Effects of Semantic and Syntactic Treatments in Bilingual Stroke Survivors

Project Funded by AIISH Research Fund

Sanction Number: SH/CDN/ARF-3.79/GNM/2010-2011

Total Grants: ₹ 5, 94,000

Total Duration of the Project: 10 + 1 Months

(Sept 2011 ï July, 2012)

(May 2014-June 2014) Extended period with approval

(Ref: SH/CDN/ARF/3.79/2013-14 dated 16-05-2014)

Principal Investigator

G. N. Rangamani, Ph.D., CCC-SLP, BC-ANCDS

Professor, Dept. of Communication Sciences and Disorders

St. Cloud State University

St. Cloud, Minnesota, U.S.A.

Principal Investigator

Prema Rao, Ph.D.

Professor of Language Pathology

Head-Center for Rehabilitation & Education through Distance Mode

All India Institute of Speech and Hearing

Mysore, 570 006

Project Assistants

Ms. Sindhu V. (25/10/2010- 27/08/2011)

Ms. Tiffy George Roy (18/08/2010-20/12/2011)

Ms. SindhushaChandran (19/05/2014-18/06/2014)

ALL INDIA INSTITUTE OF SPEECH AND HEARING

MANASAGANGOTRI, MYSORE- 570 006

Acknowledgements

This project on "Effects of Semantic and Syntactic Treatments in Bilingual Stroke Survivors" is funded by the All India Institute of Speech and Hearing (AIISH) Research Funds. We are grateful to Dr. S.R. Savithri, Director, AIISH, for supporting this project through financial grants and providing required infrastructure. We are thankful to all faculty members and staff of AIISH for their support at various stages of the project. Particularly, the enthusiasm and commitment of the research officers that participated in this project is highly appreciated. We are indebted to the stroke survivors and their family members, who graciously participated in the study; without them, this study would not be possible. Thanks to all the people who helped us directly or indirectly.

Principal Investigator — Principal Investigator

(Dr. K.S. Prema) — (Dr. G. N. Rangamani)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

The phenomenon of bilingualism has been highly intriguing to speech language pathologists across the globe. The challenges posed by bilingual persons with communication disorders are many, more so if the specific population happens to be stroke survivors with aphasia. The prevalence of persons with Aphasia in India is 3, 915,700 for an estimated total population of 1,065,070,607 i.e., approximately 0.36%, while that in the United States of America is 1, 079,615 for an estimated total population of 293,655,405 i.e., around 0.36% (Ref: www.Worldaphasia.com; www.wellsphere.com). According to the National Stroke Association, cerebrovascular accident (CVA, also known as stroke or ñbrain attackò) is the third leading cause of death in America. It is also one of the primary causal factors for disability in adults. Among other disabilities, approximately 25 to 40% of stroke survivors are left with aphasia, a chronic communication disorder that affects an individualôs ability to speak, understand, read and write. Other causes of aphasia include brain injury and neurological conditions and diseases. More common than conditions such as Parkinsonôs disease or Cerebral Palsy, about one million Americans (1 in 250) have aphasia (National Aphasia Association). Since World War II, research in aphasiology has progressed considerably in helping professionals understand the characteristics of different types of aphasia and normal brain processes of language, and develop treatment methods (see Helm-Estabrooks and Holland, 1998 for a historical update).

Although, there have been attempts to develop offline and online tests and tools for bilingual persons with and without aphasia, and measures and paradigms to examine the effect of

cross language priming on bilingualism (e.g., Kannada and Hindi versions of Western Aphasia Battery, Karanth, 1980a; Karanth, 1980 b; Deema and Prema, 2008; Rajani and Prema, 2008, and others, to mention a few) is a paucity of research on the effects of aphasia treatment in bilinguals. Studies reporting on the effects of treatment are merely a handful and are unable to shed much light on the efficacy of treatment due to the widely differing and inherent factors that are related to bilingualism per se (Roberts, 2008). A number of factors related to language acquisition and use, and linguistic structure of the languages play an important role in the rehabilitation of aphasia in bilinguals. Therefore, as Roberts (2008) concludes, there is a need for research studies in this area, given that it would simply be erroneous to extend the outcomes of treatment approaches in speakers of different languages, to bilingual speakers of those languages.

Need for the study

Despite the enormity of the population and the need to explore and evolve methods for evaluation and treatment, there appears to be a shortfall in the knowledge on brain processes to explain the language and language impairment variations seen in bilinguals (Hull & Vaid, 2006). In the words of Fabbro (2001), although ñour understanding of the organization of the bilingual brain is certainly more extensive (now)é many aspects of the organization of the bilingual brain are still unknown and further clinical researché will hopefully lead to a more advanced understanding of language organization in the multilingual brainò. Despite the fact that 50% or more adults speak more than one language, our understanding of communication disorders in bilinguals is ñnotoriouslyò limited (Ardila, 2007). Understanding the effects of brain damage on language processing in bilinguals is critical for effective rehabilitation of aphasia in people from diverse linguistic and cultural backgrounds as ñbilingualism is not just a rare, occasional

occurrence in the language /speech pathology clinic, but a phenomenon every clinic must be prepared to cope withò (Paradis, 1995).

Further, there is also an increasing urgency to establish the efficacy of various cognitive-linguistic model based treatment versus stimulation methods, generally across all populations with aphasia. While research indicates a growing evidence for efficacy of aphasia treatment even in chronic stroke survivors, much remains to be known about the efficacy of treatment procedures, and treatment variables such as frequency, intensity and duration of the treatment methods, treatment targets, and candidacy for the various procedures etc. With this perspective, the present study was designed to examine the effects of semantic and syntactic treatments in stroke survivors in India who are bilinguals. The study was conceptualized with the following objectives:

1. *To compare the semantic and syntactic impairments in the two languages of aphasic Kannada-English bilingual participants;*
2. *To determine the efficacy of a few cognitive linguistic treatment approaches that address semantic and syntactic impairments, such as the Semantic Feature Analysis Therapy with Nouns; Semantic Feature Analysis Therapy with Verbs and Mapping Therapy in bilingual and monolingual Indian stroke survivors with varying degrees of severity of aphasia;*
3. *To determine the influence, if any, of treatment in one language on the other language in aphasic individuals from this group of Kannada-English bilingual participants*

CHAPTER II

REVIEW OF LITERATURE

Management of Persons with Aphasia (PwA) is generally focused on the language deficit itself and/or on compensatory strategies for using residual skills in communication. Attempts to understand aphasia recovery in bilingual and multilingual speakers dates back to early nineteenth century. Lorch (2007) reported differential recovery patterns in patients who were premorbidly bilingual (Lorch, 2007) and physicians such as Ribot (1881; as cited in Lebrun, 1995) and Pitres (1895; as cited in Lebrun,1995) speculated on the factors that were likely to contribute to differential impairment across languages. Ribotôs law postulated that the first acquired language (L1) is less impaired or recovered more quickly than a second language (L2). Pitresô Law later refined this idea such that language familiarity and use substituted for age of acquisition. Pitresô ideas that patients first understand and then begin to speak the more familiar language and that impaired access to one or more languages might be due to inhibition rather than loss have strongly influenced aphasia research in bilingual and multilingual speakers for more than a century now. Among the factors that may influence the degree of competition for language selection is the grammatical similarity between L1 and L2. . Further, cognates, that is, word pairs that have the same meaning and similar phonological form in two languages, have been shown to improve lexical access and naming accuracy in persons with and without aphasia for picture naming (Roberts & Deslauriers, 1999) and in persons with aphasia for word naming and lexical decisions (Lalor & Kirsner, 2001) and wordï picture verification, picture naming and translation (Detry, Pillon,& dePartz, 2005). The diverse findings of performance in persons with bilingual aphasia have led researchers to explore the methods that could cut across specific languages yet reinforce the underlying cognitive linguistic concepts which are the core substrates for

communication. A few such methods and approaches that emerged in the recent decades are the Semantic Feature Analysis (SFA), the Training Underlying Forms (TUF), and the Mapping Therapy (MT).

a) Semantic Feature Analysis (SFA)

Semantic feature analysis (SFA) is a treatment for lexical retrieval impairment in which participants are cued to provide semantic information about concepts they have difficulty naming in an effort to facilitate accurate lexical retrieval (Boyle, 2004). Contemporary models of naming suggest that lexical retrieval is predicted on intact access to accurate semantic information (Raymer & Gonzalez-Rothi, 2001). Application of SFA within discourse is likely optimal for facilitating generalization to functional communication (Boyle, 2004, 2004b; Peach & Reuter, 2008; Thompson, 1989). Since the seminal work reported by Howard, Patterson, Franklin, Orchard-Lisle, and Morton (1985), semantic treatment has been a preferred approach for word retrieval deficits following aphasia. The majority of studies of SFA have concentrated on single-word training, with inconsistent generalization of improved lexical retrieval to connected speech. Studies of SFA used with individuals with a variety of neurogenic language impairments consistently report direct effects of improved single-word naming for treated items as well as improved naming of untreated, semantically related items (Boyle, 2004; Boyle & Coelho, 1995; Coelho, McHugh, & Boyle, 2000; Conley & Coelho, 2003; Lowell, Beeson, & Holland, 1995), supporting the contention that SFA facilitates improved access to the semantic system overall (Boyle, 2004).

Effects of Semantic and Syntactic Treatments in Bilingual Stroke Survivors

Investigators have trained target items that could be used in context-specific discourse tasks (e.g., story retell). Improvements have been reported consistently for use of target items in ótreatedôô discourse tasks, while generalisation to untreated discourse contexts has been less frequently demonstrated (Cameron, Wambaugh, Wright, & Nessler, 2006; Rider, HarrisWright, Marshall, & Page, 2008). Thus expansion of SFA training in discourse has yielded modest success in the context of individual treatment, but has not been examined in the context of group treatment.

SFA is well suited for training within discourse because it promotes habituation of semantic self cueing and semantically appropriate circumlocution, strategies that facilitate communication even if specific lexical retrieval fails. Group aphasia therapy provides an ideal venue for such training, providing for practice of strategies in a supportive communication environment. As noted for other individual treatments adapted to groups, group therapy provides ñan opportunity for more genuine exchange of information than that in individual sessionsôô(Clausen & Beeson, 2003) and may provide an ideal setting for practicing SFA to improve word retrieval with in more naturally occurring discourse (Beeson & Holland, 2007).

Antonucci (2009) conducted a study to investigate training of SFA in connected speech during group aphasia treatment, which provides a natural context for analyzing the effectiveness of discourse production, as well as representing an increasingly popular model of service delivery for aphasia treatment. The hypothesis was that the lexical retrieval during discourse would improve, as would overall communication informativeness. Three individuals with aphasia participated in biweekly group treatment during which SFA was trained during discourse production tasks. Two of the three individuals participated in the entire course of treatment. Discourse of the two participants was analysed such that effect sizes could be calculated for

measures of overall communication informativeness and efficiency (Nicholas & Brookshire, 1993), and for item-specific lexical retrieval (Mayer & Murray, 2003). The two individuals who participated in the full treatment protocol demonstrated improved lexical retrieval in discourse, with additional improvements observed in either general communication informativeness or efficiency. Support for the hypotheses that SFA administered during group aphasia treatment can be used successfully to facilitate word retrieval during discourse was derived from the results of the study.

SFA is also employed for retrieval of verbs since lexical representation of verbs contains information about their agreement structure. The logic of verb centered treatment is that improving access to a verb and its argument structures result in improved sentence production. Two verb centered approaches are cueing verbs treatment and verb network strengthening treatment. Cueing verbs treatment (CVT) was derived from the theory that the verb plays a critical role in specifying the relation between entities in the sentence and thus is the core of sentence (Loverso, Prescott & Selinger, 1988; Prescott, Sclinger & Loverso, 1982). A few studies have reported that CVT is associated with improved performance on standardized tests, improved production of sentences containing trained verbs and generalization to production of sentences with untrained verbs (Loverso et al, 1988; Prescott et al, 1982). However, the studies contained no measure of generalization to discourse level production. In addition, the experimental design did not adequately control for the possibility that the changes could be due to the general language stimulation rather than the specific treatment protocol.

The effectiveness of verb centered approaches to treatment (Edmonds and Babb, 2009; Edmonds, Nadeau & Kiran, 2009) with the goal of verb network strengthening treatment (VNeST) is to improve the retrieval of content words within simple active sentences. Verb

network strengthening treatment exploits training verb production along with pairs of nouns that typically occur with them. In the first two steps, the client produces appropriate agents and themes for a given verb. If the clients are unable to produce appropriate agents or themes independently, they may be provided a series of options. For instance, clients may look at printed cards with the words carpenter, photographer and author and identify which one is the best match to the verb write. The clients are also encouraged to generate pairs of agents and themes from their own experience to increase the personal relevance of the materials. The rationale for this step is that producing multiple agents/theme pairs may activate slightly different aspects of the verb, thus increasing access to the underlying representation of the verbs. The third step has the client select one of the agents/theme pairs and answers WH questions about it. In step four, the client makes judgment about the goodness of fit between verbs agents and themes in 12 auditorily presented sentences. These stages [provide the opportunity for the client to think more deeply about the items and strengthen the relation between the verb and the nouns with which it is associated. Finally the client generates the pair of agents and the themes for the verb that has been discussed, repeating steps 1 and 2. These steps are intended to reinforce the representations that have been discussed before moving on to another item. The existing studies have reported generalization to production of sentences with both trained and semantically related but untrained verbs. For example, if a client was trained on verb such as measure, generalization might be expected to a verb such as weigh. There was also generalization to connected speech tasks such as picture description (Edmonds & Babb, 2009; Edmonds et al, 2009).

A few other studies carried out much earlier had examined modality training and/or specific linguistic dimension and its effect on generlaization, Hillis (1989) addressed written naming skills in 2 individuals with aphasia by requiring them to write the names of pictures

using written cueing hierarchy. In 1990, Hillis expanded this by providing feedback to incorrect naming responses by drawing the incorrect object and contrasting it to target. The results indicated that naming skills improved and generalization to semantically related items was demonstrated. Nickels and Best (1996) suggested improved naming for treated and untreated items was noted after 10 weeks of therapy and errors changed from no response or neologism to phonologically related errors. In their study, an individual was asked to judge relationships of target pictures to related and unrelated pictures. Then the individual was given letters of the target in scramble format and asked to reassemble and verbalize the word (semantic and phonological cues).

Similarly, Pring, Whitt-Thomson, Pound, Marshall and Davis (1990) showed improvements in naming noted on treated items and semantically related foils. Improvements were maintained at 1 month for all participants and at 1 year for 6 to 7 participants used word to picture matching in a field of semantically related and unrelated choices. Participants read the word aloud before naming the picture (to provide phonological and semantic input). However, Martin, Fink and Laine (2004) reported that the progress varied for individuals depending on whether the underlying deficit was semantically or phonologically based consequent to the use of repetition priming with spoken word-to-picture matching, repetition and naming tasks to address picture naming.

Generalisation of improved word retrieval on picture naming to discourse production has been an important factor for evaluating the effectiveness of SFA treatment. Unfortunately, generalisation of word retrieval improvements to discourse production following SFA has been modest. Because of the previous, albeit limited, success of SFA in producing improved word retrieval for discourse we further examined the utility of SFA for reducing noun and verb

retrieval failures in aphasic discourse. Rather than use SFA as a means for improving generalisation of picture naming or as a compensatory strategy for lexical failures during discourse, we applied SFA as an a priori means to reduce the frequency of word retrieval failures in discourse. Semantic feature analysis was applied to object and action word retrieval failures appearing during picture descriptions and procedural questions by two participants with anomic aphasia. A single case time-series design across behaviours with replication was used to assess changes in discourse production as well as generalization of treatment effects to untrained pictures resulting from SFA. Increases were observed in verbal productivity for both participants, while the informativeness of the participantôs discourse, as measured by correct information unit analyses, also improved. Minimal changes were observed in the frequency and type of word-finding behaviours evinced by the participants; this finding was attributed to a masking effect arising from the participantsô increased quantity of verbal output. Evidence was also found that targeting word finding behaviours in connected speech generalised to naming of untrained object and action pictures. The changes effected by this discourse-based approach to SFA were as robust and as consistent as has been achieved previously with SFA treatment. The choice to use a discourse-based versus a picture-based approach to SFA treatment might be based on the ecological validity of the discourse-based approach.

Suzanne, Sandt-Koenderman, Diederik, Frans, Peter, and Evy (2004) investigated the effects of semantic treatment on verbal communication in a randomized controlled trial. Fifty-eight patients with a combined semantic and phonological deficit were randomized to receive either semantic treatment or the control treatment focused on word sound (phonology). Fifty-five patients completed pretreatment and post treatment assessment of verbal communication (Amsterdam Nijmegen Everyday Language Test [ANELT]). In an on-treatment analysis,

treatment-specific effects on semantic and phonological measures were explored. Results Indicated that both groups improved on the ANELT, with no difference between groups in overall score. After semantic treatment, patients improved on a semantic measure, whereas after phonological treatment, patients improved on phonological measures. The results indicated that target-specific treatment probably failed to generalize to other skills.

b) Syntactic approaches

Treatment focused towards sentence production is generally designed to train particular syntactic structures with the rationale that listening and producing multiple sentences that share a syntactic form but contain different lexical items will help in improving syntactic abilities. Two treatments of this sort are the sentence production program for aphasia and Treatment of Underlying Forms (TUF). The sentence production program for aphasia (SPPA, Helm-Estabrooks & Nicholas, 2000) is the revised version of the Helm Elicited Language Program for Syntax Stimulation (HELPSS) (Helm-Estbrooks, 1981). Eight different sentence structures are tested in a story completion format. The stories consist of a few sentences that provide a context to elicit the target structure. The target sentence types are arranged in a hierarchy of difficulty determined by the performance of agrammatic clients (Helm-Estabrooks & Nicholas, 2000).

c) Sentence Production Program for Aphasia (SPPA)

Treatment using SPPA includes two levels of difficulty for each item. Level A is a delayed repetition task. The clinician reads the entire story, including the target sentence and then asks a question to elicit repetition of the target sentence. For level B, the clinician reads the story without the target sentence, and then asks a question to elicit the target sentence. During the first treatment phase, the client completes level A and B for each item in succession. When the

clients achieve approximately 85% correct on the first treatment phase, they may advance to the next phase, at which only level B is completed. Studies have been conducted on the HELPSS, which is the original version of the treatment program. Of the seven treatment studies that investigated this program, five reported generalization of treatment effects to untrained exemplars of the trained structures and two have reported generalization to connected speech measures (Doyle & Bourgeois, 1986; Doyle & Goldstein, 1985; Doyle, Goldstein & Bourgeois, 1987; Fink, Schwartz, Rochon, Myers, Socolof & Bluestone, 1995; Helm-Estabrooks, Fitzpatrick, & Baressi, 1981; Helm-Estabrooks & Ramsberger, 1986, Salvatore, 1985).

d) Treatment of Underlying Forms (TUF)

Treatment of underlying forms (TUF) is an approach to the treatment of sentence deficits based on Chomskyan (Chomsky, 1995; Marantz, 1995) grammatical theory (Thompson & Shapiro, 2005). The TUF approach incorporates theories of verb argument structures and syntactic structure. The treatment involves applying movement operations to the ócunderlying formô of the sentence to derive the target sentence. The targeted sentences typically involve non canonical word order and multiple propositions. Numerous treatment studies have shown that TUF promotes generalization from complex sentence structures to those that are linguistically related but less complex (Thompson, 2001; Thompson & Shapiro, 2005; Thompson, Shapiro, Ballard, Jacobs, Schneider, and Tait, 1997; Thompson, Shapiro, Kiran, and Sobecks, 2003). Linguistically related structures are syntactic structures that have similar derivations, meaning that they have some of their syntactic operations in common. There is also experimental evidence that TUF promotes generalization across some less complex syntactic structures. Thompson, Milman, Dickey, OôConnor, Bonakdarpour, and Fix (2006) found that training on sentences with basic canonical word order generalized to other sentences that were linguistically

related in their functional morphology. Examples of functional morphology include those in the higher level sentence nodes like complementizer, tense and agreement. Tense, such as past tense-*ed* and agreement, such as present singular agreement ï *s*, both are associated with the same higher level sentence node: the inflectional phrase (IP). Complementizers, such as *who, that,* and *if,* are associated with a different high-level sentence node: the complementizer phrase (CP). Thompson et al (2006) found patterns of generalization both from present agreement inflections to past tense inflections and from past tense inflections to present agreement inflections. However, training on complementizer never generalized to past tense or present agreement, and training on tense an agreement never generalized to complementizers.

e) Cognitive-Linguistic approaches

Cognitive linguistic treatment aims to improve processing at the affected linguistic level, eg, semantics (word meaning), implicitly assuming that training of basic language skills will result in improved verbal communication. The cognitive linguistic approach has been recommended as a practice standard in the recent years for treatment focusing on the language deficits (Cicerone, Dahlberg, Kalmar, Langenbahn, Malec, Bergquist, Felicetti T, Giacino, Harley, & Harrington, 2000).

Mapping therapy (Marshall, 1995; Mitchum & Berndt, 2001; Mitchum et al, 2000; Schwartz et al, 1994) is one approach that has been applied to training sentence level comprehension deficits. Research by Schwartz et al (1994) led to the conclusion that comprehension deficits in agrammatism were a result of a failure to map grammatically defined sentences constituents (Subject, Object) onto thematic roles such as agent, theme and goal. Agramatism was not seen as a failure of syntactic analysis but rather as a failure to retrieve verb specific information about thematic roles and /or correctly merge this semantic information with

syntactic information. This treatment method was developed to address the asyntactic comprehension patterns often observed in individuals with Brocaôs type aphasia who generally show difficulty relating surface structure cues to the underlying sentence meaning, which is expressed by the thematic role assignment.

The fundamental goal of mapping therapy is to improve the individualôs ability to map the relationship between the semantic and syntactic levels of sentence representation. Typically, a spoken or a written representation of the target sentence is presented at the beginning. Then the individual is asked to identify the action (verb), the person doing the action (agent) and the person / object that is undergoing the action (theme) by pointing or verbally. In some studies, overt identification of thematic roles was avoided and the patient was exposed to the target sentence structure by verifying whether the pictured scene matches the spoken target sentence or not and by listening to both active and passive voice sentences corresponding to a pictured scene (e.g. Haendiges, Berndt & Mitchum, 1996).

Despite the variability in generalization patterns of treatment effects, mapping therapies have been generally effective in improving sentence processing abilities of individuals with non fluent or mixed type aphasia for trained sentence structures (e.g. Fink, Schwartz & Myers, 1988; Rochon, Laird, Bose & Scofield, 2005; Rochan & Reichman, 2004; Schwartz, Saffran, Fink, Myers & Martin, 1994). Some studies also reported improved sentence or discourse production ability when sentence comprehension abilities were trained in therapy (e.g. Byng, 1988; Schwartz et al, 1994). Overall, this model based treatment method appears to provide a viable option for persons whose symptoms of comprehension impairment mirror those of participants in successful studies. Auditory comprehension deficits of aphasia can contribute to difficulties in

production modalities as well and therefore, these deficits should be meticulously assessed and carefully considered during treatment planning.

f) Cross-linguistic generalization of treatment in PwA

While there are different approaches proposed for treatment of communication deficits in PwA, there have been considerable studies on bilingual population to examine the cross-linguistic generalization of targeted linguistic behavior. Gil and Goral (2004) successively treated a bilingual patient in the first 6 months post-onset, first in his L2 (Hebrew) and then in his L1 (Russian).The choice of Hebrew as the first language of therapy was motivated largely by the patientôs preference and current environment. They observed non-parallel recovery, with both languages responding to treatment in Hebrew across most tests of oral and written language comprehension and expression, but with L1 showing greater improvement than L2. Five months post-onset, after 6 weeks of therapy inL1, the patientôs performance, again in both languages, with performance in L1 remaining stronger, especially in expressive language tasks. In spite of what appears to be successful therapeutic benefits both within and across languages, the authors cautiously conclude that with the number of variables and potential interactions between them, including in this case the influence of spontaneous recovery, it remains challenging to predict which language should be treated in bilingual aphasia.

Edmonds and Kiran (2006), who focused on within-and cross-linguistic generalization in a Spanish/English semantic naming treatment studies of three bilingual individuals with aphasia, were so careful in controlling stimuli with exclusion of cognates from their study. Following mixed results, they asserted that training the non-dominant language may actually improve cross-linguistic generalization, although they noted that only one of the three participants received therapy in both languages.

Kohnert (2009) reviewed a dozen treatment studies of bilingual speakers with aphasia and reported that evidence of cross-linguistic generalization remains equivocal. Although the authors of these studies claim that language improvements following treatment appear to be consistent with cross-linguistic generalization, Kohnert notes that half of the studies included patients who were only weeks to months post-onset, a period of likely rapid spontaneous recovery. Another two studies reported no evidence of cross-linguistic generalization. Of the remaining four studies, which included six bilingual patients, the effect of cross-linguistic generalization was variable, both in terms of strength of the effect and direction of generalization between L1 and L2 as well as moderating variables such as cognate status.

Kiran and Roberts (2010) replicated the earlier study, improving upon it by studying four patients in two language pairs (Spanishï English and Frenchï English) using a multiple baseline design. Again, none of the target stimuli were cognates. They report within-language generalization in three patients, but cross-language generalization to translations to semantically related words (in both directions) in only one (Frenchï English) patient. Inspite of judicious choices in case series methodology, the results are reported to be disappointingly equivocal. The authors suggest several possibilities for these equivocal results ï especially in terms of transfer to untrained languages ï but in essence their argument relies on the familiar individual variability in monolingual and bilingual speakers.

Kurland and Falcon (2011) examined the effect of intensive semantic naming therapy in three phases (Spanish, English and mixed) on within- and across-language generalization for cognates and non-cognates, in a bilingual individual with chronic, severe expressive aphasia. They hypothesized that cognates would positively influence cross-linguistic generalization,

which might be more likely to occur from L2 to L1. Results indicate relative increases in confrontation naming ability in the following conditions: trained versus untrained, L1 versus L2 or mixed and non-cognates versus cognates. This participant demonstrated a pattern of results consistent with a differential recovery pattern in which presentation of treatment in both languages and training of cognates may have promoted interference, thus increasing the activation threshold, and lowering performance under these conditions.

For instance, Semantic Feature Analysis (Boyle, 2001) is a treatment technique that is aimed at activating the semantic network of a target item and in turn facilitating access to and production of the item, and the ability to independently generate semantic features and use them for self-cueing in all communication contexts (Murray & Clark, 2006). Studies using SFA in individuals with aphasia have shown improved retrieval of trained targets with generalization to untrained targets and maintenance effects (Murray & Clark, 2006; Wambaugh & Ferguson, 2007). Improvements in content during spontaneous discourse have also been reported (Boyle, 2004). However previous research on SFA has mainly used nouns as treatment stimuli, with very few studies demonstrating the effects on verb naming (Wambaugh & Ferguson, 2007). Wambaugh and Ferguson (2007) showed increased naming accuracy of trained verbs with limited generalization to untrained verbs, but increased extent and efficiency of verbal production in discourse. They also report that most studies focusing on verbs show a lack of generalization to untrained items.

Similarly, generalization to untrained items in syntax has been documented through the use of TUF (Thompson & Shapiro, 2005) approach. This treatment method focuses on the relationship between verbs and other sentence structural elements. Verbs are the central core of a sentence structure and carries important information such as argument structures, thematic roles,

lexical semantic and other grammatical information (Thompson, 2008), which determine the subject and object selections in a sentence. By addressing the relationship between verbs and other sentence structures, numerous studies have documented the efficacy of TUF. TUF has shown to improve not only trained sentence structures, but untrained structures as well. Improvements in sentence comprehension and production have also shown to improve written sentence production.

Yet another cognitive neuropsychological treatment approach that has been applied to training sentence level comprehension deficits is mapping therapy (Marshall, 1995; Mitchum & Berndt, 2001; Schwartz et al., 1994). Research by Schwartz et al., (1994; Saffran et al., 1980) led to the conclusion that comprehension deficits in agrammatism were a result of a failure to map grammatically defined sentences constituents (Subject, Object) onto thematic roles such as agent, theme and goal. Agrammatism was seen as a failure to retrieve verb specific information about thematic roles and /or correctly merge this semantic information with syntactic information. This treatment method was developed to address the asyntactic comprehension patterns often observed in individuals with Brocaôs aphasia who had difficulty relating surface structure cues to the underlying sentence meaning.

The fundamental goal of mapping therapy was to improve the individualôs ability to map the relationship between the semantic and syntactic levels of sentence representation. Typically, a spoken or a written representation of the target sentence is presented at the beginning. Then the individual is asked to identify the action (verb), the person doing the action (agent) and the person / object that are undergoing the action (theme) by pointing, underlining or naming. In some studies, overt identification of thematic roles was avoided and the patient was exposed to the target sentence structure by verifying whether the pictured scene matches the spoken target

sentence or not and by listening to both active and passive voice sentences corresponding to a pictured scene (e.g. Haendiges, Berndt & Mitchum, 1996).

Despite the variability in generalization patterns of treatment effects, mapping therapies have been generally effective in improving sentence processing abilities of individuals with non fluent or mixed type aphasia for trained sentence structures (e.g. Fink, Schwartz & Myers, 1998; Rochon, Laird, Bose & Scofield, 2005; Rochan & Reichman, 2004; Schwartz, Saffran, Fink, Myers & Martin, 1994). Rochon et al., (2005) investigated mapping therapy effects on sentence production abilities in a small group of individuals with non-fluent aphasia. Training was given in the production of both canonical and non-canonical reversible sentences. Three patients received treatment and two served as control participants. Patients who received treatment demonstrated acquisition of all trained sentence structures. They also demonstrated across-task generalization of treated and some untreated sentence structures on two tasks of constrained sentence production, and showed some improvements on a narrative task. One control participant improved on some of these measures and the other did not. There was no noted improvement in sentence comprehension abilities following treatment. Some studies also reported improved sentence or discourse production ability when sentence comprehension abilities were trained in therapy (e.g. Schwartz et al., 1994).

Although cognitive-linguistic treatment procedures such as SFA, TUF and Mapping therapies are shown to be efficacious in certain types of aphasic population (mainly mild to moderate degrees of aphasic severity), their efficacy in treating other types of aphasic severities remain to be investigated. Further, most of these studies are carried out on monolingual speakers of English. While there have been a number of case reports on differential impairment and recovery patterns since the beginning of the past century, treatment efficacy studies in bilingual

population are very scanty and have gained momentum only in the recent past. Particularly, cross-linguistic generalization and choice of language for treatment have received little attention.

Gil and Goral (2004) successively treated a bilingual patient first in his L2 (Hebrew) and then in his L1 (Russian) during the first 6 months post-onset. The choice of Hebrew as the first language of therapy was motivated largely by the patientôs preference and current environment. They observed non-parallel recovery, with both languages responding to treatment in Hebrew across most tests of oral and written language comprehension and expression, but with L1 showing greater improvement than L2. Even when the language of treatment was shifted to L1 five months post-onset, the patient made vast gains after 6 weeks of therapy in both languages, with performance in L1 remaining stronger, especially in expressive language tasks. In spite of what appears to be successful therapeutic benefits both within and across languages, the authors cautiously conclude that with the number of variables and potential interactions between them, including the influence of spontaneous recovery, it remains challenging to predict the language of choice for treatment in bilingual aphasia.

Further, evidence of cross-linguistic generalization remains largely equivocal according to a review of a dozen treatment studies of bilingual speakers with aphasia (Kohnert, 2009).Although the authors of these studies claim that language improvements following treatment appear to be consistent with cross-linguistic generalization, Kohnert (2009) notes that half of the studies included patients who were only weeks to months post-onset, a likely period of rapid spontaneous recovery. Another two studies reported no evidence of cross-linguistic generalization. Of the remaining four studies, which included six bilingual patients, the effect of cross-linguistic generalization was variable, both in terms of strength of the effect and direction of generalization between L1 and L2 as well as moderating variables such as cognate status.

Effects of Semantic and Syntactic Treatments in Bilingual Stroke Survivors

Edmonds and Kiran (2006), focused on within-and cross-linguistic generalization in a Spanish/English semantic naming treatment study of three bilingual individuals with aphasia by carefully and purposefully excluding cognates from their study. Following mixed results, they asserted that training the non-dominant language may actually improve cross-linguistic generalization. Recently however, Kiran and Roberts (2010) replicated their earlier study and reported within-language generalization in three off four patients, but cross-language generalization to translations and to semantically related words (in both directions) in only one (Frenchï English) patient. Thus the results were equivocal and the authors attribute the outcomes to the largely differing individual variables related to not only aphasia, but also to bilingualism.

Aim of the study

While cross-linguistic generalization and choice of language for treatment remain to be investigated further, the efficacy of cognitive-linguistic treatments in Indian languages is still unknown. Thus the goal of this proposed project was to contribute further to the understanding of aphasia and its treatment in non-English monolingual and bi-/multi-lingual stroke survivors. More specifically, the aim was to study the influence and efficacy of cognitive linguistic model-based syntactic and semantic treatments in Kannada-English bilinguals and to establish normative data on some linguistic parameters in the realm of semantics and syntax, if feasible.

Objectives of the study

The main objectives of this project were as follows:

1. To compare the semantic and syntactic impairments in the two languages of aphasic Kannada-English bilingual participants.

2. To determine the efficacy of a few cognitive linguistic treatment approaches that address semantic and syntactic impairments, such as the Semantic Feature Analysis Therapy with Nouns; Semantic Feature Analysis Therapy with Verbs and Mapping Therapy in bilingual and monolingual Indian stroke survivors with varying degrees of severity of aphasia.

3. To determine the influence, if any, of treatment in one language on the other language in aphasic individuals from this group of Kannada-English bilingual participants.

CHAPTER III

METHODOLOGY

The proposed project attempted to study the language impairment patterns, efficacy of cognitive linguistic model based treatments for aphasia in Indian speakers and cross-linguistic generalization in bilingual stroke survivors with aphasia. Due to the inherent advantages of single-case experimental design for studying the treatment effects on communication disorders, especially in a population with brain injury (McReynolds & Thompson, 1986), single-subject multiple baseline design across behaviors were used to study the outcome of therapy.

At the outset, the main objectives of this project were as follows:

a. To compare the semantic and syntactic impairments in the two languages of aphasic Kannada-English bilingual participants;

b. To determine the efficacy of a few cognitive linguistic treatment approaches that address semantic and syntactic impairments, such as the Semantic Feature Analysis Therapy with Nouns; Semantic Feature Analysis Therapy with Verbs and Mapping Therapy in bilingual and monolingual Indian stroke survivors with varying degrees of severity of aphasia;

c. To determine the influence, if any, of treatment in one language on the other language in aphasic individuals from this group of Kannada-English bilingual participants;

Research Design

Neurogenic communication disorders present a large variety of symptoms that are known to differ significantly from one person to another, due to the wide variability in the underlying neuro-pathological processes, neuroanatomical damages, and psycholinguistic variables. Thus,

single-subject designs are often used, as subject-matching is extremely difficult in such a heterogenous population (Schiavetti, Metz, & Orlikoff, 2011). Such methodological design allows for examination of the subject in detail and, over time it offers the flexibility of modification during the experiment (Schiavetti et. al, 2011). These studies can later be replicated or modified in order to continue to study the effects of particular treatments including influences of time and intensity of treatment on the subjectôs improvement as well as whether the same treatment is effective in more than one population of patients with neurogenic communication disorders (Schiavetti et. al, 2011). Such studies also play a vital role in future studies conducting meta-analyses in the areas of specific research interests. Hence, a single-subject multiple-baselinedesign was used to study the above objectives.

Participants

15 stroke survivors who met the following criteria were assessed in detail for aphasia. All participants had a left hemisphere cerebrovascular accident (CVA); no more than one incident of CVA; no other degenerative neurological conditions and psychiatric conditions such as dementia or schizophrenia; and were 18years or above. Of the 15 subjects, 5 participants did not attend treatment for the following reasons: one participant had dysarthria with no aphasia and did not meet the subject selection criteria; one participant had medical complications and stopped attending the assessment sessions; one participant dropped out of the study due to personal reasons; one 16 year old participant did not meet the subject criteria and another 35 years old lady did not participate in the treatment study as she was from out of town and could not stay back for the treatment sessions. One of the participants had a past history of TIA, but was still included in the study as he reported a complete recovery following the TIA. All participants were recruited via a referral process either from the All India Institute of Speech and Hearing

outpatient clinic, local neurologists or self-referrals. All participants signed an informed consent form (Appendix 1) that was approved by the Institutional Review Board prior to their participation in the study.

Subject 1

A 46 year old male, who suffered from a left MCA Infarct on 24th August 2010. In the supratentorial compartment, the brain parenchyma showed an irregular wedge shaped hypodense area in the left temporoparietal lobes. He was recruited for therapy on 28th September 2010.

Subject 4

A 30 year old male, suffered from CVA on 29th September, 2010. MRI reports revealed dural sinus thrombosis and subarachnoid hemorrhage secondary to CVT. He was recruited for therapy on 11th November, 2010. Therapy had begun from 24th November, 2010.

Subject 5

A 31 year old male, suffered from an acute infarct in the left MCA territory involving the left parietal, fronto-pareital and parieto-occipiatl lobes on15th July, 2010. He was recruited for therapy on 16th December, 2010.

Subject 6

A 57 year old male, suffered from an acute left MCA infarct on 19th October, 2010. MR angiogram showed total occlusion of left internal carotid artery. He was recruited for the study on 3rd January, 2010. Therapy had begun from 7th January 2010.

Subject 7

A 70 year old female, who suffered from cap bleed. He was diagnosed as having Brocaôs aphasia.

Subject 8

A 29 year old man, suffered from an acute parietal infarct in the left MCA on 17th March 2008. He has a history of rheumatic heart disease. On 22nd October, 2008, he had the second subacute infarct in the left temporoparietal region.

Subject 9

A 31 year old male, suffered from stroke on 10th October, 2009. The CT angiogram revealed a partially occluding thrombus in the left cervical ICA and Left proximal MCA causing MCA territory infarct (more than 2/3rd of the left MCA territory). He underwent a left fronto temporo parietal decompressive craniotomy on 13th October, 2009, after which he had a cranioplasty using titanium mesh on 3rd December, 2009. He was evaluated in AIISH on 2nd August, 2010. He was recruited for this study on 22nd February, 2011. Therapy had begun from 10th March, 2011.

Subject 10

A 48 year old male, suffered from an infarct in the middle cerebral artery territory infarct on the left side on 25th February, 2010. The CT investigation revealed a wedge sgaped hypodensity involving the cortical and subcortical locations of the temporoparietal region on the left side. He was recruited for therapy on 28th February, 2011.

Subject 11

A 37 year old male, suffered from an acute infarct of the left anterior and middle cerebral artery territory. CT scan revealed hypodensity in the left frontal and parietal lobes, left caudate

nucleus, left lentiform nucleus and left internal capsule. On 31st July 2010, he underwent a bone flap replacement with Titanium screw and plate fixation of the left frontal-temporal-parietal region. He was recruited for therapy on 4th May 2011.

Subject 14

A 62 year old male, suffered from an infarct in the left parieto-occipital lobe on 24th July 2010. He was recruited for therapy on 12th April 2011.[1]

All participants were reportedly medically stable, had adequate hearing and visual functions and participated fully in all testing and treatment sessions. Subjects for the study were selected based on the criteria of only one incidence of stroke. Subjects with three months post stroke were preferred for the study. They were either Kannada monolinguals or bilinguals with the proficiency of Kannada and English. Subjects who had other psychological or neurological conditions were excluded from the study.

Prior to their stroke, all participants were employed and spoke Kannada and English. They were all right handed and excepting one participant who had 7 years of education, all others had at least 12 or more years of education. Apart from P1S1, all participants had received previous therapy and reached a plateau in treatment gains. A minimum gap of at least one month was maintained between the participantsô previous and current therapies. The demographics of the participants are as described below in Table 1.

[1] In view of attrition of participants 2, 3, 12, and 13, the details are not projected.

Table 1

Demographic details and treatment information of the participants

Participant	Sex	Age (yrs)	Years of Education	Languages in order-of-proficiency**	Etiology	Months Post Onset	Aphasia Type	Treatment/s received
P1S1	M	46	17	K, H, E	L-MCA CVA	15	Conduction	1st Block ï SFA-Verbs 2nd Block ï Mapping Therapy
P2S4	M	29	17	K, E	L-MCA CVA	8	Brocaôs	SFA-Verbs
P3S7	F	70	17	K, E	L-Cap Bleed	20	Brocaôs	SFA-Verbs
P4S8	M	29	12	K, E	L-MCA CVA	28	Brocaôs	1st Block ï SFA-Verbs 2nd Block- Mapping Therapy
P5S9	M	31	12	K, E	L-MCA CVA	16	Brocaôs	SFA-Verbs
P6S5	M	30	7	K	L-MCA CVA	5	Brocaôs with apraxia	SFA-Verbs
P7S6	M	57	17	K, E	L-MCA infarct	3	Brocaôs (recovering Global)	Modified SFA-Noun; Auditory Training with CL approach
P8S10	M	47	10	K	L-MCA infarct (tempero-parietal regions)	15	Wernickeôs with auditory processing deficits	1st Block -SFA-Noun; Auditory training with CL approach; 2nd Block - SFA-Verb
P9S11	M	38	15	K, E	L-Acute infarct ï ACA and MCA territories	9	Brocaôs with apraxia	Modified SFA-Noun; Auditory Training with CL approach
P10S14	M	62	17	Ta, E, K	Infarct ï Left Parieto Occipital lobe	9	Brocaôs With apraxia	SFA-Noun

** (Kannada-K; Hindi-H; English-E, Tamil-Ta)

Detailed language history pertaining to language acquisition and use were collected from all participants. All participants completed a detailed language questionnaire (Maithreyee, 2009).

Based on the language questionnaire, one participant was a Kannada monolingual speaker; and the remaining nine participants were Kannada-English bilingual speakers, who reported of native like proficiency in Kannada (4 on a 4 point scale) and varying amounts of proficiency in English. Six of these participants reported of receiving college and professional degrees through instruction in English and rated English proficiency as good or native-like (3 to 4 on a 4 point scale). For the purposes of this study, these six participants will be considered as Kannada-English bilinguals. Whereas, the other three Kannada-English bilingual participants reported of limited functional knowledge of English use and reported their proficiency as zero to low proficiency (1 to 2 on a 4 point scale). These three participants reported that they had never used English on a daily basis, pre-morbidly. Two of them reported

Kannada as their first language and one participant reported Kodava as his first language. However, all three participants rated Kannada proficiency as native-like (ó4ô on a 4 point scale). They had lived in Mysore (a Kannada speaking area), had received schooling in Kannada medium of instruction, and had used Kannada extensively until their stroke. Some of these participants also had some working knowledge of other languages such as Hindi, Tamil, and Telugu. For the purposes of this study, these three participants were also treated as predominantly monolingual speakers of Kannada. They were assessed and treated only in Kannada and were not tested or treated in their other Indian languages. Thus, the study comprised of six bilingual and four monolingual participants.

Procedure

Detailed language history pertaining to language acquisition and use were collected from all participants. All participants completed a detailed language questionnaire (Maithreyee, 2009; Marian et al., 2007). Based on the language questionnaire, one participant was a Kannada

monolingual speaker; and the remaining nine participants were Kannada-English bilingual speakers, who reported of native like proficiency in Kannada (4 on a 4 point scale) and varying amounts of proficiency in English. Six of these participants reported of receiving college and professional degrees through instruction in English and rated English proficiency as good or native-like (3 to 4 on a 4 point scale). For the purposes of this study, these six participants will be considered as Kannada-English bilinguals. Whereas, the other three Kannada-English bilingual participants reported of limited functional knowledge of English use and reported their proficiency as zero to low proficiency (1 to 2 on a 4 point scale). These three participants reported that they had never used English on a daily basis, pre-morbidly. Two of them reported Kannada as their first language and one participant reported Kodava as his first language. However, all three participants rated Kannada proficiency as native-like (ó4ô on a 4 point scale). They had lived in Mysore (a Kannada speaking area), had received schooling in Kannada medium of instruction, and had used Kannada extensively until their stroke. Some of these participants also had some working knowledge of other languages such as Hindi, Tamil, and Telugu. For the purposes of this study, these three participants were also treated as predominantly monolingual speakers of Kannada. They were assessed and treated only in Kannada and were not tested or treated in their other Indian languages. Thus, the study comprised of six bilingual and four monolingual participants.

Test Materials

All participants were assessed for language deficits, aphasia type, and severity, using a variety of standardized test batteries. The testing Materials used for assessment were

1. Language questionnaire (Maithreyee, 2009)

The detailed language questionnaire was administered to all the participants to collect their language history.

2. Discourse samples- Procedural Speech and Spontaneous Speech
3. Clock Drawing test
4. Language proficiency Questionnaire
5. Western Aphasia Battery (WAB) - Kertesz (1982) and their equivalent versions/translations in Kannada.

   To determine type and severity of aphasia, reading and writing deficits and apraxia. Semantic and syntactic judgments, verb and sentence comprehension, and action naming of verbs were assessed in Kannada utilizing the same picture stimuli materials that were available in English.
6. Bilingual Aphasia Test (BAT)- Paradis and Libben (1987) and their equivalent versions/translations in Kannada.
7. Verb and Sentence Test (VAST) ï Bastiaanse et al., (2002)
8. Translated equivalents of action words and sentences; and spoken and written content words (nouns), were utilized in Kannada to measure comprehension of verbs and sentence types in VAST
9. Psycholoinguistic Assessment of Language Processing in Aphasia (PALPA)- Kay, Lesser and Coltheart (1992)
10. Translated equivalents of comprehension of objects were utilized in Kannada to measure comprehension of verbs and sentence types in PALPA. The same picture stimuli from the

English version of the tests were utilized for the Kannada translations of action words and objects.

11. Action Naming Test (ANT)- Obler and Albert (1979)
12. Arizona Reading and Writing Test
13. Coltheart/ Karanth Test
14. Letter and sentence reading from PALPA
15. Paragraph reading
16. Criterion words
17. Function words

The subjects were assessed on the above mentioned tests. The assessment sessions were video recorded using the FlipShare (5.0) camcorder. The videos were transferred and saved on to the computer for analysis. The some of the responses of the client were transcribed during the assessment and others were transcribed from the videos that were saved on the computer. Scoring was done according to the scoring rules of the tests.

Assessments were done before a treatment procedure could be administered (pre treatment assessment). After the treatment procedure for a specified period of time, re-assessments were done for the tests that were administered initially (post assessment). The scores obtained were entered and tabulated on excel sheets for the pre-post comparison.

Treatment

Treatments were divided into blocks of four to six weeks. Primary treatment approaches used were Semantic Feature Analysis therapy with Nouns (SFA-N); Semantic Feature Analysis

therapy with verbs (SFA-V);and/or Mapping Therapy. Each of the three treatment methods were conducted individually in treatment blocks of four to six weeks each. These treatments were conducted as prescribed in the literature. A typical treatment session included the following steps:

a. The first step in the treatment session included a brief assessment. All the ten items in the treatment list 1 were presented one at a time and the participantôs naming accuracy for that day was recorded. Presentation of treatment list exemplars were randomized (using an online random number generator) in every session. The participant was asked to name the pictures of actions words / nouns / reversible active sentences (action words in SFA-V; nouns in SFA-N; and reversible active sentences in Mapping Therapy).The percentage of accurate responses at the beginning of each treatment session was recorded and was used to measure the treatment outcome. Once a week, after every three-four sessions, the treatment list 2 and probe lists were also presented to measure generalization. Percentage accuracy responses on treatment lists and probe list were documented over time and these results are depicted in the treatment outcome graphs for every participant under results and discussion. Following this initial assessment step for the day, the subsequent treatment steps were carried out as given below.

b. For SFA therapies, a SFA chart (examples of charts used for Semantic Feature Analysis with nouns and verbs are shown in Appendix-2) was placed in front of the participant.

c. One treatment exemplar (picture of a verb / noun e.g. ócatingô or ópineappleô) was placed in the center of the chart and the participant was asked to name/describe the exemplar. Despite the accuracy of the participantôs response (i.e. whether the participant named the exemplar item correctly or not), the speech-language pathologist (SLP) followed all the

following steps for each exemplar as mentioned below. Presentation of treatment exemplars was also randomized in every session.

d. The participant was asked to describe all the relevant semantic features (as shown on the SFA chart in appendix 2) of the exemplar. These responses of the participants were not recorded as the intent of this therapy process is a metalinguistic exercise and not meant to be a memorizing exercise of naming features.

e. If the participant could not generate the semantic features on his/her own, the SLP would provide appropriate semantic and/or phonological cueing to help the participant retrieve the relevant semantic features. The semantic and phonological cueing provided was dependent on the participantôs response and did not follow any particular sequence. If the participant was still unable to name the features, the SLP provided a model and the participant was asked to repeat.

f. Then the SLP provided ten semantic judgment statements/questions pertaining to the semantic features of the exemplar (for example, ñIs an orange salty?ò, ñIs a banana round in shape?ò etc.) that was discussed in the previous step and the participant was asked to judge the accuracy of the statement / respond accurately to the question. Participantôs correct responses / errors were discussed by the SLP by providing explanations of why the judgment was right or wrong using both verbal and visual descriptions, based on the needs of the participants.

g. The participant was finally asked to name the exemplar again, before beginning the exercise with another new exemplar.

The mapping therapy process also involved the steps prescribed in the literature. These steps included identifying and naming the action, agent and theme in the sentence exemplars that were provided. This treatment utilized the same sequence of SFA therapy steps as described above, except for step d, which included descriptions of the action, agent and theme properties of the sentence exemplar.

Five bilingual stroke survivors and two monolingual participants received Semantic Feature Analysis therapy with verbs (SFA-V). Two of these bilingual participants also received mapping therapy, once SFA-V treatment was completed. One bilingual and three monolingual participants received SFA therapy with nouns (SFA-N). One of these monolingual participant also received SFA-V after SFA-N was completed. The choice of treatment method/s was based on the severity of aphasia and other associated problems such as auditory processing issues and apraxia. Additionally, in some cases, participants were available for only one method of treatment or they required SFA-N treatment prior to SFA-V treatment, and SFA-V treatment prior to Mapping Therapy. The number of treatments and order of treatments received are listed in Table-1.

All participants received intensive therapy lasting 8-10 hours/week for four to six weeks. A set of 40 verbs (20 transitive and 20 intransitive action-words) were used in therapy for SFA-V (Examples of these exemplars are listed in Appendix ï 3). SFA-N was addressed by selecting nouns from semantic categories such as Vegetables, Fruits, or Animals. Mapping therapy included 40 sentences that were active and reversible sentence types. The verbs, nouns and sentences were selected carefully such that none of the targetwords/sentences were part of the standardized testing, specifically action-naming or verb retrieval. The action words, nouns and active sentences were each divided into four separate lists independently. The action words were used in SFA-V therapy; nouns were used in SFA-N therapy; and sentences in Mapping Therapy.

Of the four lists, two were used for training and the other two were used as probe and generalization measures. However, only one list of fruit names were used in SFA-Noun therapy as the participants receiving SFA-N treatment had severe aphasia and required other supplemental modality based treatments such as exercises for apraxia, and auditory processing tasks such as word and non-word judgments; phoneme recognition and discrimination; syllable repetitions and recognition; phoneme-grapheme correspondence and use of keyword writing method (Beeson, Rising & Volk, 2003).

Baseline performances on all four lists were established pre and post therapy for 3 sessions each. Probe and generalization lists were used only to measure generalization to untrained items. The probe list was administered once a week, while the generalization list was used only during the initial baseline phase and the final outcome phase after treatment. The separate generalization list was used to overcome the possible practice effects, if any, which may result from repeated exposure of the probe list. Treatment was started with one list of 10 words, and once 80% accuracy criterion was reached in naming on confrontation (or after 4 weeks /32 hours of treatment sessions), the second list was introduced. Naming of target words was elicited by presenting colored action pictures of the words in real life situations on A5 size cards. For each verb, additional naming of agents and themes, and semantic judgment questions on agent-

verb-theme relations were carried out as described in the VNeST approach (Edmonds et al., 2009).

Treatment with nouns and sentences followed a similar protocol, with pictures of nouns from semantic categories of fruits, vegetables and animals, and sentences that were active and reversible. Once 80% criteria on the treatment lists were attained or the 8 weeks limit was reached, participants were re-assessed on all baseline measures. Effect size (Cohenôs *d*), as given

by Busk and Serlin (1992) were calculated to determine the magnitude of changes due to treatment, and were interpreted as ósmallô, ómediumô, or ólargeô as established by Beeson and Robey (2006).

CHAPTER IV

RESULTS AND DISCUSSION

The primary objectives of the study were as follows:

a. To compare the semantic and syntactic impairments in the two languages of aphasic Kannada-English bilingual participants;

b. To determine the efficacy of cognitive linguistic treatment approaches such as semantic and syntactic treatments (Semantic Feature Analysis Therapy with Nouns; Semantic Feature Analysis Therapy with Verbs and Mapping Therapy) in bilingual and monolingual Indian stroke survivors with varying degrees of severity of aphasia;

c. To determine the influence, if any, of treatment in one language on the other language in aphasic individuals from this group of Kannada-English bilingual participants;

Objective 1- Comparison of semantic and syntactic impairments in the two languages of aphasic Kannada-English bilingual participants

A comparison of aphasic symptoms across the two languages in bilinguals were studied using standardized tests batteries such as the Western Aphasia Battery, the Action Naming Test, and parts of the Psycholinguistic Assessment of Language Processing in Aphasia battery, Bilingual Aphasia Test, and the Verb and Sentence Test. Semantic and Syntactic impairments were compared using verb and sentence comprehension, naming of action words, and semantic and syntactic processing at the word and sentence levels. McNemar chi-square analysis was performed to determine differences if any between the test measures in both languages for each participant as shown in Table 2.

Table 2

Comparison of WAB, ANT, VAST AND PALPA in Kannada and English for Bilingual Participants (p≤0.05)*

Partici-pants	WAB ï Kan AQ Score	WAB ï Eng AQ Score	ANT (Kan Vs Eng)	VAST Verb Comprehension(Kan Vs Eng)	VAST Sentence Comprehension(Kan Vs Eng)	PALPA Spoken Word ï Picture Matching (Kan Vs Eng)	Written Word ï Picture Matching (Kan Vs Eng)
P1S1	39.2	29.8	0.99	0.97	0.72	NA	NA
P2S4	23	20.5	**	0.88	0.38	0.84	0.84
P3S7	50.4	57.4	0.93	0.04*	0.78	0.65	**
P4S8	50.4	59.5	0*	0.84	0.9	1	1
P5S9	57.4	50.8	0.35	0.99	0.96	0.74	0.97
P10S14	32	30.4	0.007*	0.31	0.82	0.79	0.05*

* ópôvalues were significant at or below 0.05 confidence level.

** Tests values were identical in both languages; hence chi-square analysis was not performed

*** P1S1 was also tested in L3 (Hindi) on ANT. Kan Vs Hin, p= 0.00*

NA ï Not Assessed

Table 2 indicates that all participants, with the exception of (subject P3S7 and P4S8), showed an equal or lower AQ score in their second language (English). In participant P3S7 and P4S8, a higher score on the WAB AQ in their second language as compared to their first language. Participant P1S1 had a much better AQ score in his native Kannada as compared to English and Hindi languages while his AQ scores showed equal severity of impairments in English and Hindi. He showed no significant differences between languages on all other

linguistic measures, with the exception of ANT; he did significantly better on action naming test in Kannada as compared to Hindi.

Similarly, P2S4 and P5S9 showed no significant differences between the linguistic test measures in both Kannada and English. Although P3S7 and P4S8 scored better on the English WAB AQôs as compared to the Kannada scores, they had claimed that they were more proficient in Kannada than English. It is likely that the ñautomatic speechò parts of the WAB test (e.g. colors, shapes, numbers etc. on the auditory comprehension part of the test and recall of names of animals) might have provided an inherent advantage in English as many of the English words can be used as cognates/borrowed words in functional communication without having a need to access the Kannada words specifically. For example, shapes such as ócircleô, ósquareô, etc., numbers, names of animals like ódolphinô, ówhaleô etc. are easily adapted to Kannada either as cognates by adding a vowel at the end (e.g. \sirkalu\, \skweru\) or as borrowed words, resulting in a lower overall score in Kannada; as the test requires the participants to process the words in Kannada and penalizes them for using cognates and/or borrowed words. Thus the higher AQ score in English as compared to Kannada may not be salient and can be a mere reflection of the difference in familiarity of the actual words in Kannada rather than cognitive-linguistic competency. This is corroborated by the fact that the linguistic tests did not show a consistent and significant difference across all the syntactic and semantic measures, indicating that the impairments in Kannada and English were similar for all bilingual participants. Thus, it can be observed that all bilingual participants showed parallel impairments in both Kannada and English.

Effects of Semantic and Syntactic Treatments in Bilingual Stroke Survivors

Objective 2 -To determine the efficacy of cognitive linguistic treatment approaches such as semantic and syntactic treatments (Semantic Feature Analysis Therapy with Nouns; Semantic Feature Analysis Therapy with Verbs and Mapping Therapy) in bilingual and monolingual stroke survivors with varying degrees of severity of aphasia

Efficacy of Semantic Feature Analysis Therapy with Nouns, Semantic Feature Analysis Therapy with Verbs, and Mapping Therapy in bilingual and monolingual Indian stroke survivors with varying degrees of severity of aphasia was determined. Results and discussion of each of these treatment methods are detailed below.

Semantic Feature Analysis Therapy with Verbs (SFA-V):

Five bilingual (P1S1, P2S4, P3S7, P4S8, and P5S9) and two monolingual participants (P6S5 and P8S10) received SFA-V treatment. Following therapy, all participants showed significant improvements in both linguistic comprehension and expression as measured by both pre-post criterion and standardized measures. This is consistent with the notion that common semantic representation supports both comprehension and expression (Raymer & Rothi, 2001) and SFA treatment activates semantic network and facilitates access to & production of the lexical-semantic items (Wambaugh & Ferguson, 2007).

All bilingual participants showed small to large effect size gains in the treated language, and the monolingual participants showed small to large improvements for treated word lists (see Table 3). All participants showed large effect size progresses in their ability to retrieve action names when all the 40 action words from the combined four lists were assessed. All, excepting one (P5S9), bilingual participants showed large gains on the treatment word list in the treated

language; P5S9 showed large gains on the treatment list in the untreated language (see discussion under objective 3). P1S1, P2S4, P3S7 made large gains in the untreated language as well.

Similarly both monolingual participants (P6S5 and P8S10) showed progress in therapy. While P6S5 showed gains on the treated list, P8S10 made medium-large gains on the treated lists, and also showed generalization to the untreated probe and generalization lists. Studies by Boyle (2004), Peach and Reuter (2008), Thompson (1989), Murray and Clark (2006) and Wambaugh and Ferguson (2007) have also reported an optimal facilitation of generalization to untreated words with the use of SFA therapy. P6S5 who was only 5 months post-onset of stroke, had Brocaôs aphasia with apraxia. While itôs likely that the apraxia component could have limited the progress in verbal expression for P6S5 may have had an advantage in better cognitive-linguistic processing due to the SFA-N treatment he had received prior to SFA-V treatment.

However, participant P8S10, who had Wernickeôs aphasia and was 15 months post onset of stroke, showed severe problems in his auditory processing and therefore received a modified SFA-N treatment along with intense auditory processing treatment (see results and discussion under SFA-N therapy, below).Treatments aiming at improving cognitive skills such as attention, memory and executive functions (e.g. judgment, reasoning, problem-solving, etc.) are reported to be effective in improving the processing of both linguistic comprehension and expression (Chapey, 2008). Thus improvements in cognitive processing involved during the first phase of modified SFA-N treatment may have influenced the SFA-V outcomes positively for P8S10.The progress in the ability to retrieve action words following SFA-V for each of these seven participants are as shown in Figures 1-7.

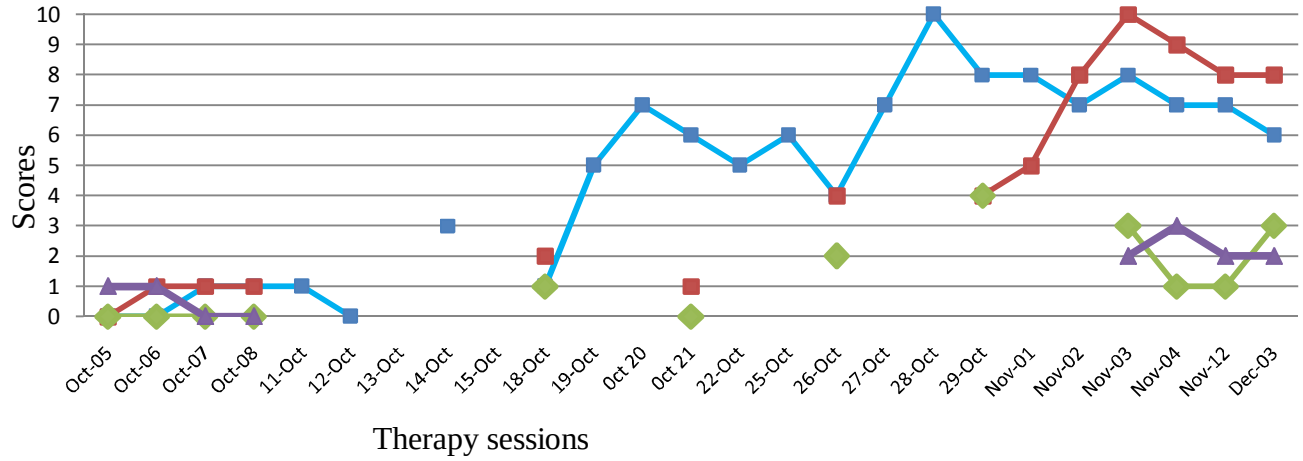


Figure 1. SFAï Verb Treatment Outcomes for P1S1on treatment list 1, treatment list 2, probe list and generalization list.

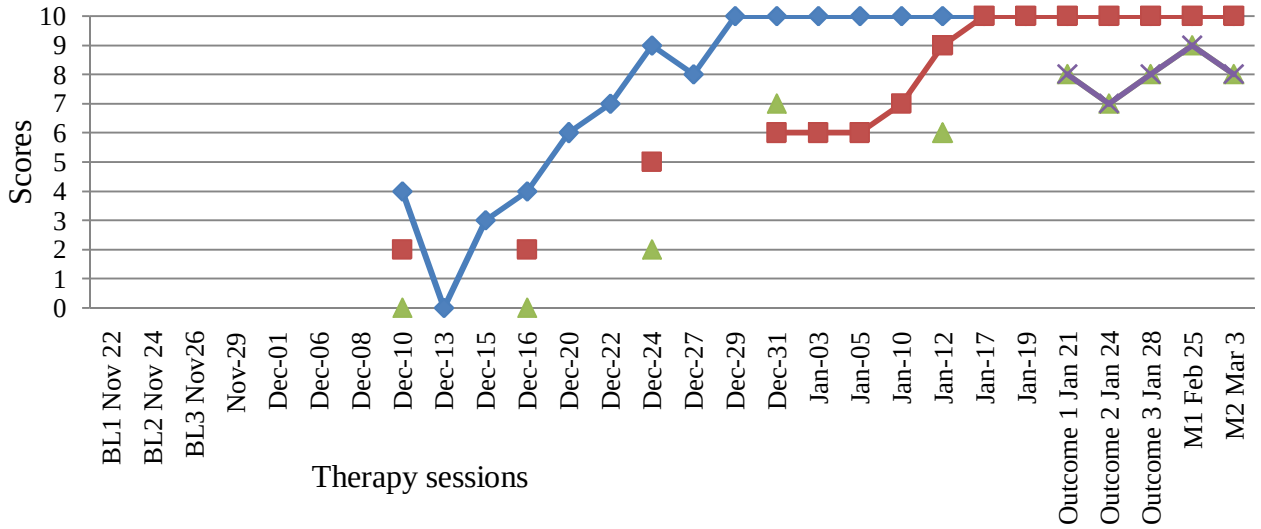


Figure 2. SFAï verb treatment outcomes for P2S4 on treatment list 1, treatment list 2, probe list and generalization list.

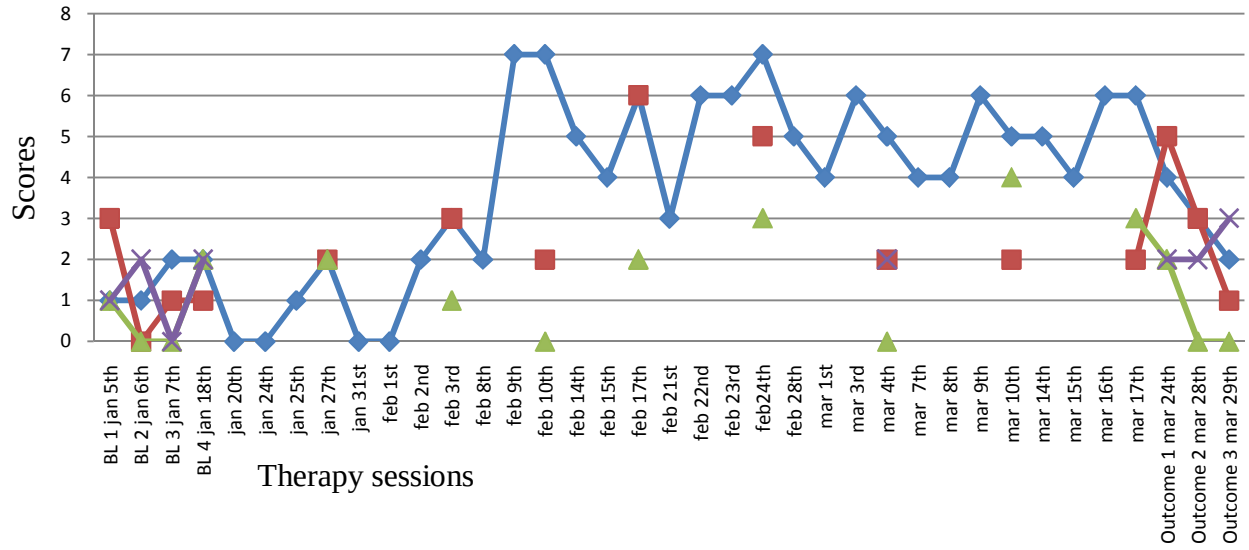


Figure 3. SFAï verb treatment outcomes for P3S7 on treatment list 1, treatment list 2, probe list and generalization list.

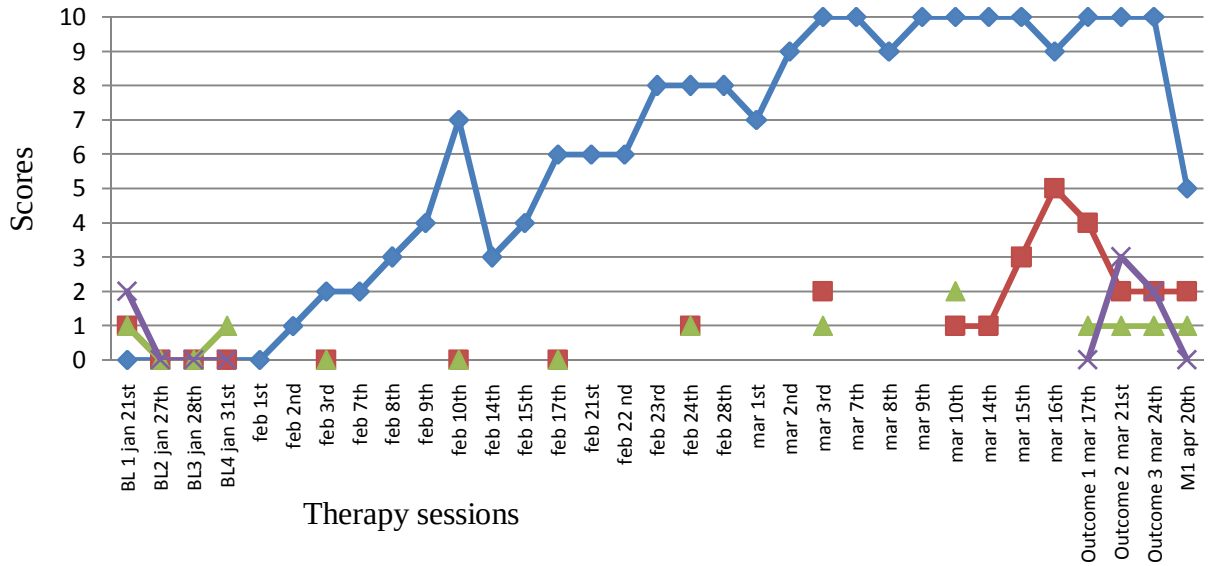


Figure 4. SFAï verb treatment outcomes for P4S8 on treatment list 1, treatment list 2, probe list and generalization list.

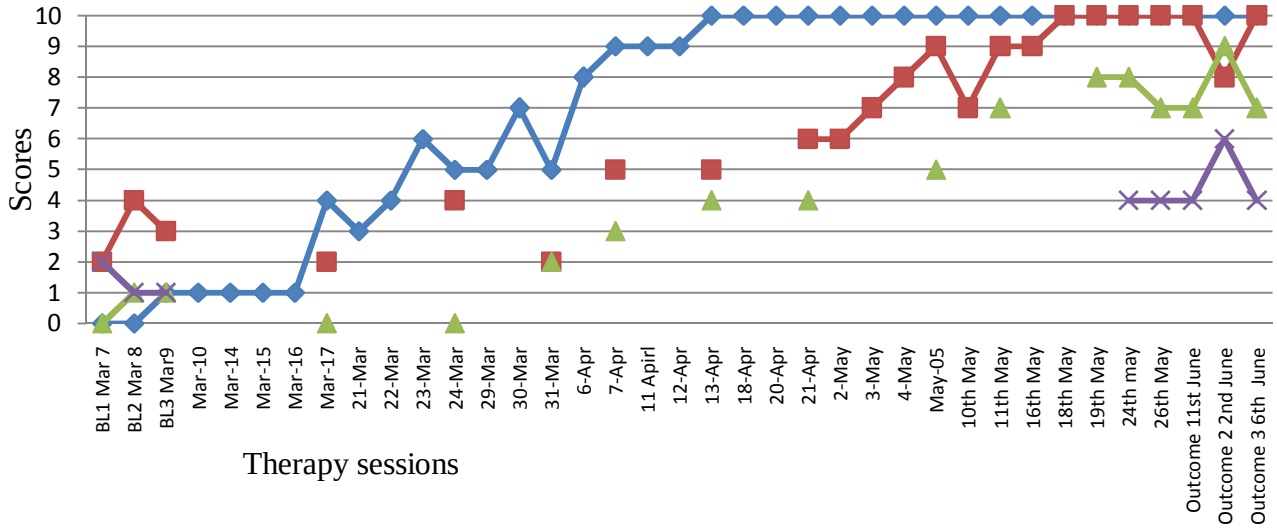


Figure 5. SFAï Verb Treatment Outcomes for P5S9 on treatment list 1, treatment list 2, probe list and generalization list.

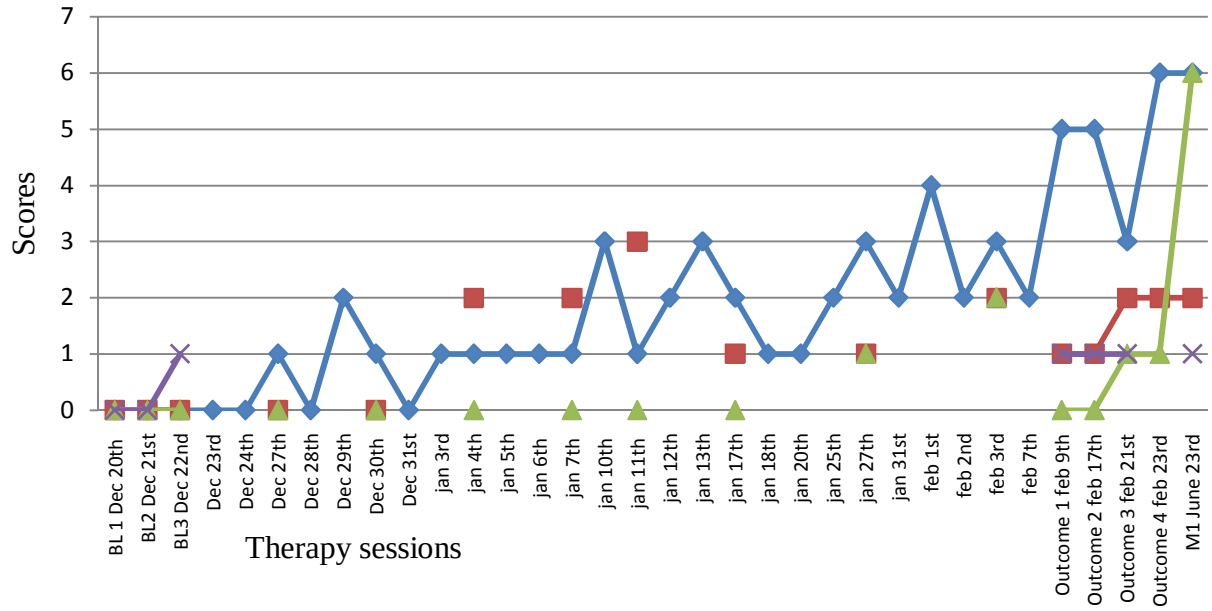


Figure 6. SFAï Verb Treatment Outcomes for P6S5 on treatment list 1, treatment list 2, probe list and generalization list.

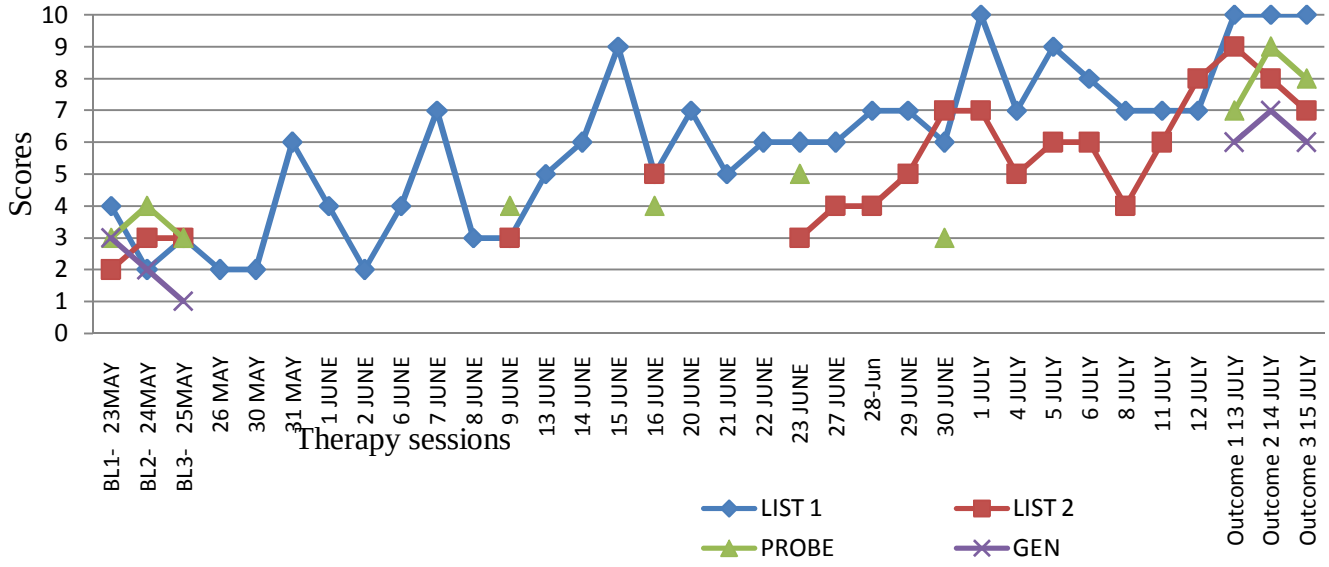


Figure 7. SFAï verb treatment outcomes for P8S10 on treatment list 1, treatment list 2, probe list and generalization list.

The Figures 1-7 show that SFAï verb treatment outcome for all the above participants was better with therapy sessions. Figure 1 shows the outcome of SFA therapy for verbs in participant P1S1. It can be noted that the scores of treatment list was 1 or less than 1 in the initial baseline recordings. With introduction of treatment, participant scores increased from 1 in session 16th October to 7 in session 20th October, but reduced to 4 in session 26th October. With sessions, participant topped to score 10 in 28th October and attained plateau at the score 7 in the final outcome sessions, which showed improvement in the participant verb naming skills with SFA. The scores of verb naming in probe list and generalization list through SFA increased in the final outcome sessions indicating that naming skills improved to non treated word lists.

Figure 2 shows an improvement in participant P2S4 from score zero in 13th December session to score 10 in 24th December within duration of 8 sessions in the treatment lists. The final

outcome session scores showed an average score of 8 indicating generalization of the naming skills in the participant.

Participant P3S7 showed a fluctuation in score throughout the therapy session, however there was no decline in the scores. Peak score increased from 2 to 7 from January to February with a slight dip to 6 in March. The Figure 3 shows a slight generalization to untreated words.

The participant P4S8 shows a linear increase in the scores of SFA-verb naming. The scores increased from zero to 6 from 1st February to 15th February and attained peak score of 10 on 3rd March which continued in the outcome sessions. However generalization in this participant was found to be insignificant although the naming skills during treatment sessions improved. The peak outcome score was 3 compared to score 2 in the baseline session.

Participant P5S9 showed a linear and considerable improvement of scores. Participant achieved the peak score of 10 within the half way of treatment duration. There was a substantial increment in the naming scores in probe and generalization word list indicating considerable generalization to untreated words with SFA-Verb naming therapy.

The scores of participant P6S5 showed fluctuations in the scores throughout the session duration; however there was an increment in the scores with sessions. The naming score was 6 at the end of the therapy. The final outcome scores showed increased scores compared to baseline scores indicating generalization to untreated words.

Participant P8S10 showed fluctuations in score throughout the therapy session; however there was no decline in the scores. The participant achieved peak score of 10 at the end of the treatment. Figure 7 also shows considerable generalization to untreated words.

Effects of Semantic and Syntactic Treatments in Bilingual Stroke Survivors

The above findings showed a linear progression from baseline to outcome session, in participants 5, and 10 there was a fluctuation in performance. The participants who had consistent linear progression (P1S1, P2S4, P4S8, and P5S9) were persons with Brocas aphasia and 5 was a person with Brocaôs with apraxia and 10 was a person with Wernickeôs aphasia. However participant 7 who had Brocaôs aphasia did not match either of the patterns mentioned above. With reference to generalization to untreated words, although there were instances in participants P1S1, P2S4 and P8S10, no specific pattern was observed. In view of differential pattern in generalization across participants of the study the results are not in consonance with the study by Loverso et al (1988) and Hillis (1990) who reported generalization of naming skills to untreated words.

In addition to the progress made in therapy, generalization of improvements in linguistic functions was also evident in the pre-post standardized measures. For all seven participants, considerable improvement as defined by Katz and Wertz (1997) was also documented through the increase of at least 5 points rise in the pre-/post-therapy Aphasia Quotient (AQ) scores on the WAB (see Table 4). All participants also showed substantial gains on the verb comprehension and verb naming tests (VAST and ANT), or on spoken and written comprehension of words (PALPA) indicating SFA-V to be an efficacious treatment even for Indian stroke-survivors with aphasia (see Table 4). Further, five out of the 7 participants, returned to their employment settings suggesting the usefulness of cognitive-linguistic treatments including SFA-V, SFA-N and/or mapping therapy.

Table 3

Pre and Post therapy average scores on retrieval of action words following SFA–V therapy and cohen's 'd' (effect-size) values (Yellow highlight = Small effect size; Red highlight = Medium to Large effect size)

Participant		P1S1	P2S4	P3S7	P4S8	P5S9	P6S5	P8S10
Tx List 1-	L1	5/30(6.1)	0/70(8.5)	7/27(4)	0/100(22.7)	0/20(2.1)	0/4.3 (4.4)	30/100 (9.9)
Pre/Post Tx avg	L2	5/15(1.5)	0/100(27)	13/50(10.6)	3/20(1.3)	3/100(23.6)		
scores and	L3	5/70(15.8)						
Cohenôs d values								
Tx List 2 -	L1	5/40(3.2)	3/90(11)	17/50(7.8)	0/27(2.2)	3/33(3.3)	0/1.3(1.78)	27/80 (6.5)
Pre/Post Tx avg	L2	2.5/15(2.0)	3/100(27)	15/47 (2.9)	13/27(2.4)	30/96 (9)		
scores and	L3	8/90(10.4)						
Cohenôs d values								
Probe List 3 -	L1	2.5/45(2.8)	0/87(15.5)	3/23(2)	7/10(0.8)	0/37(3.7)	0/0.3 (0)	33/80 (5.7)
Pre/Post Txavg	L2	0/0 (0.0)	0/77(13.7)	10/27(2.4)	17/20 (0.8)	7/76(9.2)		
scores and	L3	0/17 (1.5)						
Cohenôs d values								
Generalization	L1	2.5/30(2.6)	3/70(8.5)	3/27(2.5)	0/17(0.9)	23/33(1.1)	0/1 (1.7)	20/63 (5.3)
List 4 Pre/Post	L2	2.5/30(7.8)	0/77(13.7)	13/27(1.3)	0/0 (0)	13/44 (4.1)		
Txavg scores and	L3	5/23(3.1)						
Cohenôs d values								
All lists combined	L1	4/37(19.0)	1/80(14.5)	7/32(8.9)	2/39(28.4)	7/31(4.5)	0/7 (15.7)	28/80 (16.5)
Pre/Post Txavg	L2	3/15(8.2)	1/88(38.7)	13/38 (8.9)	9/17 (2)	13/79(25.5)		
scores and	L3	5/50(12.5)						
Cohenôs d values								

Table 4

Percentage scores and McNemar Chi-Square p -values on pre/post SFA-V therapy measures (p≤0.05)*

Participants	PRE / POST Therapy	WAB (AQ)	WAB (AQ)	VAST-Verb Comp %	VAST-Verb Comp %	VAST-Sent Comp %	VAST-Sent Comp %	ANT Verb Naming %	ANT Verb Naming %	PALPA SW-Pic Match %	PALPA SW-Pic Match %	PALPA WW-Pic Match %	PALPA WW-Pic Match %
		E	K	E	K	E	K	E	K	E	K	E	K
P1S1	PRE	29.2	39.2	45/73* (≤ 0.05)	63/80* (≤ 0.05)	23/40* (≤ 0.05)		4/33* (≤ 0.05)	7 / 21* (≤ 0.05)	NA	NA	NA	NA
	POST	35.7	46.2										
P2S4	PRE	21	23	75/83* (≤ 0.05)				0/68* (≤ 0.05)	0/60* (≤ 0.05)	NA	NA	NA	NA
	POST	73	87										
P3S7	PRE	57.4	50.4		58/75* (≤ 0.05)	38/68* (≤ 0.05)	45/68* (≤ 0.05)		18/42* (≤ 0.05)		90/100* (≤ 0.05)	75/90* (≤ 0.05)	75/98* (≤ 0.05)
	POST	60.2	61.4										
P4S8	PRE	59.5	50.4	45/63* (≤ 0.05)					0/12* (≤ 0.05)	65/80* (≤ 0.05)			
	POST	60	62.6										
P5S9	PRE	50.8	57.4	28/73* (≤ 0.05)	55/88* (≤ 0.05)			9/44* (≤ 0.05)	7/23* (≤ 0.05)	83/93* (≤ 0.05)			
	POST	59.6	65.2										
P6S5	PRE		34						3/15* (≤ 0.05)		58/88* (≤ 0.05)		25/50* (≤ 0.05)
	POST		49.2										
P8S10	PRE		42.8						40/63* (≤ 0.05)		78/90* (≤ 0.05)		80/88* (0.09)
	POST		53										

Bolded figures with * - Significant difference in pre/post scores; p ≤ 0.05.
Blank cell- Chi-square not significant.

NA ï Not Assessed, as participants had a high overall score (>80%) to begin with.

Red font - Significant change in AQ score (more than 5 points).

Table 4 suggests that the pre- and post- scores for all the participants on Aphasia Quotient was significant with a rise of 5 point in scores (Katz & Wertz, 1997) supporting the effect size a shown in Table 3. Analysis of pre- post performance on all the tests using McNemar Chi-Square indicates significant difference ($p<0.05$) on only ANT-Verb naming in Kannada. However individual difference in performance was noted for Kannada as well as in English for all other tests.

SFA-Noun therapy

One bilingual participant (P10S14) and three monolingual participants (P7S6, P8S10 and P9S11) received Semantic Feature Analysis therapy with nouns (SFA-N). The bilingual participant, P10S14, who received SFA-N therapy, had severe apraxia and aphasia with AQ scores of 32 and 30.4 in Kannada and English respectively. Following SFA-N therapy, his scores on the treated word lists showed no significant changes (see Figure 8). Yet, his AQ scores increased significantly by 5 points in his treated language (L2-English), and showed a less significant increase of 3 points in his untreated L3 language (Kannada). He also showed significant improvements in spoken word - picture matching and written word - picture matching tests on PALPA, verb comprehension subtest on VAST, and Action naming tests in both L2 and L3; however, he required phonemic cues on the action naming test.

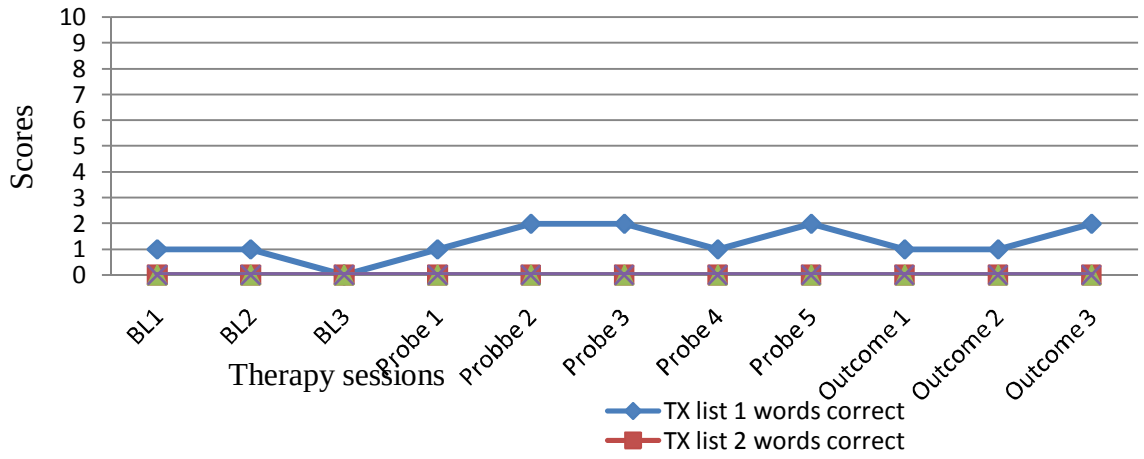


Figure 8. SFAï Noun treatment outcomes for P10S14 on each of the four lists

It is important to note that this participant had severe apraxia, with particular difficulty in initiating verbal responses. Once provided the initial phonemic cue, he would often be able to complete the verbal response. Thus, the improvement in semantic-lexical processing of action words is evident when provided the initial phoneme cues on both pre and post testing on the Action Naming Test. Thus both treatment and standardized test measures show that SFA-N therapy can be effective in Kannada-English bilingual speakers with severe aphasia. Further, the chi-square values on pre and post therapy linguistic assessment measures show parallel improvements in both Kannada and English languages of the participant as shown below in Table 5.

Table 5

Percentage scores and McNemar Chi-Square values on pre/post SFA-N therapy measures (*p≤ 0.05)

Partic i-pants	Pre/Post Therapy	WAB (AQ) E	WAB (AQ) K	VAST-Verb Comp % E	VAST-Verb Comp % K	VAST-Sent Comp % E	VAST-Sent Comp % K	ANT Verb Naming % E	ANT Verb Naming % K	PALPA SW-Pic Match % E	PALPA SW-Pic Match % K	PALPA WW-Pic Match % E	PALPA WW-Pic Match % K
P7S6	Pre/Post SFA-N	19.9 / 22.4	25.5 / 29.4	43/ 88* (≤ 0.05)	40/80* (≤ 0.05)	40/60* (≤ 0.05)	35/50 (0.10)	0/0	0/0	65/90* (≤ 0.05)	65/98* (≤ 0.05)	88/95* (≤ 0.05)	90/98 (0.08)
P8S10	Pre/Post Modified SFA-N		42.8 / 53		18/58 (≤ 0.05)		3/30 (≤ 0.05)		9/40 (≤ 0.05)		58/78 (≤ 0.05)		68/80 (≤ 0.05)
P9S11	Pre/Post Modified SFA-N		18.2 / 19.74		NA		NA		NA		85/90 (0.08)		65/70 (0.3)
P10 S14	Pre/Post SFA-N	30.4 /35.6	32 / 35.4	58 /78* (≤ 0.05)	50/83* (≤ 0.05)	30/48 (0.09)	40/58* (≤ 0.05)	0/0 37/53 (PC)*(≤ 0.05)	0/0 16/47 (PC)*(≤ 0.05)	65/83* (≤ 0.05)	70/88* (≤ 0.05)	60/75* (≤ 0.05)	45/75* (≤ 0.05)

PC- Phonemic cue

* ǿpô values were significant at or below 0.05 confidence level.

Of the remaining three monolingual participants who received modified SFA-N therapy, two participants (P7S6 and P9S11) had severe aphasia (AQ scores less than or a couple of points above 30) accompanied by apraxia. Modified SFA-N therapy involved initial treatment with auditory processing tasks such as word and non-word judgments; phoneme recognition and

discrimination; syllable repetitions and recognition; phoneme-grapheme correspondence and use of keyword writing method (Beeson, Rising & Volk, 2003). SFA-N therapy was then carried out simultaneously, by having participants sort the semantic exemplars into respective categories such as fruits, vegetables and animals, followed by semantic feature analysis using fruits category and semantic judgments using 10 questions pertaining to the accuracy of semantic features of the target exemplars (for example, ñIs an orange salty?ò; Is a banana round in shape?ò etc.). An example of a semantic feature analysis map is shown in Appendix 2.These two participants did not show any marked changes on the WAB AQ scores; yet their linguistic processing and comprehension improved as measured on the comprehension sections of VAST and PALPA subtests (see Table 5).Since the SFA-N therapy was modified and the treatment was also geared at auditory processing and written expression of words, it was not possible to work with the four lists of controlled exemplars as was done with other participants. The efficacy of the modified treatment approach was determined mainly on the treated word lists and/or generalization of improvements, if any, was measured by pre- and post-test differences on the WAB and other linguistic processing tests. The significance values of pre- and post- measures on the various linguistic assessments are detailed in Table 5. Although P7S6 was considered to be predominantly monolingual for the purposes of this study, he was also tested in English as he had reported of being educated in English medium for a few years. Interestingly, he also made significant gains on some of the linguistic measures in both Kannada and English. While this can be considered as transfer effects of treatment from one language to another, it is vital to consider the influence of other treatment variables. For example, increased focus on auditory processing tasks could have resulted in a generalized improvement in the overall auditory modality and

cognitive skills (attention and executive functions), which in turn might have contributed to the increase in linguistic pre-/post-test measures in both languages.

The third monolingual participant (P8S10) had fluent aphasia with AQ score in the moderate-severe range (40-60). P8S10 had severe auditory-verbal agnosia, and hence intensive cognitive-linguistic treatment for auditory processing of linguistic stimuli was conducted before the start of SFA-N and SFA-V treatments. This included recognition of non-words and words; recognition of Kannada phonemes and graphemes using Keyword approach (Beeson, Rising and Volk, 2003), auditory discrimination of minimal pair words and non-words, repetition and recognition of key-words, semantic judgment and semantic feature analysis of nouns during the first phase of therapy (March to May), followed by SFA-V (May-July). Following SFA-N treatment, this participant with fluent aphasia, made significant gains in the AQ scores, as well as on all linguistic measures such as word recognition subtests of PALPA, verb and sentence comprehension subtest of VAST and action naming of words on ANT (See Table 5). The performance of this participant on the SFA-N therapy using fruit category is as shown below in Figure 9.

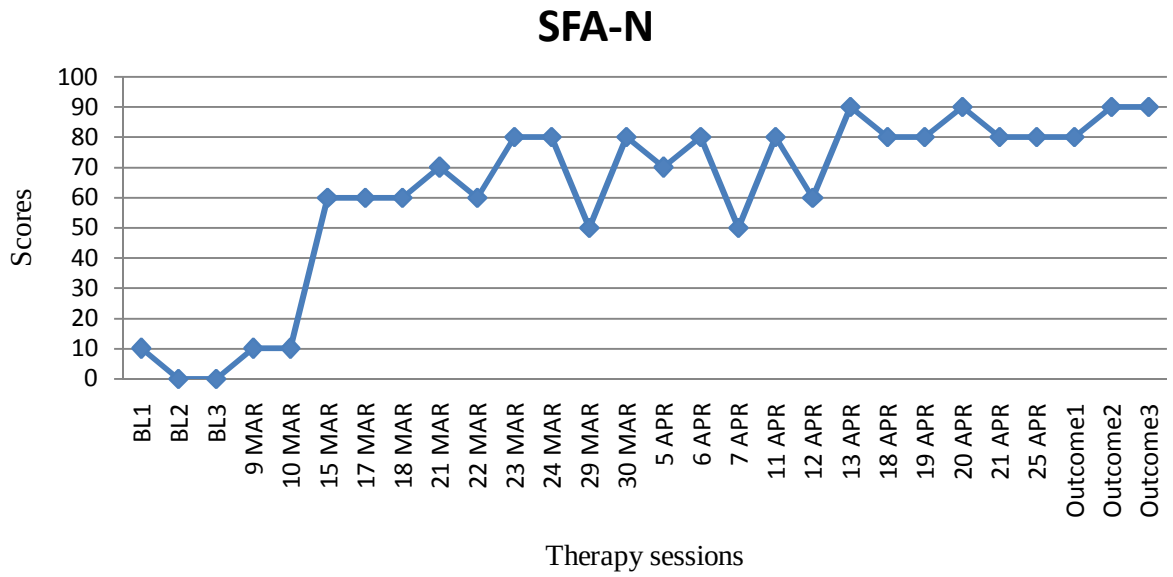


Figure 9. SFAï Noun Treatment Outcomes for P8S10 on naming of fruits

Effect size calculations using the Cohenôs ódô formula, resulted in a large effect size (13.8) indicating a substantial change from pre-therapy baseline measures to post-therapy outcomes.

All participants also showed gains in retrieval of nouns using semantic feature analysis. This indicates that the SFA-N therapy, similar to SFA-V treatment, can be very effective in Indian stroke survivors with both non-fluent and fluent aphasias.

Mapping Therapy

Two bilingual participants (P1S1 and P4S8) received mapping therapy. Both participants showed marked improvements in WAB AQ in the treated language. In addition, both participants showed significant gains on the comprehension sub-tests of VAST, indicating efficacy of mapping therapy (see Table 6). The findings parallel with results of Fink, Schwartz and Myers (1988); Rochon, Laird, Bose and Scofield (2005); Rochan and Reichman (2004); and Schwartz,

Saffran, Fink, Myers and Martin (1994) that indicates efficacy of mapping therapy. The progress in therapy for each of these participants is as shown in figures 10-11.

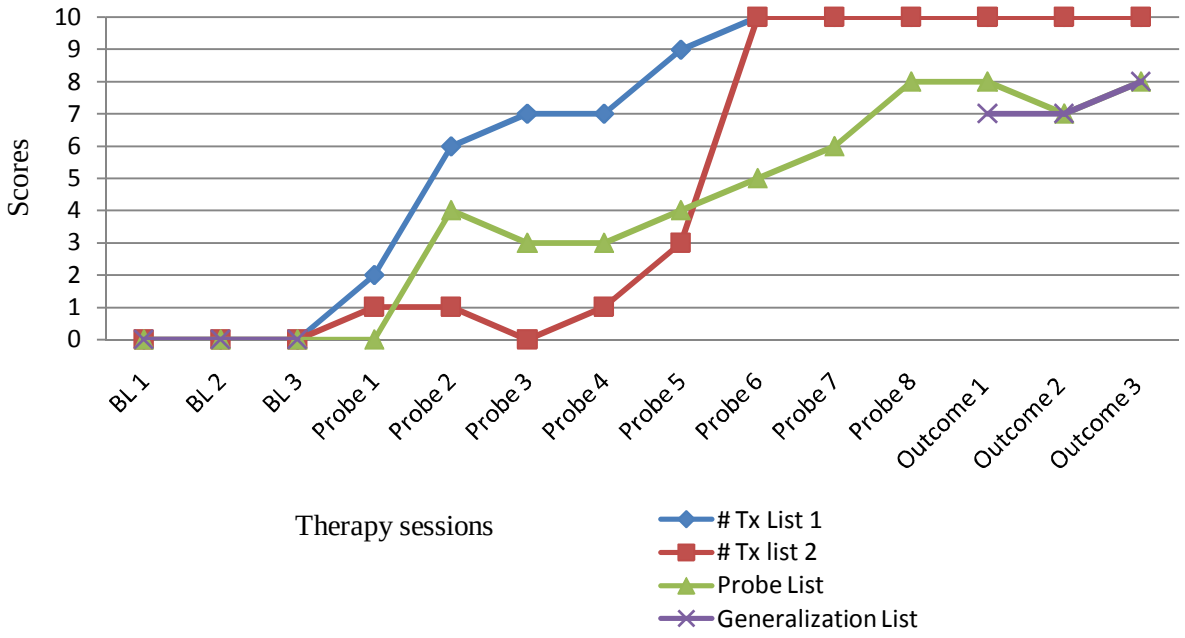


Figure 10. Mapping therapy outcomes for P1S1 on each of the four sentence lists

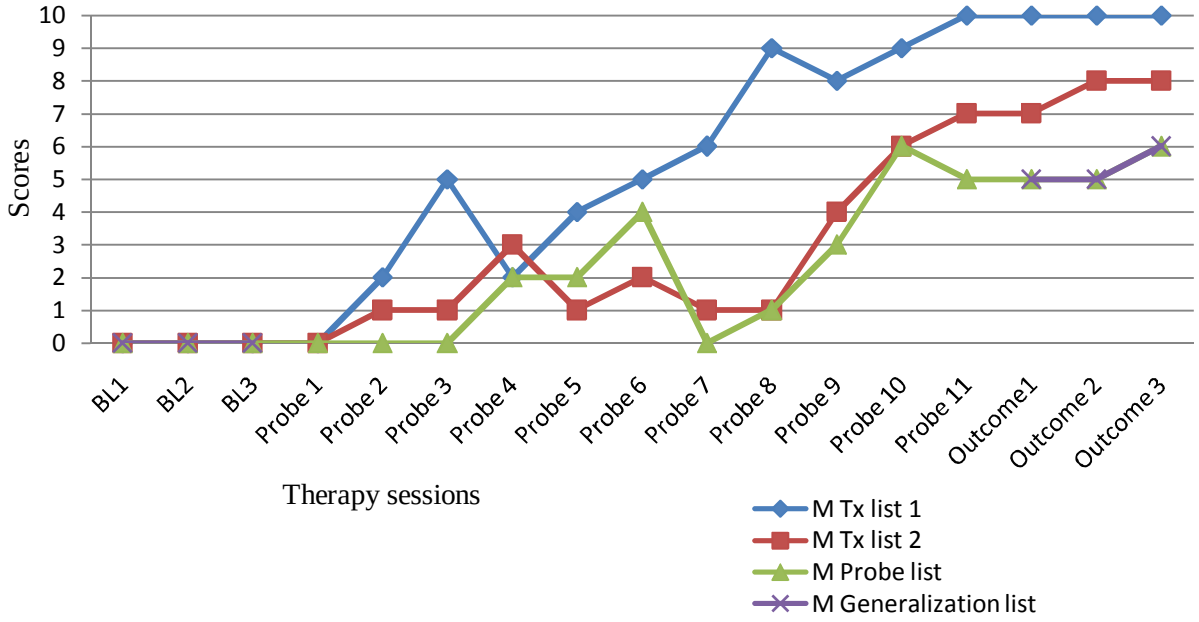


Figure 11. Mapping Therapy Outcomes for P4S8 on each of the four sentence lists

Table 6

Percentage scores and McNemar Chi-Square values on pre/post mapping therapy measures (*p≤ 0.05)

Participants	Pre/Post Therapy	WAB (AQ) E	WAB (AQ) K	VAST-Verb Comp % E	VAST-Verb Comp % K	VAST-Sent Comp % E	VAST-Sent Comp % K	ANT Verb Naming % E	ANT Verb Naming % K	PALPA SW-Pic Match % E	PALPA SW-Pic Match % K	PALPA WW-Pic Match % E	PALPA WW-Pic Match % K
P1S1	PRE	63.7	64.7	73/83 (0.10)	80/85 (0.08)	40/43 (0.40)	38/63* (≤ 0.05)	32/46* (≤ 0.05)	39/58* (≤ 0.05)				
	POST Mapping Therapy	75.6	80.9										
P4S8	PRE	60	62.6	63/78* (≤ 0.05)	63/80* (≤ 0.05)	45/58 (0.08)	58/55 (0.63)	12/18 (0.13)	12/23* (≤ 0.05)	80/90 (0.08)			
	POST Mapping therapy	62.8	66.6										

Table 7

Pre and post therapy average scores on retrieval of active sentences following mapping therapy and Cohen's d (Effect-Size) values

Partici-pants	Tx List 1- Pre/Post Txavg (Cohenôs d values -Effect Size)	Tx List 2 - Pre/Post Txavg (Cohenôs d values - Effect Size)	Probe List 3 - Pre/Post Txavg (Cohenôs d values -Effect Size)	Generalization List Pre/Post Txavg (Cohenôs d values - Effect Size)	Overall Complete Sentence Production in Tx- Pre/Post Txavg (Cohenôs d values -Effect Size)
P1S1	0.3 / 10 (23.6)	0.3 / 10 (23.6)	0.3 / 8 (13.2)	0.3 / 7 (11.5)	0.3 / 35 (41.2)
P4S8	0.3 / 10 (23.6)	0.3 / 8 (13.2)	0.3 / 5 (8.1)	0.3 / 5 (8.1)	1.3 / 28 (24.2)

Both participants (P1S1 and P4S8) showed improvements not only on the treated lists of sentences, they also showed progress on the probe and generalization lists. Anecdotally, both participants reported considerable improvements in their everyday communication with family members and in work settings.

Thus all the three cognitive-linguistic treatment methods (SFA-V, SFA-N, and mapping therapy) were effective for all participants of the study. All treatments were conducted in the dosage (6 to 8 hours per week for 8 to 10 weeks) adopted by intensive aphasia therapy programs. Each of the treatments when conducted individually or more than one (in sequence) proved to be efficacious in improving the linguistic comprehension and expression abilities in all participants. However, given the time constraints of the study, it was not possible to control the treatment sequences and combinations. Hence it would not be possible to infer the effectiveness of treatment combinations. Yet, based on the participantsô profiles, it appears that SFA-V would be beneficial for mild to moderate degree of aphasia. Participants with moderate to severe aphasia with other concomitant problems such as apraxia, auditory agnosia or other auditory processing problems, appear to benefit from SFA-N therapy when combined with other modality specific cognitive-linguistic treatment tasks. Mapping therapy appears to help participants that are in the mild to moderate range of aphasia severity. These findings are consistent with the treatment outcomes reported in the western countries.

Objective 3: Influence, if any, of treatment in one language on the other language in Kannada-English bilingual PwA.

Of the five bilingual participants (P1S1, P2S4, P3S7, P4S8, and P5S9) who received SFAï V treatment, four of them received treatment in the non-dominant second language and showed significant increase in AQ in both the treated and the un-treated primary languages. Only P4S8, who chose to receive treatment in his dominant primary language did not show any transfer to the un-treated language. In addition, while all bilingual participants showed small to large effect sizes in the overall action-word retrieval in the treated language, four participants showed medium to large effect sizes in the untreated language as well (see Table 3). P4S8

showed no transfer effects to the untreated second language. Similarly, excepting P4S8, all other participants showed gains on linguistic measures (as measured on VAST, ANT and/or PALPA) in the untreated language as well.

Similarly, as discussed earlier, the only bilingual participant, P10S14, who received SFA-N therapy showed significant improvements in linguistic measures in the untreated L3 language (Kannada). The finding is in support of Edmonds and Kiran (2006) with evident cross linguistic transfer. Though his AQ scores increased significantly by 5 points in his treated language (L2-English), and showed a less significant increase of 3 points in his untreated L3 language (Kannada), he showed significant improvements in spoken word - picture matching and written word - picture matching tests on PALPA, verb comprehension subtest on VAST, and Action naming tests in both L2 and L3. His L1 was Tamil, which was not one of the languages considered for the study. In addition though he had ranked Kannada (L3) and English (L2) equally on proficiency and use, he reported L2 (English) as his second language in order of acquisition and preferred to be treated in this language. Therefore he was treated in his L2.

Further, two bilingual participants (P1S1 and P4S8) who received mapping therapy showed marked improvements in WAB AQ in the treated language. While P1S1 showed significant gains, P4S8 showed a 4 point increase in AQ - an almost near significant value. P1S1 also showed significant gains in the untreated dominant language (L1), while P4S8 who received treatment in his pre-morbidly stronger language (L1), showed only minimal transfer effects to the weaker language (L2). For example, P1S1 showed a significant increase in sentence comprehension ability in the untreated dominant language, and action word naming in both the treated and untreated languages. Instead, P4S8 showed a significant increase in verb comprehension and action word naming in the treated language with generalization to the

untreated less dominant L2, only in verb comprehension. Yet, the fact that both participants made significant gains in the realm of syntax following mapping therapy underscores the efficacy of the treatment method.

Thus all bilingual participants showed within and cross-linguistic generalization. This finding is consistent with that of Edmond and Kiran (2006). The direction of transfer (L2 to L1 versus L1 to L2) cannot be determined un-equivocally, as there was only one participant who received treatment in L1. In addition a notable difference between this participant and the other bilingual participants, who showed cross language transfer, was in the post-onset period of stroke and severity of aphasia. The Participant who did not show cross language transfer had a CVA that was over 20 months old, whereas all the other participants with significant improvements had less than 20 months of onset period of stroke. This is consistent with the observations noted by Kohnert (2009) in her review of bilingual aphasia treatment studies on cross linguistic generalization. Despite the above, the rest of the participants who received treatment in L2 showed significant cross-linguistic generalization to L1. This finding is promising and remains to be further explored.

In summary, the study has shown that Bilingual PwA when treated with SFA-N, SFA-V and mapping therapy are facilitated for naming skills. It was also observed that they are able to generalize the performance to untreated nouns and verbs, subject to the nature of disability and the language of treatment. Further it was also observed that generalization was not limited to within language but across languages, though not in all participants. The findings of the study are promising in making a choice in treatment approach and documenting/ monitoring the progress during treatment program in PwA.

CHAPTER V

SUMMARY AND CONCLUSIONS

The primary objectives of the study were as follows:

a. To compare the semantic and syntactic impairments in the two languages of aphasic Kannada-English bilingual participants;

b. To determine the efficacy of cognitive linguistic treatment approaches such as semantic and syntactic treatments (Semantic Feature Analysis Therapy with Nouns; Semantic Feature Analysis Therapy with Verbs and Mapping Therapy) in bilingual and monolingual Indian stroke survivors with varying degrees of severity of aphasia;

c. To determine the influence, if any, of treatment in one language on the other language in aphasic individuals from this group of Kannada-English bilingual participants.

Six bilingual and four monolingual stroke survivors were examined and treated using three different cognitive-linguistic treatments. These treatments included Semantic Feature Analysis with Nouns, Semantic Feature Analysis with Verbs and Mapping Therapy. Intensive treatment was provided for 6 to 8 hours per week over an average of 8 weeks across all participants for each treatment. Single-subject multiple-baseline design was used to evaluate the outcomes of all the three treatment methods. The results of the study indicate that:

a. All bilingual aphasic participants showed similar impairment patterns in both their native Indian language and in English;

b. Cognitive-linguistic treatments such as SFA-V, SFA-N and Mapping Therapy are efficacious in treating Indian stroke-survivors with varying degrees and types of aphasia. All participants ï bilingual and monolingual ï showed significant gains on treated stimuli

with various levels of generalization to untreated stimuli and also to other linguistic measures on standardized tests such as the WAB, VAST, ANT and PALPA. Participants with mild to moderate aphasia showed significant progress on SFA-V therapy and mapping therapy, whereas participants with moderate to severe aphasia showed gains on SFA-N treatment. Participants with severe aphasia with other associated problems such as apraxia and auditory agnosia required additional cognitive treatments which included modality specific language exercises that targeted attention, memory and executive functions;

c. Bilingual participants treated in L2 showed within and cross-linguistic generalization to L1. Bilingual participants who received treatments in L1 showed within language generalization with limited transfer to L2.

Implications

The above results are promising in that cognitive-linguistic treatments such as SFA-N, SFA-V and mapping therapy appear to be viable options for treating language deficits in Kannada- English and Kannada speaking stroke survivors with aphasia. Important variables that seem to play a major role in the extent of treatment recovery are the severity of aphasia, accompanying apraxia and/or auditory processing deficits, and the time of onset of stroke. The results also offer initial guidelines for determining candidacy for various cognitive-linguistic treatments such as SFA-V, SFA-N and mapping therapy. The preliminary results are also encouraging for selecting the language of treatment in bilingual stroke-survivors with aphasia.

Limitations

While the results of the study are promising, several factors limit the generalizability of the findings. Some of these factors include:

Participant selection ï The present study did not limit the post-onset period of stroke. Three of the ten participants had recent strokes (less than 6 months) and therefore the spontaneous recovery factor could not be ruled out in the overall treatment outcomes. Future studies could utilize more controlled subject selections for both monolingual and bilingual groups.

Test materials ï While equivalent versions of WAB and BAT were available, the same picture stimuli and equivalent verbs, sentence and noun selections as in English were used in Kannada, for ANT, VAST and PALPA. In addition, since norms for most of these tests could not be established on typical Kannada monolingual and Kannada-English bilingual speakers due to time constraints, the performances of the participants were compared to the existing norms of English speakers from the western parts of the globe. Yet the finding that all bilingual participants showed similar impairments in both English and Kannada is comforting due to the fact that the Kannada test versions were equally successful in identifying similar deficits as the English versions. It would be beneficial to establish norms for the Kannada versions of the tests by testing typical, monolingual and bilingual speakers of both Kannada and Kannada-English respectively.

Study design ï Due to time constraints, the sequence of treatments could not be adequately controlled. Controlled single study designs such as alternating designs can be beneficial in determining the benefits of one treatment method over another and combinations of treatments (e.g. SFA-N versus SFA-V or combination of SFA-N and SFA-V). The present study utilized an

intensive treatment dosage. It may be beneficial to conduct groups of randomized treatment with varying dosages of treatment to establish the minimal dosage requirements for treatment efficacy.

References

Antonucci, S. M. (2009). Use of semantic feature analysis in group aphasia treatment. Aphasiology, 23 (7ï 8), 854ï 866.

Ardila, A. (2007). Bilingualism in the contemporary world. In A. Ardila& E. Ramos (Eds.), *Speech and Language Disorders in Bilinguals.* NY: Nova Science Publishers, Inc.

Beeson, P. M., Rising, K., & Volk, J. (2003). Writing treatment for severe aphasia: who benefits? *Journal of Speech, Language, and Hearing Research, 46*, 1038 ï 1060.

Beeson, P. M., & Robey, R. B. (2006). Evaluating single-subject treatment research: Lessons learned from theaphasia literature. Neuropsychology Review, 16:161ï 169. [PubMed: 17151940]

Beeson, P. M., & Holland, A. L. (2007). Aphasia groups in a university setting. In R. J. Elman (Ed.), Group treatment of neurogenic communication disorders: The expert clinicianôs approach (2nd ed., pp. 145ï 158). San Diego, CA: Plural Publishing.

Boyle, M. (2001). Semantic feature analysis: The evidence for treating lexical impairments in aphasia. *Neurophysiology and Neurogenic Speech and Language Disorders*, 11, 23-28.

Boyle, M. (2004). Semantic feature analysis treatment for anomia in two fluent aphasia syndromes. *American Journal of Speech-Language Pathology*, 13(3), 236ï 249.

Boyle, M., & Coelho, C. A. (1995). Application of semantic feature analysis as a treatment for Aphasic dysnomia. *American Journal of Speech-Language Pathology*, 4, 94ï 98.

Busk, P. L., &Serlin, R. C. (1992). Meta-analysis for single-case research.In T. R.

Kratochwill& J. R.Levin, JR. (eds). *Single-case research design and analysis: New directions for psychology and education*. Hillsdale,NJ: Lawrence Erlbaum Associates Inc. p. 17-212.

Byng, S. (1988). Sentence processing deficits: Theory and therapy. *Cognitive Neuropsychology*, 5, 629-676.

Cameron, R. M., Wambaugh, J. L., Wright, S. M., &Nessler, C. L. (2006). Effects of a combinedsemantic/phonologic cueing treatment on word retrieval in discourse. *Aphasiology*, 20(2ï 4), 269ï 285.

Chapey, R.(2008). Cognitive Stimulation: Stimulation of Recognition/Comprehension, Memory and Convergent, Divergent and Evaluative Thinking. In R. Chapey (Ed.), *Language Intervention Strategies in Aphasia and Related Neurogenic Communication Disorders.* (5th ed., pp. 469 - 506). Philadelphia: Lippincott Williams & Wilkins.

Chomsky, N. (1995). The Minimalist Program. Cambridge, MA: MIT Press

Coelho, C. A., McHugh, R. E., & Boyle, M. (2000). Semantic feature analysis as a treatment for Aphasic dysnomia: A replication. *Aphasiology*, 14(2), 133ï 142.

Conley, A., & Coelho, C. A. (2003). Treatment of word retrieval impairment in chronic Brocaôs aphasia. *Aphasiology*, 17(3), 203ï 211.

Clausen, N. S., & Beeson, P. M. (2003). Conversational use of writing in severe aphasia: A group treatment approach. *Aphasiology*, 17(6ï 7), 625ï 644.

Cicerone K. D., Dahlberg C., Kalmar K., Langenbahn D. M., Malec J. F., Bergquist T. F.,

Felicetti T.,GiacinoJ.T., Harley J. P., Harrington D. E., et al. (2000). Evidence-based cognitive rehabilitation: recommendations for clinical practice. *Archives of Physical medicine and rehabilitation. 2000; 81:1596–1615.*

Davis, L. A., Stanton, S. T. (2005). Semantic Feature analysis as a Functional Therapy Tool. Contempory Issues in Communication Science and Disorders. 32, 85-92.

Deema, J.J. &Prema, K.S. (2008).Cross language priming in normal bilingual adults Student Research at AIISH, Mysore, Vol. III: 2004-2005, Part-B: Speech Language Pathology, AIISH, Mysore, pp. 1-17.

Detry, C., Pillon, A., & de Partz, M.-P. (2005). A direct processing route to translate words from the first to the second language: Evidence from a case of a bilingual aphasic. *Brain and Language*, 95, 40ï 41.

Dippel, Frans van Harskamp, Peter J. Koudstaal and Evy G. Visch-BrinkSuzanne J.C. Doesborgh, Mieke W.E. van de Sandt-Koenderman, Diederik W.J. Processing in Aphasia after Stroke: A Randomized Controlled Trial Effects of Semantic Treatment on Verbal Communication and Linguistic. (2004). Stroke. 35:141-146

Doyle, P. L., & Bourgeois, M. S. (1986). The effects of syntax training on óadequacyô of communicaton in Brocaôs aphasia. In R. H. Brookshire (Ed.), Clinical aphasiology: Vol. 16 (pp.123-131). Minneapolis, MN: BRK Publishers.

Doyle, P. L., & Goldstein, H. (1985). Experimental analysis of acquisition and generalization of syntax in Brocaôs aphasia. In R. H. Brookshire (Ed.), Clinical aphasiology: Vol. 15 (pp.205-213). Minneapolis, MN: BRK Publishers.

Doyle, P. L., & Goldstein, H., & Bourgeois, M. S. (1987). Experimental analysis of syntax

training in Brocaôs aphasia: a generalized and social validation study. *The Journal of Speech andHearing Disorders*, 52, 143-155.

Edmonds, L., & Kiran, S. (2006). Effect of semantic naming treatment on cross linguistic generalization in aphasia in bilingual or multilingual speakers. *Journal of Language Speech, and Hearing*, 49, 729 - 748.

Edmonds, L.A., & Babb, E. (2009). Effect of verb network strengthening treatment (VNeST) on lexical retrieval in sentences in moderate-severe aphasia. Paper presented at Clinical Aphasiology Conference, Keystone, CO.

Edmonds, L.A., Nadeau, S. E., & Kiran, S. (2009).Effect of verb network strengthening treatment (VNeST) on lexical retrieval of content words in persons with aphasia. *Aphasiology*, 23,402-424.

Fabbro, F. (2001).The bilingual brain: cerebral representationof languages. *Brain and Language.* 79(2):211ï 222.

Fink, R. B., Schwartz, M. F., Rochon, E., Myers, J. L. (1998). Investigations of the sentence-query approach to mapping therapy. *Brain and Language*, 65, 203-207.

Gil, M., & Goral, M. (2004). Non-parallel recovery in bilingual aphasia: Effects of language choice, language proficiency, and treatment. *International Journal of Bilingualism*, 8, 191ï 219.

Haendiges**,** A. N.,Berndt, R.S. & Mitchum, C.C. (1996). *Brain & Language*, 52 (1): 276-302.

Helm-Estabrooks, N. (1981). Helm elicited language program for sytax stimulation. Austin, TX: Exceptional Resources.

Helm-Estabrooks, N. & Holland, A. L. (1998).*Approaches to the treatment of aphasia*. San Diego: Singular Press.

Helm-Estabrooks, N., Fitzpatrick, P. M., & Barresi, B. (1981). Response of an agrammatic Patientto a syntax stimulation program for aphasia.*The Journal of Speech and Hearing Disorders*, 46,422-427.

Helm-Estabrooks, N., & Nicholas, M. (2000). Sentence production program for aphasia (2nd ed.). Austin, TX: Pro-Ed.

Helm-Estabrooks, N., & Ramsberger, G. (1986). Treatment of agrammatism in long term Brocaôs aphasia. *The British Journal of Disorders of Communication,* 21, 39-45.

Howard, D., Patterson, K., Franklin, S., Orchard-Lisle, V., &Morton, J. (1985). Treatment of wordretrieval deficits in aphasia: A comparison of two therapy methods. *Brain*, 108(4), 817ï 829.

Hull, R., &Vaid, J. (2006).Laterality and Language Experience.*Laterality*, 11(5), 436-464.

Karanth, P. (1980a). Western Aphasia Battery in Hindi. ICMR project, All India Institute of Speech and Hearing, Mysore.

Karanth, P. (1980b). Western Aphasia Battery in Kannada. ICMR project, All India Institute of Speech and Hearing, Mysore.

Kohnert, K. (2009). Cross language generalization following treatment in bilingual speakers with

aphasia: A review.*Seminars in Speech and Language*, 30, 174ï 186.

Kiran, S., & Roberts, P. M. (2010). Semantic feature analysis treatment in Spanish-English and French-English bilingual aphasia.*Aphasiology*, 24, 231ï 261.

Kurland, J & Falcon, M. (2011). Effects of cognate status and language of therapy during intensive semantic naming treatment in a case of severe non fluent bilingual aphasia. Clinical Linguistics & Phonetics, 25(6ï 7). 584ï 600.

LaPointe, L. L. (2011). *Aphasia and related neurogenic language disorders*. Fourth edition, New York, NY: Thieme Publishers.

Lowell,S., Beeson,P.M.,& Holland,A.L.(1995).The efficacy of a semantic cueing procedure on naming performance of adults with aphasia. *American Journal of Speech-Language Pathology,* 4(4), 109ï 114.

Loverso, F. L., Prescott, T. E., &Selinger, M. (1988). Cueing verbs: a treatment strategy for aphasia adults (CVT). *Journal of Rehabilitation Research and Development*, 25,47-60.

Lalor, E., & Kirsner, K. (2001). The role of cognates in aphasia in bilingual or multilingual speakers: Implications for assessment and treatment. *Aphasiology*, 15, 1047ï 1056.

Lorch, M. (2007). Bilingualism and memory: Early 19th century ideas about the significance of polyglot aphasia. *Cortex*, 43, 658ï 666.

Marantz, A. (1995). The Minimalist Program. In G. Webelhuth (Ed.), Government and binding theory and the minimalist program: Principles and parameters in syntactic theory (generative syntax) (pp.349-382). Cambridge, MA: Wiley-Blackwell.

Marshall, J. (1995). The mapping hypothesis and aphasia therapy. Aphasiology, 9(6), 517-539.

Mayer, J. F., & Murray, L. L. (2003). Functional measures of naming in aphasia: Word retrieval in confrontation naming versus connected speech. *Aphasiology*, 17(5), 481ï 497.

Mitchum, C. C., & Berndt, R. S. (2001). Cognitive neuropsychological approaches to diagnosing and treating language disorders: Production and comprehension of sentences. In R. Chapey(Ed.), *Language intervention strategies in aphasia and related neurogenic Communication disorders* (4th edition, pp. 551ï 571). Philadelphia: Lippincott, Williams, & Wilkins.

Mitchum, C. C., Greenwald, M. L., & Berndt, R. S. (2000). Cognitive treatments of sentence processingdisorders:What have we learned? *Neuropsychological Rehabilitation*,10, 311ï 336.

Murray, L. L.,& Clark, H. M. (2006).*Neurogenic Disorders of Language*. Clifton Park, NY: Thomson Delmar Learning.

Nicholas, L. E., & Brookshire, R. H. (1993). A system for quantifying the informativeness and efficiency of the connected speech of adults with aphasia. *Journal of Speech & Hearing Research*, 36(2), 338ï 350.

Paradis, M. (1995). Bilingual aphasia 100 years later: Consensus and controversies. In M. Paradis (Ed.), *Aspects of bilingual aphasia.* Tarrytown, NY: Elsevier.

Paradis, M., &Libben, G. (1987).*The assessment of bilingual aphasia*. Hillsdale, NJ: Erlbaum.

Peach, R., & Reuter, K. (2008). Semantic feature analysis for word retrieval failures in aphasic discourse production. Poster presented at the 38th Annual *Clinical Aphasiology Conference*, Teton Village, WY.

Peach, R., & Reuter, K. (2009). A Discourse-Based Approach to SFA. *Aphasiology. 1*(1).

Pfeifer, M. (2006).2005 American community survey - southeast Asian American populations. *Asian American Press newspaper*, Saint Paul, MN, October 28.

Portney, L. G., & Watkins, M.P. (1993).*Foundations of clinical practice: Applications to Research*. Norwalk, CT: Appleton & Lange.

Prescott, T. E., Selinger, M., &Loverso, F. L. (1982). An analysis of learning, generalization and maintenance of verbs by an aphasic patient. In *Clinical Aphasiology Conference* (pp.178-182). Minneapolis, M N: BRK Publishers.

Rajani, S.,&Prema K.S. (2008).Cross language priming in bilingual aphasics. Student Research at AIISH, Mysore, Vol. III: 2004-2005, Part-B: Speech Language Pathology, AIISH, Mysore, pp. 112-126.

Raymer, A. M., & Gonzalez-Rothi, L. J. (2001). Cognitive approaches to impairments of word comprehension and production. In R. Chapey (Ed.), *Language intervention strategies in aphasia and related neurogenic communication disorders* (pp.524ï 550). Philadelphia: Lippincott Williams & Wilkins.

Rider, J. D., Harris-Wright, H., Marshall, R. C., & Page, J. L. (2008). Using semantic feature analysis to improve contextual discourse in adults with aphasia. *American Journal of*

Speech-Language Pathology, 17, 161ï 172.

Roberts, P. M., & Deslauriers, L. (1999). Picture naming of cognate and non-cognate nouns in aphasia in bilingual or multilingual speakers. Journal of Communication Disorders, 32, 1ï 23.

Roberts, P. M. (2008). Issues in assessment and treatment in bilingual and multicultural populations.In R. Chapey (Ed.), *Language intervention strategies in adult aphasia* (5th ed., pp. 245ï 276). Baltimore: Lippincott, Williams & Wilkins.

Roberts, P. M., &Deslauriers, L. (1999). Picture naming of cognate and non-cognate nouns in aphasia in bilingual or multilingual speakers. *Journal of Communication Disorders*, 32, 1ï 23.

Rochon, E., & Reichman, S. (2004). A modular treatment for sentence processing impairment in aphasia: sentence comprehension. *Journal of Speech-Language Pathology and Audiology*, 28, 25-33.

Rochon, E., Laird, L., Bose, A., Scofield, J. (2005). Mapping therapy for sentence production impairments in nonfluent aphasia. *Neuropsychological Rehabilitation*. 15(1):1-36.

Saffran, E. M., Schwartz, M. F., & Marin, O.S. (1980). The word order problem in agrammatism:II. Production. Brain and Language, 10(2), 263-280.

Salvatore, A. (1985). Experimental analysis of a syntax stimulation training procedure.In R. H. Brookshire (Ed.), *Clinical aphasiology*: Vol. 15 (pp.214-221). Minneapolis, MN: BRK Publishers.

Schwartz, M.F., Saffran, E.M., Fink, R. B., Myers, J. L., & Martin, N. (1994). Mapping therapy: Atreatment program for agrammatism. Aphasiology, 8, 19-54.

Thompson, C.(1989). Generalization in the treatment of aphasia.InL. McReynolds & J. Spradlin(Eds.), *Generalization strategies in the treatment of communication disorders* (pp.82ï 115). St. Louis, MO: Decker.

Thompson, C. K. (2008). Treatment of Syntactic and Morphologic Deficits in agrammatic aphasia. In R. Chapey (Ed.), *Language Intervention Strategies in Aphasia and Related Neurogenic Communication Disorders.*(5th ed., pp. 735- 755). Philadelphia: Lippincott Williams & Wilkins.

Thompson, C. K., Milman, L. H., Dickey, M, W., OõConnor, J. E., Bonakdarpour, B., Fix, S. C. (2006). Functional category production in agrammatism: treatment and generalization effects. *Brain and Language*, 99, 69-71.

Thompson, C. K., (2001). Treatment of underlying forms: a linguistic specific approach for sentence production deficits in agrammatic aphasia. In R. Chapey (ed.), *Language intervention strategies in adult aphasia* (4th ed., pp. 605-628). Baltimore: Williams and Wilkins.

Thompson, C. K., Shapiro, L.P. (2005). Treating agrammatic aphasia within a linguistic framework: treatment of underlying forms. *Aphasiology*, 19,1021-1036.

Thompson, C. K., Shapiro, L.P. Ballard, K. J., Jacobs, B.J., Schneider, S. S., &Tait, M. E. (1997). Training and generalized production of wh- and NP- movement structures in

agrammatic aphasia. *Journal of Speech, Language and Hearing Research*, 40,228-244.

Thompson, C. K., Shapiro, L.P., Kiran, S., &Sobecks, J. (2003). The role of syntactic treatment of sentence deficits in agrammatic aphasia: the complexity account of treatment efficacy (CATE). *Journal of Speech, Language and Hearing Research*, 46,591-607.

Wambaugh, J. L., & Ferguson, M. (2007). Application of semantic feature analysis to retrieval of action names in aphasia. *Journal of Rehabilitation Research and Development*, 44 (3), 381-394.

Webster, J., Morris, J., & Franklin, S. (2005). Effects of therapy targeted at verb retrieval and the realization of the predicate argument structure: A case study. *Aphasiology*, 19 (8), 748-764.

APPENDIX 1

INFORMED CONSENT

TITLE: Effects of Semantic and Syntactic Treatments in Bilingual Stroke Survivors
PRIMARY INVESTIGATOR: G.N. Rangamani, Ph.D., CCC-SLP, BC-ANCDS
TELEPHONE: 320-308-2092

Background information and purpose:

Aphasia is a language disorder that affects an individual's ability to effectively communicate their daily needs. Communicative functions such as speaking, understanding others, reading and writing can all be affected to varying degrees. Although language treatment methods of aphasia have been in existence over several decades, their efficacy and effectiveness of such procedures have been lacking. It is only in the recent past that evidence-based practice has gained a prime research focus with a drive to establish efficacy and effectiveness of the various treatment approaches.

The purpose of this proposed project is to contribute further to the understanding of aphasia and its treatment in both the monolingual and bilingual stroke survivors. More specifically, the aim is to study the influence and effectiveness of cognitive linguistic model-based syntactic and semantic treatments in Kannada-English bilinguals and to establish normative data on some linguistic parameters in the realm of semantics and syntax.

Depending on the needs of the clients in therapy, particular language modalities such as speaking, auditory comprehension, reading and/or writing will be worked upon using specific cognitive-linguistic or other efficacious speech-language treatment methods to overcome problems in the different communication modalities. All participants and / or caregivers will be tested on language test batteries and/or questionnaires at the beginning and end of the semester to determine baseline performance and to document progress. Each treatment session will involve planned daily living related communication activities and therapeutic strategies, which will be used to help the participants to communicate effectively in those situations. During the sessions, responses from the participants will be recorded to determine how the participants progress and also to plan the future therapy goals for each participant. Responses may be recorded on paper, audio recordings and / or video recordings. These are very critical to document progress and may be also used as therapeutic strategies. Treatment effectiveness data may also be presented at professional meetings /conferences and/or published. When information is reported on participants, no participant will be identified by their names

Participant Responsibilities:

There are no identifiable risks involved in this program. Participants will however have to find their own transportation to attend the program. Participants should also be willing to participate in all the testing and treatment sessions that may last up to 6 weeks or more.

Benefits:

Helping individuals with aphasia to communicate better will increase their overall quality of life. The improvement in their communicative functions will help them to become less

isolated socially and communicate their feelings, needs and emotions in everyday life. They will become better productive citizens.

Confidentiality:
All participants' communicative status and any language test results will all be maintained confidential at all times. All participants' records will be identified by a unique number system and all records will be maintained in the investigators' offices in locked cabinets.

Results:
Project results will be available to the participants upon request from the department of Speech Language Sciences, All India Institute of Speech and Hearing, Manasagangothri, Mysore-570 006, Karnataka, India

Contact Information:
If you have questions right now, Please ask. If you have questions later, please feel free to contact Dr. G.N. Rangamani via email at gnrangamani@stcloudstate.edu or Dr. Prema Rao at 2514449 (extn. 252) or email her at prema_rao@yahoo.com . You may also write to her at: Dr. Prema Rao, Professor of Language Pathology, Head-Department of Speech Language Sciences, All India Institute of Speech and Hearing, Manasagangothri, Mysore-570 006, Karnataka, India.

Voluntary participation / Withdrawal:
Participation in this program is completely voluntary. You may withdraw at any time if you do not wish to participate.

Your signature indicates that you have read the information provided above and have decided to participate. You may withdraw from this program at any time without penalty even after signing this form.

_____ _____

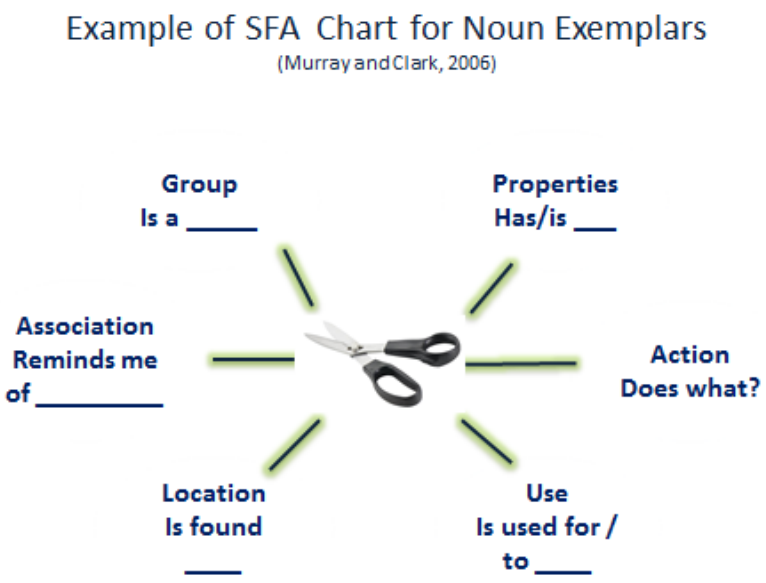
Signature Date

(If other than the participant, indicate relationship and if you are authorized to sign on behalf of the participant)

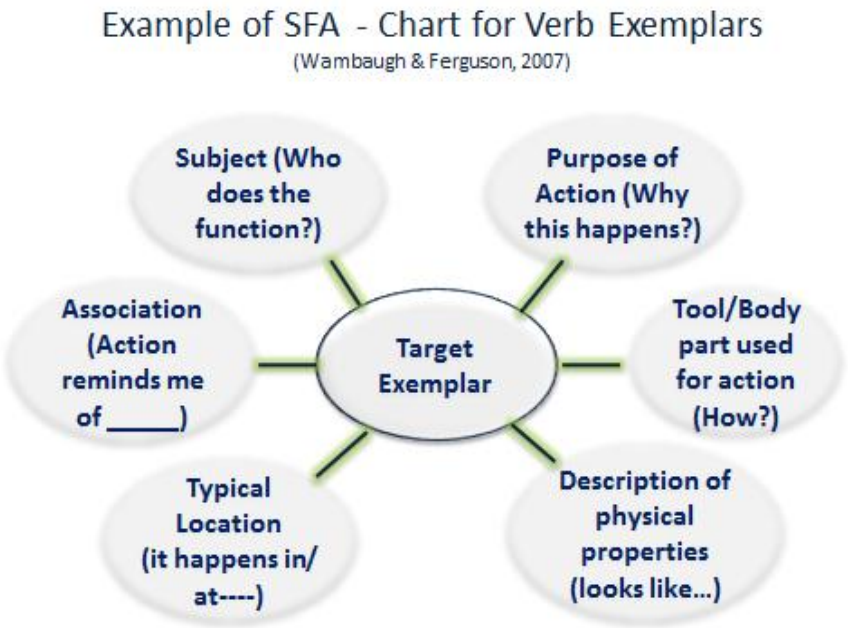
St. Cloud State University
Institutional Review Board
Approval date: 7/27
Expiration date: _____

APPENDIX-2

Semantic Feature Analysis with Nouns



Semantic Feature Analysis with Verbs



APPENDIX-3

Examples of Action Words used in SFA-V Treatment

Treatment list 1	Treatment list 2	Probe list	Generalization list
Drilling	Planting	Hitting	Kicking
Weighing	Stirring/mixing	Weaving	Pinching
Roaring	Sleeping	Barking	Bending

Examples of Nouns used in SFA-N Treatment:

1. orange
2. mango
3. grapes
4. jack fruit
5. pineapple

Examples of Reversible Sentences used in Mapping Therapy:

1. The boy is bathing the father.
2. The woman begs the man.
3. The dog chases the boy.

APPENDIX – 4

Example of a Kannada Noun Exemplar Treatment Worksheet