SEMANTIC ERRORS IN PERSONS WITH FLUENT APHASIA

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CERTIFICATE

This is to certify that this dissertation entitled **"Semantic errors in Persons with Fluent Aphasia"** is bonafide work in partial fulfillment for the degree **of Masters in Speech-Language Pathology** of the student (**Register No. 15SLP031**). This study has been carried out by a faculty of this institute and has not been submitted earlier in any other university for the award of any diploma or degree.

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This is to certify that the dissertation entitled **"Semantic errors in Persons with Fluent Aphasia"** has been prepared under my guidance and supervision. It is also certified that this dissertation has not been submitted earlier in any other university for the award of any diploma or degree.

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DECLARATION

This is to certify that this dissertation entitled “Semantic errors in Persons with Fluent Aphasia” is the result of my own study under the guidance of Dr. S.P. Goswami, Professor of Speech Pathology & Head of Speech-Language Pathology, Department of Speech Pathology, & Academic Coordinator, All India Institute of Speech and Hearing, Mysuru has not been submitted earlier in any other university for the award of any diploma or degree.

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Dedicated to my beloved family

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Appreciation can make a day; even change a life. Your willingness to put it into words is all that is necessary. -Margaret Cousins

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CHAPTER I

INTRODUCTION

Aphasia is a language disorder which results from brain damage significantly affecting all the levels of language production; form, content and use. Depending on the site and extent of lesion, the different types of aphasias are seen with varying degrees of severity. Deficits are observed in the form of errors of word retrieval, phonological processing, grammar, and syntax (Duffy, 1995). Aphasia can manifest itself in different signs and symptoms, depending on the size and location of the lesion. Grammatical problems primarily arises from lesions in the left frontal lobe and lexical-semantic problems are seen in cases where the lesion is more posterior i.e., in the temporal and/or the parietal lobe. Fluent aphasia involves little or no motor difficulties and individuals exhibit rather normal rates of speech, it is referred to as posterior aphasic syndromes (Buckingham & Kertesz, 1974).

There is a necessity to comprehend and produce words which involves semantic representations and also phonological processing. It is incontestable that word meaning and its processing is what attributes to appropriate use of semantics in a language. There are different semantic features like functional, sensory and visual among many others which constitute the representation that also helps to define the word meaning. However, in aphasia, this processing of different aspects of representation of a word and/or its meaning is affected to varying degrees, also, the severity and type of the naming and perceptual deficit is determined by the extent of impairment (Lambon Ralph, Moriarty & Sage, 2002). Speech of persons with fluent (Wernicke's) aphasia is generally characterized by jargon or

neologistic utterances, semantically related or phonologically related errors, or in some cases they find word retrieval difficult (Ellis, Miller, & Sin, 1983; Hillis & Caramazza, 1991).

Persons with fluent aphasia often present with co-occurring deficits in semantics, which includes deficits in category knowledge like in subordinate tasks (Shelton & Caramazza, 1999) thus, leading to the hypothesis that deficits in naming in persons with fluent aphasia may persist from impairments existing within the semantic system. Automatic processes of lexical semantic retrieval remain intact in fluent, comprehension impaired aphasia, but the ability to manipulate semantic properties of words is impaired in 'meta-linguistic' tasks which are sensitive to attentional resource allocation and strategic processing.

Lhermitte and Lecours (1971) defined advance response patterns which is indicative of loosening or narrowing of semantic field boundaries. Persons with aphasia were divided into three groups with regard to their ability to preserve appropriate semantic relationship along with its different hierarchies. Individuals chosen for the study were from each of the significant diagnostic categories. Nonetheless, it was found to be a clear tendency for persons with Wernicke's aphasia, those with semantic type of jargon in particular, to demonstrate loosening in the semantic boundaries. Auditory comprehension deficits resulted in qualitative changes in the association of the target to its semantic field. They also exhibited inadequate associations made in the network of the semantic system to specific words which can explain the reduced naming ability to (in case of anomic aphasia). According to the results of this study impairment in the semantic field structure is particularly observed in persons with anomic aphasia. Zurif, Caramazza, Myerson, and Galvin (1974), used an entirely different experimental

paradigm of which the results also revealed a high degree of resemblance between neurotypical individuals' semantic organization and that of persons with Broca's aphasia (who corresponded to their healthy control group). However, persons with Wernicke's aphasia had a severe disruption in semantic sense.

Lexis has been investigated in discourse tasks from two perspectives: semantic (e.g. incidence and types paraphasias, unspecific items in lexical categories) (Wagenaar, Snow & Prins, 1975; Nicholas, Obler, Albert & Helm-Estabrooks, 1985; Vermeulen, Bastiaanse & van Wageningen. 1989) and a syntactic one to examine the different varieties of word classes used (Berko-Gleason, Goodglass, Obler, Green, Hyde & Weintraub, 1980; Saffran, Sloan-Berndt & Schwartz, 1989). Specific to naming tasks, word finding difficulties have been evidenced and well documented in various studies (Dressler & Pleh, 1988, Larfeuil & Le Dorze, 1997) though, contrastive results have been reported between those findings obtained in discourse tasks and lexical performance related to it, and on single word retrieval tasks (Williams & Canter, 1981; Nicholas et al. 1985; Vermeulen et al. 1989, Armstrong, 1997). Structural problems demonstrated by individuals who have agrammatism have been documented based on the word class analyses used by persons with aphasia. Findings suggest that these individuals use less verbs when compared to nouns; less closed class words, determiners are seen to be frequently omitted and fewer pronouns are used. On the other hand, in a study conducted by Berko-Gleason et.al 1980, it was found that persons with Wernicke's aphasia use fewer nouns when compared to verbs which were used more often.

Huber (1990) also found comparable issues in persons with Wernicke's aphasia, amnesia and Broca's aphasia. Responses were elicited by using picture

stimuli for the following reasons: (1) In a more controlled research or clinical environment verbal production is obtained; and (2) the researcher can more easily identify the target words and errors exhibited in discourse which may not be very obvious in a spontaneous speech task. Severe comprehension deficits produce two noticeable effects on the organization of the semantic fields. Firstly, difficulty of recognizing verbs which are the function associates is observed. It is also noticed to be a disproportionate increase. In less severe persons with aphasia and controls this category is also least available. Second, they produce a pronounced increase in difficulty for the categorical association of functional context, for which these patients join function associates on the periphery of the semantic field. When a qualitative change is observed in the semantic organization, it is suggestive of a marked reduction of responsiveness in the two latter categories.

Christiansen (1995) examined three groups of persons with anomic, conduction and Wernicke's aphasia and a group of neurotypical individuals. She reported that the compensatory strategies may be attributed to the speech disturbances in anomic and conduction speakers' (e.g., due to word access difficulty rather than to a reduced of awareness of the related topic**,** the person with anomic aphasia omitted propositions), the persons with Wernicke's aphasia in fact had a definite impairment with respect to cohesion and coherency of a topic in conversation, i.e. these individuals exhibited an immoderate number of inapplicable propositions and appeared to show difficulty in organization skills and providing details in narration in a way that assisted the listener to infer the propositions that was intended.

1.1 Need:

Different types of errors like paraphasias and perseverations are pervasive in aphasia. Discourse analysis provides ample data regarding all the components of language in different impairments i.e., microlinguistic and macrolinguistic. It makes it possible to simultaneously examine the breakdown of language components (e.g., semantic, syntax) as well as those functions of language that interact with high-order structures (e.g., sequencing, cohesion, organization). There is a lacuna of recent research in the quantitative analysis of semantic errors produced by persons with aphasia using discourse tasks. Thus, the need arises for profiling the semantic deficits at the discourse level in persons with fluent aphasia.

1.2 Aim:

The present study aimed at profiling the semantic deficits at discourse level in persons with fluent aphasia using quantitative and qualitative analysis.

1.3 Objectives of the study:

i. To quantitatively analyze the semantic errors produced in discourse by persons with fluent aphasia using Systematic Analysis of Language Transcripts.

ii. To descriptively profile the semantic errors in persons with fluent aphasia using discourse tasks.

CHAPTER II

REVIEW OF LITERATURE

Language serves as a basic mode of communication which is greatly dependent on both comprehending and expressing meaningful speech. One can exchange thoughts, ideas and opinion through this medium. Information is conveyed through words and word meanings which are stored in the mental lexicon of individuals. Each word that is stored in the register symbolizes a concept of the world. These concepts are attained from infancy through learning from real experiences. Language functions' impairment represents one of the second most disabling consequence following motor impairment and the most common deficit caused by brain insult (Agostini et al., 2014). The lesion or damage to certain areas of the brain leads to impaired processing of various linguistic aspects including lexical semantic information. The errors manifested in persons with aphasia will vary depending on the site and level of impairment. These errors are discussed in detail in the following section.

2.1 Linguistic features in Persons with Fluent Aphasia

Under the linguistic features, lexical and semantic features will be explained in detail in this section. Persons with aphasia have difficulty processing lexical-semantic information which leads to communication difficulty in different situations. For instance, in some individuals, comprehension of the meaning of the words is impaired which results in impaired performance in naming or matching an orally presented stimulus to a picture. In another situation, the individual may have difficulty discriminating the sounds of the stimulus presented which leads to

impaired performance on the task of word-picture matching. Lexical impairment can be explained as a deficit to one or more of the mechanisms that are thought to be involved in the processing of words. There are certain aspects related to the performance in lexical-semantic tasks; lexical: differential accessibility, morphological structure and word class; and in the semantic component: categories, abstractness and representational form.

2.1.1 Frequency effect

Gordon (2000) reported that neurotypical individuals can recognize faster and put strings of letters corresponding to a real word which is frequently occurring in their language than when compared to a less frequent word. Gerratt and Jones (1987) used reaction time paradigm and reported that persons with aphasia rapidly recognized real words when compared to non-words when the real words had multiple meanings and occurred more frequently. Frequency effects in word have also been observed in verbal communication, reading and writing. It was reported that the frequently occurred words were read easier when compared to words that were less frequent (Siegel, 1959). Spelling errors were reported for less frequent words (Bricker, Schuell & Jenkins, 1964); also verbal perseverations increased on naming and reading tasks as the word frequency deceased (Santo Pietro & Rigrodsky, 1982). It can be concluded that the threshold to activate the high frequency words is less which leads to faster accessibility when compared to low frequency words.

2.1.2 Morphological structure

It is not just the strings of phonemes and graphemes, even the morphological structure or the morphemes are needed to be represented and processed to understand the complete meaning. It can be hypothesized that morphological structure is also represented in the lexicon because it is necessary for verbal language production. Normal individuals can understand and recognize the morphological forms and produce them even though they may have not encountered the word in prior (Butterworth, 1983; Badecker & Caramazza, 1990). These forms help identify and understand certain concepts in sentence or discourse. It is an accessory to syntactic content. In morphological processes, certain aspects related to form and form class may be affected depending on the level and extent of impairment.

2.1.2.1 Form class

Words have different forms in which they are represented. These are based on systematic differences in differences of form classes. Examples of form classes in the English language are nouns with inflection ‘s’ which forms plurals (cat*s*, door*s*) and may transform to adjective derivational forms (beauty-beauti*ful*). In verb, the different forms are ‘s’, ‘ed’, ‘ing’, ‘en’ based on the tense use (play*s*, play*ed*, play*ing*, tak*en*, etc). Adjectives can be represented in a comparative form (small, small*er*, and small*est*); functional words (of, on, that). Selective deficits have been reported in persons with fluent aphasia where greater difficulty was observed in verb naming task when compared to nouns (Miceli, Silveri, Villa & Caramazza, 1984).

2.1.3 Lexical Semantics

Semantic representations of morphologically complex words or items that addresses the output components consists of separate feature subsets where each specifies the different parts of the lexical system (Caramazza & Miceli, 1988). These representations can be activated based on any form of modality, phonological or the orthographic lexicon. If features related to an item are represented in a system, certain words will be part of a same category i.e. more semantic features will be shared by those words in one category. Therefore, faster processing and semantic judgment will be observed for related words when compared to unrelated words. Hart, Berndt and Caramazza (1985) reported a person with poor auditory verbal comprehension who exhibited specific deficit in the fruits and vegetables category. Difficulty has also been reported in performance of abstract and concrete words recognition. Better recognition and reading ability for concrete words haven been reported in persons with fluent aphasia (Marshall & Newcombe, 1966; Patterson & Marcel, 1977).

2.1.4 Non word errors

More imageable words and high frequency words are recognized easier than low frequency words and low imageable words (Goodman & Caramazza, 1986). These authors described a case where spelling errors were observed for unfamiliar words when compared to familiar words indicating a deficit in the phonological route. The typical errors produced are regularization errors because of the impairment in phoneme-grapheme correspondence.

2.1.5 Semantic errors

One important aspect related to semantics is the naming ability which is the production of a name that corresponds to a referent in either written or oral form. This is done by first recognizing the item, then semantic processing and using the phonological or orthographic lexicon to produce the output. Hillis, Rapp, Romani, Laudanna and Caramazza, (1988) reported the finding of a single case study, in picture naming task the individual exhibited naming difficulty in and produced semantic errors in comprehension as well as production tasks. They conclude that the semantic features were not activated and the word frequency did not serve as a cue to help in the naming task suggesting an overall semantic impairment. They also hypothesize that the modality of stimulus could have be a factor which affects the naming ability. Therefore, providing stimulus in any other modality (visual or tactile) could have yielded different responses.

2.1.6 Morphological errors

Persons with agrammatism typically omit and/or substitute function words and inflections along with reduction in the length of phrases. This affects the sentence production ability to comprehend prefixes and affixes in addition to function words. Miceli and Caramazza (1988) described the errors produced by an individual with aphasia and reported errors in single word repetition task where inflectional substitution errors were noticed. They concluded that the individual may have had a lexical deficit which in turn affected the sentence production.

To explain the above mentioned lexical-semantic deficits, several authors have proposed various models and theories. These models and/or theories will help

understand the semantic representations in normal individuals and the plausible deficits, if there is impairment in this kind of processing.

2.2 Models of Semantic processing

2.2.1 Encoding and decoding hypotheses

Kintsch (1974) proposed the existence of a store with each item in the semantic memory being a set of syntactic, semantic, phonemic, graphemic, imaginal and other sensory elements. Also, there is certain real life experiences associated with the word store. The first representation is matched to the memory and selection is based on the contextual factors. According to the encoding hypothesis, the individual selects a word from a subset which is appropriate semantically to the context of a representation of a word. This subset has nodes which constitutes the word and its encoding for trial. The encodings will then be associated to the memory structure.

Martin (1975) suggests that individuals have internal encodings of words and selection is made based upon selective activation along with the external attributes of a stimulus. Therefore, it is highly dependent on the memory capacity of the individual. Decoding hypothesis is top-down processing where the concept is broken down into its attributes. The stimulus is decoded based on the associations that it is linked to. This helps in understanding of the semantic relations between each concept and its consecutive links. One limitation of this hypothesis is that it only revolves around semantic knowledge and representation and not on the organization of concepts or how each concept is related to another.

2.2.2 Feature based theory

Feature-based theories are those that concern the organization and internal structure of semantic representations. According to these theories, semantic knowledge is composed of small units of information, so called semantic features. However, there are differences between these theories that concern the organization of the semantic features in memory. Some of these theories suggest that the semantic features are organized into two levels of knowledge. The first of these levels is the category-level, which contains information about features that are shared by many concepts in a specific category. Thus, these features are non-distinguishing, examples of shared features in the category of mammals are "has eyes", "has legs", and "produce milk". The second level is the exemplar level, which contains information about distinguishing features, that is, features that are not shared by all concepts in a category. Rather these features are a distinguishing part of a specific exemplar in a category. For example, a very unique distinguishing feature for rhinoceros is that they have a horn (Garrard, Ralph, Hodges, & Patterson, 2001; Garrard, Ralph, Hodges, Pratt & Patterson, 2005).

Semantic features are organized categorically in semantic memory. Thus, all features in a certain category are gathered at the same place, and no distinction between distinguishing or non-distinguishing features is made. The limitation with this type of organization is, that not all concepts can be organized into one single category, since category membership may be both unclear and multiple. The concept "horse", for example, could be categorized both as an animal, and as a vehicle, while the concept "tomato" botanically is a fruit, but is used as a vegetable by many (Garrard et al., 2001). This theory focuses on the idea of knowledge and semantic memory. It also talks about how each concept is attached to different other

concepts based on its features and how each some features may also provide distinguishing characteristics to identify the different between one concept and the other.

2.2.3 Spreading activation theory

Quillian (1967) proposed this theory in such a way that there is activation spreading from two or more concept nodes in a particular semantic network until the intersection is found. There are an unlimited number of associations one generates regarding a particular concept. Each concept is represented as a node in a semantic network and its properties or characteristic features are the relational links from one node to another concept node. Links are formed based on different criteria and the complete meaning is achieved when the whole network is seen as from a concept node and its connections. The links are of different types: (i) subordinate (ii) superordinate (iii) modifiers (iv) disjunctive set (v) conjunctive set and (vi) a residual class of links which is usually a verb relationship.

A search in memory when initiated between concepts and its links each node gets activated. This spreads to adjacent links beginning with the node linked to the first node, then the nodes linked to the next and so on. At each node that is reached, an activation tag also leaves that specifies the starting node and the intermediate predecessor. An intersection between two nodes is found when another starting node is encountered. This will require an evaluation of the path that led to the intersection from the starting node. The magnitude of activation observed in nearby concepts is attributed to the distance between nodes and input concept, or the relative strengths of the links between them and the input, or both. This activation spread helps in focusing on the information that is relevant to the input. Ratcliff and

McKoon (1981) reported that farther the node activation, slower will be reaction time when compared to the closer functions or nodes.

This theory provides an insight to semantic priming that takes place in processing of information and the strong connections and weak connections to a particular concept. It also explains how one main concept may be connected to another main concept with relational links. However, it does not provide adequate information about the sensory characteristics of the stimuli and in what sensory mode there is faster activation of links. It lacks information about how the semantic intersection occurs and therefore, other authors have suggested certain processing assumptions that can help understand the theory better. The schematic representation of the activation linkage has been presented in Figure 1.

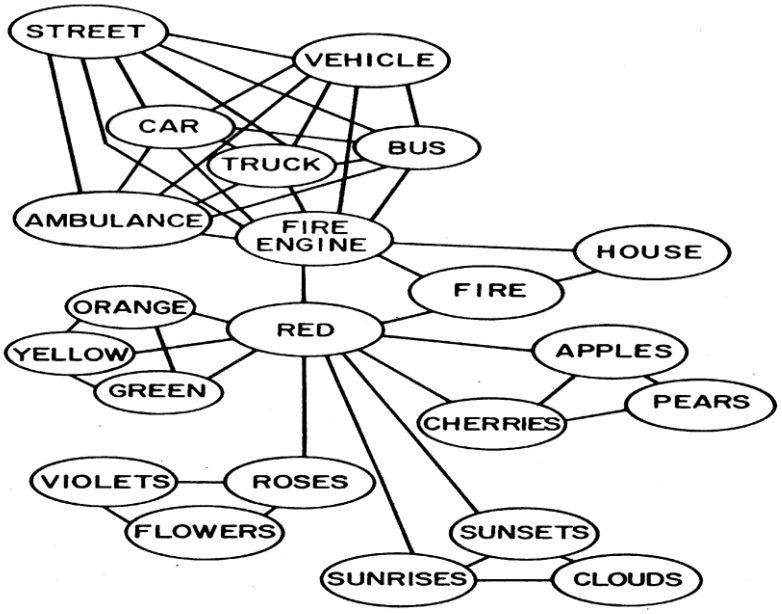

Figure 1: A schematic representation of concept relatedness in a stereotypical fragment of human memory (shorter line depicts greater relatedness) (*Source:* Collins & Loftus, 1975. A spreading-activation theory of semantic processing. Psychological review, 82(6), 407.)

2.2.4 Functional architecture model

The hypothesis proposed for this model is about the lexical form knowledge which is represented according to specific modalities, distinctively for both input as well as output processing (Shallice, 1981; Caramazza et.al, 1988). This model explains that the lexical form knowledge is represented independently, in a modality specific manner, also differentiated between input and output processing. Word perception is a task that entails both top-down and bottom up processing. First and foremost there needs to be a semantic representation which is the idea or concept regarding different objects, ideas, themes and so on. This representation is formed based on the semantic knowledge which is acquired from the sensory inputs including vision, sound, tactile, and taste. These information is then stored which contains all the representations together, followed by access to this storage. Final step is the retrieval, where as per the individual's need he/she will be able to recall and use the stored information in daily communication.

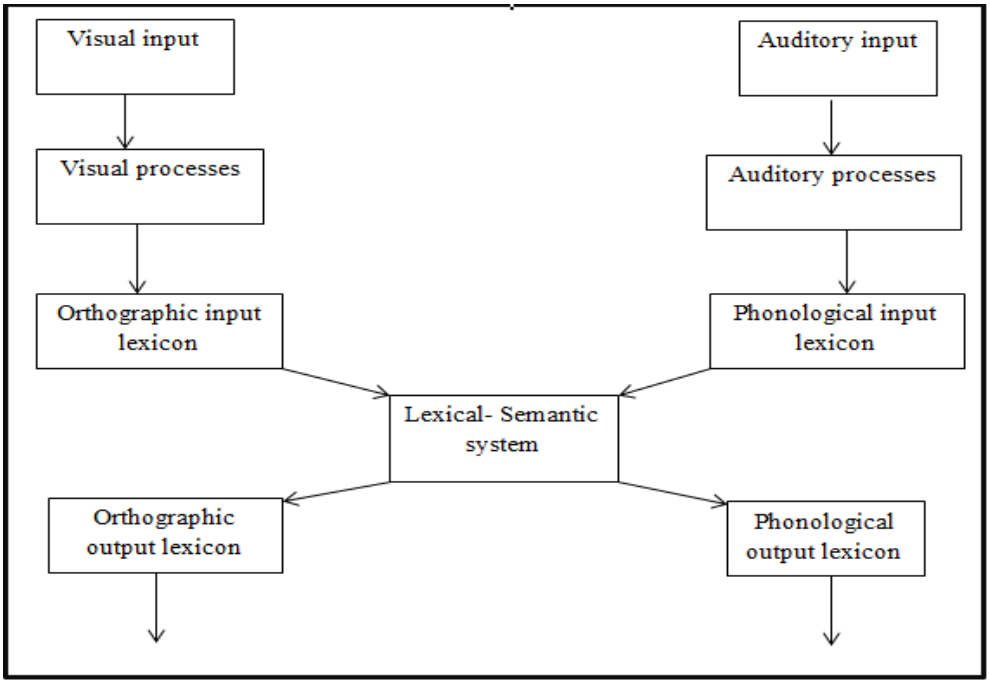

Figure 2: Schematic representation of the lexical system (*Source:* Caramazza, & Hillis, (1990). Where do semantic errors come from? Cortex, 26(1), 95-122.)

The above given schematic representation can be explained in terms of two modalities of input; visual and auditory which then undergoes processing separately in each modality. The visually processed signal forms the orthographic input lexicon and the auditorily processed signal forms the phonological input lexicon. Both the representations are connected to the lexical-semantic system. The selection takes place based on the input signal and which lexicon the stimuli belongs to. It is then consecutively sent to the orthographic output lexicon or the phonological output lexicon. According to the modality in which the output is expected to be produced the selection of the appropriate mode is generated.

To explain in terms of damage, if the phonological output lexicon is impaired, errors exhibited should only in the spoken word production (phonological errors). In contrast, if there is damage to both lexical-semantic system and the phonological output lexicon, it could lead to semantic errors. They could also result from selective damage to the phonological output lexicon which leads to the lexical components being affected and output of phonological representations are activated by semantic representations. The model emphasizes on specific modalities and separate processing for input and output. Based on the impairment in certain individuals one can hypothesize the level at which the damage has occurred. This model may be too general in its terms and it does not explain to great detail about the forms of impairments that would result due to damage from any of the components of the lexical system. Nevertheless, it helps to identify the type of errors that can exist when there is a selective damage to any of the components of the lexical system.

The aforementioned models and theories will help in providing information and an understanding about the semantic representation and processing. There are

different methods to study semantic knowledge, semantic memory, semantic categorization, thematic organization and so on. These methods will be discussed in detail in the following section.

2.3 Different methods employed in semantic analysis

2.3.1 Semantic priming

Semantic priming refers to fast and easy identification of the target when primed by a word related in meaning or when they share similar features. Related words are primed more quickly than unrelated words. It refers to the improvement in speed and accuracy in response to a target stimulus. The target stimulus can be in different forms like picture or orthographic. If the target word is semantically or associatively related to the prime word it has already been activated by this spreading. Thus, it is allowed to be processed faster than a word that is unrelated to the prime (Koivisto & Laine 1999). The different tasks used to assess semantic priming are Lexical Decision tasks, Naming, and Semantic judgment tasks. Semantic priming tasks will provide information about semantic knowledge, semantic matching and retrieval skills. However, this task does not give enough information about semantic categorization or organization. It also does not necessarily require the participant to give verbal responses.

2.3.2 Category fluency

The category fluency task is a simple test that measures the participant's capacity to generate words belonging to a specific category, for example the category of vehicles. It is usually a timed task which requires the participant to name all the vehicles for example within on minute. This type of test measures both

verbal fluency and knowledge of different categories, and gives the experimenter an idea of how capable the participant is of producing words from different semantic categories, and thus of how extensive the impairment of semantic memory is. Category fluency tasks may also give an idea of how knowledge in the semantic memory might be organized in general (Adrados, Labra, Bernados & Moreno, 2001). Even so, this task does not give enough information about spontaneous conversation or verbal skills in connected speech.

2.3.3 Picture Naming

The picture naming task is a test that has been commonly used to study semantic memory, and appears in several forms. Hundred picture naming test (Fisher & Glenister, 1992) consists of 100 line drawings, whereas The Boston Naming Test (Hawkins & Bender, 2002) contains 60 pictures. The semantic categories represented in the test are animals, fruit, plants, vehicles, furniture and clothing. The picture naming task is known to be sensitive to linguistic and conceptual difficulties, and aims to trace the process of getting access to, and retrieving information from, semantic memory. Although sensitive to linguistic and conceptual difficulties, it cannot be said with any certainty whether the participant's difficulties with finding the words required for naming the pictures are due to anomia or to semantic memory deficits. Anomia is a lexical deficit that is characterized by difficulties naming objects because of word finding difficulties, and differs thus from semantic memory deficits which are caused by damage to the semantic memory system (Adrados et al., 2001). One limitation of using this task would be the difference in real word naming situation in daily living. In day to day

communication there may be a variety of words or objects that needs to be retrieved or named which is not assessed in these tests.

2.3.4 Picture Description task

This task involves the participant to explicitly describe a set of pictures (ranging from four sets to six sets or eight sets). The participant is required to connect all the pictures in sequence and narrate the events that take place in the picture sets. This task will give an insight to the generative speech and the different concepts that are linked together in such a way that he or she can produce connected speech which is coherent and contains adequate information. It also provides the examiner an estimate of the vocabulary used including both high frequency and/or low frequency words, the use of content words or function words, more usage of nouns in comparison to verbs so on and so forth. Nevertheless, there is a restricted vocabulary that the participant will be using as the set of pictures is structured and also provides less scope for imagination in the participants' perspective.

2.3.5 Story Narration

Story processing involves comprehending the characters, events, sequences, the responses of the characters, and understanding their emotions. This will help to recreate and retell the story in coherent and structured framework. The common story retell tasks performed are stories that individuals are well aware of such as 'The Hare and Tortoise', 'The Cindrella story' and so on. The participant has to initiate with an introduction, the main idea that the story revolves around, the action and events, resolution and a coda. Narration of a story helps understand the nature

of knowledge and how it is structured in humans (van Dijk, 1977; Longacre, 1976; Grimes, 1975). It also provides information about its utilization in the comprehension and production of stories. It does not confine to structured utterances or response. There is freedom for the participant to use all the information that is present and use a variety of vocabulary to express their perspective of a story.

2.3.6 Procedural discourse

Procedural discourse requires the participant to narrate the events involved in a particular task. These tasks are those that are stored in the long term memory and specifically the implicit memory. The individual has to retrieve the information that is necessary for execution of the task and verbally narrate the procedure. The different procedures that can be used for this task are 'preparation of tea/coffee, cooking a particular dish, driving a car/cycle etc. In this type of discourse, the participant has order the utterances chronologically or conceptually (Rumelhart & Norman, 1975). It helps the experimenter to assess the performance when there is goal oriented task, the organization of information, whether or not the participant is able to sequence the steps or procedure in a right order to provide the complete meaning. It will help understand if the individual will be able to carry out a situation where verbal instructions have to be given to another individual without any aid of situational visual cues which is an important communicative skill (Ulatowska, Doyel, Stern, Haynes and North, 1983). For instance, there is a particular vocabulary that is related to a certain action or procedure which is used only if the memory of the action is retrieved. Therefore, it helps identify specific

linguistic markings and a cognitive component which constitute a communicative act.

2.4 Findings reported in literature for semantic processing

2.4.1 Behavioral studies

A study conducted by Butterworth, Howard and McLaughlin (1984) which included thirty persons with aphasia, required the participants to point to pictures when commanded auditorily. The distractors provided were from the same category as the target and in some pictures it was unrelated to the target. Results obtained suggested that there were more semantic errors produced by the persons with aphasia, the incidence of the comprehension errors in semantics was related to the severity of aphasia. In the comprehension task, naming was required to be done by the participants. This also elicited semantic errors which implied that both to auditory comprehension and naming task, semantic deficit was observed. However, the authors conclude that these errors may not be specific to the particular lexical items and its information processing but a deeper level of impairment.

Hart and Gordon (1990) examined semantic comprehension deficits in person with aphasia. Eighteen adults with aphasia were included as part of the study. Based on single word semantic comprehension tasks, one-third of the participants were found to have isolated impairments. Both auditory and visual modality was used to assess the participants' knowledge in three tasks: categorization; synonym judgment and property judgment. The results of the study suggested that in the one-third of the participants, although were found to have intact auditory perception, visual perception and speech production, single word comprehension of semantic

was moderate-severely impaired. The authors therefore verified that semantic comprehension was independent of both speech input and output processing.

Nickels (1992) compared the picture naming skills especially when semantically related to the target word in persons with aphasia. When high imageability words were provided, there was a correlation found between the semantic error production and the comprehension of such words. The authors suggest that semantic errors are seen only in word production. They also conclude stating that persons who have a central semantic deficit, between frequency and imageability there is an amount of interaction, with a frequency effect for low imageability words or items alone.

Hagoort (2003) examined speed of lexical decisions in persons with Broca's aphasia and Wernicke's aphasia. Priming task was given in which three of the four priming conditions had second prime as a homonym with two unrelated meaning and, the relation of the first prime and the target was then manipulated in different prime conditions. Automatic lexical processing was interpreted when priming took place with the shortest interval. The results patterns were found to be consistent with the fact that both persons with Broca's aphasia and Wernicke's aphasia can access the semantic lexicon automatically. In the case of persons with Broca's aphasia, the impairment was specific to selection of contextually appropriate reading of noun-verb ambiguities suggestive of failure to parse on-line morphological aspects like complex word forms into a stem and inflection. In the case of persons with Wernicke's aphasia, the performance was poor in lexical decision task, which indicated a specific impairment to accessing lexical-semantic information automatically. They conclude that there is definite impairment in the automatic processing in persons with fluent aphasia.

Persons with fluent Wernicke's aphasia routinely show lexical priming for all conditions under which control participants show priming. Most investigators have assumed that whatever underlies persons with fluent aphasia' comprehension deficits, it is not a disruption in initial access to that organization; rather, these persons appear to suffer from imprecision somewhere else in semantic/sentence processing routines, presumably further along or ''higher up'' in processing. The reason for this assumption is the findings found in priming related tasks where these individuals have similar performance results as that of the control subjects (Martin, 2001).

Bird, Howard and Franklin (2003) studied verbs and nouns production and the semantic distinctions along with performance differences in persons with aphasia when compared to neurotypical individuals. Three persons with non-fluent aphasia and one person with fluent aphasia along with neurotypical control participants were included in the study. The person with fluent aphasia experienced difficulty in naming concrete nouns which was related to impaired access to the semantic features of the concepts whereas the use of abstract nouns was within normal limits. There was near equal performance in both verbs and nouns. The persons with non-fluent aphasia performed poorly on less imageable items particularly verbs. However, in the person with fluent aphasia the naming of verbs were relatively spared. Armstrong (2000) also found similar results in her study which assessed the lexical patterns of verbs in discourse produced by four participants with aphasia.

Gordon (2008) used picture description task to measure the lexical-semantic and syntactic production in person with non-fluent when compared to persons with fluent aphasia. Eight persons with non-fluent and fluent aphasia each served as participants for the study whose connected speech samples were recorded. Correct

information units (CIUs), type-token ratios of content words (TTRs) and the proportion of semantically specific to general verbs production were measured. Syntactic analysis was carried out using quantitative production analysis (QPA). According to the results obtained, the proportion of CIUs was found to be significantly different between both the groups and the TTRs correlated significantly with the fluent aphasias' severity. However, there were not significant differences to determine severity of aphasia for the semantically specific versus semantically general verb ratio. Taking other objectives into consideration, the verb ratio was significantly different between both groups. Persons with fluent aphasia produced significantly larger proportion of semantically general (light verbs) when compared to the participants who were non-fluent.

Ralph, Moriarty and Sage (2002) studied semantic and phonological impairment in 21 persons with aphasia. The tasks used to measure the impairment were word and non-word repetition and picture naming. The results of the study indicated that anomia and its severity were considerably varied across the participants which reflected in poor confrontation naming ability. The authors also ascertained through word and non-word repetition that phonological processing was impaired in all the participants except the in the participant with the mild degree of aphasia. Additional impairments of semantic memory were also observed. The authors suggested that there could be a single, central semantic system which is impaired leading to an abnormal comprehension.

Kintz, Wright and Fergadiotis (2014) collected connected speech samples from 19 participants with anomic aphasia and 19 neurotypical individuals. The task included story retell in a way to elicit narrative discourse. The samples were transcribed in a particular format compatible with a set of programs –

Computerized Language Analysis (CLAN; MacWhinney, 2000). The samples were then segmented to CIUs. The authors reported in the results that both the group of participants was able to use semantic knowledge types and categories similarly within discourse (macro-level). They conclude that even though the persons with anomic aphasia exhibit word retrieval difficulties they may have preserved semantic knowledge.

Behavioral studies provide sufficient data to compare the production and comprehension deficits qualitatively and descriptively. However, the tasks used in each study may yield different results. Recent literature reports using discourse and connected speech to study the linguistic characteristics in the speech of persons with aphasia. Another limitation of behavioral studies is that it provides very little insight on the level or the site of impairment. This can be possible by using other methods when looking into language processing.

2.4.2 Electrophysiological studies

Electrical brain activity measures i.e., event related potentials aids in understanding processing of language. In the field of aphasia, several event related potentials have been studied in detail. These include components such as P300, N400 and mismatch negativity (MMN). Implementing this methodology to study the language in persons with aphasia will allow researchers to analyze the various types of linguistic information that these persons are sensitive to. It also helps to understand the changes that take place in the course of time to the different processes that form the foundation of language comprehension. Specifically looking into semantics, a robust and pronounced negativity is observed 400 msecs

when the brain processes a semantic anomaly or improper semantic agreement (Friederici, Pfeifer & Hahne, 1993).

Friederici et al. in 1993 investigated the patterns of brain activity during sentence comprehension in a person with Broca's aphasia with a left anterior lesion and a person with Wernicke's aphasia with a left posterior lesion. The event related potentials (ERPs) were recorded while the participants listened to sentence that included lexical-semantic and syntactic violations presented as connected speech. Sentences were presented auditorily. Prior to each sentence a fixation cross was presented on a computer screen for 500 msecs and judgment response was required by a button press.

For the lexical-semantic condition the controls showed a negative going wave about 400 msecs post onset of the critical word and this negativity was observed to be distributed over centroparietal areas in the left and the right hemisphere. This pattern resembles the N400 component observed in correlation with lexical-semantic integration processes (Kutas & Hillyard, 1989). For the phrase structure condition the normal participants displayed a left anterior negativity between 100 and 300 msecs after the onset of the critical word. Additionally, a centroparietal positive peak was observed between 300 and 700 msecs after the word indicating the word category violation.

The person with Wernicke's aphasia did not show the negative peak between 200 and 350 msecs for the semantic violation condition. However, a late posterior positivity starting as late as 1200 msecs and which was similar in latency and distribution to the one observed for the phrase structure violation condition. The person with Broca's aphasia showed a negative component between 500 and 950

msecs for the semantically incorrect sentence which was similar to normal controls Although somewhat delayed the pattern of this negativity resembles that of an N400 component usually seen in correlation with lexical-semantic processes in normals. When considering the absence of the N400 in person with Wernicke's aphasia's and the lesion site, the authors concluded that the intactness of some part of the posterior language area seems a necessary condition for the generation of an N400 component. Contrastively, the presence of N400 in the person with Broca's aphasia in whom lesion was in the anterior region suggests that posterior brain areas must be supported by an additional anterior cortical regions of the left hemisphere to guarantee the efficiency with which the normal brain processes language on line.

Swaab, Brown and Hagoort, 1996, examined the event related potentials (ERPs) in persons with left hemisphere lesion, right hemisphere lesion and elderly controls. The material used in their study was word pairs that were presented auditorily and N400 was recorded. In elderly control participants, the N400 amplitude to associatively and semantically related word targets was observed to be reduced relative to the N400 elicited by unrelated targets. Compared with this normal N400 effect, the different experimental groups showed the following pattern of results: persons with aphasia with only minor comprehension deficits (better comprehension, Broca's aphasia) showed N400 effects of a similar size as the control subjects.

In persons with aphasia with more severe comprehension deficits (impaired comprehension, Wernicke's aphasia) a clear reduction in the N400 effects was obtained, both for the associative and the semantic word pairs. Person with right hemisphere lesions showed a normal N400 effect for the associatively related

targets, but a trend towards a reduced N400 effect for the semantically related word pairs. Dissociation between the N400 results in the word pair paradigm and P300 resulted in a classical tone oddball task which indicates that the N400 effects were not a specific consequence of brain lesion, but were related to the nature of the language comprehension impairment. Therefore, in conclusion, comprehension deficits in persons with aphasia are due to impairment in integrating individual word meanings into an overall meaning representation. Persons with right hemisphere lesion are more specifically impaired in the processing of semantically more distant relationships, suggesting the involvement of the right hemisphere in semantically coarse coding.

Similar methodology was used by Van Berkum, Hagoort and Brown, 2003, that investigated the effects of both semantic and single syntactic violations combined in relation to the effects of these violations on language related event related brain potential (ERP) effects. The ERPs were recorded while the participants read the sentences with the different types of violations and the correct control sentences. ERP effects were computed relative to ERPs elicited by the sentence-internal or sentence-final nouns. The N400 effects' size to the semantic violation was found to be increased by an additional syntactic violation (a boost syntactically). However, contrastively the size of the P600/ SPS to the syntactic violation was not affected by an additional semantic violation.

According to the authors, this suggests that in the absence of syntactic ambiguity, the assignment of syntactic structure is independent of semantic context. However, semantic integration is influenced by syntactic processing. In the sentence-final position, additional global processing consequences were obtained as a result of earlier violations in the sentence. The resulting increase in the N400

amplitude to sentence-final words was independent of the nature of the violation. It was also found that it takes substantially longer to detect semantic than syntactic anomalies through a speeded anomaly detection task revealed that. In conclusion, the authors suggest that the results reveal an asymmetry in the interplay between syntax and semantics during on-line sentence comprehension. These results obtained have been supported by other authors (Kutas & Hillyad, 1989; Brown & Hagoort, 1993).

Kawohl, Bunse, Willmes, Hoffrogge and Buchner (2009) aimed to study whether a modified semantic incongruity paradigm can serve as a more graded differentiation of ERP changes in persons with mild versus severe comprehension deficits. The participants included 20 persons with aphasia with mild and severe comprehension deficits along with an age-matched control group. The ERPs were recorded in the participants while four-word sentences ending in a semantically congruent or non-congruent word were required to be read.

The results indicated that persons with aphasia with severe comprehension deficits exhibit an early positivity in the time window from 200 to 400 msecs and no N400 after the presentation of non-recurring semantically incongruent words when compared to the controls and the persons with mild comprehension impairment. Persons with mild comprehension deficits were found to have an N400 with prolonged latency in comparison with the controls. An age effect in the control groups was detected as well. The results obtained suggest that in persons with severe comprehension deficits, semantic access and integration takes place differently. These results are in congruence with other studies conducted in similar fashion investigating the semantic processing from a electrophysiological paradigm (Wassenaar, Brown & Hagoort , 2004; Sereno, Rayner & Posner,1998;

Münte ,Heinze, Matzke, Wieringa & Johannes 1994; Curran , Tucker, Kutas & Posner, 1993; Lau, Phillips & Poeppel ,2008).

Another electrophysiological type of study conducted to look into semantic processing is by using electroencephalogram (EEG) along with N400 (semantic violations). According to a study conducted by Hald, Bastiaansen and Hagoort (2006) a theta (3–7 Hz) band power increases during an interval of 300–800 msecs after critical word onset, at temporal electrodes bilaterally for both sentence conditions, and over mid-frontal areas for the semantic violations only. In the gamma frequency (~40 Hz) band, a predominantly frontal power increase was observed during the processing of correct sentences. Laganaro, Morand, Michel, Spinelli and Schnider, 2011, compared the electrophysiological activation pattern of the same subject before and after a left-hemisphere stroke. A single case study was carried out; the person was diagnosed as Wernicke's aphasia in the acute stage. Recordings were taken at three occasions; three, four, five months after stroke, using a picture naming task. A recording was also taken one year before stroke.

In all comparisons, amplitudes consistently differed after stroke from about 250-270 to 400-450 msecs after presentation of the stimuli, especially in the posterior right and left regions and on the left anterior and central electrodes. A second period of diverging amplitudes appeared in the four and five months post-stroke recordings from 450 msecs to the end of the recording period on the anterior (right and left) electrodes. By contrast, the patient did not differ from the rest of the control group before stroke also; the control participant did not display any significant changes in amplitudes at one year interval. Severe lexical- phonological impairment was observed from the ERP responses which significantly diverged from that of the control participants'. The stability of the divergent electrocortical

response over several months also suggests a lack of cortical reorganization in brain-damaged participants, with limited behavioral changes during the same period. The patient's neurolinguistic deficits, combined with the ERPs results, provide unique evidence for the role of left temporal cortex in lexical–phonological processing from about 250 to 450 msecs during word production.

Lagishetti and Goswami (2013) investigated the reaction time and accuracy of responses in persons with Broca's aphasia using frequent and infrequent words. This performance was compared to neurotypical individuals by measuring N400. Twenty participants took part in the study including ten each group (persons with Broca's aphasia and neurotypical individuals). The list of frequent and infrequent words was presented auditorily and the measurement was taken at the click of a button. The results of the study revealed that there were significant differences in the amplitude and latency of N400 for both infrequent and frequent words.

Persons with aphasia had a reduced reaction time for semantic judgment task indicating processing deficits. The authors concluded that semantic categorization is impaired in persons with Broca's aphasia. Faster reaction time was seen for frequent words when compared to infrequent words and longer latencies were obtained for infrequent words when compared to frequent words. Same authors (2012) studied the reaction time for concrete and abstract words in neurotypical population. Twenty adults (ten males and 10 females) were included in the study. The abstract and concrete words ad to be indicated using a click of a button. The concrete words were processed faster than the abstract words as obtained in the results and no significant differences in gender were found. Therefore, the concreteness of a word is important variable in the processing of words (both concrete and abstract).

These electrophysiological studies provide information regarding the activation site for semantic processing, the level of activation if necessary for the sub processes. These findings provide understanding to compute models for semantic processing, additional information for confirming diagnosis and gives some insight into intervention planning based on which is the level of impairment. To substantiate these findings radiological reports will be required to provide a complete picture of the lesion site and the deficits caused by a particular lesion.

2.4.3 Radiological findings

Perani, Cappa, Tettamanti, Rosa, Scifo, Miozzo, Basso, and Fazio (2003) conducted a study with the aim to assess the brain activity pattern during covert word retrieval task to both semantic and phonemic cues using functional magnetic resonance imaging (fMRI). Four persons with fluent aphasia were included in the study. A phoneme word fluency and semantic word fluency task were given to the participants and recording were carried out. The results obtained from the normal were: during phoneme fluency task, a selective activation of the left frontal operculum was observed and in semantic fluency task a large activation of the retrosplenial cortex was observed. In the clinical population, in the patients with good recovery the activation foci involved prevalently the perilesional or undamaged regions in the language dominant hemisphere. In the case of semantic fluency, the patients with good recovery showed activation in the inferior frontal gyrus in both Brodmann's area 44 and 45, i.e., without the dissociation observed in normal controls for the opercular and the triangular components according to the type of fluency.

In conclusion of the results, in two patients with poor recovery, an impaired performance in the phonemic fluency task was associated with the lack of significant activations; in contrast, there was an extensive activation during semantic fluency, which extended beyond Broca's area in the dorsolateral prefrontal cortex, in particular on the right side. The authors discussed that there is a central role in semantic processing. This was because semantic fluency task led to a discrete activation of Brodmann's area 46 and selective activations of the more anterior portion of inferior frontal gyrus (Brodmann's area 45, 46) have been associated with semantic encoding (Desmond, Demb, Sum, Wagner, Morell, Shear and Glover, 1995; Rizzolatti, Fadiga, Gallese, & Fogassi, 1996).

Gold, Balota, Kirchhoff and Buckner (2005) conducted a study using event related fMRI adaptation experiment where two tasks were compared. The first task included semantic verb generation, here the participants were required to associate nouns and generate verbs based on the appropriate meaning. The second task was phonological regularization which required the participants to generate regularized pronunciations for irregularly spelt words. The anterior-ventral portion of left inferior prefontal cortex (aLIPC) and its activation was examined for semantic, phonological and letter patterns in both task effects and adaptation effects. Thirty two neurotypical individuals served as participants for the study and functional images were acquired.

The results reveled that accurate performances were seen on semantic than phonological task, repeated processing yielded better performance than novel processing, phonological priming effects were significantly greater than semantic or letter and a trend of greater priming in semantic task than the letter task. Left posterior frontal region were activated for phonological –preferentiality and for

semantic preferentiality, adaptation effects were observed in the left temporal region. The authors verified that aLIPC and posterior LIPC (pLIPC) are both involved in processing of language and there exists a subdivision functionally for semantic and phonological processing. The authors also stated that aLIPC region activation is prominent for semantic tasks as found by many other authors too (Desmond et al, 1995; Gabrieli et al., 1996; Gold & Buckner, 2002). The authors concluded that there is strong response during controlled semantic processing in the aLIPC region.

Van Petten and Luka (2006) measured the electrical brain activity and concluded that there is definite contribution of left inferior frontal gyrus and left superior temporal gyrus when looking at semantically congruent and incongruent words.

Schwartz, Kimberg, Walker, Faseyitan, Brecher, Dell and Coslett (2009) employed voxel-based lesion system mapping to examine the locus of lesions that leads to semantic errors. The 64 participants who were included in the study had a mean age of 58 (range 26–78), and mean years of education of 14. Ninety-two percent of participants were at least six months post-onset. All the participants had a CT or MRI scan that confirmed left hemisphere cortical lesion. The Philadelphia Naming Test (Roach et al, 1996) consisting of 175 items was used to measure the semantic errors produced in naming. The study focused on errors classified as semantic; these are real word responses that constitute a synonym, category coordinate, superordinate, subordinate or strong associate of the target (e.g. vase for bowl; rose for flower).The Pyramids and Palm trees test (Howard and Patterson, 1992) and the Camel and Cactus test (Bozeat, Lambon Ralph, Patterson, Garrard, & Hodges, 2000) was administered to assess non-verbal semantic comprehension.

Two verbal comprehension tests were also administered; The Peabody Picture Vocabulary Test (Third edition-form A) (Dunn and Dunn, 1997) Structural images were acquired using MRI (n = 34) or CT (n = 30). The results revealed that the four comprehension tests all yielded scores below the mean for healthy elderly controls. Voxel differences were largely seen in anterior temporal lobe and lateral prefrontal areas. The major suggestion provided by the authors is the involvement of anterior temporal lobe which was observed to be most prominent. Significant results were also obtained for Brodmann area 21 and 37 which indicates that the damage to this area correlates the semantic error production much beyond the lesion size.

The main conclusion drawn from this study is the based on the analyses of the main symptom assessed; semantic errors were present when anterior temporal lobe damage is present. The authors hypothesized that based on the weights of the semantic connections activation takes place. Therefore, fine differentiation takes place at the anterior temporal lobe, which when there is a damage to lead to semantic errors. They also mentioned that Brodmann area 37 plays a role in the mapping of concept-word production. When the access is blocked to target phonology, it has been identified to be a possible basis for semantic error production in naming (Caramazza and Hillis, 1990). A part of the medial frontal gyrus that corresponds to Brodmann area 46 and 45 has a well-known association with semantic processing and competitive selection (Devlin & Watkins, 2007). This study provides substantiating evidence about the left anterior temporal lobe lesions and semantic error production in lexical access task.

Radiological studies provide ample information regarding the anatomical correlation and activation of various sites in coordination with certain tasks which provides better understanding about the tasks and areas that are involved in

processing certain specific linguistic aspects. However, it does not give information about the behavioral responses for certain tasks or the speech and language characteristics exhibited by the persons with aphasia.

Different researchers use various methodologies to study language processing in persons with aphasia. Although each methodology may have its own advantages and limitations, they provide a good understanding on the error productions, anatomical sites of lesion and level/severity of impairment. These studies also will help to construct models of language processing, predict the speech characteristics, give insight to intervention strategies and help predict prognosis in certain cases. Therefore, based on the aim and objectives of a study the researcher may opt for an appropriate methodology to study language and its processing in persons with aphasia. The next chapter will focus on the results obtained from quantitative and qualitative analysis for the participants included in the study.

CHAPTER III

METHOD

The aim of the present study was to profile the semantic deficits at discourse level in Persons with fluent aphasia using quantitative and qualitative analysis.

Objectives of the study:

i. To quantitatively analyze the semantic errors produced in discourse by persons with fluent aphasia using Systematic Analysis of Language Transcripts.

ii. To descriptively profile the semantic errors in persons with fluent aphasia using discourse tasks.

3.1 Participants

A total of seven persons with fluent aphasia, three males and four females who were native speakers of Kannada, were recruited for the study. The age range of the participants ranged from 25 years to 68 years and the mean age of the participants was 42.42. Out of the seven participants, one participant was monolingual, three were bilingual and three were multilingual. The education status of the participants varied from eleven years to seventeen years of formal education (ranged from I -PUC- MBA).

Pre-morbidly all the participants were right handed. The post stroke duration of the participants ranged from six months to 63 months. Cerebrovascular accident (CVA) was the etiology for five participants and traumatic brain injury (TBI) and tumor was the etiology for two other participants respectively. One participant belonged to the lower socio-economic status; four belonged to the upper middle

and two belonged to the upper socio-economic status. The demographic of the participants is presented in Table1.

3.1.1 Inclusion criteria

- All the participants were diagnosed as fluent aphasia. The diagnosis was made based on the performance of the participants on Western Aphasia Battery-Kannada (WAB-K; Shyamala & Vijayashree, 2008). Further, it was required to be correlated with the site of lesion.
- All participants were native Kannada speakers.
- All participants had a post onset period of greater than three months.

The factors such as type of aphasia, site of lesion, education, geographical distribution, socio-economic status, languages known, handedness, vocation, family status and any other information have been documented. This information was considered while analyzing the performance of the participants. Participants were selected by adhering to the appropriate ethical procedures as stated by the ethical committee of AIISH, Mysore. The informed consent in writing was obtained from all participants.

3.1.2 Operational Definitions

Cerebrovascular accident (CVA): It is the medical term for stroke which is death or damage to some of the brain cells which is caused due to rupture or blockage of an artery in the brain resulting in lack of oxygen.

Traumatic Brain injury (TBI): it can be referred as damage to the brain that may possibly be permanent caused by injuries like a severe blow, damage due to some external force.

Brain Tumor: It can be defined as an abnormal collection of mass or cells that grow in the brain. These abnormal cell growth or mass can either be benign (non-cancerous) or malignant (which spreads to other parts of the body).

Kannada: It is one of the Dravidian languages spoken by a large number of populations predominantly in the state of Karnataka, India.

Neurotypical group: This group refers to individuals who do not display any neurologically atypical patterns or damage to their brain, for example, Computed Tomography scan reveals normal structure, Magnetic Resonant Imaging reports normal brain imaging.

Fluent aphasia: Fluent aphasia refers to a condition where the individual is fluent and able to communicate verbally but have reduced auditory comprehension ability; and is usually seen in cases where the lesion is in the posterior part of the brain.

Post stroke onset: This refers to the duration that has passed since the episode of stroke.

Qualitative analysis: This is a type of subjective analysis which involves descriptively analyzing and reporting the characteristics observed in a particular data collected from a group of individuals.

Conversation: It refers to spontaneous speech where the experimenter and the participant involve in a one to one conversation where the topic is initiated by either communication partner and maintained by the other partner.

Picture description: This is a task which prompts the participant to give a detailed account of happenings that could be taking place when a set of pictures are presented.

Story retelling: Retelling a story requires the participant to recall, reconstruct and retell a story that he or she is aware of. This task will necessitate the participant to explicitly discuss the plot, characters, events and a summary.

Procedural discourse: This type of discourse requires the participant to describe a process or a procedure involved in a particular task, for example, driving.

3.1.2 Study design

Single subject design was employed in the study.

3.1.3 Stimuli

The following tasks were used to elicit the performance of persons with fluent aphasia at the semantic level:

- Conversation

1. Important life event 2. Stroke story and coping

- Picture Description

1. Broken window 2. Refused umbrella 3. Cat rescue

- Story Retelling

1. Hare and tortoise

- Procedural Discourse

1. Preparation of tea

The above mentioned picture description tasks are a part of the Aphasia Bank Protocol (http://talkbank.org/APhasiaBank) and the story narration task was adapted from the same in such a way to suit the Indian context.

3.2 Procedure

A discourse sample was collected from each of the participant. Each sample of 25-30 minutes duration was audio-video taped and it included all of the aforementioned tasks.

3.2.1 Data Analysis

To quantitatively analyze the data obtained from the discourse tasks, the audio-video samples were first transcribed. The transcribed data included all the utterances of the clinician, the participants and/or anyone involved in the process of data collection. The utterances were coded as 'P' for participant with specific number codes (for example, Participant 1- P1 and so on) and 'I' for investigator throughout all the transcripts.

Following this a consensus was carried out, where another speech language pathologist (SLP) compared the data transcripts with the audio-video recordings for consistency. Disagreements, if any, between the SLPs were reconciled through discussion.

The transcribed data was then transliterated. Codes were given in order to analyze the conversational data using Systematic Analyses of Language Transcripts (SALT; Miller & Chapman, 1991). This provided a quantitative profile of the participants.

A qualitative analysis of the sample was carried out focusing on the semantic error patterns exhibited by the participants. This analysis included:

- Vocabulary
- Word selection (high frequency or content words)
- Paraphasias
- Circumlocutions
- Jargon Utterances
- Semantic substitutions
- Use of indefinite terms

The details of quantitative and qualitative data will be presented and explained in the next chapter.

CHAPTER IV

RESULTS

The communication skills of persons with aphasia can be investigated in different ways which includes quantitative analysis, qualitative analysis or a combination of both. The current study aimed at profiling the semantic deficits at discourse level in persons with fluent aphasia using quantitative and qualitative analysis.

To achieve the first objective to quantitatively analyze the semantic errors produced in discourse by persons with fluent aphasia using Systematic Analysis of Language Transcripts (SALT), descriptive statistics was applied. The different parameters chosen for semantic error analysis in the SALT software were: total words, total different words, type token ratio (ratio of total different words by total words in an utterance) and mean length of utterance in words. The seven participants were grouped into two groups based on their aphasia quotient. Group one included participants whose aphasia quotient was between 50-60 range and group two consisted of participants whose aphasia quotient was in the range of 80-90. The raw scores for various parameters derived from SALT is depicted in Table-2

Table 2: *Raw scores for parameters derived from SALT analysis for all participants*

Participants	**Total words (TW)**	**Total different words (TDW)**	**Type token ratio (TTR)**	**Mean length of utterance in words (MLUW)**
		GROUP 1		
P1	998	230	0.23	5.77
P2	475	163	0.35	6.33
P6	899	204	0.23	8.10
P7	670	231	0.34	10.98
		GROUP 2		
P4	902	324	0.36	10.71
P3	780	225	0.29	5.21
P5	604	269	0.45	5.92

As seen from Table 2, four participants belonged to group one and the raw scores for each parameter obtained are − the total words ranged from 475 to 998, the total different words varied from 163 to 231, type token ratio ranged from 0.23 to 0.35 and the mean length of utterance in words varied from 5.77 to 10.98. In group two, three participants were included whose total words ranged from 604 to 902, total different words varied from 225 to 324, type token ratio varied from 0.29 to 0.45 and mean length of utterance in words ranged from 5.21 to 5.92.

Mean and standard deviation were derived for the comparison of the different parameters mentioned above across both groups is depicted in Table 3.

Table 3: *Descriptive statistics for participant groups*

Parameters	**GROUP 1**		**GROUP 2**	
	Mean	SD	Mean	SD
Total words (TW)	760.5	234.73	762	149.81
Total Different Words (TDW)	207.25	31.42	272.67	49.60
Type Token Ratio (TTR)	0.29	0.06	0.37	0.08
Mean length of utterance in words (MLUW)	7.80	2.34	7.28	2.90

Table 3 shows obvious quantitative differences between both groups for all the parameters evaluated. The mean value obtained for total words were 760.5 (S.D. = 234.73) and 762 (S.D. = 149.81) for group one and group two respectively. The mean scores for total different words were 207.25 (S.D. = 31.42) in group one and 272.67 (S.D. = 49.60) in group two. The type token ratio mean values were 0.29 with S.D. of 0.06 in group one and 0.37 with an S.D. of 0.08 in group 2. The mean scores of mean length of utterance in words were 7.80 (S.D. = 2.34) and 7.28 (S.D. = 2.90) in group one and group two respectively. The mean scores obtained for both the groups have also been represented graphically in Figure 3.

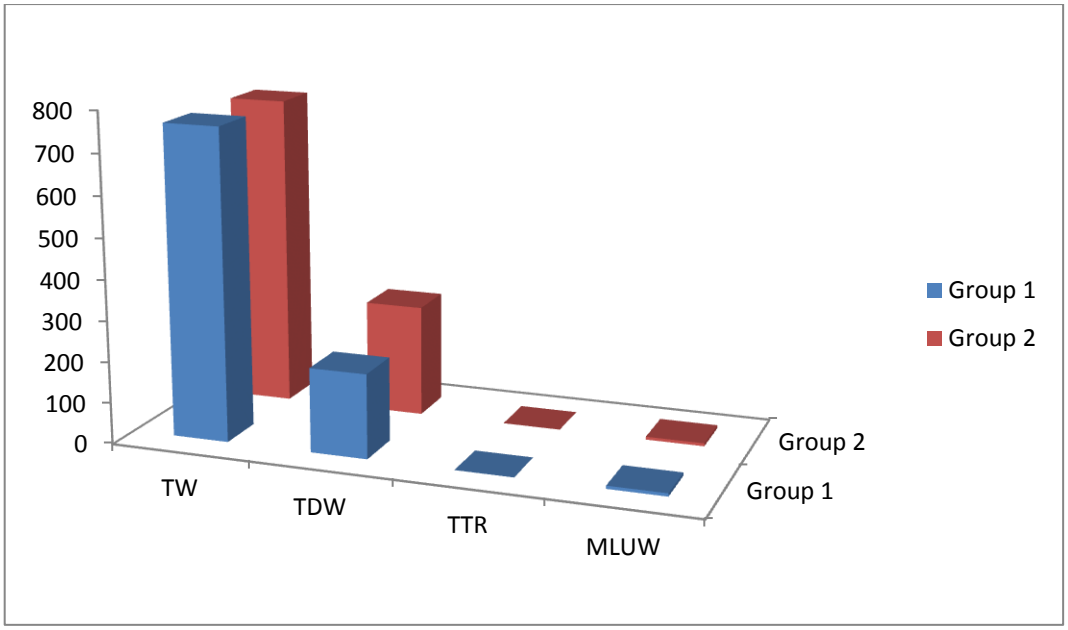

Figure 3: Mean values for different parameters assessed in SALT for the participant groups

The standard deviation was relatively high for total words and total different words which suggest great degree of variability among each of the participants in both the groups. As the participant size was small and there was high variability among the participants, the quantitative data could not be subjected to further statistical measures. Therefore, assessing communication skills quantitatively will not provide the deficits exhibited by each of the participants. For this purpose the data was subjected to qualitative analysis which was the second objective of the present study.

The communication skills in spontaneous speech, picture description, story retelling and procedural discourse were analyzed qualitatively. The group considered for qualitative analysis was based on the diagnosis of aphasia. Four participants were diagnosed as conduction aphasia, two participants as anomic aphasia and one participant was diagnosed as Wernicke's aphasia. Therefore, the

results obtained were for each participant but grouped according to the type of aphasia.

4.1 Anomic Aphasia

4.1.1 Participant 4 (P4)

P4 was involved in a general conversation where he was asked about the languages known to him and the proficiency in those languages. He was verbally able to respond appropriately. He occasionally used gestures and fillers while searching for words. The participant was also able to talk about the events and changes after therapy and, recall and sequence certain events that happened recently. An account of the stroke event and the coping, and an important life event was given adequately including all the information. There was appropriate use of tense and case markers, verbs and noun forms and pronouns. However, he exhibited whole word repetitions, unintelligible utterances. In some isolated instances inaccurate pronouns, tense forms and semantic substitutions for verbs were observed.

(The below given is an excerpt from the transcription. P: participant, I: investigator, xx- unintelligible utterances; Similar excerpts will be given as examples of the errors for each participant)

P4 : Nange actually ondu ondu wordange speak maaDake aagta irllilla like that yaavdardu xx but ill bandmele nange ishTondu fluentagi maataaDadu adu ondu great thing matte handring- hand-handwriting baritaayide andre adike swalpa time saakagilla haagaagi biTbiTTe adu matte imyu atara ellaru class anta hodre definite work maaDtiradu xx namge maaDi anta heeLidre namm maaDeilla

In picture description and story retelling task, the participant was able to understand and provide a detailed account of the events depicted. He was able to sequence and include all the key elements while narrating. Inaccuracy was observed while describing pictures in terms of tense and verb form use. Semantic substitutions of verbs and naming difficulties were also noticed.

Picture description

P4 : Amele madya hoogbeekidre maLe start aagbiDute. Avaaga avenge feel aagute heeLadu keeLbittu anta. Full ode aagtaane maLe bartaane amman kaiyal bayiskoDtane xxx tirigikonD hogtaane (Refused umbrella)

P4 : aa.. bekku bekk bekkuna ilisakke bartaayidare (Cat rescue)

Story retelling

P4 : naanu ooDe oDtaane idu maaDtini athava een een kelsa maaDakenu overconfidence irbeku over overconfidence irbaradu. En agutte ibrugu aame mattu molage ibrugu

In procedural discourse, he was able to give an elaborate procedure including ingredients and instructions required to prepare a cup of tea. Few unintelligible utterances were produced and minor errors like inaccurate tense forms were observed.

P4 : Idu.. ondu boosi tannadu adu ondu ashT ashTuna ashTu ready iDkobeeku. iDkondu firstu stove aci.

Overall, the participant was able to maintain more than ten words per utterance. Throughout the conversation, across all tasks he produced fillers and syllable and whole word repetitions with two-three iterations. He exhibited code

switching between Kannada and English while experiencing word finding difficulties. He also attempted to self-correct in connected speech.

4.1.2 Participant 5 (P5)

During the spontaneous conversation, the participant responded accurately and appropriately to all the questions posed to her. She required some probing for certain questions. There was appropriate use of tense and case markers, verbs and noun forms, and pronouns. For stroke story and coping, she was able to give a brief account of the events and also was able to narrate them in the right sequence. Circumlocutions were observed when she experienced word finding difficulties.

P5 :hmm..henge hmm idu bandbiTTe idu aadmeele idu hing maaDi hing maaDi heeLkotru.. idu xxx maaDi hang maaDi maaDu aa chanaag gotirbeeku anta nammgadu adu yaarugu gothirlilla adunna

In picture description and story retelling, the participant was able to give the main outline and sequence the events that take place in the right order. She was also able to give adequate information related to the key elements in each picture. Occasionally, errors were produced in terms of inappropriate tense forms and semantic substitutions.

Picture description

P5 : man mantu window idu idu window kiTaki haakirtane. Adu taakbiTTu, adu olagade odugbiTTu alli kuutirtane obba. Avnu nindkonDu noDtane. Moo..ol ninkonDu noDtane (Broken window)

P5 : mhm. Naayi huDugta irutte. Eenike anta ellaru huDugta irvaaga am-ambulance pakka catri na aa.ambulance ala, fire ambulance. (Cat rescue)

Story retelling

P5 : idu neen oDtiya naan oDtiya munde anta noDtare, aamele nidhanake naDkonD naDkonD bartaide, hare maatra fast agi oDta irutte. aame metige metige oDta bandu bandu finish line ge daaTi bantu

She was able to give detailed description of the instructions and step by step procedure for the preparation of tea in the correct sequence. P5 also used appropriate tense and verb forms, case markers and nouns.

P5: ond paatre, ond paatradalli ond cup niir haaki. Aa cup niir haaktiri, ondu cup niir haaktiri. ishTu glass mm.. aa..haalu haaktivi, amele kuduke stovealli iTiDdivi adu kudutairvaga haalu sakkare haaki ond camca sakkare haaktivi matte aa.. tea powder ardha camca haaktivi adu kudita kudita avaaga off maaDi. Strainer togonDu off idu togonDu a idu pour maDtivi matte coffee cup full.

Overall, the participant was able to maintain six to seven words mean length of utterance in word level. However, she produced fillers, syllable and whole word repetitions while experiencing word finding difficulties.

The errors produced by each person with aphasia are summarized in Table 4, 5 and 6.

Table 4: *Errors produced by persons with anomic aphasia*

<table>
<tr><th>Participants</th><th>Spontaneous speech</th><th>Picture description</th><th>Story retelling</th><th>Procedural discourse</th></tr>
<tr><td rowspan="2">P4</td><td>Occasional errors in pronoun and tense use</td><td colspan="2">Inaccuracy in verb and tense forms,</td><td rowspan="2">Few unintelligible utterances, fillers and repetitions</td></tr>
<tr><td colspan="3">Semantic substitutions of verbs, naming difficulties</td></tr>
<tr><td>Overall impression of communication skills</td><td colspan="4">The participant was able to appropriately initiate, maintain and terminate topic. He had adequate local and global coherence. Word finding difficulties were exhibited in terms of disfluencies.</td></tr>
<tr><td>P5</td><td>Circumlocutions</td><td colspan="2">Occasionally inappropriate use of tense forms and semantic substitutions</td><td>Fillers, syllable and whole word repetitions</td></tr>
<tr><td>Overall impression of communication skills</td><td colspan="4">Adequate cohesion and coherence was maintained at local and global level. Disfluencies were produced when she experienced word finding and retrieval difficulties.</td></tr>
</table>

4.2 Conduction Aphasia

4.2.1 Participant 1 (P1)

P1 exhibited difficulty completing the utterances. He appeared to be shy and conscious initially and therefore responded to questions in a low intensity.

However, when asked if he could recall any story that he is aware of he was able to give a brief outline immediately without any hesitation.

I : cikk cikk kategaLu, nenupidiya yaavdadru?

P1 : swalpa.. nari xx nari nari xx drakshi adu togobeku anta adu drakshi mele mele anta.

During the stroke story and coping, P1 mentioned the incidents that caused the accident in short. He also hinted that he lost consciousness and therefore does not remember most of the events that took place. He also could not recall any significant life event instead he gave a small account of a temple he visited with the family. Naming difficulty was exhibited to name places when asked to talk about an important life event. The events were not explained in the right sequence and some important events were left out. This was observed even in story retelling task.

P1 : aane mola aame mola avr ibbru aavaga hoytu ondu hogvaga mola enappa canagidiya heeLtaaidri nintaaga enappa uuTa ayta anta. aame nidhanagi hogtaa irutte aavaga idu jaasti hogakke hoge hogi du ishT bega anta xx hogbeDa anta ishT nidhanak bantu aavaga nidde maaDtane ivnu hogtaane xx bandaaga xx barutte.

During the picture description task, the participant was able to connect the pictures and give a description. He was able to identify most of the main elements. There were occasions where the participant exhibited whole word repetitions. More high frequency words were used than low frequency words. Also inappropriate use of pronouns in connected speech was observed. Difficulty was

observed in terms of low frequency nouns, circumlocutions, syllable repetitions and fillers were observed.

P1 : ond huDuga huDuga ball ball illi ball togonD kaal kaal inda hogu anta.*

I :hoDidda.

P1 : idu ball hodaaga ball kaalinda hoDdaaga ikaDe ide.(Broken window)

There were some unintelligible words produced, semantic substitutions and confusions were seen in terms of what person markers and case markers were to be used for people and inanimate objects and/or animals. Recall of certain abstract words and low frequency words was difficult. This was also observed in procedural discourse task. He was able to name all the ingredients needed in the preparation of coffee. However, instead of talking about coffee he substituted for tea powder and completed the procedure.

Picture Description

P1 : benki ella niiru niirinda haaku togonD hogtini

I *: uh huh adu en adu?*

P1 : vimaanadalli idu

I : vimaanadalli idaara? fire engine keeLilva niivu?

P1 : uh huh en anta niir bandaaga xxx (Cat rescue)

Procedural discourse

P1 : haaki aadmele idu ondu aa haalu haaktivi. haalu mele haalu mele haalu mele sakkare.

P1 :sakkare haakmele xx tea haaki tea haaki tea haakilla anta tea haaktini amele.

Overall, performance improved when semantic cues and probed for additional information that the participant missed to focus on during the different tasks.

4.2.2 Participant 2 (P2)

P2 was first involved in general conversation. She responded appropriately and asked to speak about the stroke and coping. She gave a detailed description of the events that took place.

P2 : yoga maaDtaaide naanu xx yoga maaDtaaide niir kuDi beku ishTu, mummy na karitaayidini maataDak aagtailla.

Even though the participant gave a complete account of the stroke event, she used fillers and incorrect tense forms to convey the message. In the description of an important life event, she spoke about a day at an amusement park. P2 exhibited difficulty recalling names of the different activities and the water games she played. Seven- eight words were maintained in each utterance. She was able to connect the pictures and pick out the key elements in the pictures for the description task. The participant used inappropriate pronouns for people, tense forms and case markers were not used correctly. Circumlocutions were seen in cases where she was unable to describe the picture.

P2 : idu maLe baruute anta idu heeLtane beda nange idu beda anta heeLtaaidane avnu (Refused umbrella)

She was able to describe all the three situations represented pictorially with minimal probing from the clinician. Semantic substitutions were noticed for low frequency words.

P2 : amele, police hodru, chair eeNi etkondidane. Fire engine ide

I : okay, so ee police eenike eeNi togonD bartidaare?

P2 : bekkuna kapaadakke. (Cat rescue)

For story retelling, P2 was aware of the main outline of the story, named the characters correctly and identified the main idea the story was revolving around. The case markers and tense form used in the story retelling task was fairly appropriate.

P2 : idu aame matte mola. Mola running race maadutte. Idu mola matte aame nintkonDu amele running race maaDuvaage ond chuuru sustaagoytu.

P2 : nidde maaDutte, nidde maaDtaaide, amele aame running race maadkonDu baruute. Bandaaga mola ille nintirutte, idu fastag bandu taDkondirutte.

The participant described the procedure and named each ingredient as and when required in each step. She was able to sequence and explain the procedure without leaving out any important components.

P2 : tea puDi, amele sakkare, haalu togo beku. togonDu stove acbiTTu, paatre iTbiTTu amele haal haakbeku, haal haakbiTTu kuditaairutte, kuddaaga tea puDi haakbeku, tea pui haakbiTTu ond swalpa idu maaDbeku

P2 also was provided cues by her mother, who would provide phonemic cues to help her recall the word and in naming. Occasionally semantic cues were provided by the investigator to help recall the names and items in the picture. She also used gestures to communicate when she was unable to name certain items.

4.2.3 Participant 3 (P3)

P3 was asked to talk about an important life event where she spoke about the birth of her sons. She provided a brief outline of the events that took place at the hospital at the time of delivery. While giving account of another event, she was able to provide much more details. It was an unfortunate event that she spoke about, a road accident she witnessed. She maintained seven-eight words in almost each utterance. In some occasions, P3 also exhibited syllable repetitions. While telling the happenings in a sequence, tense forms were not used appropriately.

P3 : yake nange eshTu maaDtaaide andre banni yellru ondu yellaru etkoLi amele naanu een beku maaDtirtini banni banni anta kuugtaaidini

The participant was able to use appropriate tense forms, but verb substitutions and switching to English was observed while describing few pictures. She was able to sequence all the pictures and in story retelling also, she was able to include all the main segments needed to complete the description and mentioned the main event in the story which is the running race. Inappropriate use of verb forms, case markers, pronoun confusions was noticed, but she ended the story with its moral. When abstract words were to be used the participant had difficulty and she expressed that she is unable to describe that particular component. So she explained one set of pictures based on her assumption and understanding. The investigator had to ask point to each object and bring the missed out elements to the participant’s attention after which she was able to include those in her description.

Picture description

P3 : ade ivru yelli idaare aa mm football yaaro biddidde ivaaga yaar manege bartidde hoDtiddaro avru ayyo idu eenu avru maaDtidare anta hinge kopadalli maaDtaaidare (Broken window)

C : ivange beekare hogu keLagaDe hogu anta heeLi ii eeNige maaDkobodu

C : uh huh bekkuna help maaDbohdu (Cat rescue)

Story retelling

P3 : amele ivnu tom-tortoise amele umm aa obba naanu matte niinu running hoga aa mm running race hogtaare amele ivnu aa muncane hogbiDtaare matte idu tortoise avru canagi metage naDkonD bartane. amele ivru aa tumba nidhanakke bartane matte naane ond swalpa mal- malkonDu matte malkonDu hogbeku hogli anta malkonDu idane avaaga aa tortoise bartaa irtaare oh ivru malkonDu iruva Sali naane hogbiDaNa anta finishing line banbiDtaare amele ivnu ayyayo ivnu eno naanu second bandbiTTe ashTe.

The participant used more of content words and high frequency words while describing the procedure. Circumlocutions were observed while explaining some steps. She was able to sequence each step appropriately.

P3 : tea henge maaDadu anta maaDbeku andre ondu bisi mm niiru maaDbeku amele tea so-powder haakbeku amele nange hege maaDtaare adu maatra heeLtini umm matte ginger amele adu maaDtini amele boil maaDtini amele mm mm xx umm haalu nange ondu ondtara maaDkonD amele kudistini amele idu sugar haakonD haaktini.

P3 required phonemic cues for naming certain places and did not provide a complete picture. She exhibited naming difficulty and used fillers in multiple occasions.

4.2.4 Participant 7 (P7)

P7 was involved in general conversation and then asked to narrate an important life event. She spoke about reading as a hobby and doing embroidery work as something she enjoyed. The participant did not exactly talk about a life event but spoke about the activities that make her happy. She maintained more than ten words in each utterance. While speaking about the stroke story and coping, she was able to give a brief account of the events.

P7 : namge oodtaara pustagaLu, swalpa oodsa jaasti naanu. Adu enaaru kategaLu ella oodtaaide, iiga pustakagaLu oodtaaide iiga martogide iiga, iiga kashTapaDtini andre tumba try arthanu fast fastah bartailla.

The participant first described all the objects in the picture and then tried to associate it with an activity. Focus was made on the unimportant details and thus leaving out to describe or mention the key elements in the pictures. Semantic substitutions were made and some words were switched in English. Jargon words were used during the description of one picture set. Confusions were observed in terms of tense use, case markers and pronouns.

P7 : Amele idu maLe banbiDutte. maLe banbiDittalla anta hing maaDtne. Amele ivLu, avan amma noDtaaLe, ivanna noDtaaLe, But eLLe magu papa..amele amma celt(catri), iDkonDu , adunna haakonD hogtaane. (Refused umbrella)

P7 : idu maradmele cat. ivLu, avaL appa hattmele eDudbiTTe kaTTkonbiTTide hange. avaaga cat na biDskobekalla. Adu avLu kashTa paDtidaaLe. ivLu cycle ooDkonDu hogTogtaaLe, ivLu mara hattbiTTu hagga haakOndu noDtaaLe magu. Ade idu ii magu naayi mele hattakke hogtaaide, amele illi barutte, ond gaaDi maraxx barutte . amele ivru ladder togontaare. Ladder togonDu idu togonDu bartaare busnindella togonD bandu, aa ladder na ibbru etkonD hogi alli haaksbiTTu adunna survive maaDutte. (Cat rescue)

P7 produced circumlocutions while trying to retell and had difficulty in naming the characters in the story. She focused more on the unimportant details and, unintelligible utterances inappropriate verb forms were observed. She added more characters to the story and moves out of the actual story outline getting distracted with the added characters, she is unable to maintain the same story and gets deviated from the storyline.

P7 : ivru ibbruve en maaDtaare, makkaLuge iruttella. Avnu hing bandbuDtaane, aa modlunna catch maaDakke iLiyak hogtaane, iLiyak hodre, tortoise noDtaairutte. Tortoise noDkobekaare ivru eraDanuve hakkigaLu illirutte. AlnoDi hakkigaLu hakonD noDtaairutte, idu yelladukinda doDDadu, tallagi iruttalla xxx adunna noDutte. Adunna noDkonDu adu xxx nintkoLak try maDutte.

The participant was able to describe the procedure and name all the ingredients. There were some unintelligible words, word repetitions and confusions in terms of what pronominal use is required. She was able to describe appropriately step by step preparation with no help or cue provided by the investigator.

P7 : tea maaDadu, niiru mele, swalpa niir iTirtivi, aa niir kaaybiTTu, niir yaavaga kuditaairbekaare ond spoon powder haaktivi. Amele ond camca sugar haakbiDtivi, bekaare swalpa masala haakbohdu. Adu masala xx cenaag irutte elekke, cakke, xx adella xx haakbiTTu cenaag irutte. Amele swalpa cenaagi kuditairutte. Kudiyadaaga swalpa haalu add maaDtare. ond aidu nimisha kudiyutte, kudid mele filter maaDbiDtare, amele kudiyutte. Finish.

Table 5: *Errors produced by persons with conduction aphasia*

Participants	**Spontaneous speech**	**Picture description**	**Story retelling**	**Procedural discourse**
P1	Naming difficulties, sequencing errors and missing elements (places, activities, who accompanied him)	Whole word repetitions, more high frequency words, circumlocutions, syllable repetitions and fillers were observed.	Focus on less important details, sequencing errors, naming difficulties	unintelligible words produced, semantic substitutions
Overall impression of communication skills	The participant was able to initiate and maintain topic. He had minor difficulty in terminating topic and inhibiting less important information. He was able to maintain fair local coherence however; the global coherence is slightly more affected.			
P2	fillers, naming difficulties	Circumlocutions, semantic substitutions	Minor errors in use of	Gestures used to aid in naming

	Inappropriate use of verb and tense forms; pronouns and case markers	verb and tense forms and case markers	
Overall impression of communication skills	The participant had good topic maintenance and termination skills. She was able to fairly maintain coherence at the local and global level.		
P3	Syllable repetitions, inappropriate tense forms	verb forms, case markers, pronoun confusions, missing elements, verb substitutions	Circumlocutions, more content words and high frequency words
Overall impression of communication skills	The participant had fair topic maintenance and termination skills. She was able to maintain fair local coherence and a good global coherence.		
P7	Lack of thematic coherence	Semantic substitutions, Jargon words Circumlocutions, Inappropriate verb forms, tense use, case markers,	Pronoun confusions, unintelligible utterances, word repetitions
Overall impression of communication skills	The participant had a difficulty in termination of a topic but fair topic initiation and maintenance skills. She had fair local and global coherence and cohesion, and difficulty with referents and situationality aspect.		

4.3 Wernicke's Aphasia

4.3.1 Participant 6 (P6)

P6 was initially engaged in a spontaneous conversation. The clinician asked questions related to the number of languages known to him. He responded appropriately and commented on the proficiency of the languages known to him. The participant exhibited difficulty in joining the words in the right sequence in long utterances. Inappropriate word selection and production in terms of nouns, verbs and pronouns were observed. He was unable to main the topic of discussion which was significant life event. He continued to speak about the previously discussed topic which was about the stroke and the changes it caused in his life. This indicates that he found it difficult to terminate a topic and shift to a new topic of discussion.

P6 : niiv idu niiv heeLaddu ondu adu jaasti paDtaide namge ivru yaaru heeLtiruve inta xx barutalvala adu togolke yaargu gotaagalla naav naave maataaDtaidivi ella noDkobohdu ante ne

In picture description, the participant was able to understand the main outline and provide a brief account of the happenings in the picture sets. However, he was not able to connect all the pictures and therefore missed some elements while narrating. P6 focused on the less important details in the pictures and syllable repetitions were also present. Remote paraphasias were exhibited which also appeared like a stuck in type of perseveration and in some instances, he exhibited phonemic paraphasic errors. Inappropriate use of case markers, tense and verb forms were also observed. Stuck in type of perseverations were observed when shifting from one picture set to another.

*P6 : bandaagi ivan en maaDtane pustaka*pustaka iDkonDu nintkonD irtane alla idu xx haagi nintirutidde. bandu noDbiTTu noDtane cenDalli melgaDe ninda belle*belle (Refused umbrella)*

Semantic substitutions were also observed for related nouns, code switching between English and Kannada in a single utterance was noticed.

P6 : tande adu maneyalli irbeku

I : tande alvala?

P6 : taayi, ade (Refused umbrella)

Neologistic utterances which were a result of recurrent perseveration were also observed such as:

P6 : idu pustaka matte cenDa hing ishTu ooDtane alva

I : correct

P6 : hing irtane, avnu noDtane.(Broken window)

*P6 : taayi melgaDe nintidde xx banni banni anta heeLtane so idu illi barbeku anta noDirtini alle irtare adu barudilla haage biTTide*haage biTTide. ade xx ondu eraDunuve hinge barta irtane namge beku andre melgaDe hattkontare xx cenDuna hattake (Cat rescue)*

In story retelling, the participant exhibited difficulty in naming the characters and so, phonemic cues were provided by the investigator. P6 did not sequence the events in the story in the right way and used the actions depicted in the pictures to say what the characters in the story were doing. He was able to express the main

story outline but the output varied in terms of use of tense and case markers, verb forms, and pronouns.

P6 : ivnu en maaDtane andre nange canag gotu pa hange kuuraNa anta ivne gotidde alla ivne bartane illige. idu ooDtaaide alla, il kuutirtare ibbruve xx xx

In procedural discourse, the participant produced phonemic paraphasias, case markers, tense and verb forms were used inappropriately. The procedure was not explained in the right sequence and he explained more about what his family members do at home to prepare tea. He was not able to terminate the topic and the investigator had to indicate him to stop.

P6 :tea?

I: uh huh, heeLi.

P6 :ade nimge tv

I : tea

P6 : tea torstivi nim maneyalli tea canagirutte anta namge tea adirinda togo beku andre namge manenalli athva naanu maaDbohdu illa nan taayigaLuge maaDi anta heeLtivi first

Table 6: *Errors produced by persons with Wernicke's aphasia*

Participants	**Spontaneous speech**	**Picture description**	**Story retelling**	**Procedural discourse**
P6	Inappropriate word selection,	Neologistic utterances,	Naming difficulty,	phonemic paraphasias,

	sequencing errors, inappropriate use of verb and tense forms	recurrent perseverations, semantic substitutions, phonemic paraphasias, stuck in perseverations	Inappropriate use of tense and case markers, verb forms, and pronouns; sequencing errors
Overall impression of communication skills	The participant exhibited difficulty in topic maintenance and termination; local and global coherence is affected.		

CHAPTER V

DISCUSSION

The aim of the present study was to profile the semantic deficits at discourse level in persons with fluent aphasia using quantitative and qualitative analysis. Differences in performance of different parameters for each participant in each group and across groups have been gathered from the results of quantitative and qualitative analysis. However, the range of scores varies due to multiple factors such as the education, occupation, language status, socioeconomic status and caregiver support, to name a few. The following section will discuss the semantic deficits exhibited by each participant and across two groups from the results obtained from quantitative and qualitative analysis.

5.1 Quantitative and Qualitative deficits

P1 obtained raw score of 998 for total words, 230 for total different words, 0.23 for type token ratio (TTR) and 5.77 score for mean length of utterance in words. The qualitative analysis revealed that the participant experienced naming difficulties, explaining events in a sequence and thereby missing the key elements of the events. He also produced semantic substitutions, more high frequency words and circumlocutions. The findings indicate that although the participant produced a large number of words, the variability in vocabulary was quite less, which is reflected in the scores of total different words and the TTR. The qualitative analysis showed semantic substitutions being exhibited which possibly indicates relatively preserved semantic representations however; the access to multiple items in the same category might be limited. The usage of high frequency

words more than the low frequency implies that the threshold of activation for those words is much lesser when compared to low frequency words. Similar findings have also been reported by Santo Pietro and Rigordsky (1987) who looked at the frequency effect using naming and picture description task. They reported that perseverations increased as the word frequency decreased in both the tasks.

Therefore, it can be deduced that this participant was using the vocabulary more economically to convey the main idea or concept. Thus these findings support the basis of economy model for communication (Pick, 1923). Language status and education of the individual could also contribute to performance in different tasks. He was a monolingual and possibly exhibited repetitions (whole word and syllables) and fillers while experiencing naming difficulties. He belonged to the lower socioeconomic status, completed higher secondary education and was pursuing higher education at the time of testing. He also attended college on a regular basis, stayed in a hostel facility and therefore, there was no primary caregiver present with him to fulfill his functional and communication needs. He reported that a couple of times in a week, he would have a meal with his friends and therefore it can be inferred that his communication opportunities were limited.

P2 secured 475 for total words, 163 for total different words, 0.35 for type token ratio and 6.33 for mean length of utterance in words. It can be assumed that although her total words score is low, comparatively she produced more variety of words which is reflected in her TTR score. Inappropriate tense and verb forms, pronouns and case markers were observed from the qualitative analysis. Semantic substitutions, circumlocutions, naming difficulties and fillers were also noticed

and documented. The substitutions and circumlocutions are indicative of inadequate access to the lexical semantic representations. The inappropriateness of tenses and verbs, pronouns and case markers suggest that there is no inhibition of semantic activation while shifting from one picture to another. She was bilingual, completed her higher secondary education, belonged to the upper middle socioeconomic status, not pursuing higher education and was unemployed and at the time of testing. She was supported by her mother who helped her functionally in everyday routines and during communication. The participant's mother reported that P2 was fairly independent in doing simple household chores and was able to independently go for walks which show that she had limited opportunities for communication.

The raw scores obtained by P3 for total words, total different words and TTR were 780, 225 and 0.29 respectively. The participant secured 5.21 score for mean length of utterance in words. Although her total words was relatively high, the variety of words produced was restricted which showed in the low TTR score. Qualitatively when assessed circumlocutions, inappropriate tense, verb and case markers; more use of high frequency words and content words were observed. The use of more high frequency words indicates that the participant requires less activation threshold to access those words and thereby less effort while communicating. Content words produced more than function words suggests that as the semanticity associated with those words are strong which makes them comparatively easy for retrieval. Inadequate inhibitions while shifting from one topic to another might lead to inappropriate use of tenses, verbs and case markers. Miceli et.al (1984) reported similar findings in their study which stated that verb naming was found to be difficult in persons with fluent aphasia when compares to

nouns. The participant was a multilingual, completed graduate degree, and belonged to an upper socioeconomic status. Her mother and husband provided support in terms of functional and communication needs. She reported to be a very social person premorbidly and currently has various opportunities for communication.

P4 secured a score of 902 in total words, 324 in total different words, 0.36 in TTR and 10.71 in mean length of utterance in words. In the qualitative analysis, it revealed that the participant exhibited semantic substitutions of verbs, definite naming difficulties, few unintelligible utterances, fillers and repetitions. The total utterances include all the verbal output including the disfluencies which is reflected in the total words score. However, in comparison the total different words produced is limited and so the TTR score is slightly reduced. He produced occasional errors in pronouns, verbs and tenses. The participant had difficulty in retrieval of less frequently used verbs. This indicates that the verbs that have more semanticity and less activation threshold are relatively easy to retrieve. P4 also maintained an adequate mean length of utterance in words which implies that he was able to connect words together in one utterance to convey an idea, i.e. he maintained adequate coherence at the local and global level. He belonged to the upper middle socioeconomic status, was a multilingual, working as an assistant sales manager and was in an environment that promoted communication. His wife also supported in fulfilling his needs in functional activities and communication.

The scores secured by P5 for total words were 604, 269 in total different words and 0.45 in TTR. The participant's score for mean length of utterance in words was 5.92. As seen from the scores, she produced comparatively less total words. However, the total different words produced were relatively high and thus

reflected in the high TTR score. P5 obtained the highest TTR score when compared to all the other participants. It can also be noted that the overall mean length of utterance in words is fairly reduced which suggests that she had difficulty in adding multiple words due to reduced retrieval ability in a single utterance thus producing shorter utterances to convey meaning. Kintz et.al (2014) reported similar findings where persons with anomic aphasia exhibited retrieval difficulties however; preserved semantic knowledge. The participant showed occasional errors in tense forms, produced semantic substitutions and fillers along with repetitions. Due to the naming difficulties, she produced semantic substitutions which points to the fact that words that require less threshold for activation can be more easily retrieved. Also, to maintain the flow of speech the participant produces disfluencies while facing difficulties in retrieval of words. She was a multilingual, holds an undergraduate degree and belonged to an upper socioeconomic status. She reported to be a very social person premorbidly and post stroke her mother aids in fulfilling functional needs and facilitating communication.

P6 obtained 899 as a raw score for total words, 204 for total different words, 0.23 for type token ratio and, in the mean length of utterance in words he obtained a score of 8.10. The high total words score and low score TTR is an indication that although more words are uttered, the vocabulary produced is limited. When the data was assessed qualitatively, it was found that the participant produced sequencing errors, used inappropriate verbs, tenses, pronouns and case markers in different tasks. This indicates that inadequate suppression is taking place while shifting from one task to another and possibly reduced activation while describing a new concept. Stuck in type of perseverations produced by P6 can also be

interpreted as due to lack of lack of suppression of the linguistic units activated. It can be hypothesized that the cognitive adaptation is limited in this participant while shifting from one task to another. Phonemic paraphasias produced can be explained as due to the co-activation of the target (lexical representation) to the produced and an already active unit which is the competitor. The appropriate selection and planning at the phonemic level followed by implementing at the articulatory level might be affected leading to inappropriately produced words with minor substitutions of phonemes.

Kurowski and Blumstein (2016) hypothesized the same in their study looking at the production of persons with fluent and non-fluent aphasia. They reported that the speech errors produced by these individuals where a word has the properties of multiples phonemes is due to the activation at two sites, lexical level and the phonemic level. The participant was a bilingual, graduate and was from a political background and belonged to the upper middle socioeconomic status. Premorbidly he was involved in many social activities and services, however; post stroke his communication opportunities and social participation reduced. His daily activities and communication needs were supported by his wife.

The total words score, total different words and type token ratio obtained by P7 were 670, 231 and 0.34 respectively. She obtained a raw score of 10.98 for mean length of utterance in words. She was able to produce a large number of words and relatively less different words which is reflected in the fairly reduced TTR score. She exhibited reduced thematic coherence, semantic substitutions, jargon words, circumlocutions, unintelligible utterances and word repetitions. These findings indicate that concrete concepts are easily accessed and retrieved when compared to abstract concepts therefore she had difficulty producing thematically

coherent output. Contradictory findings were reported by Bird et.al (2003) where the concrete noun naming was impaired when compared to abstracts nouns. They also reported that naming of verbs was relatively spared in persons with fluent aphasia. Inappropriate usage of verbs, tenses, case markers and pronoun confusions were also observed in P7.

These errors indicate that there is reduced suppression of these features while shifting from one topic to another. It can also be hypothesized that the suppression might be taking place however; the activation threshold is not met while initiating a new topic. She was supported by her husband who helps her functionally for her daily needs and facilitates in fulfilling her communication needs. P7 was a bilingual, completed her higher secondary education, was a homemaker and belonged to the upper middle socioeconomic status. She and her husband lived alone and quite away from other family members. She informed that she was involved in household chores and kept herself occupied with her hobbies like stitching and doing embroidery work. It can be understood that her communication opportunities are limited.

Participants who were bilingual and multilingual were able to use code switching while experiencing naming difficulties. It can also be observed that those participants who were involved in social participation premorbidly, continued to be verbose post stroke. It can be hypothesized that certain factors like the premorbid social participation, personality, education, occupation and language status also influences the performance and use of vocabulary in the participants. Other factors like medical services received and caregiver support might have also contributed to better performance in the participants.

5.2 Quantitative deficits across the groups

The four parameters assessed in SALT analysis yielded obvious differences in scores across both the groups. The mean scores for total words, total different words and type token ratio were 760.5, 207.25 and 0.29 respectively in group one. On the other hand, group two obtained 762, 272.67 and 0.37 scores for total words; total different words and type token ratio respectively (refer Table 3 for mean values of both groups on page 47). These results suggest that participants with comparatively better aphasia quotient are able to produce a large number of words and different vocabulary which is seen from the better scores in TTR.

These results are in accordance with the study conducted by Gordon (2008) who reported that TTRs significantly correlated with the severity of fluent aphasia. The better performance can also be attributed to the language status; all three participants belonging to this group were multilingual; they completed higher education and were actively involved in social participation premorbidly. However, it can be noted that the standard deviation (S.D.) values are quite high for total words and total different words (refer Table 3 for S.D. values of both groups on page 47). This indicates that there is individual variability in the performance of each participant belonging to respective groups. The S.D. values for group two can be attributed to the diagnosis of aphasia of one of the participant (P3) which was conduction aphasia, whereas the other two participants (P4 & P5) were diagnosed as anomic aphasia.

The mean length of utterance in words was 7.80 for group one and 7.28 for group two. The minor differences of mean values in both groups suggest that even though group one produced less words and restricted vocabulary, these

participants constructed longer utterances. On the contrary, even though the participants of group two produced more variety of words, they produced comparatively shorter utterances. This indicates that the participants were able to use the vocabulary with less effort in constructing phrases and sentences. This further substantiates the economy of effort model for communication. It can also be understood that although the mean length of utterance in words is reduced in group two, they had adequate communication intent, were able to use a relatively wide range of vocabulary and also able to produce coherent verbal output. Whereas, although the participants belonging to group one produced a large number of words; the vocabulary was restricted and the quality of verbal output was reduced.

Hence, it should be noted that large number of words produced does not reflect the range of vocabulary and TTR may be an appropriate quantitative measure to analyze the variety of words used by an individual. Also, the mean length of utterance in words does not directly correlate to the quality of output. The individual may be able to join words appropriately and construct shorter utterances and simultaneously convey the important information. Therefore, it is necessary that the clinician should not depend on only quantitative analysis assessing a few parameters rather; the errors should be analyzed both quantitatively and qualitatively.

5.3 Processing of semantic features and its activation

All the seven participants exhibited certain features which varied to certain degree across tasks. These characteristics observed in them were usage of high frequency words than low frequency, more concrete concepts than abstract and;

content words than function words. Inappropriateness was observed in terms of use of verb and tense forms, pronouns and case markers in most of the participants in varying degree across different tasks. These characteristics can be explained by the Spreading activation theory proposed by Quillian (1967), which states that there is a spread of activation that takes place from one node to another until the multiple nodes make contact. Every concept can be assumed to be represented as a semantic node and its features or core properties serve as links to relate or connect from one node to another concept node. Quillian (1969) hypothesized that priming, a tracing process, takes place as a part of memory search. So, when one concept is primed it tags the activation and spreads by tracing a vast set of links in the semantic network.

When a new concept is introduced via any sensory modality, the tags activated make contact with the previously activated tags to find an intersection. Also, the strength of each link can be attributed to multiple semantic concepts associated to a particular link. Therefore, the use of high frequency words is suggestive of those links that get activated at a faster speed due to frequent use of those words when compared to low frequency words that are less frequently accessed in the semantic network. Abstract concepts and words are intangible and the semantic features associated with these words are less, however; concrete concepts are tangible and more semanticity is connected to these ideas. It can therefore be assumed that the activation links are of more strength in concrete concepts when compared to abstract concepts which leads to faster access and retrieval. Content words are more hardwired in the system because of the definite meaning associated to these words. Function words however; are additional attributes which provide meaning to an utterance holistically. The participants produced more content words which

can be assigned to the semanticity involved in these words and the strong activation links which get tagged when each concept is activated. Also, the use of content words is sufficient to provide meaning related to a particular utterance thus economically using the vocabulary (Pick's economy of effort model, 1923).

Inappropriate use of verb, tense and case markers; and pronoun confusions while shifting from one activity or task to another can be attributed to the disinhibition of semantic activation. Once the adequate threshold is reached, appropriate activation of a particular concept takes place. This activation has to be terminated when there is a demand of a new task or activity so as to meet the threshold level required for the next task. If the disinhibition does not take place it leads to confusions and inaccurate use of verbs and tense forms, and case markers which were previously activated but did not terminate when a new task is introduced.

It can be understood that some of the characteristic features observed in the speech of persons with fluent aphasia can be associated to the processing and activation of the semantic nodes related to particular concepts. The stronger the semantic links, faster activation takes place which leads to easier access and faster retrieval. In Table 7, the semantic errors produced by persons with fluent aphasia are classified in terms of semantic facilitators, barriers, or both.

Table 7: *Semantic errors in persons with fluent aphasia*

Semantic errors observed in persons with fluent aphasia		
Semantic Facilitators	**Semantic Barriers**	**Both Facilitators and Barriers**
Semantic substitutions	Jargon utterances	Circumlocutions
Semantic paraphasias	Neologistic utterances	Sequencing errors (events)
Phonemic paraphasias	Stuck in type of perseverations	Missing key information in narration
Use of high frequency words than low frequency words	Recurrent perseverations	Inappropriate use of tense and verb forms; and case markers
More content words than function words	Unintelligible utterances	Naming difficulties
Use of concrete concepts and words than abstract concepts	Disinhibition of less relevant information	
Awareness of contextual cues	Difficulty in topic maintenance and termination	
Thematic coherence		
Ability to judge semantic correctness		

CHAPTER VI

SUMMARY AND CONCLUSION

Persons with fluent aphasia typically have posterior lesions and it has been documented that these individuals have disturbances in lexical-semantic, phonological and syntactic related aspects in language production (Blumstein, Milberg & Shrier 1981; Caramazza & Berndt, 1978). Specifically in semantic related processing, it is essential that individuals comprehend the representations associated with the word meaning, processes phonological aspects and then produces words. Ellis et.al (1983) reported that the speech of persons with fluent aphasia is characterized by semantically or phonologically related errors, jargon and/or neologistic utterances, and in certain cases word retrieval difficulties. Research also suggests that persons with Wernicke's aphasia have disrupted semantic representations (Zurif et.al, 1974).

According to a study conducted by Berko-Gleason et al. (1980), persons with fluent aphasia were found to use fewer pronouns, fewer nouns when compared to verbs, less closed class words and omitted determiners. In narration task, the findings reported by Christiansen, 1995; suggest that persons with anomia and conduction aphasia exhibited word access difficulty whereas persons with Wernicke's aphasia exhibited impairment in maintaining appropriate cohesion and coherence, providing adequate information and organizing events while narrating. Till date there is limited research that has looked into profiling the semantic deficits using quantitative and qualitative analyses. Thus, the need arose for profiling the semantic errors in persons with fluent aphasia. Discourse was chosen

as a medium for elicitation of response as it provides umpteen information regarding both microlinguistic and macrolinguistic impairments.

The aim of the present study was to profile the semantic deficits at the level of discourse in persons with fluent aphasia. Seven participants (three males and four females) who were native speakers of Kannada were recruited for the study. There were four tasks primarily used to elicit verbal output which included spontaneous conversation, picture description, story retelling and procedural discourse. The audio and video taped speech sample was subjected to quantitative analysis using SALT software. The parameters assessed in the software were total words, total different words, type token ratio (TTR) and mean length of utterance in words. The participants were divided into two groups based on their aphasia quotient. The participants with aphasia quotient ranging from 50-60 were grouped into the first group, and participants with aphasia quotient between the ranges of 80-90 belonged to group two.

Descriptive analysis was carried out and mean values and standard variation were obtained for all the parameters. The mean value of TTR was comparatively better in participants with greater aphasia quotient which indicates that these individuals use a wide range of vocabulary. Gordon (2008) also reported similar findings where TTR scores correlated with aphasia quotient. Obvious differences were found in other parameters namely total words and total different across both groups, and better performance was observed for participants with higher aphasia quotient which can be attributed to the language status, education and premorbid social participation. However, the mean length of utterance in words were relatively greater in group one when compared to group two which could suggest the use of vocabulary with less effort so as to produce coherent verbal output.

The qualitative analysis revealed that persons with anomic aphasia were able to maintain adequate local and global coherence; and able to initiate, maintain and terminate topic appropriately. The semantic errors observed were the occasional pronoun and tense confusions, linguistic disfluencies, semantic substitutions and circumlocutory behaviors which can be attributed to word retrieval difficulties. Persons with conduction aphasia had mild difficulties in topic maintenance and termination. They were able to maintain coherence fairly at the local and global level and their speech was characterized by jargon words, circumlocutions, use of high frequency words, semantic substitutions, naming difficulties and disinhibition of irrelevant information. It was found that the person with Wernicke's aphasia had affected local and global coherence and exhibited difficulty in topic maintenance and termination. The participant's speech was characterized by inappropriate word selection, neologistic utterances, perseverations (stuck in and recurrent type), semantic and phonemic paraphasias; and naming difficulties. All the participants invariable of the type of fluent aphasia produced errors in use of case markers, tense and verb forms and pronoun use to a varying degree in different tasks. The performance can hence be put in a continuum where the quality of verbal output is comparatively better in persons with anomic aphasia followed by conduction aphasia and the Wernicke's aphasia.

6.1 Conclusions

The present study provides definite corroborative evidence of semantic deficits; further the findings also strengthen the existing literature of obvious semantic deficits in persons with fluent aphasia. This is being one of the few documented studies in the Indian context more specific in the Kannada speaking population. Further, this study has been unique as it has used discourse as a means

to assess semantic aspects in persons with fluent aphasia. To conclude, the results of the current study revealed that there is definite semantic impairment in persons with fluent aphasia although the degree of this deficit varied with the type of aphasia. The findings also indicate that the impairment at the level of semantic accessibility and retrieval whereas, the semantic representation is relatively spared in persons with fluent aphasia.

6.3 Implications of the study

- Discourse provides a holistic view in the understanding of an individual's overall communication skill in day to day environment.
- Discourse tasks should also be included in routine assessment as it allows for in depth understanding of the quality of verbal output at the microlinguistic and macrolinguistic level. It is recommended that clinicians incorporate discourse in both assessment and intervention.
- It is recommended that the existing assessment tools can be modified including discourse tasks which provide the information about the quality of verbal output.
- The study further substantiates that a speech language pathologist must rely on qualitative analysis rather than quantitative as qualitative analysis allows for deeper understanding into the deficits seen in persons with aphasia.
- Certain speech and language characteristics produced by persons of fluent aphasia can be used as facilitators for communication and the semantic barriers can be utilized as opportunities and converted as the same to facilitate communication skills.

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APPENDIX I

Excerpt from the transcript of P4

I: adu biTTu bere eenaadru ondu *event* nim *life*alli tumba nenapiradu	I: that left another any one event your life in more remember
I: nenipmaaDkonDre tumba khushi aagutte nimge.	I: remember if much happy will be for you
I: eenaadru, nim *school* alli aagirbahdu, *college*alli aagirbohdu eennaaru aagirbohdu. nimge tumba *proud* agi *feeling* aytu.	I: any, your school in happen might, college in happen might any happen might .for you more proud like feeling happen
I: eenaadru	I: any
P: m hm, adu mm aa..alli ellaa aa mm bengaluralli Teju ella aa..mm	P: (mhm) that (mm aa) there all (aa mm) banglore in teju all (aa mm)[FP]
I: teju anta idaara?	I: teju that there?
P: uh huh, avru tumba ella hoogbeku andre ella aaa..mmm..*trip* hoogtaaidvi adella nange ishTa	P: (uh huh) they much all go[EW:went] must means all (aa mm) trip go/ing we that all for me like
I: ishTa, jotege hoogtaaidri.	I: like with going.
I: yellige hoogidira?	I: where to go?
P: adu aa. Shiiraa shiraDi.	P: that aa shiraa*shiradi
I: shirDi	I: shirdi
P: amele adu mm.aa.. ooty matte matte ineenu matte aa mm xxx xxx	P: after that (mm..aa)[FP] ooty and and then what and (aa mm)[FP] xxx xxx
I: markara?	I: markara?
P: uh huh, ill illaa	P: (uh huh) no no
I: illa?	I: not?
P: aa..ma ma xx	P: (aa.. ma ma)[FP] xx
P: matte in eeno ella hoogtaaidvi	P: and some other all go/ing[EW:went] we
I: madikeri?	I: maDikeri?

I: tumba jaaga hoogidira	I: more places went?
P: uh huh.	P: (uh huh)[FP]
I: *so* adu nim *favorite*.	I: so that your favourite
I:adralli ondu *favorite trip* yaavdu nimdu?	I: this in one favourite trip which your?
I: niivu *enjoy* maaDiradu yaavdu jaasti?	I: you enjoy did which more?
P: ade ondu aa aid-aaru aaru dina hogididu ade ondu ella hogididdu ade ondu aa amm enu?	P: that one (aa) five six*six day went that one all went that one (aa..amm) what ?
I: enjoy maaDiddu	I: enjoy did
P: *enjoy* aa..	P: enjoy (aa)
I: adu yaavdu aaru dinak hoogiddu yellige?	I: that which six days for went when?
P: aa.. shirDi amele allella mm ell ellora	P: (aa) shirdi after all there (mm) ell*ellore
I: ellora?	I: ellora?
P: amele amele mm aa matte Ajanta matte alli aa mm goa allella	P: after*after (mm aa) and Ajanta and there (aa mm) goa all that
I: ok ok, al yell hodri yell *stay* maaDiddu een een nooDidri	I: ok ok there where went where stay did what*what saw?
P: mm adu mm eenu umm eeno idu	P: (mm) that (mm) any (umm)[FP] some there
P: naanu idna?	P: i there was?
P: aa illa niinu irlilla (to son)	P: (aa) no you not there (to son)
I: adu yell hoogidri naanu ildenu (Client's son)	I: that where went me not there (Client's son)
P: adu naanu nin appana maduve maaDadu aavaga hoogididdu	P: that me[EW:I] your father to married then went
I: nanna yaako karkonD (Client's son)	I: me why didn’t take (Client's son)
P: oo aaytu aaytu	P: (oo) ok ok
P: adu T aa T aa T adukke een ante?	P: that t aa taa taa that what that?

I: aa T matte T	P: aaa t and t
I: *tata motors* ah?	I: tata motors huh?
P: illa adu	P: not that
I: *van*?	I: van?
P: adella	P: not that
P: ippattu hoogbekandre adu een maaDtira	P: twenty go must then that what does?
I: *tempo traveller*?	I: tempo traveler?
P: uh huh	P: (uh huh)[FP]
I: ahh, *ok* adiralli hoogidra?	I: ahh ok in that gone?
P: uh huh hoogididdu.	P: (uh uh) went
P: ameele alli yaavdu nange gottirlilla mm aa ivaaga mm nange gottaglilla	P: after there none for me didn't know (mm) (aa) now mm for me don't know
I: nenap bartaailla adu?	I: memory know not that?
P: adu	P: that
I: *names*?	I: names
P: bartirlilla	P: did/n't know
I: *ok, so* canaag ella kaDe nooDkonDu, *beach* hoogidra?	I: ok so nice all side saw beach went?
P: uh huh adu goa ade ille adunna nange ivaaga hoode adu maamuli alva adukke naanu eeno gottila	P: (uh huh) that goa that here that to for me now[EW:have] went[EW:gone] that common right so I something don't know
I: manglore alli idri *beach* nooDi nooDi	I: mangalore in there beach saw*saw
P: uh huh adukke naanu gottila adukke naanu avaaglindane hoogtidde hooga naanu oo naanu hoogide anta heeLtidde ivaaga alle hoogiddana eenu majja irlilla	P: (uh huh) so I don't know so I since then used to go*go I oh! I went said now there went that no joy not there.
I: maamuli aagooytu.	I: common like.

The transcription employed in the transcribing process is provided in the next section.

Appendix II

Transcription system- Kannada

Kannada has a CV/VCV combination of word structure. It also has many borrowed words from English which are usually modified to fit the CV/VCV structure. For example, ‘car’, ‘bus’, ‘pen’, ‘pencil’, etc. are borrowed words used in Kannada, but are pronounced with a vowel in the word final position, such as ‘bus-u’, ‘car-u’, ‘pen-u’, ‘pencil-u’, etc. However, there are word contractions in which the final vowel is deleted.

Example: ondu- ond

Kannada also has short and long vowels and that are transcribed by using the following system.

Vowels:

- Short vowels: a, i, e, u, o
- Long vowels: aa, ii, ee, uu, oo

Diphthongs: ai, au

Consonants:

- Bilabials: m, p, ph, b, bh
- Velars: k, kh, g, gh
- Alveolars: c, ch, j, jh, r, l, s
- Palatals: T, Th, D, Dh, N, y, sh, L
- Dentals: t, th, d, dh, n
- Labiodentals: v (or bilabial)
- Glottal: h

The ‘h’s represent aspirated consonants.

Clusters are represented by a combination of same or different consonants.

For example, ‘tt’, ‘tr’, ‘lk’ and so on.

Appendix III

Key to transcription conventions and SALT codes

There were certain conventions and codes used particularly for the SALT software analysis which is given below:

1. Transcript Format. Each entry begins with one of the following symbols. If an entry is longer than one line, continue it on the next line.

$ Identifies the speakers in the transcript; always the first line of the transcript.

Example: $ Child, Examiner

C: Child/Client utterance. The actual character used depends on the $ speaker line.

E: Examiner utterance. The actual character used depends on the $ speaker line.

+ Typically used for identifying information such as name, age, and context.

2. Bound Morphemes. Words which contain a slash "/" indicate that the word is contracted, conjugated, inflected, or pluralized in a regular manner. The root word is entered in its conventional spelling followed by a slash "/" and then the bound morpheme.

English

/S Plural. Words that end in "s" but represent one entity are not slashed.

Examples: kitten/s, baby/s, pants, rana/s, feliz/s, flor/s

Irregular plurals are not marked, but are typed as spelled, e.g., leaves, mice, geese, lives, wolves.

/Z Possessive inflection.

Examples: dad/z, Mary/z. Do not mark possessive pronouns, e.g., his, hers, ours, yours.

/S/Z Plural and Possessive. Example: baby/s/z

/ED Past tense. Predicate adjectives are not slashed.

Examples: love/ed, die/ed, was tired, is bored

/3S 3rd Person Singular verb form. Irregular forms are not slashed.

Examples: go/3s, tell/3s, does

/ING Verb inflection. The gerund use of the verb form is not slashed.

Examples: go/ing, run/ing, went swimming

/N'T, /'T Negative contractions. Irregular forms are not slashed

Examples: can/'t, does/n't, won't

/'LL, /'M, /'D, /'RE, /'S, /'VE Contractible verb forms.

Examples: I/'ll, I/'m, I/'d, we/'re, he/'s, we/'ve

2. **Mazes**. Filled pauses, false starts, repetitions, and reformulations.

( ) Surrounds the words/part-words that fall into these categories.

Example: C: And (then um) then (h*) he left.

3. **Omissions**. Partial words, omitted words, omitted bound morphemes, and omitted pronominal clitics are denoted by an asterisk (*).

* Following one or more letters this indicates that a word was started but left unfinished. Example: C I (w* w*) want it.

* Preceding a word indicates that an obligatory word was omitted.

Example: C Give it *to me.

4. Spelling Conventions.

• Filled pause words: AH, EH, ER, HM, HMM, UH, UM, MM, and any word with the code [FP]

5. [ ] Codes. Codes are used to mark words or utterances. Codes are placed in brackets [ ] and cannot contain blank spaces. Codes used to mark words are inserted at the end of a word with no intervening spaces between the code and the word.

[EW] used to mark word-level errors.	C: And they coming[EW:coming] to place.

6. End of utterance punctuation

Every utterance must end with one of these six punctuation symbols.

? Question.

~ Intonation prompts. Example: E And then you have to~

^ Interrupted utterance. The speaker is interrupted and does not complete his/her thought/utterance.

> Abandoned utterance. The speaker does not complete his/her thought/utterance but has not been interrupted.

Statement, comment. Do not use a period for abbreviations.

! Surprise, exclamation