Paradis, 1993; Watamori & Sasanuma, 1978) that along with the treated language, the non-treated language(s) also benefit from intervention (cited in Goral M, 2007). Also Gil & Goral (2004) presented a single case study of a 57-year-old non-monolingual male, who suffered an ischemic left frontoparietal infarct. The participant received treatment in Hebrew for three-and-a-half months post injury five times per week for 45-minute sessions. Once results indicated progress of cross-linguistic generalization, he received a second treatment focused on Russian, for a period of one-and-a-half months. Although the focused language of treatment switched from Hebrew (L2) for three-and-a-half months to Russian (L2) for a month-and-a-half, there was an improvement in both the untreated languages within the treatment period, thus crosslinguistic generalization. However, the participants' Russian language consistently made more improvements through the entire therapy treatment.

Edmonds and Kiran (2006) found cross-language generalization only when the non-treated language was the speaker's more dominant language or when the participants were highly proficient in both their languages. They administered naming treatment to two bilingual individuals. Their first participant was dominant in English and less proficient in Spanish, who demonstrated improvement only in the treated language when treated in his dominant language and improvement in both the treated and the non-treated languages when treated in his less dominant language. Their second participant was a balanced bilingual who was treated in Spanish only and established improvement in both the treated and the non-treated languages. They attributed this difference to the difference in their dominance level of the non-treated languages.

According to Leung, J (2010) for the potential benefits of cross-linguistic generalization and overall improvement following rehabilitation, clinicians should take into consideration the client's family's preference when deciding which the language to use for therapy.

Overall comparison of tasks and translations

An overall comparison of tasks and translations were carried out for ***Kannada-English*** bilinguals using mixed ANOVA and it can be observed from the table 12 below that there was no significant difference ($p<0.005$) between the translations while significant difference was present across the groups but there was no interaction between translations and groups.

Table 12: *Overall comparison of tasks and translations-KE*

	F	Sig.
Translation	.125	.727
Groups	.016	.902*

Similarly for ***Malayalam-English*** group independent t-test was done and a significant difference ($p<0.005$), [t (18) =28.505] was present for group I for all tasks as seen in table 13.

Table 13: *Overall comparison of tasks and translations-ME*

Groups	Mean	SD.
Group I	36.8	6.70
Group II	97.5	0.71

The results obtained from the present study can be used to comment on the following aspects

1. Nature of lexical organization
2. Nature of disruption of the two languages in bilingual individuals with aphasia
3. Evidence supporting models of bilingual lexical organization
4. Selection of therapeutic strategies for bilingual individuals with aphasia

Nature of lexical organization

Kroll (1993) found many contradictory findings in early research about the organization of the bilingual language system originated from the fact that researchers of bilingualism did not make a clear distinction between lexical and semantic word representations. Studies that emphasized word meanings mostly produced evidence for a single language system shared by both languages, whereas studies that chiefly addressed lexical processes seemed to provide support for two discrete, language-specific systems.

There are several sources of evidence that L1 and L2 words access a common conceptual system. Firstly, studies of interference effects, such as the negative priming effect, have constantly shown that processing in one language interferes with processing in the other language (Francis, 1999). Secondly, primed lexical decision tasks have shown that the recognition of a target word is facilitated when it is preceded by a tachistoscopically presented prime which is a semantic associate in the other language (Francis, 1999). Thirdly, semantic comparisons (e.g. semantic categorization tasks) between words from different languages have been shown to take no longer than comparisons between words of the same language, yet again signifying the integration of semantic information between languages (Potter, So, Voneckardt, & Feldman, 1984; Francis, 1999). Fourthly, Dijkstra et al. (Dijkstra, Grainger, & Van Heuven, 1999; Dijkstra, Van Jaarsveld, & Ten Brinke, 1998) concluded that lexical decisions are faster for cognates than for interlingual homographs and language-unique words of the same frequency. Such a facilitatory effect should not occur if semantic representations (at least for cognates) are not shared across languages. Finally, using fMRI, the brain activity of proficient bilinguals was measured by Illes et al. (1999) by performing a semantic categorization task (abstract vs. concrete words) in L1 and L2. These authors were unable to find significant differences in brain activity between both language conditions. In both L2 and L1, there was enhanced activation in the left inferior prefrontal cortex, which is in consonance with findings from previous monolingual studies.

A review of experiential work suggests that the lexical representations of a bilingual's two languages are independent (Smith, 1991) in contrast to this findings Geneese & Nicoladis (2006) hypothesized that the bilinguals have one unitary language system which is not identical to the language organization in monolinguals whereas Kangas (1981) states that bilinguals practically have one grammar system and two separate lexicons.

The result of the comparison of *EK vs. KE* and *EM vs. ME* translation indicates that there is a common conceptual store for both languages. On the basis of the comparison of performance of translation tasks in this study, it can be hypothesized that the bilingual lexicon is organized in such a way that there exists separate lexical stores for both languages and a conceptual store which coincides with the *Mixed memory model* (Kroll & Stewart, 1994).

Nature of disruption of the two languages in bilingual individuals with aphasia

The nature of disruption of the two languages in bilingual individuals with aphasia is discussed with the help of the subtests of BAT (part-C) which is as follows, The word recognition task was performed comparatively better than the other tasks by both the language groups this may be because the stimuli contained only concrete words which are easier to process than abstract words. This is in congruence with De Groot and Comijs (1995) who concluded that concrete and frequent words are processed faster than abstract and infrequent words. The response expected was selection of the correct item from a set of words.

In the word translation task, the participants performed better in concrete than in the abstract words. This may be because the concrete words would share more semantic features across languages than abstract words and thus, be easier to process across languages (De Groot, 1993; De Groot – Comijs, 1995; van Hell et al., 1998) (cited in Centowska, A. E., 2006).

The sentence translation task was equally difficult for both forward and backward translations where the group of words produced by the aphasia group was reduced. Adrover-Roig D et al. (2011) presented a case-study wherein the authors assessed the case with the Bilingual Aphasia Test which revealed impaired spontaneous and automatic speech production and L1 speech rate, also impaired L2-to-L1 sentence translation. Impairments in cross-language translation, which are peculiar features of bilingual and polyglot aphasia, may selectively affect only one direction (e.g. only from LI into L2 or vice versa) or both directions of translation (Paradis, 1984). According to De Groot (1994) in mixed memory model, the L1 lexical store is larger than the L2 lexical store, at least for unbalanced bilinguals. This is in consonance with the results of sentence translation task where in the participants were able to produce more number of word groups (Appendix A & B) in L1 than L2.

Grammaticality judgment is one way of examining sentence processing in both normal individuals and persons with aphasia, who often demonstrate grammatical judgment skills that exceed their sentence comprehensions skills. In the present study even though group I participants were able to identify the grammaticality aspect they were unable to correct the sentence appropriately.

Evidence supporting models of bilingual lexical organization

There exists an asymmetry in performance of translation tasks which is primarily used to evaluate which processing route, conceptual or lexical, is used between L1 and L2 in the mental lexicon (Grainger – Frenck-Mestre, 1998; la Heij et. al, 1996; Sholl et al., 1995). According to Kroll & Stewart (1994) the asymmetry is influenced by the age of language acquisition and word type (De Groot, 1993; De Groot et al., 1994; De Groot – Comijs, 1995; van Hell–De Groot, 1998). In other words, research on the asymmetry can indirectly explain how various word types are processed (cited in Centowska, 2006).

The evaluation of the lexical processing of different word types has been the scope of research by De Groot and Comijs (1995) within the category of word types, differentiated between the familiarity variables (word frequency, word familiarity), and semantic variables (concreteness, availability of context and definition accuracy). Generally, research indicates that concrete and frequent words are processed faster than abstract and infrequent words. The mixed memory model was formulated specifically to account for such phenomena (De Groot, 1993). The crucial feature of the mixed model framework is the fact that conceptual and lexical connections vary in strength. The strength of connections depends on the magnitude of activation occurring on a particular connection and between particular representations. More the activation occurs on a connection the stronger it gets and the faster the processing on that connection. For example, high frequency words result in greater magnitude of activation than low frequency words as they possess stronger connections and their processing requires less time.

In the present study it has been observed that the backward translation tasks have less reaction time that the forward translation tasks which is well documented in literature. It can be hence speculated that backward translations are more influenced by familiarity variables than forward translations. This is in agreement with the study done by Connine et al. (1990) where four experiments investigated printed word frequency and subjective familiarity. Words of different printed frequency and subjective familiarity were presented. Smaller reaction time (RT) for high-familiarity and high-frequency words was found in visual and auditory lexical decision task.

Also, De Groot & Annette (1992) conducted three experiments which looked for the determinants of performance in 3 versions of the word translation task. Experiment 1 was the normal-translation version and the cued-translation version, Experiment 2 consisted of recognition of translation task. In both experiments, word frequency and word imageability were manipulated. Both affected the performances in all 3 versions of the task. In Experiment 3 (normal translation), along with the effects of frequency and imageability; context availability, cognate status, accuracy, length of the stimulus words and of their translations, and familiarity were studied. It was found that the frequency of the stimulus word, frequency of the response word, cognate status, and availability of context accounted for unique translation variance.

Lexical-semantic variables (such as word frequency, imageability and age of acquisition) have been studied extensively to address the structure of the word production system. Crepaldi, D et al. (2012) investigated this issue in Chinese by studying the effect of frequency of word, imageability, age of acquisition, visual complexity, grammatical class and morphological structure in word and picture naming and on naming and reading accuracy of healthy and brain-damaged individuals was seen. It was found that grammatical class interacts consistently across tasks with morphological structure, both the group of participants found simple nouns easier to read and name than complex nouns, whereas simple and complex verbs were the most difficult.

The phenomenon that concrete words are easier to process across languages has been explained by means of the decompositional conceptual representation in the bilingual memory (De Groot, 1993; De Groot – Comijs, 1995; van Hell et al., 1998) (cited in Centowska, 2006). The meaning of a word is a set of different semantic features forming the semantic representation of a word in the conceptual store. The semantic representations of translation equivalents can to a lesser or greater degree overlap in semantic features. For that matter, the degree of overlap depends on the word type of the translation pair. For example, concrete words would share more semantic features across languages than abstract words and thus, be easier to process across languages.

Similarly in our study the word translation tasks where in a set of five concrete words and five abstract words were used and the results indicate that there is a better performance observed for the concrete words over the abstract words and this is evident in all the participants. This finding is in line with the word type effect delineated in the mixed model.

Moreover, backward translation seems to be more influenced by familiarity variables than forward translation. This phenomenon can be explained by a blend of two facts. Firstly, the backward translation is based on lexical processing and is greatly influenced by variables entailing lexical processing. Secondly, the strength of lexical connections seems to be directly proportional to the frequency of words. The occurrence of this interrelation can be explained in the following manner. Frequent words have stronger lexical connections because they are generally more frequently processed in L1 or/and L2, and during translation from one language to another. Logically then, familiarity variables affect more in the backward translation which entails more lexical processing.

Furthermore, the forward translation has been proved to be more influenced by the semantic variables, including word concreteness, than the backward translation. The explanation for this finding seems evident. Forward translation is said to use the conceptual route and sensitivity to semantic variables is naturally associated with conceptual processing. Therefore, the forward direction will be more strongly influenced by the presence of semantic variables, for example, by processing of words varying in concreteness.

The experiment by Kroll and Curley (1988) included a translation task in the forward direction (L1 to L2). The comparison of the RTs for the forward and the backward direction of lexical processing rendered the following results. The forward translation proved to be a significantly longer process than the backward translation. It has already been proven that the backward processing in beginner bilinguals requires only the lexical access. It has also been mentioned that longer RTs in picture naming are attributable to the conceptual access. Therefore, significantly longer RTs in the forward processing were also interpreted as a sign of the presence of the conceptual access.

De Groot et al. (1994) suggest that faster processing in the backward direction can be attributed to abstract words rather than concrete words. In their study concrete words were processed with approximately the same speed in both directions and thus, did not cause any asymmetry, whereas abstract words were processed noticeably faster in the backward direction, triggering the asymmetry.

The findings of our study duplicated the general results of Centowska, (2006) that high frequency words and concrete words are processed faster than their counterparts. However, according to this study the fact that concrete words are generally processed faster than abstract words can be attributed to shorter RTs in the backward direction and only for those concrete words which are simultaneously high frequency words. However, contrary to the results obtained by De Groot et al. (1994), it was the forward translation and not the backward translation that is was more sensitive to word frequency. According to the author, this result is probably an outcome of the age of acquisition of the participants.

A difference in performance is often interpreted as reflecting a difference in ability or in the organization of the two languages (cited in Roberts P. M (1998) (e.g., Altarriba & Mathis, 1997; Berney & Cooper, 1978; Dufour & Kroll, 1995; Junque et al., 1989; Kolers, 1963; Taylor, 1976; Vogel & Costello, 1986). As per the results obtained from the present study one can conclude that the lexical organization in bilinguals consists of two distinct lexical systems and one common conceptual system which is as explained in *Mixed memory model/ Distributed feature model.*

Selection of therapeutic strategies for bilingual individuals with aphasia

The results of across task comparison in the present study indicate that there is significant difference in both the languages across the tasks with more score for simpler tasks like word recognition. This suggests that a hierarchical order must be followed during therapeutic intervention starting with simpler tasks and then gradually proceeding on to complex tasks.

In the present study it is seen that there was no significant difference between the performances in both the languages in bilingual individuals with aphasia. This proves that there exists a common entity between the two languages. As stated in the mixed model (Kroll & Stewart, 1994), this would be the conceptual store which is shared by both the languages. Hence providing therapy in any one of the languages would have beneficial effects on the other language also. The extent to which the language would be benefited relies on the structural similarity between the two languages.

SUMMARY AND CONCLUSIONS

The current project was taken up to study the lexical organization in Kannada-English and Malayalam-English bilinguals with and without aphasia through translation tasks on neurotypical bilingual population and bilingual aphasia population. The diagnosis of Aphasia was made on the basis of administration of the 'Western Aphasia Battery' (Shewan & Kertesz, 1980). The 'International Second Language Proficiency Rating Scale' (Wylie & Ingram, 2006) was also administered on all the participants to rate their second language proficiency. Part C of 'Bilingual Aphasia Test' was administered to Kannada – English (KE) and Malayalam- English (ME) bilinguals with and without aphasia. 'Part C' of the English- Kannada (Paradis & Rangamani, 1989) version of the 'Bilingual Aphasia Test' was used for the Kannada- English bilinguals. The Malayalam version of the test was not available hence it was adapted (Shyamala & Liveem, 2012) to Malayalam and standardized for its use in the present study.

Results of the present study revealed significant difference between the two groups of aphasia and neurotypical subjects except for word recognition task in ME bilingual individuals. Also, a significant difference was present between word recognition and grammaticality judgment tasks among KE and EK bilinguals with aphasia but all the tasks were affected in ME and EM bilingual with aphasia. There were no significant difference in EK vs. KE and EM vs. ME but significant difference was seen across the groups in KE and ME bilinguals.

Hence it can be concluded that the bilingual lexicon is organized in such a way that there is a common entity between the processing of the two languages. It is obvious that there exist separate lexical stores for both languages. The common unit would be a single conceptual store which coincides with the *Mixed memory model / Distributed feature model* (Kroll & Stewart, 1994). Therefore based on this view, therapy provided for one language would have beneficial effects on the other language of the bilingual individual. The extent of improvement would depend on various other factors such as structural similarity of the two languages, pre morbid language ability and so on.

Aphasia participants had translation deficits which were evident in the word and sentence translation tasks and grammaticality judgment tasks. The performance on word recognition task was comparatively better and this can be attributed to the translation prime provided for the task.

It is also found that the concrete and frequent words are processed faster than the abstract and infrequent words. The backward translation tasks had less reaction time than the forward translation tasks however the difference was not significant hence the forward and backward translations can be considered equally difficult.

Implications of the study:

The result of the study adds to the existing information in the following ways:

1. It explains the nature of lexical organization of the two languages in Kannada-English bilinguals.
2. It provides significant information regarding the nature of disruption of the two languages in Kannada-English bilinguals with Aphasia.
3. It provides evidence for the existing models of the bilingual mental lexicon.
4. The findings of the study will be very useful in making clinical decisions.

Hence, a study of this nature is significant and relevant at these times due to the increasing incidence of Aphasia in the Indian bilingual population.

Limitations of the study:

1. The reaction time can be measured using appropriate instruments such as DMDX
2. This study is only limited to Kannada-English and Malayalam-English speakers. Different languages can be included
3. Some variables like socioeconomic status, duration of intervention, multilingualism were not monitored in this study.
4. Only Broca's aphasia was included in the study, other types of aphasias can be included.

Future directions:

The results of this study could be utilized in the following ways:

1. The scores could be considered clinically to distinguish between individuals with Aphasia and neurotypical individuals.
2. The scores could be used to examine the recovery patterns of individuals with Aphasia.
3. The results could help one decide whether the same research question needs to be carried further in specific types of Aphasia and with different methods.
4. The results could substantiate clinical decisions taken with reference to the language therapy.
5. The results could be utilized for theoretical and conceptual construction of ideas related to bilingual lexical representation in a Kannada-English bilingual.

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