COGNITIVE LINGUISTIC DEFICITS IN APHASIA

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CHAPTER I

INTRODUCTION

Communication is the most significant characteristic of human being through the entire span of life. The acquisition, development and maintenance of communication capabilities in human beings are dependent on the adequate functioning and appropriate integration of distinct neural networks. Human communication skills demand the synergy of voice, speech, language and cognition. Communication results from the interactions of cognition and language and its complex interactions that takes place between different aspects of memory, attention and language itself.

Most recently, with increasing focus on communication in human society, research is geared towards the relationship that exists between communication and other human capabilities collectively known as "cognitive skills". Cognition involves wide range of mental processes such as attention, pattern recognition, memory, organization, language, reasoning, problem solving, classification, concepts and categorization. These cognitive processes are all inter-related with one another rather than existing in isolation. Study of cognitive processes helps us to learn how we acquire, store, retrieve and use knowledge (Matlin, 1983).

Language has three highly interrelated and integrated components Cognitive, linguistic, and pragmatic (Muma, 1978). Cognitive refers to the manner in which individuals acquire knowledge about the world and in which they continue to process this knowledge. It refers to all of the processes by which sensory input is transformed, reduced, elaborated, stored, recovered, and used (Neisser, 1967). Through cognitive processes, we achieve knowledge and command of our world; that is, we process information. According to Chapey, (1994), these processes can be operationally defined as the five mental operations in the Guilford (1967) Structure-of-Intellect (SOI) model: recognition/understanding (attention/perception), memory, convergent thinking, divergent thinking, and evaluative thinking. In addition, the term executive function is identified as a component of our cognitive system (Ylvisaker & Feeney, 1998).

Linguistics refers to language content, form, and use. Language content, or semantics, is the meaning, topic, or subject matter involved in an utterance (Wiig & Semel, 1984). Language form consists of a system of rules for communicating meaning and includes three rule systems; phonology, morphology and syntax. Pragmatic refers to a system of rules and knowledge that guides how we use language in social settings (Bates, 1976). It includes knowledge of how to converse with and what to say to different partners and in different contexts, and how to initiate, maintain, and terminate discourse and conversation (Craig, 1983). It also refers to the use, purpose, or function that a particular utterance serves. For example, the same content and form "Where are my keys?" can be used to question a statement, request information, indirectly request an action, and so on.

Cognitive Linguistics is the study of the mind through language and the study of language as a cognitive function. Cognitive Linguistics has two main goals: (1) to study how cognitive mechanisms like memory, categorization, attention, and imagery are used during language behavior; and (2) to develop psychologically viable models of language that cover broad ranges of linguistic phenomena, including idioms and figurative language. Cognitive linguistics recognizes that the study of language is the study of language use and that when we engage in any language activity, we draw unconsciously on vast cognitive and cultural resources, call up models and frames, set up multiple connections, coordinate large arrays of information, and engage in creative mappings, transfers, and elaborations. Language does not "represent" meaning; it prompts for the construction of meaning in particular contexts with particular cultural models and cognitive resources.

Cognitive linguistic practice can be divided into two main areas: cognitive semantics and cognitive (approaches to) grammar. The area known as cognitive semantics is concerned with investigating the relationship between experience, the conceptual system, and the semantic structure encoded by language. Specifically, scholars working in cognitive semantics investigate knowledge representation (conceptual structure), and meaning construction (conceptualisation). Cognitive semanticists have employed language as the lens through which these cognitive phenomena can be investigated. Consequently, research in cognitive semantics tends to be

interested in modelling the human mind as much as it is concerned with investigating linguistic semantics.

A cognitive approach to grammar, in contrast, is concerned with modelling the language system (the mental 'grammar'), rather than the nature of mind per se. However, it does so by taking as its starting point the conclusions of work in cognitive semantics. This follows as meaning is central to cognitive approaches to grammar, which view linguistic organisation and structure as having a conceptual basis. From this it follows that cognitive linguists reject the thesis of the autonomy of syntax, as advocated by the Generative tradition in linguistics.

Cognitive-communication impairment is the generic term used to refer to the cognitively based communication disorders resulting from deficits in both linguistic and nonlinguistic cognitive processes. Cognitive-communication disorders are communication impairments resulting from underlying cognitive deficits due to neurological impairment. These are difficulties in communicative competence (listening, speaking, reading, writing, conversation and social interaction) that result from underlying cognitive impairments (attention, memory, organization, information processing, problem solving, and executive functions).There are various cognitive communication disorders like aphasia, TBI, dementia etc.

Aphasia has been traditionally defined as an isolated disorder of language comprehension and production due to a developmental or acquired cause. The cognitive school emerged when clinics began to show aphasic patients do have intellectual problems. Aphasia is now recognized as a language disorder resulting from neuro-physiological damage along with impairment of cognitive processing. It is a cognitive disorder marked by an impaired ability to comprehend or express language in its written or spoken form. This condition is caused by diseases which affect the language areas of the dominant hemisphere. Clinical features are used to classify the various subtypes of this condition. General categories include receptive, expressive, and mixed forms of aphasia.

Darley, Aronson, and Brown (1975) describe aphasia as "a multi-modality reduction in the capacity to decode (interpret) and encode (formulate) meaningful linguistic elements. It is manifested in difficulties in listening, reading, speaking and writing". Kertesz (1985) defined

aphasia as "an acquired loss of language due to cerebral damage, characterized by errors in speech (paraphasias), impaired comprehension, and word-finding difficulties (anomia)".

Aphasia is defined as "the loss or deterioration of verbal communication due to an acquired lesion of the nervous system involving one or more aspects of the comprehending and producing verbal messages" (Basso and Cubelli, 1999). Aphasia is defined as the loss or impairment of language caused by brain damage. Although aphasic disability is complex, but many aphasic patients are clinically similar and fall into recurring identifiable groups. Over the years, a bewildering amount of nomenclature has been used to describe and classify the various aphasia syndromes. Regarding these classifications, Kertesz (1979) states that many of researchers describe the same phenomena from a different views based on their studies and in fact they compliment rather than contradict each other.

Definitional problems arise because the term 'aphasia' has been used to describe a variety of impairments in language, which are caused by brain damage or are suspected to be caused by brain damage. So language impairment, however, is the primary characteristic of aphasia, while in multi faceted disorders like psychosis or dementia, it might be a secondary characteristic. In aphasiology, the term 'localization' often encompasses matters relating aspects of language impairment to alterations in brain function and the determination of the sites of the lesion producing the impairment.

On occasions, clinicians of aphasiology will readily claim that there are clinical forms of aphasia as there are aphasic patients (or else as many aphasiological terminologies as there are many aphasiologists). Experienced clinical aphasiologists acknowledge, on the one hand, that aphasic semeiology varies widely from one another but on the other, that certain symptom complexes seem to be shared by sub- groups of patients. Aphasia is a breakdown in the two-way translation process that establishes the relation between thought and language (Damasio, 1999). As a consequence, people with aphasia have an inability to translate, with reasonable fidelity. Nonverbal sets of images (thoughts) into linguistic symbols and grammatical relationship (or the inverse problem-translating a received language massage into thought). Rather, aphasia is a defect in aspects of linguistic processing like syntax, lexicon, phonology, morphology of a word.

At a general level, assessment involves forming impressions and making judgments about others. It carries an evaluative flavour while dealing with the whole person (Fiske & Pearson, 1970). The key element in assessment is "the act of acquiring and analyzing information" (Hammill, 1987). The purpose of assessment varies from screening, identification, classification, placement, and programming to certification and research.

Benton (1967) has pointed out the choice of a model. Language functioning determines what kind of test we construct or use. Two approaches to test construction should be recognized as equally reasonable.

1. To construct tests on the basis of one of the currently accepted conceptions of aphasia. This 'taxonomic' or diagnostic approach ensures that the test measures all aspects is viewed as important in a specific theoretical approach but makes it possible that it will not be widely used as different conceptualization of aphasia as held by other workers in the field.

2. To approach the problem pragmatically, avoid specific conceptualizations, and construct a test that contains a variety probe of all abilities.

Both approaches have been applied in the construction of the currently used tests. Even within these two approaches, specific assessment instrument will show a good deal of variability.

Cognitive -communicative tests that are available for assessment of traumatic brain Injury (TBI) patients are e.g. Measures of cognitive –linguistic abilities (MCLA) (Ellmo et al., 1995), scales of cognitive ability of traumatic brain Injury (SCATBI) (Adamovich and Henderson, 1992), Boston Naming test (Goodglass and Kaplan, 1983), Ross Test of Higher Cognitive processes (Ross and Ross, 1979) and Ross Information Processing Assessment (RIPA2) (Ross-swain 1996), among others. But these tests are standardized for use specific to the cognitive communication problems in individuals with traumatic brain Injury. Also, most of the tests concentrate on one or few cognitive-linguistic domains, or test the global linguistic domain. Norms of this restrict to the western population. There is a need to develop such a test battery exploring the cognitive communicative impairments if any in the clinical group of aphasia.

CHAPTER II

REVIEW OF LITERATURE

2.1 Definition for cognitive-communicative disorders

The American Speech-Language-Hearing Association (ASHA; 1991) defines cognitive–Communicative disorders as 'alterations in communication due to deficits in a variety of linguistic and nonlinguistic cognitive processes'. Although this definition implies that linguistic and nonlinguistic processes may contribute separately or simultaneously to communicative (dys) function, the word 'and' serves to obscure the potential interaction between the two. Similarly in a review of treatment efficacy in TBI (Coelho et al., 1996), the authors define Cognitive–communicative disorders as 'those impairments of linguistic as well as (our italics) nonlinguistic cognitive functions', which leaves the interaction between them, similarly open.

ASHA defines cognitive communicative impairments as communicative disorder that results in deficits in linguistic and non-linguistic cognitive processes (ASHA, 1987).

2.2 Cognitive–Linguistic and Cognitive–Language

The term cognitive–linguistic or cognitive language shares a similar range of literature to the other terms — for example, multiple sclerosis (Wallace & Holmes, 1993), subcortical lesions (Whelan & Murdoch,2005), dementia (Mahendra, 2001) and TBI (Hinchliffe et al., 1998b). It appears to have been used over a long period of time interchangeably with cognitive–communicative. Kennedy and DeRuyter (1990), having argued against the use of cognitive–communication, support the use of the term cognitive language disorders in recognition of the fact that 'language is both the result of cognitive processing and functions as a copartner in an integral-reciprocal relationship between cognitive and language processes'. Turkstra et al. (1995) conceptualize cognitively based verbal deficits as interacting with cognitive deficits to produce pragmatic communication disorders. This conceptualization, which is in line with our own, is not generally reflected in the bulk of the literature. This interpretation views high-level language

disorders, complex language disorders and cognitive–communication disorders as redundant terms.

Cognition may be regarded as having five primary domains; attention, memory, executive functions, language and visuospatial skill (Sarno, 1998). The ASHA (1987) cognitive and language subcommittee identifies several aspects of cognition that may affect language:

1. Impaired attention, perception or memory
2. Inflexibility, impulsivity or disorganized thinking or acting
3. Inefficient processing of information (rate, amount, complexity)
4. Difficulty processing abstract information
5. Difficulty learning new information, rules and procedures
6. Ineffective problem solving and judgment
7. Inappropriate or unconventional social behavior
8. Impaired executive functions, self-awareness of strengths and weaknesses, goal setting, planning self-initiating, self-inhibiting, self-monitoring and self-evaluation.

Also a significant contribution towards the cognition and language relationship comes from the reports on the language abilities in subjects with neurological disorder. Linguistic aphasiologist and neurolinguists have their major contribution in this regard.

2.3 Evidence from Adult neurological language disorders

Lesser (1987) considered the cognitive system as outside but contributing to language processing (specifically the processes for reading aloud). Language sets the tone for cognitive activities the left hemisphere appears to perform-the logical sequential apexes of mental operations (swindell et.al, 1998).Au et.al. (1988) using definition of aphasia as a linguistic disorder in the relative absence of other cognitive dysfunctions put forth her view that language could not be isolated from general cognitive influences. Yet, she reported, other cognitive function could be identified that are separate from language.

On the other hand, language comprehension is frequently necessary for such cognitive skills as the acquisition of new knowledge, as when a person attends a lecture, reads a manual, or listens to a boss's instruction (Boyle and Strikowsky-Harvey, 1999). Higher level cognitive

processing like reasoning and metacognitive thinking are largely mediated by language (ASHA, 1987).

David (1989) studied individuals with aphasia and dementia and put forth his view that language is a cognitive process in its own right and forms a subsystem of cognition. In other words, cognition is a Superordinate in concept to the language subsystem. This view has been supported by McNeil and Kimelman (1986) and Marshall (1989). Davis further specified that language use may involve processes of a particular kind. There may be language specific cognitive processes (e.g. syntactic parsing) distinguishable from general cognitive processes (e.g. attention) .The language specific factors would be particular kinds to knowledge, representation, and process. He argued that language disorders should be diagnosed with respect to underlying cognitive subsystems impaired.

Considering the above arguments it is observed that there is a considerable overlap in the cognitive and language domains. Language disorder or decline and severe, persistent cognitive impairments may coexist. Both these functions are highly interrelated and interdependent. Noting the relation between cognition and language, American speech-Language Hearing Association (ASHA) has stated that certified speech language pathologists are qualified to diagnose and treat individuals with cognitive-communicative impairments.(ASHA,1988).

Cognitive communication abilities have been provoked in great detail in case of certain neurogenic language disorders such as traumatic brain injury (TBI), closed head injury (CHI), dementia and also to a certain extent in individuals with right hemisphere damage (RHD).In these disorders, language deficit is often not the glaring sign/symptom. Rather it is the most prominent cognitive deficits that catch the attention of the attending physician. In slowly developing disorders like Parkinson's disease, Dementia, Alzheimer's disease etc., cognitive symptoms are the first to catch the attention of the caregivers. In earlier stages of dementia and mild cases of TBI, the subtle language disorders often go unnoticed. However in the past few decades, research in speech language pathology had tried to document the speech and language problems of this population, and have come up with significant inferences on better profiling of these cognitive communicative impairments in TBI, CHI and RHD.

2.3.1 Cognitive -communicative impairments in right cerebrovascular accident patients.

Right Hemisphere Damage (RHD) often results in a loss of orientation and in thought disorders. These disturbances are evident in tasks of conversation (Myers, 1986).the communication impairments associated with right hemisphere damage are described as disorders of expression and reception of complex contextually based communicative events resulting from disturbance of the attentional and perceptual mechanisms underlying non symbolic , experiential processing (Myers 1986).however ,RHD patients do not exhibit the auditory comprehension problems that are found in dementia patients (Bayles and kasniak,1987)

Right Hemisphere Damage (RHD) often results in impairment in the cognitive domains of orientation, scanning, visual neglect, attention, memory, integration, planning and reasoning/ problem solving Boyle and Strikowsky-Harvey (1999), which are characterized by intuitive cognitive processes (Swindell et al., 1998). These have been widely researched and but their impact on speech and language abilities are being recognized only since the past twenty odd years.

2.3.2 Cognitive communicative impairments in dementia

Dementia refers to an acquired intellectual deterioration in an adult. (Bennett, 1999).Dementia is often equated with compromised cognitive skills .cognitive communication abilities and its disruption is documented in various types of dementia. Although decline in phonology syntax and semantic studied (Bayels et.al 1999, Bennett; 1999), the degree of decline in communication abilities exceeds decline in these specific language areas (Ripich and Terrell, 1988).

Dementia Alzheimer's type (D.A.T): the patient with mild D.A.T is forgetful and memory deficit is apparent only with in depth interviewing. The patient performs normally on tasks of oral reading, Superordinate identification, auditory comprehension and writing to dictation, but is clearly impaired on tasks such as object description, picture description, and superordinate naming. But as D.A.T progress, performance of linguistically oriented cognitive tasks steadily deteriorates and by the last stage (late dementia) patients have very severe cognitive impairments accompanied by loss of all verbal abilities. Bayles, Boone; et.al, (1989) posit that it is possible

to differentiate D.A.T from normal elderly subjects and aphasia on the basis of cognitive - communicative measures alone.

Parkinson's disease: from cognitive communicative point of view , parkinsonism is marked by emotional or personality changes ,memory disorder, defective ability manipulate acquired knowledge and striking slowness in the rate of information .processing vocabulary and general facility with languages (comprehension) are thought to be preserved.

2.3.3 Cognitive Linguistic Impairments in Aphasia

Aphasia has been traditionally defined as an isolated disorder of language comprehension and production due to a developmental or acquired cause. The cognitive school emerged when clinics began to show aphasic patients do have intellectual problems (Martin, 1981; Davis, 1993).

Martin (1981) defines aphasia as "the reduction because of brain damage, of the efficiency of the action or the interaction, of the cognitive process that support language. It is characterized by a reduction in and dysfunction of language content or meaning, language form or structure and language use or function and the cognitive processes which underline language, such as memory and thinking (Chapey, 1981).This position is similar to those who espouse that aphasia results from impaired cognitive processing and its description should include some reference to the cognitive processes assumed to underlie or support language.

Aphasia is now recognized as a language disorder resulting from neuro-physiological damage along with impairment of cognitive processing. (Gupta, 2000). The debate on whether cognition and language are related and whether cognition precedes language or vice versa still continues, but, it has been observed that there is considerable overlap in the cognitive and language domains. Language disorder or decline and severe, persistent cognitive impairments may coexist. Both these are highly interrelated and inter-dependent.

Boyle and Strikowsky-Harvey (1999) have described in detail the impact of cognitive impairments on language or other aspects of communication.

Table1: Cognitive impairment and their impact on language /communication

Cognitive impairment	**Impact on language/communication**
Orientation	Patients are confused about time and place and may provide inaccurate information in their discourse that can seriously impairment conversational exchanges.
Scanning	Reading comprehension may be impaired; patient may be unable to check/self correct writing
Visual neglect	May impair reading and writing. May impair pragmatic aspects of discourse, such as making eye-contact with partners who are in the affected hemi space.
Attention	Patients may miss information in spoken discourse or in written material, which may have an impact on their responses and cause communication breakdown.
Memory	Patient may not retain and/or recall information that is conveyed in spoken or written form. This may impair their responses and cause communication breakdowns.
Integration	Difficulty in appreciating the relationship of discrete elements to an overall structure. It may impair pragmatics and discourse comprehension or production
Planning	It can also impair the patient's ability to interpret and respond appropriately to humor, sarcasm, or indirect request, thus impairing conversational interactions.
Reasoning/problem solving	Poor planning can affect the organizations and coherence of discourse.

Patients may be unable to identify and change aspects of their behavior that is causing communication breakdowns; they may be unable to explain problems in order to seek assistance or to communicate potential solutions.

Language outcomes following traumatic brain injury, (TBI) and subsequent difference edema seldom conform to classic aphasia syndromes and are relatively rare in all degrees of

severity. (Heilman, Saffron and Geschwind, 1971) generalized and persistent expressive and receptive language impairment and global cognitive deficits are more than norm in cases with TBI. (Levin, Grossman, sarwar and Meyers, 1981). Anomia is often reported to be the primary aphasic symptom in the absence of general cognitive disruption after TBI (Levin et al; 1981).Halpern, Darley and Brown (1973) used the phrase –'language of confusion' to describe the verbal consequences of general cognitive disruption characteristic of the severe TBI. Thus the language problem following TBI are more effectively termed as 'cognitive- communication disorders' rather than 'aphasia'.

The language problems following of cerebrovascular accident or a stroke are more accurately labeled as "aphasia'. Stroke tends to have one sided focal effects, though there is enormous range of differences between stroke patients with respect to the depth, extent and site of damaged tissue. In all these patients, language impairment with relatively intact functions of the brain is the major sign. Various classification system have been put forth to differentiate among the symptom complexes of an aphasic patients (Kertesz and Poole; 1983. Chapey; 1981) .However, time and again; the inability of these classification system to account for all patients with aphasia and the inability of an aphasic patients to conform to all the signs and symptoms of a particular aphasia type, has been pointed out. With the realization of the insufficiency of these classification systems, arguments regarding the definition and existing classification systems came up.

Limitations of one or more aspects of cognitive functions along with motor impairment are probably the most common consequence of stroke. A mild degree of cognitive impairment at least, occurs in the majority of patients who have suffered a stroke (Robinson, 1998). The frequent occurrence of lasting alterations of functions in area of brain quite distant from the lesion have been suggested by electrophysiological studies (Gummow et.al., 1984) and by many patients who experience sensorimotor symptoms in their limbs on the supposedly unaffected side (Von Ravensburg et al., 1984).During acute stages of the disorder, secondary diffuse effects typically add symptoms of widespread brain pathology as edema and other physiological reaction take place and other secondary effects of stroke can cause more serious bilateral or diffuse damage than stroke itself. Thus stroke patients frequently display signs of bilateral or

diffuse damage during the early stages of their illness. At one month post stroke, most patients with hemiplegia (lateralized paralysis) have perceptual deficits as well; regardless of the side of lesion (Edmans and Lincoln., 1989).Attention disorder have been reported by coslett et al (1993) in case of left hemisphere stroke patients. Martin (1990) reported of a reduced memory span. Tartaglione et.al (1991) reported of an impaired decision making process as expressed by accuracy of response in left hemisphere damage.

Given the nature of these evidences, one of the arguments that was put forth by the increasing interest in aphasia by neuropsychologist was the question of why aphasia is not considered as a cognitive disorder of communication. It may be postulated that Davis view of language specific cognitive abilities is true and these cognitive linguistic abilities changes with age. That aphasia type change with the age, even within the over 50 population is confirmed by a study by Obler et al.,(1978) , where they showed a 11year difference between patients with Broca's aphasia (mean=52 years) and those with Wernicke's aphasia (mean= 63 years). Thus it would appear that the clinical observation of increasing fluency of aphasia from childhood to adulthood is substantially confirmed even within the older age groups. These results may also be interpreted as proof of changing localization of language and language-related cognition areas, even through adulthood to old age, that is, there appears to be continuous reshuffling of functions of various areas of brain.

In any event, memory, attention, disinhibition, and perception of the real world do interact in language performance in ways that the dementias are only beginning to tell us (segalowitz, 1983). A number of behaviors of dementia such as paragrammatism and verbal paraphasias also obtain in the aphasias, in ways that have been less obviously attributable to deficits of underlying psychological mechanisms. The debate here is whether these evidences can help us conclude there is cognitive decline in aphasias. Certainly, if there is necessary intellectual decline in the aphasias, it is minimal compared to the decline of the dementias.

a) Attention and Aphasia

Given the number and loci of brain regions that sub-serve attention and working memory and the lesion locations that commonly produce aphasia, it is not surprising that patients with a variety of aphasia types and severities may present with concomitant impairments of one or both of these

cognitive functions. In terms of attention, one, several, or all attention functions might be compromised. Compared to their healthy age-matched peers, patients with aphasia perform less accurately, more slowly, or both on sustained attention (Gerritsen, Berg, Deelman, Visser-Keizer, & Meyboom-de Jong, 2003), attention switching (Connor et al., 2001; Robin & Rizzo, 1989; Zeigler, Kerkhoff, Cate, Artinger, & Zierdt, 2001), and focused and divided attention tasks (Erickson, Goldfinger, & LaPointe, 1996)

Sustained attention is typically assessed by requiring subjects to maintain a consistent behavioural response during some long, continuous and repetitive task; focused attention tasks require subjects to select and respond to relevant targets or processes and inhibit or ignore irrelevant ones (Posner and Peterson, 1990). Glosser and Goodglass (1990) found that aphasic subjects, particularly those with frontal lesions had difficulty with sustained and focused attention. They used a task in which aphasic subjects watched a (200 trials) random sequence of X's and O's and has to press a response bar for each occurance of preassigned target (X or O).Aphasic adult's ability to divide their attention has been investigated. Divided attention tasks require subjects to attend to two or more messages or to perform two or more cognitive operations simultaneously (Wickens, 1984). This was also seen to be affected.

Several researches have examined aphasic adult's ability to "orient" their attention. Rizzo et al (1989) compared the performances of aphasic adults to those of adults with right hemisphere brain damage or no brain damage on orienting tasks in both the visual and audio modalities. They found that all of their brain-damaged subjects had orientation impairments, primarily to the space contralateral to their lesion. Aphasic subjects displayed the greatest difficulty orienting the auditory targets.

Studies indicate that patients with aphasia may present with deficits of attention and these deficits may negatively affect the word- to discourse-level language production and comprehension abilities of patients with aphasia. For example, at the word-level, Ziegler et al. (2001) found poorer word discrimination performance among patients with aphasia, regardless of aphasia severity, when word pairs were presented auditorially in different locations within their right versus left spatial field. Because tonal cues regarding the spatial sound location improved the word discrimination performance of these patients, Ziegler et al. concluded that rapid

attention-shifting problems were affecting the word-processing skills of their subjects with aphasia. Additional studies have produced similar findings indicating that naming, oral reading, and auditory comprehension at the word level can be negatively affected in patients with aphasia by attention conditions such as the spatial location of stimuli (Coslett, 1999; Coslett, Schwartz, Goldberg, Hass, & Perkins, 1993) or the presence of competing stimuli or tasks (Erickson et al., 1996; King & Hux, 1996; Murray, 2000). Based on the findings of dual-task studies and investigations of the effects of adverse listening conditions on the language skills of healthy adults, researchers also have concluded that attention problems can have detrimental effects on the lexical-semantic, syntactic, and pragmatic abilities of patients with aphasia at sentence and discourse levels.

Another type of attention problem observed to coexist with aphasia is right neglect. Although neglect is conventionally attributed to right hemisphere lesions, recent research findings indicate that it also frequently may occur following left hemisphere lesions, with incidence rates ranging from 15 to 65% (Bartolomeo, Chokron, & Gainotti, 2001; Kerkhoff, 2001).According to the attentional hypothesis, the ability to shift between resource capacities, the ability to allocate attentional resources, or both are pathologically reduced by brain damage (Blackwell and Bates, 1995; Haarmann et al. 1997).Also they said that this resulted in syntactic processing deficits

As noted by O'Donnell, attention is typically viewed as a multidimensional cognitive system consisting of a number of basic (eg. arousal and vigilance) and complex (eg. selective and divided attention) functions. Of the two basic attention functions, deficits of both vigilance and arousal have been reported in aphasia patients. Vigilance or sustained attention refers to the ability to maintain a consistent behavioral response to infrequent events and is measured via long, continuous, and repetitive tasks (eg. monitoring for a target letter while letters are sporadically flashed on a computer screen over a 10 minute time period). Arousal or activation typically refers to physiological correlates of vigilance (eg. heart rate, blood pressure, salivary cortisol level). Focussed and Divided attentions have also reported to be affected in Aphasia.

Murray (1999) reported that various attentional mechanisms may be impaired in the presence of aphasia and influence language performance. Attentional processes are also embedded in the construct of executive functioning. LaPointe and Erickson (1991) used a dual

task paradigm to address allocation of attentional processes in subjects with aphasia. They presented their subjects with an auditory work identification task under two separate conditions. Under the first condition, the subjects simply indicated when they heard the target word. Under the second condition, the subjects listened for the target word while simultaneously sorting cards according to colour. Results showed that all subjects performed with high accuracy under the first condition. However, under the dual task condition, subjects with aphasia performed with significantly less accuracy than healthy controls. Poorer performance during the dual task condition was believed to be due to the increased demands placed on the attentional system, which LaPointe and Erikson believed to be limited in capacity. Thus, LaPointe and Erickson concluded that variability in linguistic performance may be accounted for by inadequate attentional resources and/or allocation of attentional resources.

b) Memory and Aphasia

Several researchers have found memory deficits in persons with aphasia (Beeson, Bayles, Rubens, & Kaszniak, 1993; Burgio & Basso, 1997; Ween, Verfaellie, & Alexander, 1996).Martin (1990) reported that reduced memory span was an observed trait in individuals with aphasia. Short term memory (STM), Long term memory (LTM) and Working memory (WM) have been studied in aphasics.

Many studies in aphasia have documented impaired STM for both auditory and visual stimuli. Martin and Feber (1990) found that patients with fluent aphasia, like the non-brain damaged adults were better at recalling easy versus hard to articulate word lists. In contrast ease of articulation had no effect on the STM performance of patients with non fluent aphasia. These results suggest that STM problems in aphasia may reflect difficulties with covert articulatory rehearsal. Other studies have questioned the existence of a link between verbal STM and comprehension. A study by Caramazza and Zurif, 1976; Schwartz, Saffron and Martin, 1980 reported that agrammatic Broca's aphasics showed very restricted short-term memory spans and difficulty in syntactic analyses of sentences. McCarthy and Warrington (1987) reported an impressive range of sentence comprehension abilities in two patients with impaired verbal STM, and argued that memory is not necessarily involved in maintaining surface word order. However, the patients performed poorly on longer ordered dependent sentences particularly

when the conventional order of mention was violated. For e.g. They could match a sentence such as "she watered the flower before she went to the shop" to a picture with relative ease. However, the sentence, "before she went to the shop she watered the flowers" which requires some mental transposition of the words, proved more difficult. McCarthy and Warrington suggested that verbal STM may be involved in backup procedure particularly in situations where appropriate central cognitive representation cannot be constructed.

In terms of non-verbal STM abilities, Gordon, 1983 found that aphasic patients, particularly those with lesions of the middle temporal gyrus, had difficulties recalling tonal sequences. Butters et al, 1970 noted poor retention of geometric patterns in patients with fluent aphasia. In aphasia, WM capacity is proposed to be pathologically reduced which results in comprehension breakdowns when aspects of linguistic processing are lost during online computations. Thus, when the demand for processing resources is low (processing of syntactically simple or small amounts of information), WM capacity is not stressed and language comprehension, even in severe aphasia will not suffer. By contrast as demand for processing resources increases, WM capacity is exceeded and there is a marked decline in comprehension. Martin and Feber (1990), studied aphasic patients with working memory deficits and found that they had difficulty in processing sentences with a high semantic load (i.e. in terms of many content words) e.g. "Touch the small yellow circle and the large green square", such tasks are required to be performed in the token test.

Caspari et al. (1998) reported significant associations between performance on working memory and reading comprehension tests in a group of patients with aphasia. Likewise, there is ongoing deliberation regarding the relationship between working memory and sentence processing in aphasia. Although debate persists regarding whether there are separate working memory capacities for interpretative and post interpretative sentence processes (e.g., Caplan & Waters, 1999 vs. Kolk, Chwilla, van Herten, & Oor, 2003), most investigators concede that working memory does have a role in syntax processing, particularly in contexts such as searching a sentence for an antecedent, determining the truth value of a sentence, or assuring that the syntactic interpretation of a sentence fits the communicative context. Although additional studies support a relationship between working memory and auditory comprehension deficits in

patients with aphasia (Balasubramanian, Murphy, Spatafore, Lopardo, & Dickinson, 2001; Radanovic et al., 2003; Yasuda et al., 2000) and between working memory deficits and overall aphasia severity (Pluth, Bogdanova, White, Lundgren, & Albert, 2003), how working memory problems might impact the discourse production skills of patients with aphasia has been the focus of few studies and, thus, requires further investigation.

Although few investigations have focused on the LTM abilities of aphasic patients, there is some evidence for disruption of this aspect of memory. Beeson and colleagues (1993) assessed memory using a semantic encoding procedure to provide a means to examine cued recall in addition to free recall, as a comparison of free recall versus cued recall provides information regarding the integrity of executive control processes that direct the encoding and retrieval of long-term memories. They found differences in performance of subjects with anterior versus posterior lesions on the free recall test (long term memory) but not the cued recall test. They suggested that cued recall tasks do not require the same self-directed retrieval demands as free recall tasks and that the poor verbal long-term memory performance in subjects with anterior lesions may best be explained as a reflection of executive control deficits associated with frontal lobe damage. On the other hand Burgio and Basso (1997) found verbal and spatial memory deficits among left hemisphere damaged patients, regardless of the lesion site. Also Della Barba et al (1995) found that LTM abilities in aphasia were not dependent on lesion site but rather on whether the patient could make semantic associations amongst the items to be recalled.

c) Executive function and aphasia

There is an increasing recognition that the communication problems one observes in persons with aphasia extend beyond verbal deficits and that the myriad of symptoms observed are not solely due to a faulty linguistic system. Rather, there exists a coalition of causal elements resulting in a wide range of communicative deficits. There is some preliminary evidence suggesting that communicative success of clients with aphasia may depend on the integrity of executive function skills (Ramsberger, 1994).

Executive functions are called into play when an individual is involved in a complex, novel activity. They allow us to plan, sequence, organize, and monitor goal-directed activities in a

flexible manner as demanded by situational and environmental changes (Ylvisaker & Feeney, 1998). Ramsburger (2000) suggests that ‘‘executive functions may serve an important mediating role in the complicated task of human communication especially when routine processing schemas are no longer viable due to primary speech and language processing disorders’’

Glosser and Goodglass (1990) were among the first researchers to specifically examine executive functioning ability in persons with aphasia. They administered four experimental executive function procedures to 22 left-brain-damaged, 19 right-brain damaged and 49 healthy controls. Brain-damaged subjects were divided into groups according to site of lesion: prefrontal, retrorolandic, and mixed. The test procedures included the nonverbal continuous performance test, graphic pattern generation, sequence generation task, and the Tower of Hanoi. Results indicated that subjects with left frontal lobe lesions were significantly more impaired than subjects with left retrorolandic or mixed left hemisphere lesions. In addition, results suggested that the observed impairments were independent of the subjects' linguistic deficits.

Other studies have demonstrated that persons with aphasia have difficulty in various aspects of cognition that fall under the umbrella of executive functioning, such as Working memory, attention, and problem solving. Working memory may be considered a foundation for executive abilities (Conner, MacKay, & White, 2000). It provides storage and workspace for information, thus permitting interactions between attention, perception, and memory (Baddeley, 1992). The executive controller performs operations on information held in working memory so that this information may be used effectively.

d) Problem solving skills and aphasia

The relationship of language to other mental or cognitive process is only partially understood .In the 1960's Vygotsky (1962) described language as the central component of cognition and a mediator of problem solving behaviours.subsequently, Luria (1980) designated language as a key mediator of mental processes. The manner and extent to which the disruption of language present in aphasia affects cognitive processes is unclear. Luria noted the role of aphasia in producing other cognitive deficits, such as the planning and execution of other complex behaviors.

Problem solving generally requires a series of steps, including analysis of a problem, generating possible solutions, testing solutions, and modifying behavior/ switching strategies when a solution is unsuccessful. This ability has most often been associated with prefrontal cortex, as patients with frontal lesions often show impaired problem solving due to impaired strategy formation and an inability to modify behavior based on feedback (Baldo, Delis, Wilkins, & Shimamura, 2004;; Stuss & Alexander, 2000).

Aphasia can also affect problem solving abilities that are not obviously linguistic – for e.g. arithmetic skills. Weisenberg and McBride (1953) documented the diminished performance of aphasic subjects on typical nonverbal tests compared with normal subjects.Prescott, Loverso, and selinger (1984) described their use of a puzzle called the tower of Hanoi to study the relationship of aphasia with problem solving. The puzzle is a visual problem that doesn't depend overtly on the language skills for its solution. Nevertheless differences existed between aphasia subjects and their controls in the ability to solve the puzzle. A better understanding of language, aphasia and cognition becomes increasingly important as we continue to treat all factors affecting the communicative ability of aphasic patients.

Some studies with aphasic patients would seem to challenge the notion that language directly supports reasoning and problem solving (Basso et al., 1973; Kinsbourne & Warrington, 1963; Varley & Segal, 2000). Basso et al. (1973) reported that performance on the Raven s Matrices test was impaired in both left hemisphere patients with aphasia and right hemisphere patients, and that there was no correlation between Raven's performance and language scores. They did find, however, that aphasics performed poorly on reasoning tests but concluded that this was due to lesions that encroached on other regions critical for cognition.

Kinsbourne and Warrington (1963) tested two patients with jargon aphasia and reported that they scored in at least the average range on a number of neuropsychological measures.They concluded that ‘‘inductive thinking may remain essentially intact in spite of gross syntactical disorder’’, however, that these two patients had mild to no receptive language impairment, which may have contributed to their relatively preserved cognitive abilities Also, one of the two patients in Kinsbourne and Warrington's study failed a category sorting test, suggesting that problem solving was disrupted to some extent in at least one of the two patients.

Varley and Segal (2000) reported that an agrammatic patient with a large lesion affecting most of the temporal lobe was able to perform a number of cognitive tasks quite well, including a theory of mind task. They concluded that, while grammar may be crucial to one's ability to attain a certain level of cognitive development, ''cognition can operate without grammar'' in the adult. However, while this patient was poor at grammaticality judgments, he was able to comprehend difficult task instructions in the theory of mind task, suggesting that his language comprehension was only mildly to moderately impaired.

e) Orientation and Aphasia.

Orientation is an indicator of general intellectual function and is defined as the ability to report time, place, and personal data. Orientation is considered an indicator of general impairment of cognitive function, and is therefore a standard component in mental status examinations (Nelson, Fogel and Faus, 1987). Kapur (1988) stated that Orientation to time is more vulnerable than orientation to place and person. Orientation is an important prognostic indicator of functional outcome in stroke. In spite of this only sparse knowledge is available on the frequency and time-course of orientation in stroke. Conflicting reports on the frequency of impaired orientation have been published. Impaired orientation was found in 14% of stroke patients assessed within 1 week after stroke onset (Wade, Skilbeck and Hewer, 1989) and in another study frequency of orientation impairment was 41% assessed 7–10 days poststroke (Desmond et.al, 1994) The frequency of impaired orientation in unselected patients with acute stroke is not known and knowledge of the time-course of recovery is sparse.

Desmond et.al, (1994) attempted to correlate impaired orientation to lesion localization and reported impaired orientation related to anterior and posterior artery territory infarcts, and thus the limbic, system, but the finding was not significant in a multivariate analysis.

Pedersen et.al (1996) studied the frequency, the determinants and the recovery of orientation in 1,014 acute stroke patients and they were assessed for orientation subscore in the Scandinavian stroke scale for every week until the discharge. They found impaired orientation in almost 1 of 4 unselected stroke patients. And impaired orientation was found in 12% after completed rehabilitation

f) Intelligence and Aphasia

Wechsler (1958) defines intelligence as the global capacity of an individual to act purposefully, to think rationally, and to deal effectively with his environment. The working definition of intelligence says intelligence is a complex trait that is measured by intelligence tests (Wechsler, 1971). Many investigators have reported that aphasics are more impaired than non-aphasics on the non-verbal portions of the Wechsler intelligence scales (Orgass, Hartje, Kerschensteiner and Poeck, 1972). Particularly, it appears that those aphasics who manifest signs of constructional apraxia are at greatest risk for non-verbal intellectual impairment (Alajouanine and Lhermitte, 1964). However, this association between constructional apraxia and non-verbal intellectual impairment seems to hold for patients with both left and right sided lesions.

2.4 Assessment of Cognitive–Linguistic Function

A number of assessments that are routinely used in the field of neurogenic communication disorders are specifically aimed at cognitive–linguistic skills. Thus, the Measure of Cognitive–Linguistic Abilities (MCLA; Ellmo et al., 1995), the Cognitive Linguistic Quick Test (CLQT; Helm- Estabrooks, 2001) and the Scales of Cognitive Ability for Traumatic Brain Injury (SCATBI; Adamovich & Henderson, 1992)4 all combine the terms ‘cognitive’ and ‘linguistic’ (in the title, the manual or both) but vary in the degree to which they explicitly discuss the relationship between the two.

The MCLA is designed for use in Traumatic Brain Injury (TBI) and has as one of its three major purposes ‘to recognise the important interrelationship between cognition and language’. It samples various discourse tasks (story recall, story generation, picture description) as well as direct testing of inferential linguistic ability via, for example, proverbs. While it would be difficult to argue against the notion that these are cognitive–linguistic functions, they do not throw light on why a respondent might have difficulty with, say, story generation. In other words, the lack of focus on the mechanisms underlying any emerging difficulty in communication means that it is difficult to interpret test performance.

The cognitive linguistic quick test (CLQT) is intended to provide rapid assessment of five 'primary domains of cognition', namely attention, memory, executive functions, and language and visuospatial skills in people with acquired neurological dysfunction as a result of stroke, TBI or dementia. Of the 10 tasks contained within the test, five are designed to involve minimal language demands, in order to allow for cognitive testing of people with aphasia. It is unclear why the linguistic domain — identified as one of the five cognitive domains — was singled out for inclusion in the title and how the CLQT 'provides an overall measure of cognitive–linguistic function'. Although it certainly provides a means of assessing some cognitive abilities (including language), it does not facilitate understanding of the 'integral–reciprocal relationship' (Kennedy & Deruyter, 1990) between cognition and language. The title of the SCATBI (i.e., scales of cognitive ability) would appear to suggest that linguistic skills are not a particular focus of the assessment. Indeed, the titles of the scales — Perception and Discrimination, Orientation, Organisation, Recall and Reasoning — similarly do not highlight the role of language over and above any other function. The scales are said to 'provide a systematic method of assessing cognitive deficits' but are then also 'designed to measure aspects of cognitive/linguistic performance'. The use of 'cognitive/linguistic' here, in parallel with its use in other assessments, does not serve to illuminate the theory or structure underlying the test.

To some extent the subtests from these assessments simply represent a straightforward distinction, long established in measures of intelligence, between nonverbal and verbal functions. We would argue that what is missing, if they are indeed going to address the issue of cognitive–linguistic function, is an exploration of the interaction between the two. In fact, the assessments do contain subtests that offer the opportunity for such exploration. For example, in the SCATBI there are two subtests that require respondents to listen to a spoken paragraph on audiotape and signal each occurrence of a particular word ('no' in the first, 'to' in the second). The second subtest includes distraction in the form of background cafeteria noise. No overt link is made in the scoring procedure as to the effect of distraction on the previously established skill.

Relatively little modification would be required for these subtests to provide more meaningful information on cognitive–linguistic ability. Most importantly, the two listening tasks (without distraction) would need to present a similar degree of difficulty so as to constitute, in

effect, parallel forms of the same basic task. This would allow the first task not only to tap the primary listening skill but also to serve as a true baseline for establishing the effect of distraction on listening. Norms could then be developed in terms of, in this particular case, a 'distraction decrement', that is, the degree to which distraction negatively influences listening performance. Given that distraction could reasonably be expected to adversely affect the listening performance of non-TBI individuals, the key result would be the predicted potential increase in the decrement after TBI.

2.4.1 Assessment of Cognitive Impairments in Aphasia

Formal Assessment:

To establish individual profiles of cognitive functions, a neuropsychological assessment is required. Studies of cognition in people with aphasia typically have employed cognitive tests with no obvious linguistic demands. For example, Raven's coloured progressive matrices.

1) **Raven's Coloured Progressive Matrices (RCPM)**

It was given by Raven, Court and Raven, 1979. It is a test of visual analogic thinking in which each item consists of a visual matrix with a missing piece. The task is to select the piece that best completes the particular design from an array of six. This was one of the tests used by Basso, DeRenzi, Scotti and Spinnler (1973) and interestingly, they found that the correlation between scores earned by 33 subjects with left hemisphere damage on the Raven's and scores earned on a language test of naming and comprehension was "practically zero". In other words, it was impossible to predict analogic thinking ability on the basis of language test performance.

2) **Cognitive Linguistic Quick Test (CLQT)**

CLQT given by Helm-Estabrooks, 2001 was recently developed to meet the needs of clinicians who want to obtain basic information about the relative status of attention, memory, executive functions, language, and visual spatial skills of their patients.

The CLQT consists of 10 tasks and can be administered in15-30 minutes. Field testing was conducted with both non-clinical (no known neurological dysfunction) and neurological examinees who were demographically representative of the United States adult population

according to sex, age, education level, race/ethnicity, and region. The target ages were 18-89 years.

One pilot test and three research studies led to the final version of the CLQT. In Study 1, 30 certified speech language pathologists and licensed psychologists tested 92 individuals, 28 with one of the following neurological diagnoses; left CVS, right CVA, bilateral CVAs, Alzheimer's disease, and closed head injury. Each of these individuals was matched by age, race/ethnicity and educational level to at least two clinical examinees (except for those clinical cases with11 years or less of education who had one match each) for a total of 64 non-clinical examinees. In study 2, 61 clinicians in 31 states tested 154 non-clinical examinees. In study 3 another 119 examinees (38 clinical and 81 non-clinical) were tested. On the basis of scores earned by non-clinical examinees during the research studies, two sets of normal cut-off scores (ages 18-69 and 70-89) were established for all tasks, cognitive domains, and overall cognitive performance.

3) Cognitive Linguistic Assessment Protocol for Adult (CLAP)

Cognitive Linguistic Assessment Protocol for Adults (by Aruna Kamath, 2001) .The following core cognitive abilities that support language are assessed:

1) Attention, perception, discrimination (visual and auditory)
2) Memory (episodic, working memory, semantic memory)
3) Reasoning, problem solving
4) Organization.

Responses are scored based on accuracy of responses.

Informal Assessment:

Informal assessment of cognitive process can be done by using methods such as: observation, interviewing, conversation, certain simple tasks

It could include assessment of the following features:

- Orientation
- Space

- Attention and concentration (RT, vigilance, Cancellation etc)
- Memory – verbal and nonverbal
- Concept formation & reasoning
- Problem solving
- Perception

2.4.1 Assessing Attention Impairments in Aphasia:

Ideally, the attention skills of aphasia patients should be evaluated in both unstructured and structured contexts to provide information about if and how such problems interfere with daily activities and social interactions. During unstructured observations, clinicians might note whether their aphasic patients appear alert, are able to resist distraction from external or internal stimuli, and can maintain their attention over a specific length of time (i.e. intact vigilance). Such observations should be made while aphasic patients complete daily routine tasks (eg. physical therapy session, watching television) and interact with a variety of communication partners (eg. family versus healthcare team members, children versus adults).

Structured assessments of attention might include one or more of the following: standardized tests of attention, attention protocols from the research literature, and language tasks completed under different attention conditions.

It is important, however, to consider the extent to which linguistic variables may affect scores on this attention tasks.

a) **The Stroop Test** (Trenerry et al, 1989) is a population measure of focused attention, it is inappropriate for aphasic patients because it requires rapid naming of colors or reading aloud of words. Poor Stroop performance by aphasic patients, therefore, maybe the result of impaired language rather than attention problems. Even some of these tests might have questionable validity for patients with moderate to severe aphasia.

b) **Test of Everyday Attention(TEA)** (Robertson et.al 1996) may be most useful in clinical practice because it (1) assesses a variety of attention functions, including selective attention, attention switching and sustained, focused, and divided attention abilities of adults 18 to 80

years of age (2)includes everyday life materials and tasks and thus, in contrast to most other structured attention tests, has good ecological validity(Robertson et.al 1996); (3) has been standardized on a group of stroke patients (although how many of these stroke patients had aphasia was not specified) and (4) includes parallel test forms so that it can be used to measure reliably intervention progress. In addition to the large group of non-brain damaged adults, the normative sample for the TEA includes 74 unilateral stroke patients and this is validate to discriminate patient populations (i.e. Stroke, traumatic brain injury , early Alzheimer's disease , and progressive supranuclear palsy).

c) **The paced Auditory serial Attention test** (Gronwall, 1977) originally known as the Paced Auditory Serial Addition Task (PASAT). The subjects are given a number every 3 seconds and are asked to add the number they just heard with the number they heard before. This is a challenging task that involves working memory, attention and arithmetic capabilities. Versions with numbers presented every 2 seconds are also available. The original version presented the numbers every 2.4 seconds with 0.4 decrements for subsequent trials. The PASAT was originally developed for use in evaluating patients with head injury [1]. The advantage in this population was supposed to be minimal practice effects. This test has been widely used in other conditions besides traumatic brain injury.

d) **D2 Test** (Brickencamp, 1962) a cancellation test involving simultaneous presentation of visually similar stimuli, has been proposed as a particularly useful measure of attention and concentration Processes (Brickencamp & Zillmer, 1998).The task is to cancel out all target characters (a "d" with a total of two dashes placed above and 0 or below), which are interspersed With nontarget characters (a "d" with more or less than two dashes, and "p" characters with any number of dashes), in 14 successive timed trials (Brickencamp, 1962).

e) **Trail Making Test** (Maj et al 1993) is a neuropsychological test of visual attention and task switching. The task requires a subject to 'connect-the-dots' of 25 consecutive targets on a sheet of paper or computer screen. Two versions are available: A, in which the targets are all numbers (1, 2, 3, etc.), and B, in which the subject alternates between numbers and letters (1, A, 2, B, etc.). The goal of the subject is to finish the test as quickly as possible, and the time taken to complete the test is used as the primary performance metric.

f) **Rating Scale for Attentional Behaviour** (Ponsford and Kinsella, 1992) it was originally developed for the traumatic brain injury population, this tool may provide clinician with information about if and how attentional problems might be interfering with their aphasic patients daily behaviors. The scale includes 14 items (e.g. tired easily, 'been unable to pay attention to more than one thing at once', missed important details in what he/she is doing)which are rated on a scale that ranges from 0 (behaviors that does not occur at all) to 4 (behaviors always occur).

Another approach to assessing the role of attentional factors in aphasic patients' language skills might be to administer formal or informal language tests in conditions that maximize as well as minimize extralinguistic demands. For example, a clinician could administer a written narrative task in both quiet (e.g. therapy room) and distracting environments (eg. hospital room). Comparison of the written narratives elicited under the different attention conditions might help determine whether deficits of language (i.e. similar writing problems elicited under both conditions), attention (i.e. writing problems only elicited in the distracting environment), or both (i.e. writing problems elicited in both environments but more severe problems associated with the distracting environment) are contributing to an aphasic patient's writing problems.

2.4.2 Assessment of Memory impairments in aphasia

Informal Assessment

a) Span Tasks (Serial Recall)

Span tasks usually assess a person's ability to repeat a series of items, which might include digits, letters, or words, immediately following a single presentation. The lists may be subspan, with fewer than seven items to be recalled, or supraspan, with more than nine items. These tasks require processing by working memory—the phonological loop for verbal information and the visuospatial sketch pad for visual information. The phonological loop also may be used to rehearse visual information if verbalization is used as a memory strategy. For supraspan tasks, the episodic buffer would presumably process information and "chunk" it for temporary storage. The function of the central executive in span tasks is to allocate attentional resources to the to-be-remembered information.

b) Verbal List-Learning Tasks

List-learning tasks typically require the patient to learn a string of related or unrelated words. The list may be presented over three to five learning trials, assessing a person's ability to benefit from repetition. Typically, the lists include at least 10 words. This is a declarative learning task, in which information is encoded into long-term memory. The episodic buffer would presumably be involved in organizing or "chunking" the information for recall. This might include organization of words by semantic category, development of stories or visual associations to aid encoding, and synthesis of information with information previously stored in long-term memory that could help impose meaning or structure on the material to be learned. The central executive would be involved in allocating attention, including inhibiting competing information to reduce intrusion errors.

c) Immediate Recall Tasks

On immediate recall tasks, examinees are asked to spontaneously (i.e., without hints/cues) recall stimulus materials immediately following presentation. The information to be recalled can be verbal, such as paragraphs or stories, or visual, such as a picture or a design/figure. Performance relies on the storage aspects of working memory, including the episodic buffer, phonological loop, and visuospatial sketch pad. The central executive also is involved in allocating attention and reducing interference. There is some debate about the temporal distinction between short- and long-term memory (Ranganath, Cohen, & Brozinsky, 2005), and thus whether immediate recall of supraspan information is truly dependent only on working memory. Stimuli such as stories seem to be clearly beyond simple working memory span, yet patients with declarative learning and memory problems often can recall key information immediately after it was presented.

d) Delayed Recall Tasks

On delayed recall tasks, examinees are required to recall information that was presented previously, usually with at least a 15-min delay. Again, the information can be verbal, such as stories or words, or visual, such as pictures, faces, or designs. This type of task presumably taps

into the long-term store, particularly the declarative memory episodic store. The central executive also is involved in allocating attention and using strategies to facilitate encoding and retrieval, including conducting a mental search for the information and distinguishing it from other competing information.

e) Recognition Memory Tasks

Recognition memory tasks involve presentation of previously presented items, such as words or pictures, mixed with distracter items that were not initially presented. Examinees are required to identify the previously presented items. These tasks yield two scores. The number of hits, or correctly identified targets, indicates their ability to recognize items they have been exposed to previously. The number of false positive errors, or nontarget items that were identified as targets, provides evidence of difficulty distinguishing between competing bits of information. Recognition performance requires the long-term episodic store, as well as the episodic buffer and central executive.

f) Prospective Memory Tasks

Prospective memory tasks require the retention of instructions over time, in order to perform some activity at a specified interval (Cockburn,1996). For example, examinees may be told to remind the examiner to order lunch in 15 min. The examinee must retain these instructions, monitor the passage of time, and initiate the reminder at the appropriate time. This type of memory has been hypothesized to be more related to "real-world" functioning than other standardized memory tasks because the task demands are similar to those involved in everyday activities (Mateer, Sohlberg, & Crinean, 1987). Prospective memory tasks presumably involve the storage aspects of working memory in that the examinee must continuously rehearse the information in order to retain it over time. The episodic buffer and the central executive also are involved in monitoring the passage of time and initiating a response. Evidence for the role of attention in prospective memory is provided by studies that have found a relationship between performance on prospective memory tasks and on tasks of attention and speed of processing (Schmitter-Edgecombe & Wright, 2004).

g) Testing Implicit or Procedural Memory

There are no formal or standardized clinical tools available to assess nondeclarative memory, despite the fact that the relative preservation of implicit memory, skills, and habits in many persons with brain injury has the potential to be used as a tool in rehabilitation. There have been many studies in which individuals with profound amnesia were able to learn facts and routines as habits, with no declarative recall of the therapy or therapists (e.g., Turkstra & Bourgeois, 2005). Thus, the assessment of a person's implicit learning, procedural learning, and habit formation could add substantially to goal setting and treatment planning in rehabilitation. This assessment can be conducted informally, by observation of an individual's abilities in real-world settings. Preservation of skills in these areas can be used to compensate for impairments in declarative memory and other areas of cognition, including impaired language and social communication. Adoption of measures used in the experimental cognitive neuroscience literature, such as pursuit rotor learning and priming tasks, may be useful clinically. For example, patients who are able to learn motor skills, such as a pursuit rotor task (learning to use a stylus to trace a rotating pattern), may be able to learn and retain motor sequences involved in self-care skills, as well as learning exercise sequences taught in therapy sessions.

Formal Assessment

1) Wechsler Memory Scale –Third Edition (WMS-III)

The Wechsler Memory Scale –III was devised to measure the people's learning and memory and its functions. There are 17 subtests and which are grouped into primary subtests (10) and optional subtests (7). The primary subtests assess for eight functions such as Auditory immediate, visual immediate, immediate memory, auditory delayed, visual delayed and auditory recognition delayed, general memory and working memory. The WMS –III (Wechsler, 1997) has three subtests that measure aspects of working memory. These include forward digit span, backward digit span, and letter number sequencing. Span tasks have been used extensively in research to measure the working memory storage. The optional subtests measures four functions such as single trial learning, learning slope, retention and retrieval. The response type of the WMS-III is of verbal response only. A benefit of using the WMS-III is that the test is

standardized and has normative data for adult's upto age 89 to compare individuals' performance. The span subtests as well as the letter number sequencing subtest requires verbal responses ; therefore it is not suitable for many individuals with severe form of aphasia and these subtest will be appropriate for individuals presenting with mild forms of aphasia.

2) N-Back Tasks

This task is used to assess the working memory deficits in aphasia. In this task a stream of items is presented verbally or visually and the participant is instructed to respond when the current item is the same as the one n back. For e.g. for a 1-back task the individual responds when the current item is the same as the one immediately preceding it. This task doesnot require a verbal response; participants can respond through a button response. The task complexity is increased by increasing the n back, thus increasing the memory load and we can study the participants working memory system.

2.4.3 Assessment of Intelligence in Individuals with Aphasia

1) Raven's progressive matrices (RPM)

This test has demonstrated to be a measure of general intelligence obtained through non-verbal means. The test requires the subject to examine a visual array from which a subsection appears to have been cut out. Via oral or pointing response, the subject has to indicate which of the several multiple-choice alternatives the correct one is. This task assesses various cognitive abilities, including visuoperception, abstract reasoning, spatial relation, and counting and mental flexibility. Significant impairment in the performance of the RPM test is seen in patients with both right and left hemisphere lesions, particularly in association with constructional apraxia (Zangwill, 1975).

Among patients with left brain damage, impairment on the RPM test is associated with the presence of aphasia (Basso et al. 1973), and among aphasics, such defects are primarily restricted to patients with language comprehension impairment (Costa, Venghan, Horwitz and Rilter, 1969).

2) Wechsler Adult Intelligence Scale – WAIS (1955)

This test can also be used to assess intelligence of individuals with aphasia.

It comprises 11 subtests. Six subtests are grouped into a verbal scale and 5 into a performance scale. Verbal scale assesses arithmetic, information, comprehension (including practical judgment and common sense), similarities (the subject has to say in what way two things are alike), digit span and vocabulary.

Performance Scale includes digit symbol (9 symbols are paired with 9 digits and the subjects have to write them down in one and a half minutes), picture completion, block design, picture arrangement (sequencing), object assembly.

Full scale IQ, verbal IQ, and, performance IQ is obtained. It thus gives an idea about delayed recall, verbal skill, and performance skill.

3) Weigl Colour Form Sorting Test

This test assesses conceptual ability. Tasks calling for sorting of colours, objects, forms etc were thought by Kurt Goldstein to be good representatives of conceptual thinking. Conceptual ability is the fundamental ability to generate a concept of a class of things and to discriminate those things that belong to the class from those that do not.

The subject's task is to form a principle and sort the tokens accordingly and then form a second principle and re-sort the tokens to fit it. Thus it involves a conceptual shift. Patients with frontal or fronto-parietal lesions were found to exhibit difficulty in conceptual abilities (Mc Fie and Piercy, 1952)

2.5 Importance of Cognitive domains in rehabilitation of aphasia.

Attention and working memory deficits also may have direct effects on the rehabilitation process, and consequently, aphasia treatment outcomes. For example, several groups of researchers have observed that patients with aphasia who had concomitant cognitive deficits (including poor performance on attention and working memory tests) were less likely to benefit from aphasia treatment than their aphasic peers who did not have these coexisting

problems (Sinotte, Nicholas, & Helm-Estabrooks, 2003). Relatedly, research conducted with other neurogenic patient populations also indicates that attention and working memory problems can affect learning, and thus, slow the rate or the degree to which patients can acquire new skills or learn to use independently compensatory strategies (Robertson, Ridgeway, Greenfield, & Parr, 1997).

Evans, Wilson, Needham, and Brentnall (2003) found that the performance of brain injury patients on an attention test was a strong predictor of their use of memory because rehabilitation may be negatively affected by attention and working memory impairments, so too may the social and vocational outcomes of patients with aphasia. Ramsing, Blomstand, and Sullivan (1991) found that attentional abilities were most influential on aphasic patients' ability to return to work, more so than their language abilities. There are also studies which reports that there is association between performance on an auditory-verbal memory test and the number of emotional, cognitive, and activity changes reported by left hemisphere stroke patients using aids, which in turn was associated with greater levels of independence.

Need for the study

Aphasia is now recognized as a language disorder resulting from neuro-physiological damage along with impairment of cognitive processing. The debate on whether cognition and language are related and whether cognition precedes language or vice versa still continues, but, it has been observed that there is considerable overlap in the cognitive and language domains. Language disorder or decline and severe persistent cognitive impairments may coexist. Both these are highly interrelated and inter-dependent. There is very little existing literature on how these cognitive linguistic deficits manifest in individuals with aphasia. There is need to explore cognitive-linguistic deficits if any and to develop a test battery for such assessment in Aphasia.

Aim of the study

The present study aimed to study the performance of individuals with aphasia on various cognitive linguistic domains using a battery of tests, the assessment aimed to explore cognitive-linguistic deficits if any in individuals with Aphasia.

CHAPTER III

METHOD

The aim of the present study was to evaluate the performance of individuals with aphasia on cognitive-linguistic tasks using a test battery; the cognitive linguistic deficits were explored.

3.1 Subjects

- 20 normal healthy adult individuals and 20 age matched right – handed individuals with aphasia following left hemisphere damage were taken for the present study.

Table 1: *Demographic data of Normal adults and individuals with aphasia*

Age range	**Normal adults**	**Individuals with Aphasia**	
		Nonfluent group	**Fluent Group**
30-40yrs	5	Broca's aphasia (3)	Wernicke's (2) , Anomic (1)
40-50 yrs	5	Broca's aphasia (4)	Wernicke's (1) , Anomic (1)
50-60 yrs	5	Broca's aphasia (2)	Wernicke's (2) , Anomic (1)
60-70 yrs	5	Broca's aphasia (2)	Transcortical sensory (1)
Total	20	11	9

3.2 Subjects Selection Criteria

The following criteria were considered for selection of subjects.

- All participants were diagnosed as having aphasia by a Speech Language Pathologist and/or neurologist.

- These subjects with mild\moderate aphasia should have a single left hemisphere lesion, confirmed by CT scan.
- All subjects should have normal\suitably vision and hearing abilities and also functional (though reduced) reading and writing abilities.
- The subject should be able to speak, read and write in Kannada. He\she should have a minimum of primary school education.
- Different aphasic syndromes were considered. This was determined on the basis of clinical observation and Western Aphasia Battery (WAB, Kertesz & Poole, 1974) findings.
- Both male and female aphasics were considered for the study. Participants included three females and seventeen males.
- All participants were right handed. This was determined using self-report and information from significant others.
- None of the participants had any auditory or visual deficit as assessed informally.

3.3 Procedure

The following test batteries were administered to study the cognitive – linguistic deficits in individuals with aphasia.

1. Western Aphasia Battery (Kertesz, 1982).
2. Addenbrooke‘s Cognitive Examination –Revised (John R.Hodges, 2005).
3. Cognitive – Linguistic Assessment Protocol (Rajasudhakar & Shyamala, 2006).
   Instructions specific to the task were given in Kannada .The scoring was carried out simultaneously for each task as per the scoring procedure scheduled for each item in the test batteries.

3.3.1 Western Aphasia Battery (Kertesz, 1982).

The Western Aphasia Battery (Shewan & Kertesz, 1982) was designed to provide a means of evaluating the major clinical aspects of language function: content, fluency, auditory comprehension, repetition and naming plus reading, writing and calculation. In

additional the nonverbal skills of drawing, block design and praxis are evaluated and Raven's Colored Progressive Matrices test is usually administered as well. The scoring provides two main totals, in addition to the subscale scores. These are the Aphasia Quotient (AQ) score and Cortical Quotient (CQ) score. AQ can essentially be thought of as a measure of language ability, whilst CQ is a more general measure of intellectual ability and includes all the subscales. The Western Aphasia battery (WAB) was used to discern the presence, degree, and type of aphasia.

It comprises 7 subtests:

1. Spontaneous speech
2. Comprehension
3. Repetition
4. Naming
5. Reading and writing
6. Praxis
7. Construction

Oral language subtests (AQ)

I) Spontaneous speech

a) Description of test and materials.

This section was designed to elicit conversational speech from the patient in reply to questions asked in the context of an interview and a picture description .Changing the wording of the questions and few encouraging comments are permitted. The two important aspects of spontaneous speech which are examined are the information Content and fluency.

Consists of six questions which are mainly the translations of original WAB and the picture card. This picture card was modified to the Indian culture .

Scoring:

Information content and fluency were scored according to the set criteria for spontaneous speech

(See appendix -I)

II) Auditory verbal comprehension

As the patient performance is often complicated by difficulties of verbal expression, apraxia and intellectual functions ,comprehension task attempts to cover various aspects of this feature, by using (a) Yes-No questions,(b) a pointing task of auditory recognition , and (c) a series of sequential commands

(a) Yes-No questions

Description of the materials

The patients were asked to reply or nod "Yes" or "No" to 20 questions. the first nine questions were most relevant to the patients .The next five questions are related to the environment and the last six are more general in their context, yet they remain semantically simple and short , although there was an increase in linguistic complexity requiring more comprehension of syntax, such as relational words. The use of Yes /No responses avoids to some extent the pointing difficulty or apraxia that may interfere with the tasks of comprehension.

Instruction: The patients were instructed to answer with Yes or No only. If the patient continues to chat/talk or answers in sentences, the instruction should be repeated .

Scoring:

Three points were scored for each correct answer. Record responses in the appropriate column:-verbal, gestural or eyeblink. If the patient self corrects, the last answer is scored .If the response is ambiguous, score 0.

b) Auditory Word Recognition

Description of test and materials:

The patients were asked to respond for an item, spoken by the examiner, from an array in the same category. Materials of this task are six objects, six line drawings of objects, six letters, six numbers, six geometric forms, six colours, six items of furniture in the room, six body parts of the patient, five items of finger recognition and seven of right and left orientation.

Instruction:

Patients were instructed to point to each item, by saying, point to the---------- or show me the ---------- in the order listed. One repetition of each command was allowed.

Scoring:

One point was scored for each correct response .If the patient points to more than one item, it was scored as 0, unless it was clear that the patient recognizes his / her error and corrected. For the seven items requiring left-right discrimination, the patient must get both the side and body part correct to receive credit.

c) sequential commands :

Description of the test

This subtest was also used to examine the comprehension of syntax consist of 11 commands. The initial commands and sequences were simple and short to establish rapport, to place the patient in set and to allow the examiner to ascertain that the patient understands that he /she is to perform to the commands. Most of the sequential commands involve the manipulation of touching one object with another, using prepositions of "with/to" "on top" "over" and "other side". The length of sentences and the number of clauses were also increased.

Instruction:

On the table infront the patient line up the pen, comb and book in this respective order and label each, verbally "see the pen, comb and the book .I will ask to point to them and do thngs with them just as I say. Are you ready". If the patient does not seem to understand the task, point with the comb to the pen to demonstrate and start again.

Scoring:

Scoring is same as given in the original WAB .Credit was given for partial response if the underlined portion of the sentence, representing action or an object, was appropriately performed.

III) Repetition:

Description of the test

Repetition was tested by high frequency words of increasing length, composite words, numbers, number-word combinations, high and low probability sentences and sentences of increasing length and grammatical complexity. It includes tests of oral agility, a test sentence that contains all the letters and test sentences which consists specifically of short grammatical words.

Instructions:

Patients were asked to repeat the words listed in the test material then the responses were recorded.

Scoring:

Scoring two points for each recognizable word. Minor dysarthric errors or colloquial pronunciations are scored as correct .Take 1 point off for error in order of word sequence or for each literal paraphasias (phonemic error)

IV) Naming: Naming task includes

(a) Object Naming:

Naming of objects on visual confrontation constitutes 69% of the naming score. Twenty common prototypical objects that are easily available are shown individually .The sample contains various categories ,shapes and size .The patient first is asked to name the object on visual presentation .In the case of no response or incorrect response, the patient is allowed to participate it and if necessary , the first phonemic of the word is given as a cue .If it is a composite word, the first half is given as a semantic prompt .A total of 20 seconds is allowed for all of these steps for each object .

Scoring:

Score 3 points if named correctly or with minor articulatory error, 2 points for recognizable phonemic paraphasia and I point if an phonemic or tactile cue is required.

(b) Word Fluency – this is 20% of the naming score. It is measure by naming as many animals as the patient can name in 1 minute. The patient should be prompted by being given examples at the beginning. (Not to be counted if the patient repeats them) and again at 30 seconds. If no response are forthcoming.

Scoring:

Score 1 point for each animal named, even if distorted by literal paraphasias

(c) Sentence Completion: this is 10% of the naming score. Here the patient is asked to complete what the examiner says. There are 5

Scoring:

Score 2 points for correct response and 1 point for phonemic paraphasias

Responsive speech- this is 10% of the naming score. Here the word finding is facilitated by the context of the preceding sentence. There 5 items in this.

Scoring:

Score 2 points for acceptable responses; score 1 point for phonemic paraphasias.

V) Reading – This task include

(a) Reading comprehension of sentences:

This test utilizes the technique of sentence completion with a four –way multiple choice. There are 8 sentences. These sentences range in complexity from 3 words to all small paragraph of two sentences.

Here the patient is instructed to read these sentences and point to the missing word . Ask him to choose the best from those from given four choices. Instructions may be repeated if the patient does not seem to understand.

(b) Reading commands – this is scored for reading a loud and for doing what the cards requests, separately .It consists of 6 commands which are increasing in length and complexity. If the

combined score of A and B is 50 or more, discontinue reading tests and give a full credit of 100 minus twice the difference from 60.

(c)Written word stimulus – Object choice matching

Here the objects are placed in a random order in front of the patient , and the patient is asked to point to the object that corresponds to the word presented on cards. Score 1 point for each correct response.

(d) Written word stimulus – Picture choice matching

The card with pictures on it is placed before the patient and the patient is instructed to point to the picture that matches the word that is presented individually on cards . Score 1 point for each correct response.

(e) Picture stimulus – Written word choice matching

The card which has the words listed on it is placed before the patient. The patient is then requested to point to the word that is same as the picture. The pictures are presented individually on cards. Score 1 point for each correct response.

(f) Spoken words – Written word choice matching

The patient is presented with cards and asked to select the orally presented target word from a choice of 5 items. Score 1 point for each correct response.

(g) Letter discrimination:

Six individual letters are spoken by the examiner and the patient is asked to choose from the printed choice of six letters.

(h) Spelled Word Recognition:

Here the patient is asked to name the word that is spelled orally by the examiner. Score 1 point for each correct response.

(i) Spelling:

Six common stimulus words are spoken. 2-7 letters in length. The patient is asked to spell each of them.

VI) Writing

Writing tasks are divided into the standard subtests such as writing on request, dictation and copying.

(a) Writing on request- the patient is asked to write his name and address .score 1 point for each recognizable word or number. Deduct ½ point for each spelling mistake or paraphasic error.

(b) Written output – the patient is asked to write as much as he can in the sentences about the same picture that was shown for the spontaneous speech subtest. Score 34 points for a full description, 8 points for each complete sentences with 6 words or more, 1 point for each correct word in complete or short sentences. Deduct ½ point for each spelling or paraphasic error score isolated words 1point, to a maximum of 10 points.

(c) Writing to dictation –The patient is asked to write the sentence that the examiner dictates to him. The sentence may be broken up it the patient cannot remember it and parts repeated once. Score 10 points for the complete sentence or 1 point for each correct word. Deduct ½ point for each spelling mistake or Paraphasic error.

(d) Writing to dictated or visually presented words – The patient is asked to write the words that are dictated to him. If the patient fails to write the name of one of the objects dictated, the actual object is shown and the patient is encouraged to write the name. If he still fails, the word is spelled by the examiner and the patient is asked to write it. The last alternative is to have the patient spell the word using cut-out letters.

(e) Alphabets and Numbers :

The alphabets and serial number from 0 to 20 are asked to write. Score ½ point for each letter or number even if it is out of order.

(f) Writing of dictated letters and numbers :
Six letters and six numbers are dictated. Score ½ point each for correctly written letter and one for each complete number.

(g) Copying of words of a sentence :
Score 1 point for each correct word, 10 points for the complete sentence .Subtract ½ point for each incorrect letter.

VII) Apraxia

Twenty commands are given for upper limb, buccofacial, instrumental (transitive) and complex performances.

Instruction: Tell the patient "I am going to ask you to do some things, try and do them as well as, you can". If the patient fails to perform the command well, imitate the action .If this also fails, then give the patient the real object.

Scoring: The patient is scored 3 for acceptable, 2 for approximate performance, 2 for imitation only 1 for approximate performance on imitation or if performed with actual object.

VIII) Constructional, Visuospatial and calculation Tasks:

(a)Drawing:

The patient is asked to draw a circle, square, Christmas tree, cube, clock, house and person, and also to bisect a line (to quantitative visuospatial neglect).

Scoring considers completeness, perspective and quality and penalizes perseveration, disconnected lines, inappropriate angles and neglect.

(b) Block Design:

The first 3 items and a demonstration item from the Wechsler's Intelligence Scale Bloch Design (Koh's Blocks) are used, with a modified scoring system (see Appendix).

(c) Calculation:

The calculation task utilizes one or two digit numbers 3 items for each of addition, subtraction, multiplication and division .These tasks are presented visually on cards as well as the examiner speaking the numbers and requested arithmetical operations.

(d) Raven's Colored Progressive Matrices:

Sets A, AB, and B are used to assess visuospatial perceptual function and nonverbal intelligence .The aphasia test.

3.3.2 Addenbrooke's Cognitive Examination-Revised (ACE-R) (John R.Hodges, 2005):

General cognitive ability was measured using the revised form of the ACE (Mioshi, Dawson, Mitchell, Arnold, & Hodges, 2006). The ACE-R is a cognitive screening instrument that takes between 12 and 20 minutes to administer and score in clinical settings. It gives a maximum score of 100 and there are five subdomains relating to different components of cognition:

a. Attention and orientation (18 points)
b. Memory (26 points)
c. Fluency (14 points)
d. Language (16 points) and
e. Visuospatial (16 points).

The ACE-R incorporates all the thirty items of the original MMSE, another widely used and validated screening tool in mental status evaluation. It contains a much more adequate measure of verbal short term memory composed of seven items administered over three trials, in addition to a delayed recall trial. An additional 10 object naming items were included and it contains two word generation tasks. And wider assessment of the basic language functions, such as comprehension, reading and repetition are included.

a) Attention and orientation

i) orientation

The orientation is indicator of the general intellectual ability and it is defined by the ability to report time, place and personal data. In this subsection two major questions were asked. The first one is to ask the participant for the day, date, month, year and season and one point is scored for each correct answer. The later question was to ask the participants for the name of the building, the floor, the town and country. One point was given for each correct response.

ii) Registration

In this subsection the participants were asked to repeat the three words after the clinician e.g. lemon, key and ball. And after a number of repetitions by the subjects they were instructed to remember them as clinician will be going to ask them later. The number of trials were recorded and scored in the first attempt.

iii) Attention and concentration

It includes calculation and spelling tasks. In the calculation task the participant were asked to subtract seven from hundred and the answer is recorded and again seven was subtracted from the answer and this was done for five times. Each correct calculation was scored as one point.

If the participant made more errors on calculation task the spelling test will be given. In this task the participant was asked to spell a word "world" and then to spell it backwards. One point was calculated for correct response and the errors were counted for each omission, letter transposition, insertion or misplacement.

b) Memory

The memory section of ACE-R incorporates three subsections which includes

i. Recall
ii. Anterograde memory
iii. Retrograde memory

i) Recall

In this task the participants were asked to recall the words that the clinician had asked them to repeat and remember (lemon, key and ball) in the registration task. And each correct word will be scored with one point.

ii) Anterograde Memory

The clinician instructed the participant that he is going to read a name and address and he has to repeat it after him for three times and then the clinician will ask him later. The last trial would be taken for the scoring.

iii) Retrograde Memory

The participants were asked for the name of the current prime minister, the woman who was the prime minister, the president of India, the prime minister who was assassinated. Each correct response were scored with one point.

c) Verbal Fluency

In includes two tasks letters and animals. In the letter task the participant were given a letter and he has to generate as many letters in a minute time. The repetition / perseveration and intrusions such as words beginning with other letters will be recorded but will not be taken for scoring. And proper names will not be counted.

In the animals test, the participant will be asked to say as many animals as possible which begin with any letter in a given one minute time. The repetitions will be recorded and counted but will not be considered for scoring.

d) Language

i) Comprehension

The participants were shown a written text and asked to read the sentence and do as it says. (E.g. close your eyes). If the participant reads and do it correctly he would be scored with one point. In an other task of three-stage command .The participant was instructed to “take a paper in your right hand. Fold the paper in half. Put the paper on the floor. For each correct command one point was scored.

ii) Writing

The participant was instructed to write a sentence and the sentence should contain a subject and a verb and it should have a meaning.

iii) Repetition

The participants were asked to repeat each of four words one at a time and the first trails will be considered for scoring and then each sentences were asked to repeat.

iv) Naming

The participants were instructed to name the pictures of five animals and five objects. Each correct response was scored with one point. And in the comprehension of the pictures the3 participants were asked to point out the respective pictures which are related to the statements given below the pictures.

v) Reading

The participant was instructed to read the words given. And a score of one point will be given only if all the words are correct.

e) Visuospatial skills

i) Overlapping Pentagons

The subject was asked to copy the pentagons overlapping picture. And a score of one point was given only if all the five sides of the pentagon and its intersection.

ii) wire cube

The participant was asked to copy the cube. If the cubes had 12 lines then it was scored as 2 and if the cube had fewer lines than the 12 lines it was scored as 1.

iii) Clock

The subject was instructed to draw a clock face with numbers and the hands at ten past five. The circle (1), numbers (2) and hands (2) are scored separately.

iv) Perceptual abilities

Counting dots

The participants were asked to count the dots without pointing them.

Identifying letters

The subject was asked to identify the letters given. Each correct response was scored with one point.

Recall

The subject was asked to tell the name and address that he told to remember in the beginning of the test. For recall of each correct item one point was given.

Recognition

If subject failed to recall one or more items then this test was done and some hints were given in this test to recall the previous items with options of X, Y and Z. for each correct recognition one point was given.

3.3.3. Cognitive – Linguistic Assessment Protocol for Adults (Rajasudhakar, 2005).

The following core cognitive abilities that support language are assessed:

- Attention, perception, discrimination (visual and auditory)
- Memory (episodic, working memory, semantic memory)
- Reasoning, problem solving
- Organization.

Responses are scored based on accuracy of responses.

Domain I: Attention, Perception and Discrimination.

Two main modes were considered for this domain.

(1) Visual
(2) Auditory

Two types of attention processes were evaluated, viz., selective attention and sustained attention. The cognitive process of perception and discrimination were contingent on attention and the three are parallel processes.

Visual category

(a) The cancellation at a letter level: The cancellation of the entire stipulated letter was considered a task requiring sustained attention.

(b) The cancellation at the word level: similar to above test, this is a sustained attention task.

(c) Contingent cancellation: This task requires fulfillment of a pre-requisite contingency before cancellation of the letter. This task was used to evaluate the selective attention.

Scoring: performance on each subtest was scored based on accuracy of responses. The time taken for each task was also noted.

Auditory category

(a) Sustained auditory attention was evaluated using a task where the subject was required to count mentally how many times a particular letter was read out in a list.

(b) , (c) The second subtest involved the subject's ability to discriminate amongst a pair of letters\words read out by the tester (same\different task).this is predominantly a discrimination task.

(d) The last subtest required the subject to recite the names of the months in the backward direction (i.e. December to January).This task involves attention and recall process too.

Scoring: performance on each task was scored for number of correct answers. Subtest (a) was given one point for every correct count. One point was deducted for every count above the correct number of total occurrence of stipulated letter.

Domain II: Memory

Three main types of memory processes were tested.

1) Episodic memory
2) Working memory and
3) Semantic Memory

Episodic memory: was tested by asking questions that tested orientation of self with respect to place, self and time and also a few questions of general knowledge.

Scoring: A score of one was given for each correctly answered question.

Working Memory: was evaluated using digit forward and digit backward repetition tasks. A maximum of seven digits were included in the list

Scoring: A score of one was given if all the digits in the list were repeated in the correct expected order.

Semantic Memory: Tasks included items to test for language-knowledge such as:

a. Coordinate naming: the subject was given a noun-class and asked to name at least five objects which may be included within that class.
b. Superordinate naming: is a task complementary to coordinate naming. A list of items belonging to a particular class was given to the subject to identify the class which the given items may be classified.
c. Word naming fluency : is a task to evaluate recall , and involved the subject's naming five words that begin with the specified letter. This is a timed task time taken for each trial is noted.
d. Generative naming: The subject was asked to name the target word, the description of which (in terms of use) was given.
e. Sentence repetition tasks: a phrase\sentence was read out to the subject and a immediate repetition was expected. The target utterances were not very long.
f. Carrying out commands: Two objects; a pen and a book were placed in front of the subject. Commands of various levels of complexity, which required manipulation of these objects, were given.

   Scoring: all items were allotted a score of one for each correctly answered question. Except for word naming fluency none of the tasks were timed.

Domain III: Problem solving

This domain includes various tests that assess reasoning abilities to aid in problem solving. The following tasks were considered.

(a) Sentence disambiguation: Ambiguous sentences were given to the subject, and was instructed to explain the two interpretations that could be made from the sentence.

Scoring: one point was scored for each correct explanation of the meaning of the sentence .Two points were scored only if the both the meaning interpretations were clearly stated.

(b) Sentence formulation: This is a word order unscrambling task to form a grammatically correct sentence.

(c) Predicting the outcome of a described situation

(d) Comparing and contrasting two objects: Here, the subject was required to give one similarity and one difference between a pair of objects named.

(e) Predicting the cause of a described situation

(f) Answering why questions.

(g) Sequential task analysis: The steps involved in carrying out a named task was required to be listed by the subject. The subject was required to analyze the task into atleast four steps for a full score to be given.

Scoring: each of the above tasks were given a score of one for a correct answer. They were untimed tasks.

Domain VI: Organization

Organization of available information to result in coherent communication is an important metalinguistic and metacognitive task.

a) **Categorization abilities** were tested as a measure of word class organization abilities
b) **Analogies:** This task consisted of items to test ability to reorganize word concept to meet task demands. This task also involves logical reasoning processes.
c) **Sequencing of events** in a temporal order to form a coherent story was also taken up as a task of organizational skills.

Scoring: A score of one was given for each correct answer. The tasks were not timed.

All the items within a subtest were placed in an order of increasing complexity. All the tasks were given only one trial each. The individual test items in the assessment protocol are appended in the appendix.

The data obtained was subjected to appropriate statistical analysis. In addition general trends in the responses of the subjects, and specific responses, i.e., accuracy , timing, and quantitative and qualitative performance was noted down for a detailed descriptive analysis of cognitive –linguistic performance of individuals with aphasia. The results were presented in the following sections.

CHAPTER IV

RESULTS AND DISCUSSION

In the present study, an attempt was made to study the performance of individuals with aphasia on the various cognitive linguistic tasks on a battery of tests such as Western Aphasia Battery (Kertesz, 1982), Cognitive linguistic assessment protocol for adults (Rajasudhakar & Shyamala, 2006) and Addenbrooke's cognitive examination (Hodges, 2006) .These were administered in 20 normal adults and 20 individuals with aphasia. The results were analyzed using SPSS software version 16.0.

The results are described below in the following order & sections,

4.1 Comparison of performance of normal adults and Individuals with aphasia on Western Aphasia Battery -Kannada

4.2 Comparison of performance of normal adults and Individuals with aphasia on CLAP

4.3 Comparison of performance of normal adults and Individuals with aphasia on ACE-R

4.4 Three group (Normal adults , Nonfluent aphasics and Fluent aphasics) comparison of scores on WAB-K subtests

4.5 Three group (Normal adults , Nonfluent aphasics and Fluent aphasics) comparison of scores on CLAP-K subtests

4.6 Three group (Normal adults , Nonfluent aphasics and Fluent aphasics) comparison of scores on ACE-K subtests

4.7 Within group comparison of Individuals with aphasia (Broca's, Wernicke's and Anomic) on WAB-K subtests

4.8 Within group comparison of Individuals with aphasia(Broca's, Wernicke's and Anomic) on CLAP-K subtests

4.9 Within group comparison of Individuals with aphasia (Broca's, Wernicke's and Anomic) on ACE-K subtests

4.10 Comparison total scores of all three tests (WAB,CLAP and ACE)

The statistical methods used were as follows.

- Multivariate- ANOVA was used for comparing the normal adults and Individuals with aphasia across each subsections of the assessment protocol.
- Kruskal wallis Test was done to find the overall significance in comparing the different types of aphasia (Broca's, Wernicke's and anomic aphasia) across the each subsections of the assessment protocol.
- Mann-Whitney test was done to compare different types of aphasia (Broca's, Wernicke's and anomic aphasia) across the each subsections of the assessment protocol.

4.1 Comparison of performance of normal adults and Individuals with aphasia on Western Aphasia Battery

a) Mean and Standard deviation

The table 2 shows the Mean and standard deviation for Western Aphasia Battery-Kannada in Normal adults and individuals with Aphasia across all the sub domains.

Table 2. *Mean and S.D for all the WAB tasks across groups.*

Tasks	Normals		Individuals with Aphasia	
	Mean	S.D	Mean	S.D
WABIC	10.00	.00	4.85	4.85
WABFL	9.80	.41	4.20	4.20

WABSST	19.80	.41	9.15	9.15
WABYN	60.00	.00	46.60	46.60
WABAWR	59.70	.57	38.10	38.10
WABSC	79.65	.74	46.90	46.90
WABCT	199.35	1.03	131.55	131.55
WABR	99.60	.75	44.55	44.55
WABON	59.55	.88	19.95	19.95
WABWF	19.60	.75	4.75	4.75
WABSecCom	10.00	.00	2.60	2.60
WABRS	9.75	.44	3.75	3.75
WABNT	98.95	.94	31.75	31.75
WABRead	99.05	1.70	27.00	27.00
WABwritin	95.95	4.60	21.05	21.05
WABRWT	195.05	5.22	48.30	48.30
WABPrax	60.00	.00	52.45	52.45
WABDraw	29.10	1.58	18.75	18.75
WABBlock	8.25	1.01	4.70	4.70
WABCalcu	23.40	.94	13.65	13.65
WABRCPM	36.35	1.08	16.65	16.65
WABconsT	97.8500	1.81	53.70	53.70
WABT	771.05	6.02	366.90	366.90

[WABIC – Information content; WABFL-Fluency; WABSST-Spontaneous speech total; WABYN-yes/no questions; WABAWR- auditory word recognition; WABSC- sequential commands ; WABCT-comprehension total; WABR- repetition ; WABON-object naming ; WABWF-word fluency; WABSecCom- scentence completion; WABRS- responsive speech ; WABNT-naming total; WABRead-reading ; WABwritin-writing ; WABRWT-reading and writing total; WABPrax-praxis; WABDraw-

Drawing ; WABBlock- Block design; WABCalcu-Calculation ; WABRCPM-Raven's score; WABconsT-construction total; WABT-western aphasia battery total scores]

In Table 2 the mean and standard deviation of normal adults were higher than that of the individuals with aphasia in all the sub domains of aphasia such as spontaneous speech, comprehension, repetition, naming, reading and writing, praxis and construction tasks.

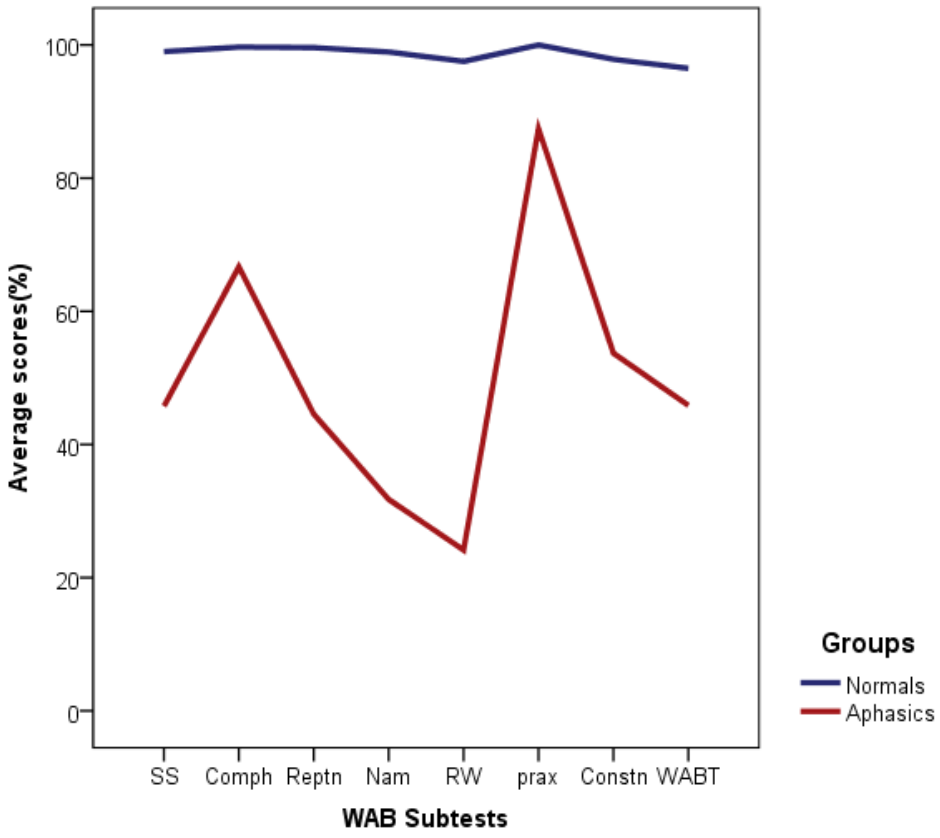

Figure 1: Average scores of WAB Subtests in Normals and Individuals with aphasia

Figure 1 showed the average percentage scores of all the subtests of western aphasia battery. The two lines depicted were the two groups one with the higher scores is the normal adults and one with the poorer scores is for individuals with aphasia. In the subtasks overall lowest score is for the reading and writing, then naming and repetition tasks. And the highest scores in the aphasic group is for the non-linguistic tasks such as praxis and construction tasks such as drawing, raven's scores .

a) Comparision of Normal adults Vs Aphasic subjects on WAB-K

Multivariate-ANOVA was computed to study the differences in the normal adults and individuals with aphasia on various subtest of Western aphasia battery in Kannada. The results showed there was an overall significant difference between normal group and individuals with aphasia on various tasks in western aphasia battery –Kannada at 0.001 levels.

The significance and F-value for all the subtests in Western aphasia battery are shown in the Table 3.

Table 3: *F-Value and significance levels of WAB-K subtests*

Tasks	F(1,38)	Sig.
WABIC	74.90	.000
WABFL	78.19	.000
WABSST	77.00	.000
WABYN	14.30	.001
WABAWR	31.44	.000
WABSC	24.19	.000
WABCT	27.59	.000
WABR	94.59	.000
WABON	156.24	.000
WABWF	196.45	.000
WABSecCom	117.69	.000
WABRS	105.63	.000
WABNT	239.64	.000
WABRead	287.85	.000
WABwritin	496.70	.000
WABRWT	478.70	.000

WABPrax	23.83	.000
WABDraw	72.49	.000
WABBlock	72.61	.000
WABCalcu	103.40	.000
WABRCPM	183.17	.000
WABconsT	223.72	.000
WABT	283.04	.000

These results are in accordance with the study by Carol.S.et.al (1984) who studied the WAB subtests in normal adults and individuals with aphasia for the WAB types and clinical impression. The results revealed that there was a significant difference between normal adults and individuals with aphasia in all the subtasks. Normals adults performed better in all tasks compared to individuals with aphasia.

In the raven's matrices subtests the individuals with aphasia performed poorer than normal adults and these results were supported by the study by Basso et al. (1981) who reported that performance on the Raven s Matrices test was impaired in both left hemisphere patients with aphasia and right hemisphere patients, and that there was no correlation between Raven's performance and language scores. They did find, however, that aphasics performed poorly on reasoning tests but concluded that this was due to lesions that encroached on other regions critical for cognition.

4.2 Comparison of performance of normal adults and Individuals with aphasia on CLAP subtests

a) Mean and Standard deviation

The table 3 shows the Mean and standard deviation for CLAP-Kannada in Normal adults and individuals with Aphasia across all the sub domains.

Table 4. *Mean and S.D for all the CLAP-K tasks across groups.*

	Normals		Individuals with Aphasia	
	Mean	S.D	Mean	S.D
CLAPapdVLC	9.90	.30	8.35	1.95
CLAPapdVCLC	9.15	.81	6.85	2.23
CLAPapdVWC	9.70	.57	8.30	1.78
CLAPapdASC	9.40	.82	5.90	3.11
CLAPapdALPD	5.00	.00	3.85	1.84
CLAPapdAWPD	5.00	.00	3.40	1.69
CLAPapdAMBN	9.40	.68	3.45	3.37
CLAPapdT	57.60	1.87	40.20	10.87
CLAPmEOrienQ	10.00	.00	6.05	2.83
CLAPmEDF	4.50	.51	2.10	1.25
CLAPmEDB	4.20	.69	1.00	.85
CLAPmSCoN	5.00	.00	1.90	1.37
CLAPmSSuN	5.00	.00	1.65	1.13
CLAPmSWNF	4.75	.44	1.50	1.10
CLAPmSGenN	5.00	.00	1.80	1.64
CLAPmSSenR	6.25	2.22	3.60	3.05
CLAPmSCaryC	10.00	.00	7.30	3.26
CLAPmT	58.45	1.05	27.35	10.10
CLAPpsSenDA	8.35	1.53	1.25	1.20
CLAPpsSenF	4.45	.51	1.10	1.44
CLAPpsPO	9.50	.68	2.45	2.70

CLAPpsCC	9.00	1.12	1.85	2.27
CLAPpsPC	9.40	.82	2.20	2.30
CLAPpsWhy	5.00	.00	2.30	1.55
CLAPpsSA	10.00	.00	3.30	2.61
CLAPpsT	56.05	2.72	14.55	11.87
CLAPorgCatgz	9.85	.36	3.90	2.12
CLAPorgAnalog	10.00	.00	2.95	2.35
CLAPorgSE	38.70	1.59	10.55	6.73
CLAPorgT	58.55	1.79	17.90	9.85
CLAPTotal	230.65	5.90	98.95	33.28

[CLAPapdVLC- visual letter cancellation ; CLAPapdVCLC-visual contingent letter cancellation ; CLAPapdVWC-visual word cancellation ; CLAPapdASC-auditory sound count ; CLAPapdALPD-auditory letter pair discrimination ; CLAPapdAWPD-auditory word pair discrimination ; CLAPapdAMBN-auditory month backward naming ; CLAPapdT-attention, perception and discrimination total ; CLAPmEOrienQ- orientation and recent memory questions ; CLAPmEDF- episodic digit forward ; CLAPmEDB-episodic digit backward ; CLAPmSCoN-semantic coordinate naming; CLAPmSSuN-semantic superordinate naming ; CLAPmSWNF-semantic word naming fluency ; CLAPmSGenN-semantic generative naming ; CLAPmSSenR- semantic scentence repetition ; CLAPmSCaryC- semantic carryout commands ; CLAPmT- memory total ; CLAPpsSenDA- scentence disambiguation ; CLAPpsSenF-scentence formulation ; CLAPpsPO- predicting outcome ; CLAPpsCC- compare and contrast ; CLAPpsPC- predicting cause; CLAPpsWhy- why questions ; CLAPpsSA- sequential analysis ; CLAPpsT-problem solving total ; CLAPorgCatgz- categorization ; CLAPorgAnalog- analogies ; CLAPorgSE- sequential events ; CLAPorgT- organization total ; CLAPTotal-cognitive linguistic assessment protocol total]

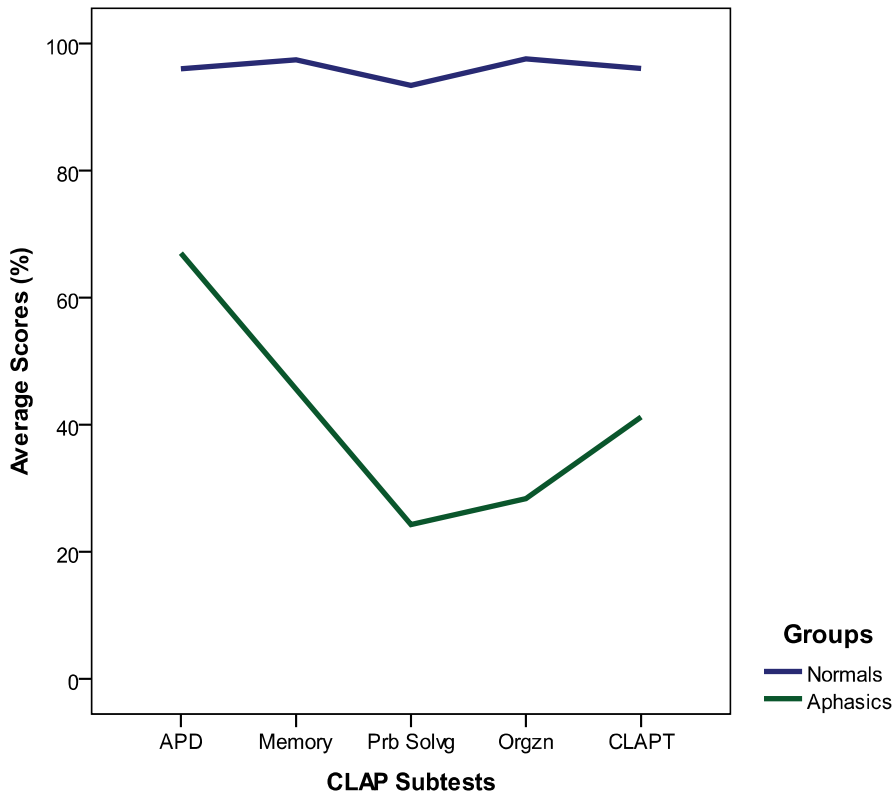

Figure 2: Average scores of CLAP Subtests in Normals and Individuals with aphasia

Figure 2 showed that the average percentage scores of all the subtests of Cognitive linguistic assessment protocol. The two lines depicted were the two groups one with the higher scores is the normal adults and one with the poorer scores is for individuals with aphasia. In the subtasks overall lowest score is for the problem solving and organization tasks. And the highest scores in the aphasic group is attention, perception and discrimation tasks.

b) Comparision of Normal adults Vs Aphasic subjects on CLAP-K

Multivariate-ANOVA was computed to study the differences in the normal adults and individuals with aphasia on various subtest of Cognitive Linguistic assessment protocol in Kannada. The results showed there was an overall significant difference between normal group and individuals with aphasia on various tasks in CLAP –Kannada at 0.005 levels. Except

the auditory phoneme discrimination tasks in the domain of attention perception and discrimination was significant at 0.01levels.

The results of the present study is supported by Gerritsen, Berg, Deelman, Visser-Keizer, and Meyboom-de Jong, 2003 , compared patients with aphasia and age matched healthy pears , individuals with aphasia perform less accurately, more slowly, or both on sustained attention , attention switching (Connor et al., 2001; Robin & Rizzo, 1989; Zeigler, Kerkhoff, Cate, Artinger, & Zierdt, 2001), and focused and divided attention tasks (Erickson, Goldfinger, & LaPointe, 1996; King & Hux, 1996) .

Table 5: *F-Value and significance levels of CLAP-K subtests*

Tasks	F (1,38)	Sig.
CLAPapdVLC	12.27	.001
CLAPapdVCLC	18.76	.000
CLAPapdVWC	11.21	.002
CLAPapdASC	23.67	.000
CLAPapdALPD	7.78	.008
CLAPapdAWPD	17.75	.000
CLAPapdAMBN	59.59	.000
CLAPapdT	49.76	.000
CLAPmEOrienQ	38.76	.000
CLAPmEDF	62.89	.000
CLAPmEDB	167.72	.000
CLAPmSCoN	102.00	.000
CLAPmSSuN	173.70	.000
CLAPmSWNF	150.04	.000
CLAPmSGenN	76.0	.000
CLAPmSSenR	9.86	.003
CLAPmSCaryC	13.70	.001

CLAPmT	187.37	.000
CLAPpsSenDA	264.94	.000
CLAPpsSenF	95.29	.000
CLAPpsPO	127.65	.000
CLAPpsCC	158.51	.000
CLAPpsPC	172.80	.000
CLAPpsWhy	59.961	.000
CLAPpsSA	131.015	.000
CLAPpsT	231.920	.000
CLAPorgCatgz	152.269	.000
CLAPorgAnalog	179.961	.000
CLAPorgSE	330.484	.000
CLAPorgT	329.660	.000
CLAPTotal	303.575	.000

In the present study, in the attention perception domain the aphasic subjects performed more poorly on the auditory subdomain than that of the visual subdomain. This results is supported by Rizzo et al (1989) compared the performances of aphasic adults to those of adults with right hemisphere brain damage or no brain damage on orienting tasks in both the visual and audio modalities. They found that all of their brain-damaged subjects had orientation impairments, primarily to the space

The results are also supported by the study by Conner, MacKay and White (2000) they demonstrated that persons with aphasia have difficulty in various aspects of cognition that fall under the umbrella of executive functioning, such as working memory, attention, and problem solving. Working memory may be considered a foundation for executive abilities

4.3 Comparison of performance of normal adults and Individuals with aphasia on ACE-R subtests

a) Mean and Standard deviation

The table 5 shows the Mean and standard deviation for Western Aphasia Battery-Kannada in Normal adults and individuals with Aphasia across all the sub domains.

Table 6. *Mean and S.D for all the ACE-R tasks across groups.*

	Normals		Individuals with Aphasia	
	Mean	S.D	Mean	S.D
ACEaoOrien1	5.00	0	2.63	1.21
ACEaoOrien2	5.00	0	3.05	1.35
ACEaoReg	3.00	0	1.68	.88
ACEaoAC	4.70	.47	2.36	1.30
ACEaoT	17.70	.47	9.57	3.65
ACEmRecall1	2.85	.36	1.31	.94
ACEmAM	6.65	.48	2.15	1.67
ACEmRM	3.80	.41	1.10	.93
ACEmRecall2	6.75	.44	1.57	1.01
ACEmRecog	5.00	.00	1.57	.83
ACEmT	24.90	.96	7.68	2.60
ACEfL	6.45	.60	1.10	.73
ACEfA	6.55	.60	2.10	.87
ACEfT	13.00	1.07	3.21	1.27
ACElC	4.00	.00	3.00	1.41
ACElw	1.00	.00	.42	.50

ACElRep	4.00	.00	2.68	.94
ACElN	12.00	.00	2.94	2.12
ACElNC	4.00	.00	2.78	1.18
ACElR	1.00	.00	1.05	.70
ACElT	26.00	.00	12.89	3.44
ACEvaOPent	1.00	.00	.52	.51
ACEvaWCube	2.00	.00	.94	.77
ACEvaCLK	5.00	.00	2.00	1.49
ACEvaCDots	4.00	.00	2.78	1.03
ACEvaILetters	4.00	.00	3.42	.90
ACEvaT	16.00	.00	9.68	2.51
ACET	97.70	1.62	43.21	10.30

[ACEaoOrien1-orientation1; ACEaoOrien2-orientation2; ACEaoReg-registration ; ACEaoAC-attention and concentration ; ACEaoT-attention and orientation total ; ACEmRecall1-recall1; ACEmAM-Anterograde memory; ACEmRM-retrograde memory ; ACEmRecall2-recall2; ACEmRecog-recognition ; ACEmT-memory total; ACEfL-letter fluency ; ACEfA-animals fluency ; ACEfT-fluency total ; ACElC-language comprehension ; ACElw-language writing; ACElRep-repetition ; ACElN-naming; ACElNC-naming comprehension; ACElR-reading ; ACElT-language total; ACEvaOPent- overlapping pentagons; ACEvaWCube-wired cubes; ACEvaCLK-clock ; ACEvaCDots-counting dots ; ACEvaILetters-identifying letters; ACEvaT-visuospatial abilities total;; ACET-Addenbrooke's cognitive examination total]

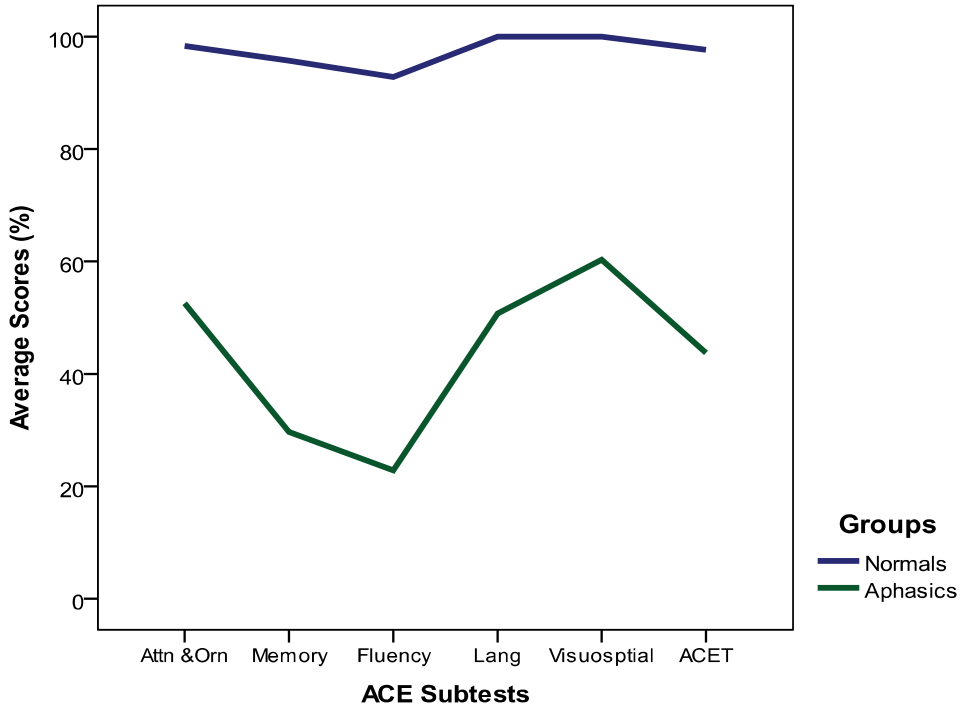

Figure 3: *Average scores of ACE Subtests in Normals and Individuals with aphasia*

Figure 3 shows the average percentage scores of all the subtests of Addenbrooke's cognitive examination. The two lines depicted were the two groups one with the higher scores is the normal adults and one with the poorer scores is for individuals with aphasia. In the subtasks overall lowest score is for memory and fluency tasks. And the highest scores in the aphasic group is for the non-linguistic tasks such visuospatial skills.

b) Comparision of Normal adults Vs Aphasic subjects on Addenbrooke's Cognitive Examination-Kannada

Multivariate-ANOVA was computed to study the differences in the normal adults and individuals with aphasia on various subtest of Addenbrooke's Cognitive Examination in Kannada. The results showed there was an overall significant difference between normal group and individuals with aphasia on various tasks in CLAP –Kannada at 0.01 levels.

Except that in the reading task of the language subtest which is not significant between both the groups.

In the orientation domains, the individuals with aphasia performed poorer to the questions involving the time than other questions. And this study id in accordance with study done by Kapur (1988) in which he stated that Orientation to time is more vulnerable than orientation to place and person. Orientation is an important prognostic indicator of functional outcome in stroke. In spite of this only sparse knowledge is available on the frequency and time-course of orientation in stroke.

Table 7: *F-Value and significance levels of ACE-K subtests*

Tasks	F (1,38)	S.D
ACEaoOrien1	76.54	.000
ACEaoOrien2	41.49	.000
ACEaoReg	44.25	.000
ACEaoAC	56.60	.000
ACEaoT	97.11	.000
ACEmRecall1	45.48	.000
ACEmAM	132.08	.000
ACEmRM	137.86	.000
ACEmRecall2	430.71	.000
ACEmRecog	334.02	.000
ACEmT	763.73	.000
ACEfL	615.22	.000
ACEfA	343.41	.000
ACEfT	675.34	.000
ACElC	10.01	.003
ACElw	26.09	.000

ACElRep	38.75	.000
ACElN	364.97	.000
ACElNC	20.99	.000
ACElR	.11	.740
ACElT	289.61	.000
ACEvaOPent	17.07	.000
ACEvaWCube	36.48	.000
ACEvaCLK	81.11	.000
ACEvaCDots	27.57	.000
ACEvaILetters	8.25	.007
ACEvaT	126.02	.000
ACET	545.74	.000

4.4 Three group (Normal adults , Nonfluent aphasics and Fluent aphasics) comparison of scores on WAB-K subtests

Multivariate-ANOVA was computed to study the differences in the normal adults and individuals with aphasia, which were further divided into two groups as Nonfluent and Fluent aphasics on various subtest of Western Aphasia battery in Kannada.The results showed there was an overall significant difference between normal group, Nonfluent aphasic group, fluent aphasic group on various tasks in WAB–Kannada at 0.001 levels.

Table 8: *F-Value and significance levels of WAB-K subtests across three groups*

Tasks	F(2,37)	Sig.
WABIC	126.83	.000
WABFL	144.66	.000

WABSST	160.74	.000
WABYN	14.76	.000
WABAWR	17.94	.000
WABSC	17.49	.000
WABCT	20.26	.000
WABR	60.52	.000
WABON	129.28	.000
WABWF	130.60	.000
WABSecCom	74.09	.000
WABRS	68.63	.000
WABNT	215.20	.000
WABRead	247.47	.000
WABwritin	279.03	.000
WABRWT	366.58	.000
WABPrax	15.63	.000
WABDraw	37.85	.000
WABBlock	35.83	.000
WABCalcu	59.35	.000
WABRCPM	115.90	.000
WABconsT	137.38	.000
WABT	150.81	.000

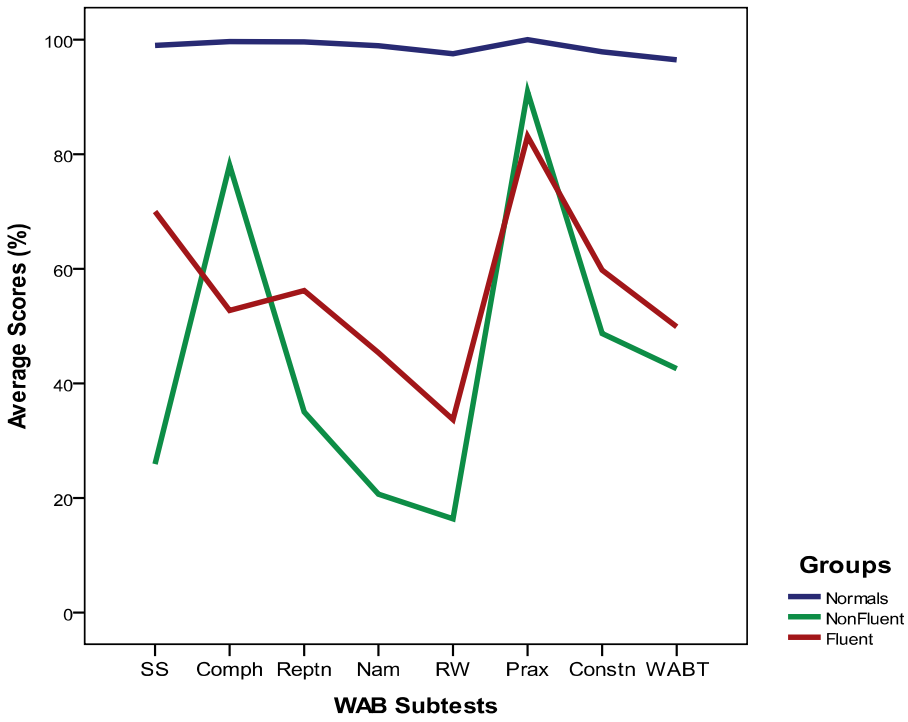

Figure 4: *Average scores of WAB Subtests in Normals and Individuals with aphasia (Fluent and Nonfluent Group)*

The Figure 4 showed that the average percentage scores of all the subtests of Western aphasia battery for the three groups such as normals, nonfluent and fluent group. The three lines were depicted in the figure, one with the higher scores is the normal adults (blue color) and two with the poorer scores is for individuals with aphasia (red colored line depicts fluent type and green colored line depicts nonfluent group).

Post Hoc Duncan test was done to find out any significant difference in each tasks of WAB-K across three groups (Normal, Nonfluent and Fluent groups). The test results showed that there was a significant difference between the three groups in spontaneous speech, sequential commands task of comprehension section, repetition, naming tasks, reading and writing, praxis, calculation and raven's scores. There was no significant difference between normals and non-fluent types of aphasia in the yes/no section. And there was no significant difference between fluent type of aphasia and non-fluent type of aphasia in auditory word recognition drawing task, block design and total score of Western Aphasia Battery-Kannada.

These results of the current study support the findings of Baldo et al. (2001) said that, the patients with left frontal lesions perform poor than the patients with right frontal lesions on the verbal fluency tasks.

4.5 Three group (Normal adults , Nonfluent aphasics and Fluent aphasics) comparison of scores on CLAP-K subtests

Multivariate-ANOVA was computed to study the differences in the normal adults and individuals with aphasia, which were further divided into two groups as Nonfluent and Fluent aphasics on various subtest of Cognitive Linguistic Assessment protocol in Kannada.The results showed there was an overall significant difference between normal group, Nonfluent aphasic group, fluent aphasic group on various tasks in CLAP–Kannada at 0.001 levels.

Table 9: *F-Value and significance levels of CLAP-K subtests across three groups*

Tasks	F (2,37)	Sig.
CLAPapdVLC	13.18	.000
CLAPapdVCLC	18.64	.000
CLAPapdVWC	9.25	.001
CLAPapdASC	20.71	.000
CLAPapdALPD	3.91	.029
CLAPapdAWPD	15.98	.000
CLAPapdAMBN	31.86	.000
CLAPapdT	31.92	.000
CLAPmEOrienQ	26.69	.000
CLAPmEDF	30.96	.000
CLAPmEDB	82.53	.000
CLAPmSCoN	51.07	.000
CLAPmSSuN	208.81	.000
CLAPmSWNF	100.15	.000

CLAPmSGenN	37.71	.000
CLAPmSSenR	15.61	.000
CLAPmSCaryC	12.47	.000
CLAPmT	92.33	.000
CLAPpsSenDA	138.91	.000
CLAPpsSenF	65.51	.000
CLAPpsPO	77.93	.000
CLAPpsCC	102.96	.000
CLAPpsPC	91.62	.000
CLAPpsWhy	33.38	.000
CLAPpsSA	89.02	.000
CLAPpsT	154.68	.000
CLAPorgCatgz	100.88	.000
CLAPorgAnalog	96.85	.000
CLAPorgSE	178.44	.000
CLAPorgT	182.14	.000
CLAPTotal	151.35	.000

In the present study when the comparison is made between the three groups normals, Nonfluent and fluent groups on attention tasks the Nonfluent group performed poorer than the other two groups and there was significant difference between the three groups .And similar results were obtained by Glosser and Goodglass (1990) who found that aphasic subjects, particularly those with frontal lesions had difficulty with sustained and focused attention. They used a task in which aphasic subjects watched a (200 trials) random sequence of X's and O's and has to press a response bar for each occurance of preassigned target (X or O).Aphasic adult's ability to divide their attention was investigated. And this was also found to be affected.

In the current study the problem solving strategies were investigated in individuals with aphasia and age matched peers using a number of tasks and the results showed that aphasic group performed poorer on these tasks. And these results were supported by a study by Baldo, Delis, Wilkins, and Shimamura, 2004 in which patients with frontal lesions showed impaired problem solving due to impaired strategy formation and an inability to modify behavior based on feedback.

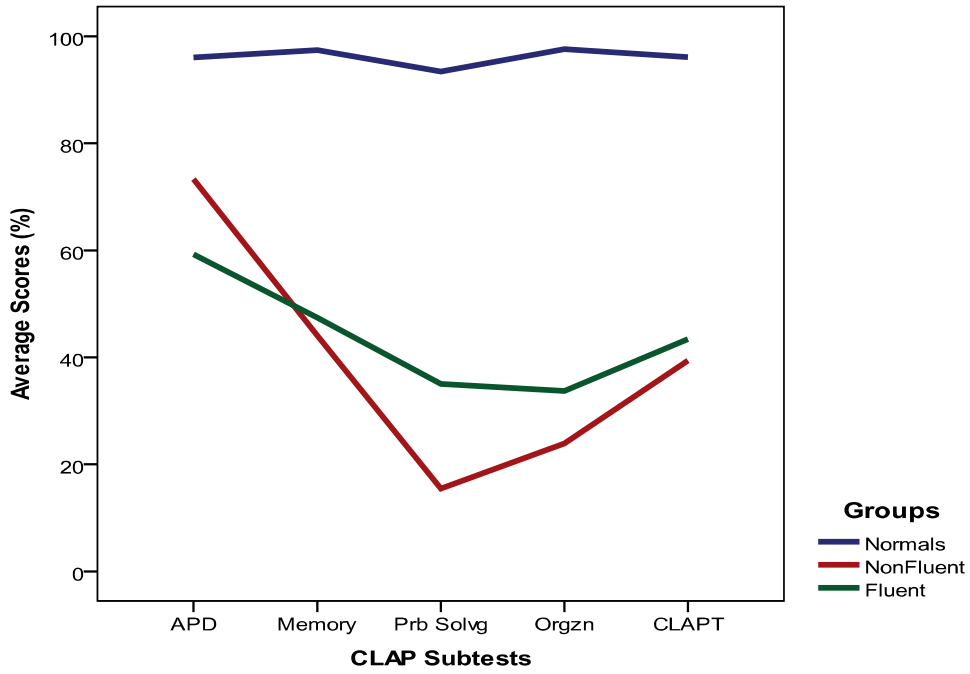

Figure 5: *Average scores of CLAP Subtests in Normals and Individuals with aphasia (Fluent and Nonfluent Group)*

The Figure 5 showed that the average percentage scores of all the subtests of Western aphasia battery for the three groups such as normals, nonfluent and fluent group. The three lines were depicted in the figure, one with the higher scores is the normal adults (blue color) and two with the poorer scores is for individuals with aphasia (red colored line depicts Nonfluent type and green colored line depicts fluent group).

Post Hoc Duncan test was done to find out any significant difference in each tasks of CLAP-K across three groups (Normal, Nonfluent and Fluent groups). The test results showed

that in domain I (attention, attention, perception and discrimination) there was a significant difference between the three groups in Visual contingent letter cancellation, auditory sound count, auditory word pair discrimination, total of attention, perception and discrimination domain and in domain II (Memory) orientation and recent memory questions, superordinate naming and word fluency naming was significantly different between these three groups. In domain III (Problem solving) there was significant difference in scentence formulation, predicting outcome, compare and contrast and sequential analysis and total score of problem solving. In domain IV (organization) there was significant difference found between three groups in categorization and sequential events and total score of organization.

There was no significant difference between normals and non-fluent types of aphasia in the domain I (attention, attention, perception and discrimination) in Visual letter cancellation, visual word cancellation and in domain II (Memory) scentence repetition and carry out commands was not significantly different between normal and nonfluent groups. And there was no significant difference between fluent type of aphasia and non-fluent type of aphasia in month backward naming , digit forward, digit backward, coordinate naming ,generative naming , scentence disambiguation, predicting cause, why questions ,analogies and total scores of all CLAP domains.

These results were supported by Glosser and Goodglass (1990) were among the first researchers to specifically examine executive functioning ability (problem solving, organization, working memory) in persons with aphasia. They administered four experimental executive function procedures to 22 left-brain-damaged, 19 right-brain damaged and 49 healthy controls. Brain-damaged subjects were divided into groups according to site of lesion: prefrontal, retrorolandic, and mixed. The test procedures included the nonverbal continuous performance test, graphic pattern generation, sequence generation task, and the Tower of Hanoi. Results indicated that subjects with left frontal lobe lesions were significantly more impaired than subjects with left retrorolandic or mixed left hemisphere lesion.

4.6 Three group (Normal adults , Nonfluent aphasics and Fluent aphasics) comparison of scores on ACE-K subtests

Multivariate-ANOVA was done to study the differences in the normal adults and individuals with aphasia, which were further divided into two groups as Nonfluent and Fluent aphasics on various subtest of Addenbrooke's Cognitive Examination-revised in Kannada.The results showed there was an overall significant difference between normal group, Nonfluent aphasic group, fluent aphasic group on various tasks in CLAP–Kannada at 0.001 levels. Except for the reading task in the language subsections which shows no significant difference between the three groups.

Table 10: *F-Value and significance levels of CLAP-K subtests across three groups*

Tasks	F (2,36)	S.D
ACEaoOrien1	37.23	.000
ACEaoOrien2	34.32	.000
ACEaoReg	21.69	.000
ACEaoAC	30.34	.000
ACEaoT	48.50	.000
ACEmRecall1	22.25	.000
ACEmAM	64.28	.000
ACEmRM	75.67	.000
ACEmRecall2	209.83	.000
ACEmRecog	163.73	.000
ACEmT	378.93	.000
ACEfL	304.88	.000
ACEfA	168.44	.000
ACEfT	328.69	.000
ACElC	14.39	.000

ACElw	13.27	.000
ACElRep	18.99	.000
ACElN	281.89	.000
ACElNC	24.90	.000
ACElR	1.21	.310
ACElT	141.00	.000
ACEvaOPent	9.07	.001
ACEvaWCube	17.87	.000
ACEvaCLK	39.77	.000
ACEvaCDots	15.43	.000
ACEvaILetters	8.44	.001
ACEvaT	66.07	.000
ACET	269.10	.000

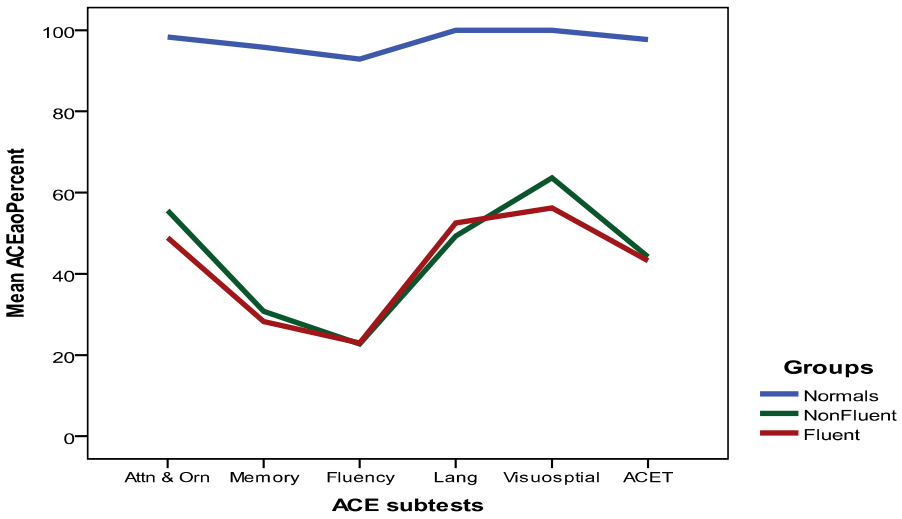

Figure 6: *Average scores of ACE Subtests in Normals and Individuals with aphasia (Fluent and Nonfluent Group)*

The Figure 6 showed that the average percentage scores of all the subtests of Western aphasia battery for the three groups such as normals, nonfluent and fluent group. The three lines were depicted in the figure, one with the higher scores is the normal adults (blue color) and two with the poorer scores is for individuals with aphasia (red colored line depicts fluent type and green colored line depicts nonfluent group).

Post Hoc Duncan test was done to find out any significant difference in each tasks of ACE-K across three groups (Normal, Nonfluent and Fluent groups). The test results showed that in domain I (Attention and orientation) orientation part 2, domain II (Memory) retrograde memory, Domain IV (Language), Naming, Naming comprehension are significantly different between the three groups. There was no significant difference between normals and non-fluent types of aphasia in language comprehension and identifying letters.

There was no significant difference between fluent and nonfluent type in tasks such as registration, attention and concentration, recall, Anterograde memory, recognition, fluency (letter and animals), writing, repetition, overlapping pentagons, wirecubes, clock drawing and counting dots. These results were contradicting to a study done by Martin and Feber (1990) they found that patients with fluent aphasia, like the non-brain damaged adults were better at recalling easy versus hard to articulate word lists. In contrast ease of articulation had no effect on the STM performance of patients with non fluent aphasia. This may because of the milder form of aphasia , there is no significant difference between the fluent and non-fluent types of aphasia.

4.7 Within group comparison of Individuals with aphasia (Broca's, Wernicke's, Anomic Aphasia, on WAB-K subtests

a) Mean and Standard deviation

The table 10 shows the Mean and standard deviation for Western Aphasia Battery-Kannada in different types of Aphasia across all the sub domains.

Table11. *Mean and S.D for all the WAB tasks across Aphasia subgroups.*

Tasks	Broca's		Wernicke.s		Anomic		TCS
	Mean	S.D	Mean	S.D	Mean	S.D	Mean
WABIC	3.00	1.84	6.80	.83	8.33	1.52	5.00
WABFL	2.18	1.25	7.00	1.22	7.33	2.51	3.00
WABSST	5.18	2.92	14.20	1.78	15.67	3.78	8.00
WABYN	53.36	6.50	22.60	9.94	57.33	4.61	60.00
WABAWR	42.18	9.71	16.00	14.98	57.00	2.64	47.00
WABSC	57.36	23.85	15.00	17.81	73.33	11.54	12.00
WABCT	152.90	32.61	53.60	42.18	187.33	17.78	119.00
WABR	35.00	23.35	37.40	7.60	76.33	7.76	90.00
WABON	12.45	10.03	28.40	12.01	28.33	20.03	35.00
WABWF	2.72	2.93	7.40	4.87	9.33	5.85	.00
WABSecCom	1.45	2.50	3.80	3.03	5.66	3.21	.00
WABRS	2.72	1.61	5.0	2.00	6.66	3.51	.00
WABNT	20.63	12.87	44.60	10.21	50.00	30.6	35.00
WABRead	16.36	10.02	25.00	8.33	61.66	7.63	50.00
WABwritin	16.36	9.24	20.00	9.35	30.33	25.89	50.00
WABRWT	32.72	14.72	45.00	17.59	93.66	28.29	100.00
WABPrax	54.54	5.14	44.20	5.11	56.00	5.29	60.00
WABDraw	17.72	4.19	19.00	5.65	21.66	9.23	20.00
WABBlock	4.54	1.36	4.80	1.48	5.00	3.00	5.00
WABCalcu	12.36	3.20	13.00	5.43	18.66	2.30	16.00
WABRCPM	14.09	5.12	16.00	6.04	24.33	5.13	25.00
WABconsT	48.72	9.85	52.80	11.90	69.33	16.56	66.00

WABT	340.63	81.861	293.60	29.45	548.33	35.80	478.00

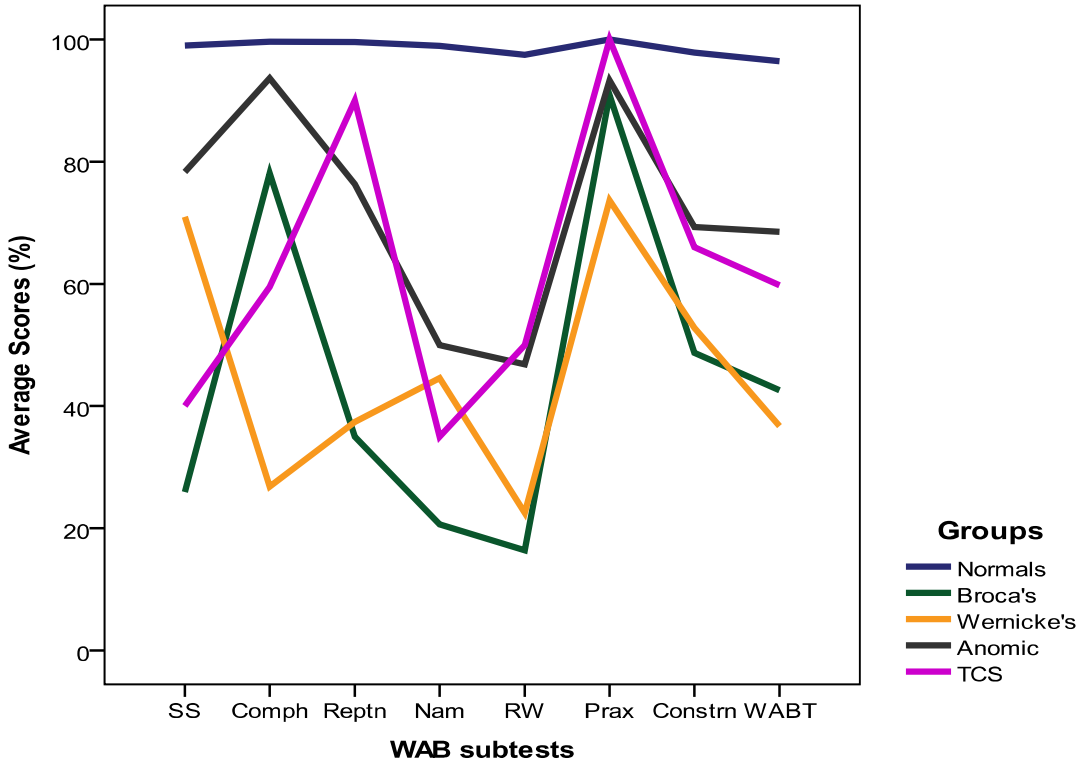

Figure 7: *Average scores of WAB Subtests in Normals and different types of Aphasia*

The Figure 7 showed that the average percentage scores of all the subtests of Western aphasia battery for within group comparision of individuals with aphasia (Normals, Broca's, Wernicke's, anomic and transcortical sensory aphasia). The five lines were depicted in the figure, one with the higher scores is the normal adults (blue color) and other four with the poorer scores is for individuals with aphasia [Broca's (green), Wernicke's (orange), anomic (black) and transcortical sensory aphasia (pink)].

Kruskal Wallis test was done to find the within group comparison of individuals with aphasia (Broca's, Wernicke's and anomic aphasia). The test results revealed that there was no significant difference between three aphasic subtypes on tasks of sentence completion, writing, drawing,

block design, construction. And all other tasks and total score of WAB were significantly different between these three groups at 0.05 levels.

Mann Whitney test was done to see any significant difference across these three groups of aphasic population. When the comparison is made between Broca's aphasia and wernicke's aphasia group there was no significant difference found in tasks such as repetition, reading, scentence completion, all the construction tasks and reading and writing tasks and total WAB scores. And all other tasks were significant at 0.05 levels.

The significant difference between the broca's and wernicke's aphasia in the comprehension tasks were supported by the study done by Heilman and Scholes (1976) in which the nature of the comprehension errors in Broca's, wernicke's and conduction aphasia. Twenty six aphasia patients (9 Broca's, 9 Wernicke's and 8 conduction aphasics) and eight controls were given a test which helped to differentiate comprehension errors caused by syntactic incompetence from those caused by lexical incompetence. They reported that wernicke's made significantly more lexical errors than the other groups and no significant difference between the lexical errors made by Broca's, conduction and control groups.

The Broca's and Anomic aphasia groups were compared using Mann Whitney test there was no significant difference between yes/no questions, object naming , writing ,praxis, drawing and construction total. And all other subtasks were significantly different between the two groups at 0.05 levels. And when Comparision is made between wernicke's and anomic aphasia there is no significant difference between Fluency, spontaneous speech total , all the naming subtest and construction tasks and its total scores. All other subtests were significantly different between wernicke's and anomic aphasia at 0.05 levels. These no significant difference between the naming tasks within the aphasia groups may be because of subject selection criteria in which milder forms of aphasia are considered for the present study.

These results were supported by the study by Kohn &Goodglass (1985) who examined the distribution of error types in picture naming of 9 Broca's aphasia, 9 Wernicke's aphasia, 7 frontal anomics and 9 posterior anomics. The relative distribution of three prominent naming errors- Phonemic errors, semantic errors and multiword circumlocutions tended to distinguish the

two anomic subgroups from the other types of aphasia. The reported that anomic aphasia produced the fewest phonemic errors, and the most multiword circumlocutions which suggests that minimal word production difficulty in anomic aphasia relative to other aphasia syndromes.

4.8 Within group comparison of Individuals with aphasia on CLAP-K subtests

a) Mean and Standard deviation

The table 12 shows the Mean and standard deviation for Cognitive linguistic Assessment Protocol -Kannada in different types of Aphasia across all the sub domains.

Table12. *Mean and S.D for all the CLAP-K tasks across Aphasia subgroups.*

Tasks	Broca's		Wernicke.s		Anomic		TCS
	Mean	S.D	Mean	S.D	Mean	S.D	Mean
CLAPapdVLC	9.18	1.07	5.80	1.92	9.66	.57	8.00
CLAPapdVCLC	7.90	1.70	4.40	2.30	7.00	1.00	7.00
CLAPapdVWC	8.90	1.22	6.60	2.40	9.0	1.00	8.0
CLAPapdASC	7.27	2.32	1.60	1.14	7.66	.57	7.00
CLAPapdALPD	3.72	1.00	3.60	3.57	4.66	.57	4.00
CLAPapdAWPD	4.09	.70	.80	.83	5.00	.00	4.00
CLAPapdAMBN	2.72	2.79	1.20	1.30	9.00	1.00	6.00
CLAPapdT	44.00	4.42	24.00	5.74	52.00	2.64	44.00
CLAPmEOrienQ	7.09	.94	1.80	1.48	9.00	1.73	7.00
CLAPmEDF	2.00	.77	1.00	1.00	4.00	1.00	3.00
CLAPmEDB	.90	.70	.40	.54772	2.33	.57	1.00
CLAPmSCoN	1.72	1.27	1.00	.70	3.66	1.15	3.00
CLAPmSSuN	.90	.70	2.20	.83	2.66	.57	4.00
CLAPmSWNF	1.00	.77	2.60	.89	1.00	1.00	3.00

CLAPmSGenN	1.63	1.43	1.40	1.14	2.00	2.64	5.00
CLAPmSSenR	1.72	1.55	3.60	1.14	8.33	.57	10.00
CLAPmSCaryC	8.54	1.03	2.60	3.13	9.6667	.57	10.00
CLAPmT	26.45	4.67	16.60	4.27	42.33	4.50	46.00
CLAPpsSenDA	.81	.87	.80	.83	3.00	1.00	3.00
CLAPpsSenF	.45	.52	1.2000	1.30	3.66	1.52	.00
CLAPpsPO	1.45	1.69	1.4000	1.51	6.66	3.05	6.00
CLAPpsCC	.81	.75	.8000	.83	6.33	1.15	5.00
CLAPpsPC	1.63	1.12	.80	.83	6.33	3.21	3.00
CLAPpsWhy	1.90	1.22	1.40	1.14	4.66	.57	4.00
CLAPpsSA	2.18	1.16	2.20	1.48	8.33	1.52	6.00
CLAPpsT	9.27	2.61	9.60	7.02	39.00	7.21	24.00
CLAPorgCatgz	3.00	1.48	3.20	1.09	7.33	1.15	7.00
CLAPorgAnalog	2.36	1.74	1.60	1.14	5.66	2.08	8.00
CLAPorgSE	8.72	6.13	10.0	7.90	15.00	5.00	20.00
CLAPorgT	15.00	8.67	14.80	9.28	28.00	2.00	35.00
CLAPTotal	94.63	9.82	65.00	13.54	151.33	27.79	159.00

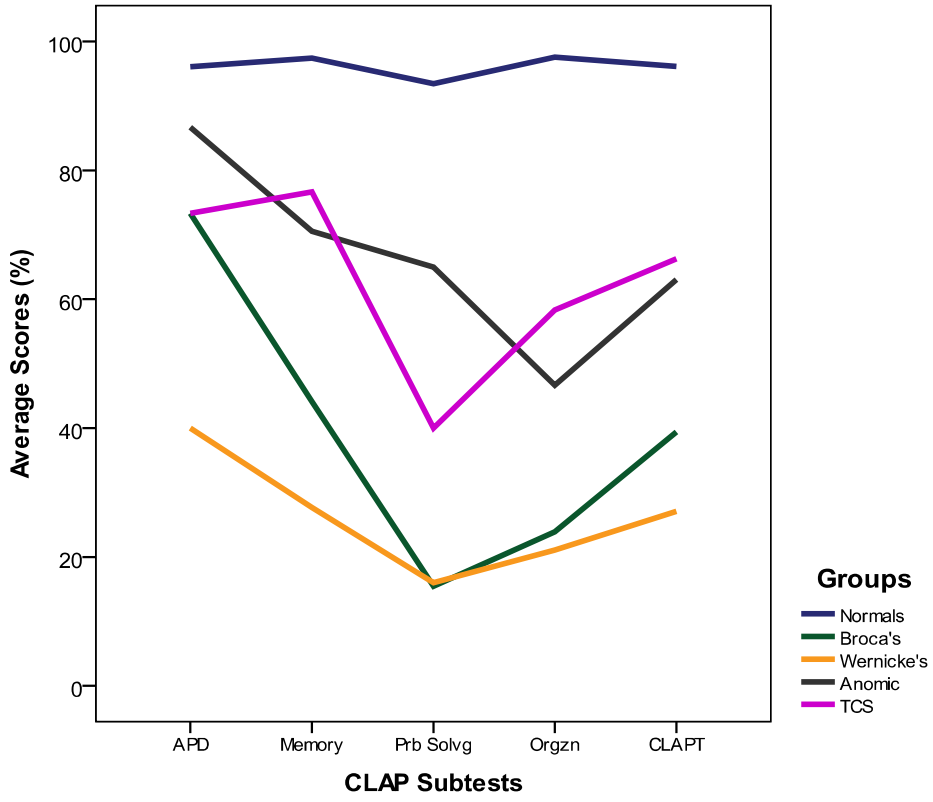

Figure 8: *Average scores of CLAP Subtests in Normals and different types of Aphasia*

The Figure 8 shows the average percentage scores of all the subtests of Cognitive Linguistic Assessment Protocol for within group comparision of individuals with aphasia (Normals, Broca's, Wernicke's, anomic and transcortical sensory aphasia). The five lines were depicted in the figure, one with the higher scores is the normal adults (blue color) and other four with the poorer scores is for individuals with aphasia [Broca's (green), Wernicke's (orange), anomic (black) and transcortical sensory aphasia (pink)].

Kruskal Wallis test was done to find the within group comparison of individuals with aphasia (Broca's, Wernicke's and anomic aphasia). The test results revealed that there was no significant difference between three aphasic subtypes on tasks of visual word cancellation, phoneme discrimination, Generative naming and sequencing events. And all other tasks and total score of CLAP-K were significantly different between these three groups at 0.05 levels.

Mann Whitney test was done to see any significant difference across these three groups of aphasic population. When the comparison is made between Broca's aphasia and wernicke's aphasia group there was no significant difference found in tasks such as visual word cancellation, phoneme discrimination, month backward naming, digit forward , digit backward and coordinate naming , generative naming, all problem solving and organization tasks. All other tasks and total score of CLAP are significantly different between broca's and wernicke's aphasia at 0.05 levels.

The Broca's and Anomic aphasia groups were compared using Mann Whitney test there was no significant difference between letter cancellation, contingent letter cancellation, word cancellation , sound count , letter pair discrimination , Word naming fluency, generative naming ., carryout commands and sequential events . And all other subtasks were significantly different between the two groups at 0.05 levels. And when Comparision is made between wernicke's and anomic aphasia there is no significant difference between contingent letter cancellation, word cancellation, superordinate naming, generative naming, scentence formulation and sequential events. All other subtests were significantly different between wernicke's and anomic aphasia at 0.05 levels.

The results of the present study summarizes that in the memory domain of the cognitive linguistic assessment protocol there were no significant difference was found in most of the tasks and these results support the study done by Burgio and Basso (1997) they found that verbal and spatial memory deficits among left hemisphere damaged patients, regardless of the lesion site. Also Della Barba et al (1996) found that LTM abilities in aphasia were not dependent on lesion site but rather on whether the patient could make semantic associations amongst the items to be recalled.

4.9 Within group comparison of Individuals with aphasia on ACE-K subtests

a) Mean and Standard deviation

The table 12 shows the Mean and standard deviation for Addenbrooke's Cognitive Examination-Kannada in different types of Aphasia across all the sub domains.

Table13. *Mean and S.D for all the ACE-K tasks across Aphasia subgroups.*

Tasks	Broca's		Wernicke.s		Anomic		TCS
	Mean	S.D	Mean	S.D	Mean	S.D	Mean
ACEaoOrien1	2.63	1.12	2.20	1.64	3.33	.57	3
ACEaoOrien2	3.63	.92	1.60	1.51	3.33	.57	3
ACEaoReg	1.63	.80	1.20	.83	2.66	.57	3
ACEaoAC	2.09	.94	2.00	1.58	4.00	1.00	3
ACEaoT	10.00	2.56	7.00	5.00	12.33	2.88	9
ACEmRecall1	1.36	1.02	1.00	1.00	1.66	.57	2
ACEmAM	2.18	1.83	1.20	.83	3.66	1.15	3
ACEmRM	1.36	1.02	.40	.54	1.33	.57	1
ACEmRecall2	1.54	1.21	1.60	.89	1.66	.57	2
ACEmRecog	1.63	.80	1.00	.70	2.33	.57	2
ACEmT	8.00	2.14	5.20	1.92	10.66	1.15	10
ACEfL	1.00	.77	1.20	.83	1.33	.57	1
ACEfA	2.18	.98	2.20	.83	1.66	.57	2
ACEfT	3.18	1.40	3.40	1.34	3.00	1.00	3
ACElC	3.63	.50	1.20	1.64	3.66	.57	4
ACElw	.36	.50	.60	.54	.33	.57	0
ACElRep	2.63	.92	2.40	1.14	3.33	.57	4
ACElN	1.90	1.44	3.40	1.14	6.00	2.64	9
ACElNC	3.3636	.67	1.80	1.64	2.3333	.57	2
ACElR	.9091	.83	1.40	.54	1.0000	.00	1
ACElT	12.81	2.04	10.80	4.86	16.6667	2.51	19
ACEvaOPent	.45	.52	.80	.44	.3333	.57	0

ACEvaWCube	.90	.83	1.20	.83	.6667	.57	0
ACEvaCLK	2.09	1.70	1.20	.83	3.0000	1.00	2
ACEvaCDots	3.00	.89	2.00	1.22	3.3333	.57	3
ACEvaILetters	3.72	.46	2.40	1.14	4.0000	.00	4
ACEvaT	10.18	2.08	7.60	2.70	11.3333	2.08	9
ACET	44.18	5.58	34.00	13.43	55.0000	3.60	54

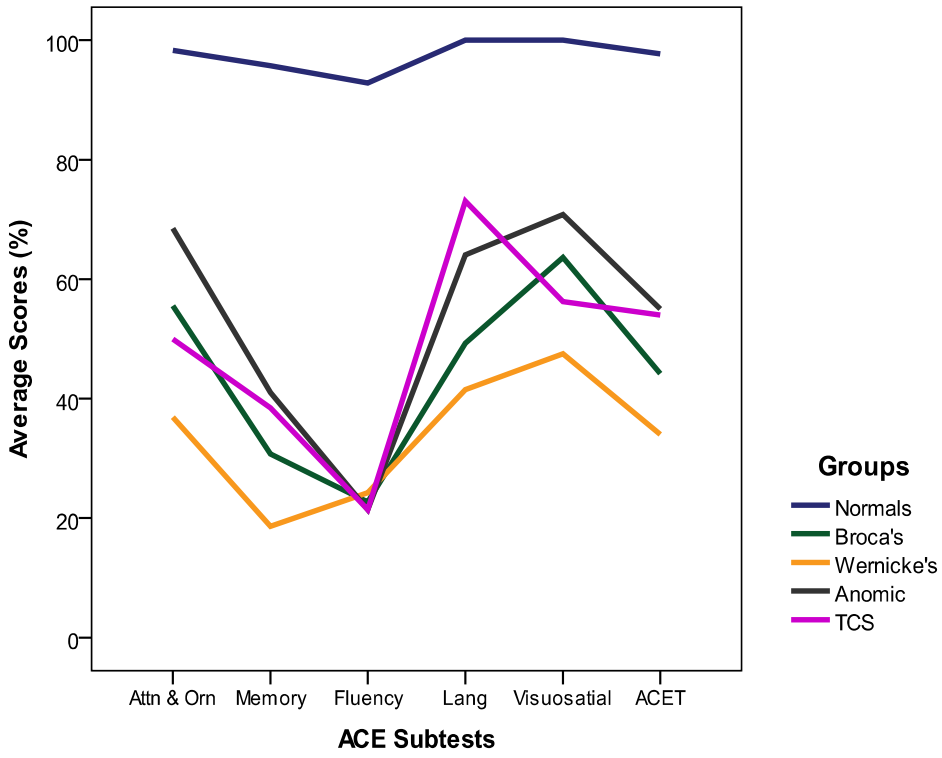

Figure 9: *Average scores of ACE Subtests in Normals and different types of Aphasia*

The Figure 9 showed that the average percentage scores of all the subtests of Addenbrooke's cognitive examination for within group comparision of individuals with aphasia (Normals, Broca's, Wernicke's, anomic and transcortical sensory aphasia). The five lines were depicted in the figure, one with the higher scores is the normal adults (blue color) and other four with the

poorer scores is for individuals with aphasia [Broca's (green), Wernicke's (orange), anomic (black) and transcortical sensory aphasia (pink)].

Kruskal Wallis test was done to find the within group comparison of individuals with aphasia (Broca's, Wernicke's and anomic aphasia). The test results revealed that there was significant difference between three aphasic subtypes on tasks of orientation2, Anterograde memory, memory total scores, language comprehension, naming, identifying letters and ACE total scores at 0.05 levels. And in all other tasks there was no significant difference between these three groups.

Mann Whitney test was done to see any significant difference across these three groups of aphasic population. When the comparison is made between Broca's aphasia and wernicke's aphasia group there was significant difference found in tasks such as orientation2, memory total scores, language comprehension, naming, identifying letters at 0.05 levels.

The Broca's and Anomic aphasia groups were compared using Mann Whitney test there was significant difference between attention and concentration, memory total scores. Language comprehension, naming, naming comprehension, language total scores and overall scores of ACE at 0.05 levels. And when Comparision is made between wernicke's and anomic aphasia there is significant difference was found in registration, attention and concentration, Anterograde memory, recognition , memory total scores , clock drawing , identifying letters and total scores of ACE at 0.05 levels.

4.10 Comparison total scores of all three tests (WAB,CLAP and ACE-R)

a) Mean and Standard deviation

The table 14 shows the Mean and standard deviation for three tests (WAB, CLAP, and ACE) for normals and aphasia.

Table 14: Mean and standard deviation for three tests (WAB, CLAP, and ACE) for normals and aphasia.

TESTS	Normals		Individuals with Aphasia	
	Mean	S.D	Mean	S.D
WAB	771.05	6.02	366.90	107.26
CLAP	230.65	5.90	98.95	33.28
ACE	97.70	1.62	43.75	10.31

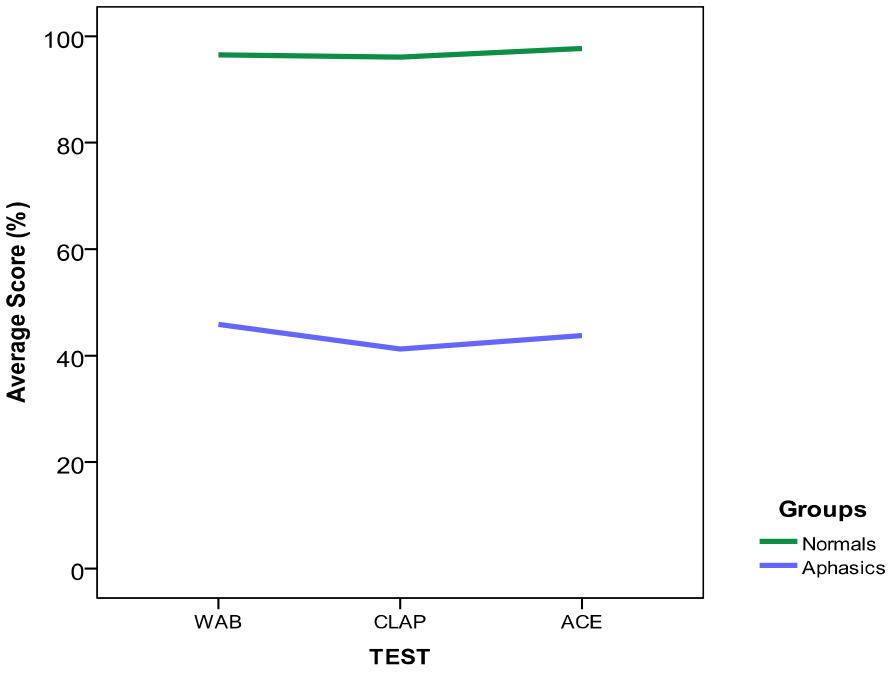

Figure 10: *Average scores (%) for Normals vs. Individuals with aphasia across three tests*

Figure 10 showed that the average percentage of total scores of the entire test batteries (WAB, CLAP. ACE). The two lines depicted were the two groups one with the higher scores is the normal adults and one with the poorer scores is for individuals with aphasia. Individuals with aphasia performed poorer in cognitive linguistic assessment protocol than the

other two tests. And this may be because of the complexity of the tasks that are there in CLAP domains such as the attention, perception and discrimination, memory, problem solving and organization.

b) Comparison of Normal and individuals with aphasia in all the three tests.

Multivariate-ANOVA was computed to study the differences in the normal adults and individuals with aphasia across three tests. And the results showed that there was a significant difference between these two groups in all the three tests such as WAB, CLAP and ACE at 0.001 levels.

Table 15: *F-Value and significance levels of total scores of all tests across Normals and Individuals with aphasia.*

Tests	F(1,38)	Sig.
WAB	283.04	.000
CLAP	303.57	.000
ACE	533.81	.000

c) Three group (Normal adults, Nonfluent aphasics and Fluent aphasics) comparison of scores on total scores of all the tests.

Multivariate-ANOVA was done to study the differences in the normal adults and individuals with aphasia, which were further divided into two groups as Nonfluent and Fluent aphasics on total scores of WAB, CLAP and ACE. The results revealed that that there was a significant difference between these three groups (Normals, Nonfluent and Fluent) in all the three tests such as WAB, CLAP and ACE at 0.001 levels.

Table 16: *F-Value and significance levels of total scores of all tests across three groups*

Tests	F(1,38)	Sig.
WAB	150.81	.000
CLAP	151.35	.000
ACE	260.49	.000

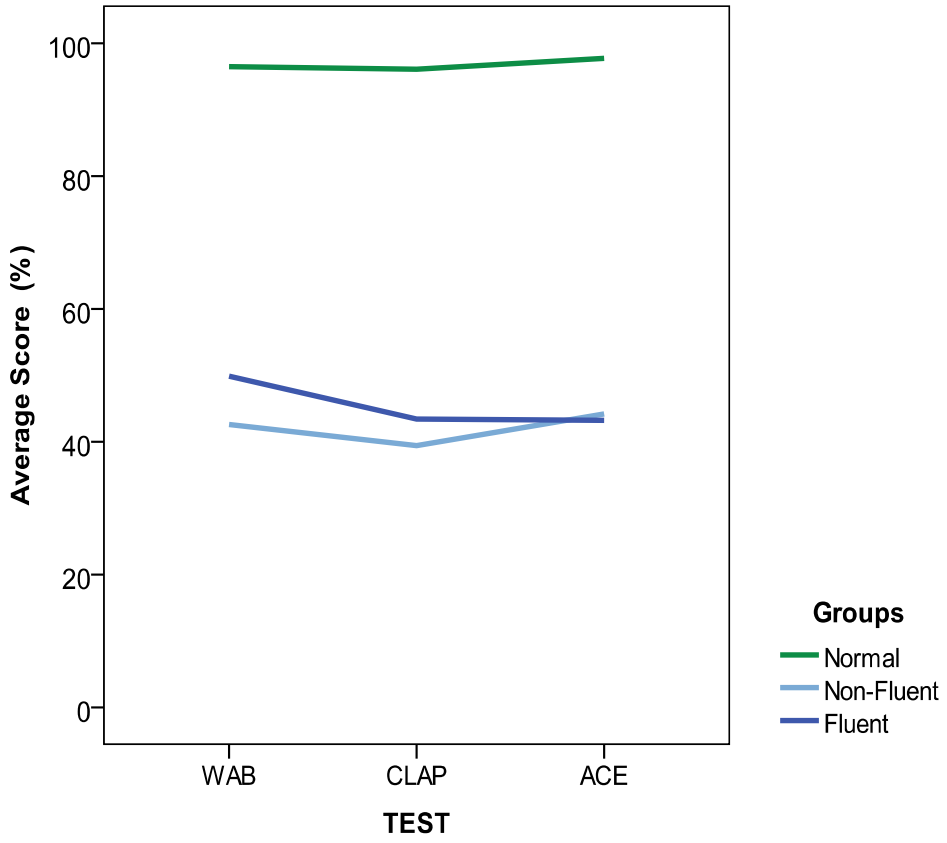

Figure 11: Average scores (%) for three groups (Normals, Nonfluent and fluent aphasia) across tests

Figure 11 showed that the average percentage scores of the entire all the test batteries (WAB, CLAP. ACE) in three groups (normals, nonfluent and fluent groups). The three lines were depicted in the figure, one with the higher scores is the normal adults (green) and other two with the poorer scores is for individuals with aphasia (Nonfluent group is depicted in the light blue colour and fluent group is depicted in the dark blue colour).

Post Hoc Duncan test was done to find out any significant difference in each of the tests across three groups (Normal, Nonfluent and Fluent groups). The test results showed that in Western aphasia battery total scores (WABT) and Cognitive linguistic assessment protocol (CLAPT) total scores there was a significant difference between the Normal and Nonfluent group. .There was no significant difference between normals and fluent types of aphasia in total scores of WAB and CLAP total. And there was significant difference between fluent type of aphasia and normals in total scores of ACE (Addenbrooke's cognitive examination) total scores.

d) Within group Comparision of individuals with aphasia (Broca's, wernicke's and anomic) across total scores of three tests.

Kruskal Wallis test was done to find the within group comparison of individuals with aphasia (Broca's, Wernicke's and anomic aphasia). The test results revealed that there was a significant difference between these three tests across different types of aphasia. Mann Whitney test was done to see any significant difference across these three groups of aphasic population. When the comparison is made between Broca's aphasia and wernicke's aphasia group there was significant difference found for total scores of Cognitive Linguistic Assessment Protocol. When broca's and anomic aphasia was compared there was a significant difference found for all the total scores at 0.05levels. And when Comparision is made between wernicke's and anomic aphasia there is significant difference was found for all the total scores of the three tests at 0.05 levels.

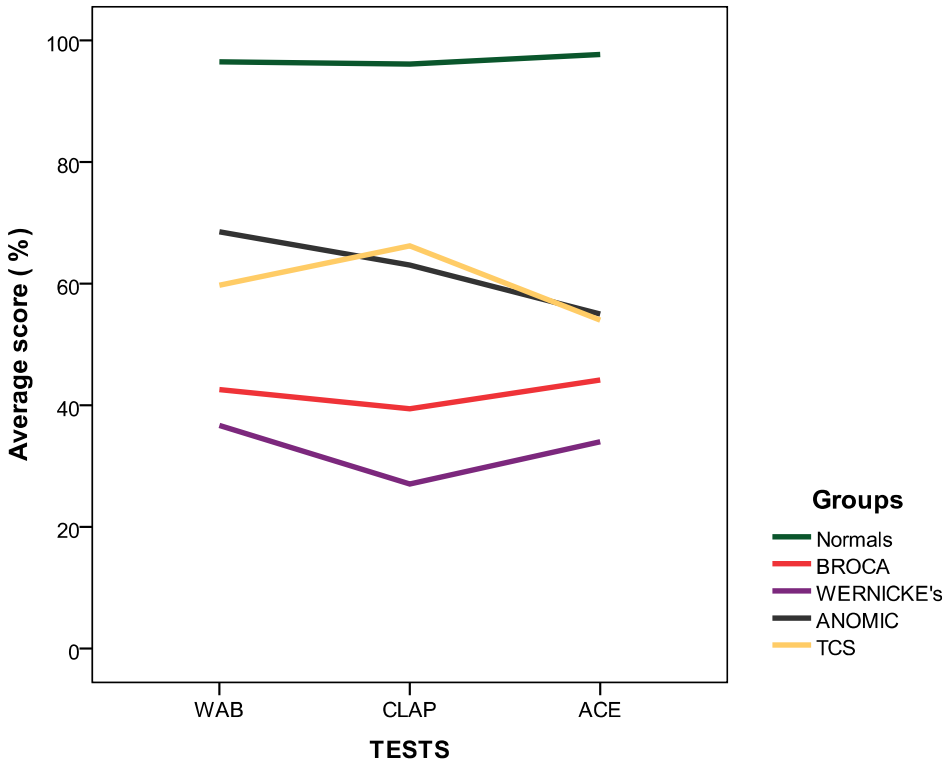

Figure 12: Average scores (%) for Normals vs. different types of aphasia across test

Figure 12 showed that the average percentage scores of the entire all the test batteries (WAB, CLAP. ACE) in subtypes of aphasia. The five lines were depicted in the figure, one with the higher scores is the normal adults (green) and other four with the poorer scores is for individuals with aphasia [Broca's (red), Wernicke's (violet), anomic (black) and transcortical sensory aphasia (yellow)

CHAPTER V

SUMMARY AND CONCLUSIONS

Communication is mainly an active and intentional two way process where exchange of messages takes place between speaker and listener. Language is the most complex of human cognitive functions, and neither the nature of human language itself nor the brain mechanisms for producing or receiving it are understood.Language forms an important mode of communication and involves use of arbitrary set of symbols (code) arranged in prescribed manner to convey meaning. To produce speech, the language phenomenon involves using a code, retrieval of linguistic units , organizing and further processing most of which involve cognitive processing, viz,, using a set code requires memory, organizing, abstract reasoning, attention, orientation etc.,though studies have suggested the inter relation among cognitive processes, the exact relationships of language with other cognitive process are minimally explored.

Only in the 1970s, with increasing interest in the geriatric communication problems and realization of the cognitive processes impinging on the communication abilities, was the term cognitive –communicative processes introduced. ASHA (1987) taking cognizance of the intricate relation between the cognitive disorders, language and communication problems, defined the role of speech language pathologists in assessment and intervention of cognitive communication disorders. Assessment procedures were developed for various cognitive communication disorders such as traumatic brain injury, dementia in general, and dementia in Alzheimer's type in particular. These disorders are of majorly of cognitive origin and has language problems as associated problem with those cognitive deficits. And a communicative disorder like aphasia is not so explored in the relation between the language and the cognitive domains.

Considering the dearth of studies in cognitive-communicative abilities in individuals with aphasia. The present study intended to investigate the performance of normal adults and individuals with aphasia in Kannada speaking population on various cognitive linguistic domains . The primary objective was to study the performance of individuals with aphasia and normal adults using a battery of tests such as western aphasia battery (Kerestz, 1982), cognitive

linguistic assessment protocol for adults (Rajasudhakar & Shyamala, 2006) and Addenbrooke's cognitive Examination in Kannada (Deepa & Shyamala, 2009) which assesses cognitive – linguistic abilities in normals and cognitive communicative disorders .

These test batteries were administered on 20 normal adults and 20 individuals with aphasia from 30 to 60 years. The subjects met the selected inclusion criteria native Kannada speaker, with normal\suitably vision and hearing abilities and also functional (though reduced) reading and writing abilities. And had no psychological illness or any drug or alcohol abuse. The test protocol was administered in the same environment and scoring was done simultaneously as scheduled for each of the tests. The data thus obtained was subjected to statistical analysis using SPSS software Version 16.0. The mean and standard deviation were computed for each subtests in the test batteries across the normals and individuals with aphasia.

Multivariate-ANOVA and post hoc Duncan's test was carried out to find out the significant difference between normal group and individuals with aphasia using various cognitive linguistic tasks in the test batteries such as western aphasia battery, cognitive linguistic assessment protocol and Addenbrooke's cognitive examination. The results revealed that there was a significant difference between Normals and Individuals with aphasia in all the subtests of the test batteries. And three group comparisons was made between normals, nonfluent group and the fluent group and in all the test batteries there was a significant difference between the groups. Kruskal Wallis test and Mann-Whitney test was done to find out the within group comparisons of individuals with aphasia (Broca's, wernicke's and Anomic aphasias) and results revealed there was no significant difference between these subjects in all the subtests of the test batteries.

When the total scores of all the three tests were compared across normal and aphasic group there was a significant difference between normals and individuals with aphasia confirming the presence of cognitive-linguistic deficits in aphasia. And when within group comparison is made between the types of aphasia there was a significant difference found across the total scores of each test.

Implications of the present study:

1. The results of the present study revealed that the test batteries used would serve as a set of sensitive tools and help the professionals to assess the cognitive linguistic abilities in individuals with aphasia.
2. These test results have enriched the existing theoretical Knowledge on the relation between cognition and language in aphasia.
3. Profiling of various cognitive linguistic performances be a prerequisite in the assessment and would help in therapeutic intervention in individuals with aphasia.

Future research and Suggestions

1. The future research should focus on cross-linguistic / ethanocultural differences in the cognitive linguistic abilities in aphasics in the Indian context
2. Cognitive linguistic abilities of a monolingual aphasic group can be compared with that of bilingual aphasic group.

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APPENDIX-I

COGNITIVE LINGUISTIC ASSESSMENT PROTOCOL IN KANNADA (CLAP-K)

DOMAIN I: ATTENTION, DISCRIMINATION AND PERCEPTION.

Visual subset.

a. Letter cancellation: ಇದರಲ್ಲಿ ಇರುವ ಪ್ರತ್ಯೇಕ "ಲ" ಅಕ್ಷರವನ್ನು ಅಡ್ಡ ಗೆರೆ ಎಳೆದು ಗುರುತಿಸಿ

ಮ	ಓ	ಎ	ಲ	ವ	ಯ	ಮ	ವ	ಕ	ಲ	ಸ	ಆ
ಡ	ಹ	ತ	ಗ	ಫ	ಎ	ಶ	ಲ	ಝು	ಇ	ಕ	ನ
ಲ	ದ	ಬ	ಯ	ಓ	ಲ	ಊ	ಕ	ಇ	ಜ	ಓ	ರ
ಪ	ವ	ಚ	ಎ	ಯ	ಎ	ಟ	ಲ	ಎ	ವ	ಬ	ಶ
ಓ	ಝು	ಲ	ಇ	ಎ	ಬ	ಳ	ವ	ಯ	ಲ	ಕ್ಷ	ವ
ಳ	ಲ	ಕ	ವ	ಜ	ವ	ನ	ಬ	ಲ	ಎ	ವ	ಪ

Scoring: _____ correct out of 100. Note down the time taken to complete task_____

b.Contingent letter cancellation: "ಇ" ಅಕ್ಷರ ಪಕ್ಕ ಇರುವ ಪ್ರತ್ಯೇಕ "ಕ" ಅಕ್ಷರವನ್ನು ಅಡ್ಡ ಗೆರೆ

ಪ	ಳ	ಲ	ಸ	ಬ	ಇ	ಕ	ಫ	ರ	ಝು	ಎ	ಕ	ತ	ಹ
ಸ	ಗ	ಕ	ಇ	ಊ	ಕ	ಜ	ಹ	ಕ	ಕ	ಡ	ಬ	ಇ	ಕ
ನ	ಶ	ಶ	ಚ	ಇ	ಇ	ಕ	ಊ	ಪ	ಇ	ಕ	ವ	ಜ	ಡ
ಇ	ಕ	ಅ	ಯ	ಚ	ಹ	ಇ	ಕ	ಇ	ಬ	ಇ	ಮ	ಕ	ಫ
ಳ	ಲ	ಇ	ಕ	ವ	ರ	ಗ	ಕ್ಷ	ಇ	ಕ	ಟ	ವ	ಇ	ಕ

Scoring: _____ correct out of 100. Note down the time taken to complete task_____

c. Word Cancellation: ಇದರಲ್ಲಿ ಇರುವ ಪ್ರತ್ಯೇಕ "ಕಿತ್ತಳೆ" ಪದವನ್ನು ಅಡ್ಡ ಗೆರೆ ಎಳೆದು ಗುರುತಿಸಿ

ಮಾವು	ಸೇಬು	ಸೀಬೆ	ಕಿತ್ತಳ	ಮಾವು	ಹಸಿರು	ಹಳದಿ	ಬಾಳೆಹಣ್ಣು
ಕಿತ್ತಳೆ	ನೇರಳೆ	ಸಪೋಟ	ದ್ರಾಕ್ಷಿ	ನಿಂಬೆ	ನಿಂಬೆ	ನೀಲಿ	ಪರಂಗಿ
ಕಿತ್ತಳೆ	ಹಲಸು	ಕಿತ್ತಳೆ	ನಿಂಬೆ	ನಿಂಬೆ	ಕಿತ್ತಳೆ	ಮೊಸಂಬಿ	ಕಿತ್ತಳೆ
ದ್ರಾಕ್ಷಿ	ಕಿತ್ತಳೆ	ನೀಲಿ	ಸಪೋಟ	ಸೀಬೆ	ಸೇಬು	ನೇರಳೆ	ನೀಲಿ
ನಿಂಬೆ	ಸೇಬು	ಕಲ್ಲು	ಕಿತ್ತಳೆ	ಸೇಬು	ಬಾಳೆ	ಕೆಂಪು	ಹಸಿರು
ಹಳದಿ	ಬಿಳಿ	ಮಾವು	ಸೇಬು	ಸೀಬೆ	ಕಿತ್ತಳೆ	ಕೆಂಪು	ಬಿಳಿ
ನೀಲಿ	ಕಿತ್ತಳೆ	ಹಳದಿ	ನೇರಳೆ	ಕಂದು	ಬೂದು	ಮಾವು	ಸೇಬು

Scoring:_____ correct out of 100. Note down the time taken to complete task_____

Auditory subset:

a. Sound count

ನಾನು ಈಗ ಕೆಲವು ಅಕ್ಷರಗಳನ್ನು ಓದುತ್ತೆನೆ, ಎಷ್ಟು ಸಾರಿ "ಬ" ಶಬ್ದ ಬಂತು ಎಂದು ಕೇಳಿಸಿಕೊಂಡು ಹೇಳಬೇಕು

ಮ ಬ ತ ಜ ಬ ಪ ಶ ವ ಗ ತ ಬ

ಲ ಬ ಶ ಕ ರ ಬ ಪ ಫ ಬ ಳ ಚ

ಬ ಜ ಳ ಬ ಬ ಹ ತ ಸ ದ ದ ಲ

Scoring: _____ correct out of 100. (-1 for each extra count beyond 10) Note down the time taken to complete task_____

b. Letter pair discrimination:

ನಾನು ಈಗ ಜೋಡಿ ಅಕ್ಷರಗಳನ್ನು ಹೇಳುತ್ತೇನೆ, ಆ ಅಕ್ಷರಗಳು ಒಂದೇನಾ, ಬೇರೆ ಬೇರೆನಾ ಎಂದು ಹೇಳಿ.

ಬ ಪ

ತ ತ

ಲ ಲ

ಚ ಜ

ದ ಕ

Scoring: _____ correct out of 5. Note down the time taken to complete task_____

c. Word pair discrimination.

ನಾನು ಈಗ ಜೋಡಿ ಪದಗಳನ್ನು ಹೇಳುತ್ತೇನೆ, ಆ ಪದಗಳು ಒಂದೇನಾ, ಬೇರೆ ಬೇರೆನಾ ಎಂದು ಹೇಳಿ.

ಕುರಿ ಕೂರಿ

ಬಳೆ ಮಳೆ

ನೀನು ನಾನು

ಹೂವು ಹೂವು

ಚಪ್ಪಲಿ ಚಕ್ಕಲಿ

Scoring: _____ correct out of 5. Note down the time taken to complete task_____

d. Backward month naming.

"ತಿಂಗಳ ಹೆಸರು ಉಲ್ಟಾ ಕ್ರಮದಲ್ಲಿ ಹೇಳಿ"

Scoring: 1 point for every month named. Eg. “Dec, Nov, Aug, July, June, May, April, March, February, January: = 8marks. Dec and Nov are not scored as they are used to help the subject begin; months named in wrong order are not scored. Eg. Dec, nov, Oct, Sept, Aug, June, July, May, March, April, Feb, Jan. = 6marks.

Scoring: _____ correct out of 10. Note down the time taken to complete task_____

DOMAIN II. MEMORY

Episodic memory:

a. Orientation and recent memory questions.

1. ನಿಮ್ಮ ಹೆಸರು ಏನು? (What is your name?)
2. ನಿಮ್ಮ ತಾಯಿಯ ಹೆಸರು ಏನು? (What is your mother’s name?)
3. ನೀವು ಊಟ ಯಾವಾಗ ಮಾಡುತ್ತೀರ? ಬೆಳಗ್ಗೆ/ ಮಧ್ಯಾಹ್ನ/ ಸಂಜೆ/ ರಾತ್ರಿ (When do you eat food, morning/ afternoon/ evening/ night)
4. ಇದು ಯಾವ ಊರು?(What place is this?)
5. ಭಾರತದ ಈಗಿನ ಪ್ರಧಾನ ಮಂತ್ರಿ ಯಾರು?(Who is the present prime minister of India?)
6. ಸೂರ್ಯನು ಪೂರ್ವದಲ್ಲಿ ಹುಟ್ಟುತ್ತಾನೋ ಪಶ್ಚಿಮದಲ್ಲೊ?(Does the sun rise in the east or in the west?)
7. ತಂದೆಯ ತಂದೆಗೆ ಎನೆಂದು ಕರೆಯುತ್ತಾರೆ? (ಅಜ್ಜ) (A father’s father is a –grandfather)
8. ಬ್ಯಾ ಕ್ ನಲ್ಲಿ ಇಟ್ಟಿರುವ ಹಣಕ್ಕೆ ಪ್ರತಿ ತಿಂಗಳು ಬರುವ ಸಂಪಾದನೆಯನ್ನು ಏನೆಂದು ಕರೆಯುತ್ತಾರೆ? (ಬಡ್ಡಿ) (Monthly earnings in a bank account is called ---interest)
9. ಒಂದು ಪದದ ಅರ್ಥವನ್ನು ನೀವು ಎಲ್ಲಿ ಹುಡುಕುತ್ತೀರಾ? (ನಿಘಂಟು) (What do you use to look up the meaning of a word?) (dictionary)
10. ಮಾರ್ಚ್ ತಿಂಗಳು ಜೂನ್ ತಿಂಗಳ ಮುಂಚೆ ಬರತ್ತಾ? (Does the month of March come before July?)

Scoring: 1 Mark for every question answered correctly. Total:_____ correct out of 100. Note down the time taken to complete task_____

Working Memory:

a. Digit Forward

" ನಾನು ಈಗ ಕೆಲವು ಅಂಕಗಳನ್ನು ಹೇಳುತ್ತೇನೆ, ಅದನ್ನು ಕೇಳಿಸಿಕೊಂಡು, ನೀವು ಅದೇ ಕ್ರಮದಲ್ಲಿ ಪುನಃ ಹೇಳಬೇಕು".

8	6	6				
5	8	1	2			
1	4	6	2	7		
1	5	9	3	4	7	
2	5	8	7	1	7	9

Scoring: 1 Mark for every correctly repeated sequence. No points if all numbers repeated but in wrong order. Total _____ correct out of 5. Note down the time taken to complete task_____

b. Digit backward:

ನಾನು ಈಗ ಕೆಲವು ಅಂಕಗಳನ್ನು ಹೇಳುತ್ತೇನೆ, ಅದನ್ನು ಕೇಳಿಸಿಕೊಂಡು, ನೀವು ಉಲ್ಟಾಕ್ರಮದಲ್ಲಿ ಹೇಳಬೇಕು".

2	5	7				
9	7	1	8			
5	4	6	1	9		
8	4	3	9	7	6	
7	4	2	9	6	3	5

Scoring: 1 Mark for every correctly repeated sequence. No points if all numbers repeated but in wrong order.

Total _____ correct out of 5. Note down the time taken to complete task_____

Semantic Memory:

a. Coordinate naming.

"ಬರವಣಿಗೆಯಲ್ಲಿ ಉಪಯೋಗಿಸುವ ಐದು ವಸ್ತುಗಳನ್ನು ಹೆಸರಿಸಿ"

Scoring: 1 point for each item named, max. 5 points
No point given for items like 'rubber', 'duster' etc.

Total_____ out of 5. Note down the time taken to complete task_____

b. Super ordinate:

"ಕೆಳಗೆ ಕೊಟ್ಟಿರುವ ಪದಗಳು ಯಾವ ಗುಂಪಿಗೆ ಸೇರುತ್ತವೆ ಎಂಬುದರ ಹೆಸರು ಹೆಳಿ"

ಬೆಕ್ಕು ಮಂಗ ಹುಲಿ ನಾಯಿ ಆನೆ
ಶೂಗಳು ಬೂಟುಗಳು ಚಪ್ಪಲಿಗಳು ಸ್ಯಾಂಡಲ್ಗಳು
ಪಕ್ಷಿ ಮೋಡ ವಿಮಾನ ನಕ್ಷತ್ರಗಳು
ಹಾಲು ನೀರು ಸಕ್ಕರೆ ಚಹಾಪುಡಿ ಕುಡಿಕೆ
ಮೇಜು ಕುರ್ಚಿ ಡಸ್ಟರ್ ಕಪ್ಪುಹಲಗೆ ಕಿಟಕಿ

Scoring: 1 point for every correct answer.

Total _____ out of 5. Note down the time taken to complete task_____

Answers:

a. ಪ್ರಾಣಿಗಳು

b. ಕಾಲಿಗೆ ಹಾಕುವ ವಸ್ತುಗಳು

c. ಆಕಾಶ

d. ಪಾನೀಯ, ಚಹಾ ಮಾಡುವುದು

e. ಕ್ಲಾಸ್ ರೂಮು

f.

c. Word Naming Fluency:

"ನಾನು ಹೇಳಿದ ಅಕ್ಷರದಿಂದ ಐದು ಪದಗಳನ್ನು ಹೇಳಿ"

i. ಪ

ii. ಅ

iii. ಸ

iv. ಇ

v. ತ

Scoring: 1point for 5 words on every letter.
If unable to name at least 5 words on a letter, no point given for that item.

Total score_____out of 5. Note down the time taken to complete task_____

d. Generative naming.

"ನಾನು ಕೆಲವು ಪ್ರಶ್ನೆಗಳು ಕೇಳುತ್ತೇನೆ ಅದಕ್ಕೆ ಉತ್ತರ ಕೊಡಿ'.

i. ಬರವಣಿಗೆಗೆ ಏನನ್ನು ಉಪಯೋಗಿಸುತ್ತೀರಾ? (ಪೆನ್)

ii. ಮಳೆ ಬಂದರೆ ಏನನ್ನು ಉಪಯೋಗಿಸುತ್ತೀರಾ? (ಕೊಡೆ)

iii. ಸಮಯ ನೋಡೋಕೆ ಏನನ್ನು ಉಪಯೋಗಿಸುತ್ತೀರಾ??(ಗಡಿಯಾರ)

iv. ಕಾಲಿಗೆ ಏನನ್ನು ಹಾಕುತ್ತೀರಾ? (ಶೂ, ಬೂಟು)

v. ಸಿಗ್ನಲ್ ಗಳಲ್ಲಿ ಯಾವ ಬಣ್ಣ 'ನಿಲ್ಲಿಸಿ' ಎಂಬುದನ್ನು ಸೂಚಿಸುತ್ತದೆ?(ಕೆಂಪು)

Scoring: 1point for every correct answer.

Total :_____out of 5. Note down the time taken to complete task_____

e. Sentence repetition.

"ನಾನು ಕೆಲವು ಪದಗಳು ಹೇಳುತ್ತೇನೆ ಅದನ್ನು ವಾಪಸ್ ಹೇಳಿ"

i. ಕಿಟಕಿ

ii. ನಲವತ್ತೈದು

iii. ಐವತ್ತೈದುವರೆ ಕಿಲೋಮೀಟರ್

iv. ರೈತನು ಹೊಲ ಹೂಳುತ್ತಿದ್ದಾನೆ

1 point for every morpheme correctly repeated.

Total: _____out of 10. Note down the time taken to complete task_____

f. Carry out commands

"ನಾನು ಈಗ ನಿಮಗೆ ಕೆಲವು ಕೆಲಸ ಮಾಡಲಿಕ್ಕೆ ಹೇಳುತ್ತೇನೆ ಅದು ಎಷ್ಟು ಆಗತ್ತೋ ಅಷ್ಟು ಮಾಡಿ"

i. ಕುರ್ಚಿ ತೋರಿಸಿ

ii. ಪೆನ್ನು ಮತ್ತು ಬುಕ್ಕು ತೋರಿಸಿ

iii. ಪೆನ್ನಿನಿಂದ ಬುಕ್ಕು ತೋರಿಸಿ

iv. ಕಣ್ಣು ತೋರಿಸಿ ಮತ್ತು ಕಾಲು ತೋರಿಸಿ

Total: _____out of 10. Note down the time taken to complete task_____

DOMAIN III: PROBLEM SOLVING:

a. Sentence disambiguation.

"ನಾನು ಕೆಲವು ವಾಕ್ಯಗಳನ್ನು ಹೇಳುತ್ತೇನೆ, ಒಂದು ವಾಕ್ಯಕ್ಕೆ ಎರಡು ಅರ್ಥವಿರುತ್ತದೆ, ಅದು ಹೇಗೆ ಅಂತ ನೀವು ಹೇಳಬೇಕು"

Eg. ಶ್ರೀಪತಿ ತಮ್ಮ ಮನೆಗೆ ಹೋದರು

ii. ತಿಂಡಿ ಆಯ್ತಾ?

iii. ಈ ರಾಮಾಯಣ ಯಾರಿಗೆ ಬೇಕು?

iv. ಆ ಬಣ್ಣದ ಬೀಸಣಿಗೆ ನನಗೆ ಬೇಡ?

v. ಹುಡುಗಿ ಹೂವು ಬಿಡಿಸುತ್ತಿದ್ದಾಳೆ?

vi. ಗೋವಿಂದ ಸ್ನಾನ ಮಾಡಿ ಊಟ ಮಾಡ್ಲಿಲ್ಲ?

Scoring: 1 point for every correct interpretation, 2 points given on an item only if both the interpretations are correctly explained.

Total :_____out of 10. Note down the time taken to complete task_____

b. Sentence formulation:

"ಪದಕ್ರಮವನ್ನು ಬದಲಾಯಿಸಿದ ವಾಕ್ಯಗಳನ್ನು ನಾನೀಗ ಕೊಡುತ್ತೇನೆ, ನೀವು ಇವುಗಳನ್ನು ಬಿಡಿಸಿ ಸರಿಯಾದ ವಾಕ್ಯ ಏನೆಂಬುದನ್ನು ತಿಳಿಸಿ".

1. ಬಾಗಿಲಿಗೆ ಮುಂದಿನ ಹಾಕಿದೆ ಬೀಗ.
2. ಯಾಗಿತ್ತು ತುಂಬಾ ನೀರು ಬಿಸಿ.
3. ಹೋಯಿತು ಸೂರ್ಯನ ಐಸ್ ಕ್ರೀಮ್ ಕರಗಿ ಬಿಸಿಲಿನಲ್ಲಿ.
4. ದಂತವೈದ್ಯರು ಹಲ್ಲನ್ನು ನನ್ನ ತುಂಬಿದರು.
5. ಹತ್ತು ನಿಮಿಷ ಕೈ ಗಡಿಯಾರ ಮುರಿದ ಹಿಂದಿತ್ತು.

Answers

1. ಮುಂದಿನ ಬಾಗಿಲಿಗೆ ಬೀಗ ಹಾಕಿದೆ .
2. ನೀರು ತುಂಬಾ ಬಿಸಿ ಯಾಗಿತ್ತು .
3. ಸೂರ್ಯನ ಐಸ್ ಕ್ರೀಮ್ ಬಿಸಿಲಿನಲ್ಲಿ ಕರಗಿ ಹೋಯಿತು.
4. ದಂತವೈದ್ಯರು ನನ್ನ ಹಲ್ಲನ್ನು ತುಂಬಿದರು.
5. ಮುರಿದ ಕೈ ಗಡಿಯಾರ ಹತ್ತು ನಿಮಿಷ ಹಿಂದಿತ್ತು.

Scoring: 1 point for each correctly arranged sentence.
Toatl score_____ out of 5. Note down the time taken to complete task_____

c. Predicting Outcome:

I. ಅಕಸ್ಮಾತಾಗಿ ಕರೆಂಟ್ ಹೊರಟುಹೋದರೆ ನೀವೇನು ಮಾಡುವಿರಿ?
II. ಬೇರೆಯವರಿಂದ ಕೇಳಿಪಡೆದು ತಂದ ದುಬಾರಿ ಪದಾರ್ಥ ಕಳೆದುಹೋದಾಗ ಏನು ಮಾಡುವಿರಿ?
III. ನಿಮ್ಮ ಬೀಗದಕೈ ಕಳೆದುಹೋದಾಗ ಏನುಮಾಡುವಿರಿ?
IV. ಪತ್ರಕ್ಕೆ ಸ್ಟಾಂಪ್ ಹಾಕದೆ ಪೋಸ್ಟ್ ಮಾಡಿಬಿಟ್ಟಿರುವಿರಿ ಆಗೇನು ಮಾಡುವಿರಿ?
V. ನಿಮಗೆ ಹುಷಾರು ಇಲ್ಲದಿದ್ದಾಗ ನೀವು ಡಾಕ್ಟರ್ ಹತ್ತಿರ ಹೋಗಿಲ್ಲವೆನ್ನಿ, ಹಾಗೆನಾಗುವುದು?

Scoring: 2 points if outcome stated clearly and is possible (coherent answer). 1point if outcome correct but not explained clearly. No point scored if answer does not go with the theme of the question.

Total _____ out of 10. Note down the time taken to complete task_____

d. Compare and Contrast:

"ನಾನೀಗ ಎರೆಡೆರೆಡು ಪದಗಳನ್ನು ಹೇಳುತ್ತೇನೆ, ಅವು ಹೇಗೆ ಹೊಂದುತ್ತವೆ ಅಥವ ಹೇಗೆ ಬೇರೆಯಗುತ್ತವೆ ಎಂದು ತಿಳಿಸಿ."

I.	ಫ್ರಿಜ್ ಮತ್ತು ಸ್ಟವು
II.	ಚೆಂಡು ಮತ್ತು ಬಲೂನು
III.	ತಟ್ಟೆ ಮತ್ತು ಪಾತ್ರೆ
IV.	ವೃತ್ತಪತ್ರಿಕೆ ಮತ್ತು ಮ್ಯಾಗಜೀನ್
V.	ಏರೋಪ್ಲೇನು ಮತ್ತು ಹಾಕಿ

Scoring : 1 point for a similarity and 1 point for a difference for each item.
Total _____ out of 10. Note down the time taken to complete task_____

e. Predicting cause.

"ನಾನೀಗ ಯಾವುದಾದರು ಒಂದು ಸ್ಥಿತಿಬಗ್ಗೆ ಹೇಳುತ್ತೇನೆ, ಅದಕ್ಕೆ ಕಾರಣವೇನಿರಬಹುದು ಎಂದು ತಿಳಿಸಿ"

I.	ನಿಮ್ಮ ಗಿಡಗಳು ಬತ್ತಿ ಹೋಗಿವೆ
II.	ನಿಮ್ಮ ಕೊಠಡಿಯಲ್ಲಿ ಹೊಗೆ ತುಂಬಿದೆ.
III.	ಬೀಗದ ಕೈಯಿ ಬೀಗಕ್ಕೆ ಹೊಂದುತ್ತಿಲ್ಲ.
IV.	ನಿಮ್ಮ ಆರೋಗ್ಯ ಕೆಟ್ಟಿದೆ.
V.	ನಿಮ್ಮ ಗಡಿಯಾರ ಕೆಲಸ ಮಾಡುತ್ತಿಲ್ಲಾ.

Scoring: subject is expected to give atleast two reasons for each problem. Score 1 point for each correct cause stated. Max 2 points per item.

Total: _____ out of 10. Note down the time taken to complete task_____

f. Why questions.

I.	ನಿತ್ಯವು ವ್ಯಾಯಾಮ ಮಾಡಬೇಕು ಏಕೆ?
II.	ಸಂಚಾರಿ ಸಿಗ್ನಲ್ ಗಳಿರಬೇಕು ಏಕೆ?
III.	ಪೆನ್ನಿನಲ್ಲಿ ಬಿಳಿ ಇಂಕನ್ನು ಉಪಯೋಗಿಸುವುದಿಲ್ಲ ಏಕೆ?
IV.	ಬೂಟು ಹಾಕುವುದೇಕೆ?
V.	ಗಿಡಗಳಿಗೆ ನೀರು ಹಾಕಬೇಕು ಏಕೆ?

Scoring : 1 point for every correct answer.
Total _____ out of 5. Note down the time taken to complete task_____

g. Sequential analysis.

"ಯಾವುದಾದರೊಂದು ಕೆಲಸವನ್ನು ನಾನು ಹೇಳುತ್ತೇನೆ.ನೀವು ಆ ಕೆಲಸ ಮಾಡುವ ಕ್ರಮವನ್ನು ತಿಳಿಸಬೇಕು"

I.	ಪಾತ್ರೆ ತೊಳೆಯುವುದು
II.	ಗಿಡ ನೆಡುವುದು
III.	ಶರ್ಟ್/ ಸೀರೆ ಖರೀದಿಸುವುದು.
IV.	ಟೀ ಮಾಡುವುದು
V.	ಪತ್ರವನ್ನು ಅಂಚೆಪೆಟ್ಟಿಗೆಗೆ ಹಾಕುವುದು.

Scoring: subject expected to elaborate at least 4 steps in each analysis. Score 2 point for every correctly analyzed item. 1 point for correct analysis, but in less than 4 steps. 0 points if analysis is not temporally correctly sequenced.

Total_____ out of 10. Note down the time taken to complete task_____

DOMAIN IV: ORGANIZATION

a. Categorization.

"ನಾನೀಗ ನಿಮಗೆ ಒಂದು ವಸ್ತುವಿನ ಹೆಸರನ್ನು ಹೇಳುತ್ತೇನೆ, ಕೆಳಕಂಡ ಕೆಲವು ಬೇರೆ ಹೆಸರುಗಳಲ್ಲಿ ಮೊದಲು ಹೇಳಿದ ವಸ್ತುವಿನ ಗುಂಪಿಗೆ ಹೊಂದುವಂತ ಎರಡನ್ನು ಆಡ್ಡಗೆರೆ ಎಳೆದು ಗುರುತಿಸಿ"

I.	ನಾಯಿ:					
	ಹೂವು	ಟೋಪಿ	ಇಲಿ	ಪೆನ್ಸಿಲ್	ಸಿಂಹ	
II.	ಸಕ್ಕರೆ:					
	ಗಿಣ್ಣು	ಬೆಲ್ಲ	ಮೆಣಸಿನಕಾಯಿ	ಜೇನುತುಪ್ಪ	ಗುಹೆ	
III.	ಗುಂಡಿ:					
	ಸೇಫ್ಟಿಪಿನ್ನು	ಗಡಿಯಾರ	ಕ್ಲಿಪ್	ಬಳೆ	ಉಗುರು	
IV.	ಪುಸ್ತಕ:					
	ಲ್ಯಾಂಪ್	ವೃತ್ತ ಪತ್ರಿಕೆ	ಚಿತ್ರ	ಫೈಲ್	ಮ್ಯಾಗಜೀನ್	
V.	ಕತ್ತರಿ :					
	ಸೂಜಿ	ಗಾಜು	ಬ್ಲೇಡು	ಚಾಕು	ಬೆಂಕಿಪೊಟ್ಟಣ.	

Scoring: 1 point for every correctly identified coordinate category.

Total _____ out of 10. Note down the time taken to complete task_____

b. Analogies.

"ನಾನು ಪರಸ್ಪರ ಸಂಭಂದಿಸಿದ ಎರಡು ವಸ್ತುಗಳ ಹೆಸರನ್ನು ಹೇಳುತ್ತೇನೆ, ನಂತರ ಒಂದೆ ಒಂದು ಹೆಸರನ್ನು ಹೇಳುತ್ತೇನೆ, ಮೊದಲಿನ ಪದಗಳ ಜೋಡಿಯಲ್ಲಿ ಸಂಭಂದಿಸಿರುವಂತೆ ಇದಕ್ಕೆ ಸಂಭಂದಿಸಿದ ಯಾವುದಿರಬಹುದು ಎಂದು ತಿಳಿಸಿ."

Eg. ಪೆನ್ನು: ಬರೆ :: ಪುಸ್ತಕ:_____(ಓದು)

I.	ಛತ್ರಿ: ಮಳೆ	::	ಸ್ವೆಟ್ಟರ್ : _____(ಚಳಿ)
II.	ಆನೆ: ಇಲಿ	;:	ಸಮುದ್ರ:_____(ಕೆರೆ/ತೊರೆ/ನದಿ)
III.	ಏರೋಪ್ಲೇನು: ಆಕಾಶ	::	ಕಾರ್:_____(ರಸ್ತೆ)
IV.	ಸಮಯ: ಗಂಟೆ	: :	ಭಾರ:_____(ಕೆಜಿ)
V.	ಡಾಕ್ಟರ್: ಆಸ್ಪತ್ರೆ::		ಉಪಾಧ್ಯಾಯ:_____(ಶಾಲೆ/ಸ್ಕೂಲು)

Scoring: 2 points for every correct answer.
Total:_____ out of 10. Note down the time taken to complete task_____

c. Sequencing events.

"ವ್ಯಾಕರಣವನ್ನು ಬದಲಾಯಿಸಿದ ಕೆಲವು ಕಥೆಗಳು ಇಲ್ಲಿ ಬರೆದಿವೆ, ನೀವು ಇವುಗಳನ್ನು ಬಿಡಿಸಿ ಸರಿಯಾದ ವ್ಯಾಕರಣವನ್ನು ಬರೆದು ಕಥೆ ಏನೆಂಬುದನ್ನು ತಿಳಿಸಿ."

i. ಅದು ಮರವೊಂದಕ್ಕೆ ಸಿಕ್ಕಿ ಹಾಕಿಕೊಂಡಿತ್ತು.
ಆದರ್ಶ ಗಾಳಿಪಟವನ್ನು ಮಾಡಿದ
ಗಾಳಿ ಬಂದಾಗ ಮೇಲೆ ಬಂತು.

ii. ವಿದ್ಯಾ ಆ ಬೀಜವನ್ನು ಬಿತ್ತಿದಳು
ವಿದ್ಯಾಳಿಗೆ ಒಂದು ತೋಟ ಮಾಡಬೇಕೆನಿಸಿತು.
ಒಂದು ವಾರದ ಹೊತ್ತಿಗೆ ಚಿಕ್ಕ ಹಸಿರು ಮೊಳಕೆಗಳು ಹೊಡೆಯುವುದನ್ನು ಅವಳು ನೋಡಿದಳು.
ವಿದ್ಯಾಳ ತಾಯಿ ಅವಳಿಗೆ ಕೆಲವು ಬೀಜಗಳನ್ನು ತಂದುಕೊಟ್ಟರು.
ಅವುಗಳಿಗೆ ವಿದ್ಯಾ ದಿನವೂ ನೀರು ಹಾಕುತ್ತಿದ್ದಳು.

iii. ಕಾರು ಸ್ಟಾರ್ಟ್ ಆಗುವುದಿಲ್ಲ ಎಂಬುದನ್ನು ಅರಿತ ವಿವೇಕ ಬಸ್ ಹತ್ತಿದ.
ವಿವೇಕ ಬಹಳ ಲೇಟಾಗಿ ಎದ್ದ.
ಹೊತ್ತಿಗೆ ಸರಿಯಾಗಿ ಕೆಲಸ ಮಾಡಬೇಕೆಂದುಕೊಂಡ ಇನ್ನು ಮುಂದೆ ಬೇಗ ಏಳುತ್ತೇನೆಂದು ಸಂಕಲ್ಪ ಮಾಡಿಕೊಂಡ.
ಕಾರಿನಲ್ಲಿ ಕುಳಿತ ಮೇಲೆ ಅದು ಆಷ್ಟು ಸುಲಭವಾಗಿ ಸ್ಟಾರ್ಟ್ ಆಗಲಿಲ್ಲ ಎಂದು ಅವನಿಗೆ ಅನ್ನಿಸಿತು.
ಆದಕಾರಣಾ, ಅವನು ಬೇಗ ಸ್ನಾನ- ಡ್ರೆಸ್ ಗಳನ್ನು ಮುಗಿಸಿ ತನ್ನ ಕಾರಿನ ಬಳಿ ಓಡಿದ.

iv. ನನಗೆ ಕಿರುಚಲು ಆಗದಷ್ಟು ಭಯ ಆಗಿತ್ತು.
ಅಂದು ಕಗ್ಗತ್ತಲಿನ ರಾತ್ರಿ
ಅಬ್ಬಾ, ಅದೆಂತಹ ಶಬ್ದ
ಇದ್ದಕಿದ್ದಹಾಗೆ ನನ್ನ ಬೆಕ್ಕು ಹಾಸಿಗೆಯ ಮೇಲೆ ಹಾರಿತು.
ಮನೆಯಲ್ಲಿ ನಾನೊಬ್ಬನೆ ಇದ್ದೆ

ಹಾಸಿಗೆ ಮೇಲೆ ಕುಳಿತು (ಸಾಕಷ್ಟು) ಜೋರಾಗಿಯೇ ಕೀಳಿಸಿಕೊಂಡೆ.

v. ಬಸ್ ಸ್ಟಾಪ್ ನಲ್ಲಿ ಇನೂ ಕೆಲವು ಮಕ್ಕಳು ಬಸ್ ಗಾಗಿ ಕಾಯುತ್ತಿದ್ದರು.
ಶಾಲೆಯ ಬಳಿ ಇದ್ದ ಸ್ಟಾಪ್ ಬಂತು, ರೀಟಾಳನ್ನು ಬಿಟ್ಟು ಉಳಿದ ಮಕ್ಕಳೆಲ್ಲ ಬಸ್ ನಿಂದ ಇಳಿದರು.
ರೀಟಾ ಸ್ಕೂಲಿಗೆ ಬಸ್ನಲ್ಲಿ ಹೋಗಬೇಕಿತ್ತು ಆದ್ದರಿಂದ ಅವಳು ಬಸ್ ಸ್ಟಾಪಿಗೆ ಬಂದಳು.
ಅವಳು ಕಂಡಕ್ಟರಿಗೆ ಬಸ್ ನಿಲ್ಲಿಸುವಂತೆ ಕೇಳಿಕೊಂಡು ಬಸ್ ನಿಂದ ಇಳಿದಳು
ಮಕ್ಕಳೆಲ್ಲ ಬಸ್ ಹತ್ತಿದರು
ರೀಟಾ ಇದ್ದಕ್ಕಿದ್ದಹಾಗೆ ಎದ್ದು ಕುಳಿತಳು ಆಗ ಬಸ್ ಸ್ಕೂಲಿನ ಬಳಿ ಇದ್ದ ಬಸ್ ಸ್ಟಾಪ್ ಬಿಟ್ಟು ಮುಂದೆ
ಹೋಗಿದೆ ಎಂಬುದು ಅವಳಿಗೆ ತಿಳಿಯಿತು
ಶಾಲೆಗೆ ಓಡಿಹೋಗಿ ಸರಿಯಾದ ಸಮಯಕ್ಕೆ ತನ್ನ ಕೊಠಡಿಯನ್ನು (ಕ್ಲಾಸನ್ನು) ತಲುಪಿದಳು.
ಬಸ್ ಬಂತು
ರೀಟಾಳಿಗೆ ಬಸ್ ನಲ್ಲಿ ನಿದ್ದೆ ಬಂತು.

Answers:

ಆದರ್ಶ ಗಾಳಿಪಟವನ್ನು ಮಾಡಿದ
ಗಾಳಿ ಬಂದಾಗ ಮೇಲೆ ಬಂತು.
ಅದು ಮರವೊಂದಕ್ಕೆ ಸಿಕ್ಕಿ ಹಾಕಿಕೊಂಡಿತ್ತು.

ವಿದ್ಯಾಳಿಗೆ ಒಂದು ತೋಟ ಮಾಡಬೇಕೆನಿಸಿತು.
ವಿದ್ಯಾಳ ತಾಯಿ ಅವಳಿಗೆ ಕೆಲವು ಬೀಜಗಳನ್ನು ತಂದುಕೊಟ್ಟರು.
ವಿದ್ಯಾ ಆ ಬೀಜವನ್ನು ಬಿತ್ತಿದಳು
ಅವುಗಳಿಗೆ ವಿದ್ಯಾ ದಿನವೂ ನೀರು ಹಾಕುತ್ತಿದ್ದಳು.
ಒಂದು ವಾರದ ಹೊತ್ತಿಗೆ ಚಿಕ್ಕ ಹಸಿರು ಮೊಳಕೆಗಳು ಹೊಡೆಯುವುದನ್ನು ಅವಳು ನೋಡಿದಳು.

ವಿವೇಕ ಬಹಳ ಲೇಟಾಗಿ ಎದ್ದ.
ಆದಕಾರಣಾ, ಅವನು ಬೇಗ ಸ್ನಾನ- ಡ್ರೆಸ್ ಗಳನ್ನು ಮುಗಿಸಿ ತನ್ನ ಕಾರಿನ ಬಳಿ ಓಡಿದ.
ಕಾರಿನಲ್ಲಿ ಕುಳಿತ ಮೇಲೆ ಅದು ಅಷ್ಟು ಸುಲಭವಾಗಿ ಸ್ಟಾರ್ಟ್ ಆಗಲಿಲ್ಲ ಎಂದು ಅವನಿಗೆ ಅನ್ನಿಸಿತು.
ಕಾರು ಸ್ಟಾರ್ಟ್ ಆಗುವುದಿಲ್ಲ ಎಂಬುದನ್ನು ಅರಿತ ವಿವೇಕ ಬಸ್ ಹತ್ತಿದ.
ಹೊತ್ತಿಗೆ ಸರಿಯಾಗಿ ಕೆಲಸ ಮಾಡಬೇಕೆಂದುಕೊಂಡ ಇನ್ನು ಮುಂದೆ ಬೇಗ ಏಳುತ್ತೇನೆಂದು ಸಂಕಲ್ಪ ಮಾಡಿಕೊಂಡ.

ಅಂದು ಕಗ್ಗತ್ತಲಿನ ರಾತ್ರಿ

ಮನೆಯಲ್ಲಿ ನಾನೊಬ್ಬನೆ ಇದ್ದೆ

ಇದ್ದಕಿದ್ದಹಾಗೆ ನನ್ನ ಬೆಕ್ಕು ಹಾಸಿಗೆಯ ಮೇಲೆ ಹಾರಿತು.

ಹಾಸಿಗೆ ಮೇಲೆ ಕುಳಿತು (ಸಾಕಷ್ಟು) ಜೋರಾಗಿಯೇ ಕೀಳಿಸಿಕೊಂಡೆ.

ನನಗೆ ಕಿರುಚಲು ಆಗದಷ್ಟು ಭಯ ಆಗಿತ್ತು.

ಅಬ್ಬಾ, ಅದೆಂತಹ ಶಬ್ದ

ರೀಟಾ ಸ್ಕೂಲಿಗೆ ಬಸ್ನಲ್ಲಿ ಹೋಗಬೇಕಿತ್ತು ಆದ್ದರಿಂದ ಅವಳು ಬಸ್ ಸ್ಟಾಪಿಗೆ ಬಂದಳು.

ಬಸ್ ಸ್ಟಾಪ್ ನಲ್ಲಿ ಇನೂ ಕೆಲವು ಮಕ್ಕಳು ಬಸ್ ಗಾಗಿ ಕಾಯುತ್ತಿದ್ದರು.

ಬಸ್ ಬಂತು

ಮಕ್ಕಳೆಲ್ಲ ಬಸ್ ಹತ್ತಿದರು

ರೀಟಾಳಿಗೆ ಬಸ್ ನಲ್ಲಿ ನಿದ್ದೆ ಬಂತು.

ಶಾಲೆಯ ಬಳಿ ಇದ್ದ ಸ್ಟಾಪ್ ಬಂತು, ರೀಟಾಳನ್ನು ಬಿಟ್ಟು ಉಳಿದ ಮಕ್ಕಳೆಲ್ಲ ಬಸ್ ನಿಂದ ಇಳಿದರು.

ರೀಟಾ ಇದ್ದಕ್ಕಿದ್ದಹಾಗೆ ಎದ್ದು ಕುಳಿತಳು ಆಗ ಬಸ್ ಸ್ಕೂಲಿನ ಬಳಿ ಇದ್ದ ಬಸ್ ಸ್ಟಾಪ್ ಬಿಟ್ಟು ಮುಂದೆ

ಹೋಗಿದೆ ಎಂಬುದು ಅವಳಿಗೆ ತಿಳಿಯಿತು

ಅವಳು ಕಂಡಕ್ಟರಿಗೆ ಬಸ್ ನಿಲ್ಲಿಸುವಂತೆ ಕೇಳಿಕೊಂಡು ಬಸ್ ನಿಂದ ಇಳಿದಳು

ಶಾಲೆಗೆ ಓಡಿಹೋಗಿ ಸರಿಯಾದ ಸಮಯಕ್ಕೆ ತನ್ನ ಕೊಠಡಿಯನ್ನು (ಕ್ಲಾಸನ್ನು) ತಲುಪಿದಳು.

Scoring: use story (i) as example.
Correct sentence order of other stories are as follows

The first two items are given 1 point for every correctly ordered sentence. Therefore item (ii), (iii) 5 points each. Item (iv) carries 2 points for every correctly ordered sentence. Total of 12 points. Items (v) carries 2 points for every correctly ordered sentence. Total of 18 points.

Total score:_____ out of 40. Note down the time taken to complete task_____

Cognitive Linguistic Assessment Protocol (Score Sheet)

I. Attention, perception and discrimination.

Subtest	Test Item	Subjects	Max.Score	Time in secs	
Visual	a. Letter Cancellation b. Contingent letter cancellation c. Word Cancellation		10 10 10	* * *	**/ 60**
Auditory	a. Sound count b. Letter pair discrimination c. Word pair discrimination d. Months backward naming		10 5 5 10	- - - *	

II. Memory

Subtest	**Test Item**	**Subjects**	**Max.Score**	**Time in secs**	
Episodic	a. Orientation and recent memory questions b. Digit forward c. Digit backward		10 5 5	- - -	**/ 60**
Semantic	a. Coordinate naming b. Superordinate naming c. Word naming fluency d. Generative naming e. Sentence repetition f. Carryout commands		5 5 5 5 10 10	* - * - - -	

III. Problem Solving

Subtest	Test Item	Subjects	Max.Score	Time in secs	
	a. Sentence disambiguation b. Sentence formulation c. Predicting outcome d. Compare and contrast e. Predicting cause f. Why questions g. Sequential analysis				**/ 60**

IV. Organization

Subtest	Test Item	Subjects	Max.Score	Time in secs	
	a. Categorization b. Analogies c. Sequencing events				**/ 60**

APPENDIX-II

ADDENBROOKE'S COGNITIVE EXAMINATION- ACE- R- KANNADA.

Final Revised Version A (2005)

Name: _____ Date of Birth: _____/____/_____

Age/Sex: _____/____ Date of testing: _____/____/_____

Diagnosis: _____

ORIENTATION:

Ask: What is the ಇವತ್ತು ಯಾವ	Day ದಿನ	Date ತಾರೀಖು	Month ತಿಂಗಳು	Year ಇಸವಿ	Season ಋತು/ಕಾಲ	[Score 0-5] ☐
Ask: Which ಇದು ಯಾವ	Building ಕಟ್ಟಡ	Floor ಮಹಡಿ	Town ನಗರ/ಪಟ್ಟಣ	State ರಾಜ್ಯ	Country ದೇಶ	[Score 0-5] ☐

REGISTRATION:

Tell: 'I'm going to give you three words and I'd like you to repeat after me: lemon, key and ball'. After subject repeats, say 'Try to remember them because I'm going to ask you later'. Score only the first trial (repeat 3 times if necessary). ನಾನು ನಿಮಗೆ ಮೂರು ಪದಗಳನ್ನು ಹೇಳುತ್ತೇನೆ. ನಾನು ಹೇಳಿದ ನಂತರ ನೀವು ಅದನ್ನು ಹಾಗೆಯೇ ಹೇಳಬೇಕು. ನಿಂಬೆಹಣ್ಣು, ಬೀಗದ ಕೈ, ಚೆಂಡು. ನಾನು ಈಗ ಹೇಳಿದನ್ನು ನೆನಪಿನಲ್ಲಿಡಿ, ಮತ್ತೆ ನಿಮಗೆ ಅದರ ಬಗ್ಗೆ ಕೇಳುತ್ತೇನೆ. Register number of trials.....	[Score 0-3] ☐

ATTENTION & CONCENTRATION:

Ask the subject: ' could you take 7 away from a 100? After the subject responds, ask him or her to take away another 7 to a total of 5 subtractions. If subject make a mistake, carry on and check the subsequent answer (i.e. 93, 84, 77, 70, 63 -score 4) Stop after five subtractions (93, 86, 79, 72, and 65)..... ನೂರರಲ್ಲಿ ಏಳು ಕಳೆಯಲು. ಆಗುವುದೇ ಪ್ರಯತ್ನಿಸಿ? ವ್ಯಕ್ತಿ ಹಾಗೆ ಮಾಡಿದಾಗ, ಮತ್ತೆ ಒಂದು ಸಂಖ್ಯೆಯಿಂದ ಏಳು ಕಳೆಯಲು ಹೇಳಿ. ಹೀಗೆ 5 ಸಲ ಕಳೆಯುತ್ತಾ ಬರಲಿ. ವ್ಯಕ್ತಿ ತಪ್ಪಿದಲ್ಲಿ ಅವನು ಮುಂದುವರಿಯಲಿ ಮತ್ತೆ ಉತ್ತರವನ್ನು ಪರೀಕ್ಷಿಸಿ (ಹೀಗೆ 93, 84, 77, 72, 63 – ಎಣಿಕೆ). 5 ಸಲ ಕಳೆದ ನಂತರ ನಿಲ್ಲಿಸಿ (93, 86, 79, 72, and 65)..... Ask: 'could you please spell **WORLD** for me? Then ask him/her to spell it backwards.	[Score 0-5] ☐

MEMORY:

MEMORY- RECALL:

Ask: 'Which 3 words did I ask you to repeat and remember?' .... ಆಗ ನಾನು ನಿಮಗೆ ಮೂರು ಪದವನ್ನು ಹೇಳಿ, ನೆನಪಿನಲ್ಲಿಡಿ ಎಂದು ಹೇಳಿದೆ ಅವು ಯಾವುವು?	[Score 0-3] ☐

MEMORY – ANTEROGRADE MEMORY:

Tell: ' I'm going to give you a name and address and I'd like you to repeat after me. We'll be doing that 3 times, so you have a chance to learn it. I'll be asking you later'. ನಿಮಗೆ ಒಬ್ಬರ ಹೆಸರು ಹಾಗು ಅವರ ವಿಳಾಸವನ್ನು ಹೇಳುತ್ತೇನೆ. ನಾನು ಹೇಳಿದ ನಂತರ ನೀವು ಅದನ್ನು ತಿರುಗಿ ಹೇಳಬೇಕು. ಹಾಗೆ ಮೂರು ಸಲ ನಿಮಗೆ ಅದನ್ನೆ ಹೇಳುತ್ತೇನೆ - ಹಾಗೆ ಮಾಡುವುದರಿಂದ ನೀವು ಅದನ್ನ ಕಲಿತು ನೆನಪಿನಲ್ಲಿಡಬಃಉದು. ಸ್ವಲ್ಪ ಹೊತ್ತಿನ ನಂತರ ಅದನ್ನು ನನಗೆ ಹೇಳಬೇಕು. Score only the third trial				[Score 0-3] ☐
	1st trial	2nd Trial	3rd Trial	[Score 0-7] ☐
Sundara Murthy ಸುಂದರಮೂರ್ತಿ 73 ,Narayanashashtri road 73, ನಾರಾಯಣಶಾಷ್ತ್ರಿ ರಸ್ತೆ Gandhinagara ಗಾಂಧಿನಗರ Bangalore ಬೆಂಗಳೂರು				

MEMORY- RETROGRADE:

• Name of current prime Minister…….. ಭಾರತದ ಈಗಿನ ಪ್ರಧಾನ ಮಂತ್ರಿಯ ಹೆಸರು • Name of the woman who was Prime Minister…… ಭಾರತದ ಮಹಿಳಾ ಪ್ರಧಾನ ಮಂತ್ರಿಯ ಹೆಸರು • Name of the town where Tajmahal is……	[Score 0-4] ☐

ತಾಜ್ ಮಹಲ್ ಇರುವ ಜಾಗ ಯಾವುದು? • Name of the famous Kannada Film actor who got 'Padmabhushana' award……. 'ಪದ್ಮಭೂಷಣ' ಪ್ರಶಸ್ತಿ ವಿಜೇತ ಕನ್ನಡ ಚಿತ್ರರಂಗದ ಪ್ರಸಿದ್ಧ ನಟ ಯಾರು?	

VERBAL FLUENCY- Letter 'P' and animals.

• **Letters** Say : I'm going to give you a letter of the alphabet and I'd like you to generate as many words as you can beginning with that letter, but not names of people or places. Are you ready? You've got a minute and the letter id 'P' ನಾನು ನಿಮಗೆ ಒಂದು ಅಕ್ಷರ ಕೊಡುತ್ತೇನೆ. ಅದರಿಂದ ಶುರುವಾಗುವ ಪದಗಳನ್ನು ಹೇಳುತ್ತಾ ಹೋಗಬೇಕು. ಆದರೆ ಆ ಅಕ್ಷರದಿಂದ ಶುರುವಾಗುವ ವ್ಯಕ್ತಿಯಾ ಅಥವ ಸ್ಥಳದ ಹೆಸರುಗಳನ್ನು ಹೇಳಬಾರದು. ನೀವು ಸಿದ್ದರಿದ್ದೀರಾ? ನಿಮಗೆ ಒಂದು ನಿಮಿಷ ಮಾತ್ರ ಇದೆ. ಆ ಅಕ್ಷರ ಪ.	[Score 0-7] ☐
• **Animals** Say: 'Now can you name as many animals as possible, beginning with any letter? ಈಗ ನಿಮಗೆ ತೋಚಿದ ಅಷ್ಟು ಪ್ರಾಣಿಗಳನ್ನು ಹೆಸರಿಸಬೇಕು. ಇದೇ ಅಕ್ಷರದಿಂದ ಶುರುವಾಗಬೇಕೆಂಬ ನಿಬಂಧನೆ/ ನಿಯಮ ಇಲ್ಲ.	[Score 0-7] ☐

P 'ಪ'	Animals ಪ್ರಾಣಿಗಳು	Raw Score		Scaled
		P 'ಪ'	Animals ಪ್ರಾಣಿಗಳು	Score

LANGUAGE

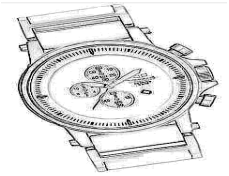
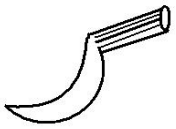
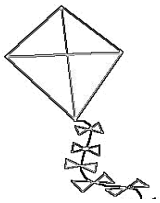
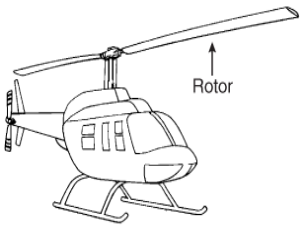
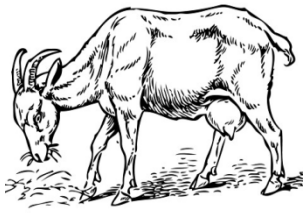
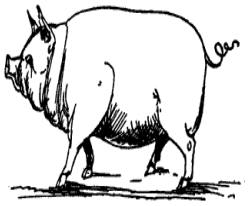
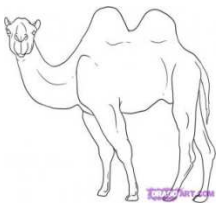
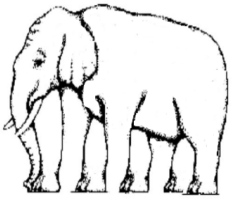
LANGUAGE- Spontaneous speech. Observe the subjects spontaneous speech and record the following Fluency (Phrases > 5 words) Paraphasic errors (Phonemic or semantic) Word finding difficulties.	

LANGUAGE- Comprehension. • Shown written instruction: **Close your eyes** **ನಿಮ್ಮ ಕಣ್ಣುಗಳನ್ನು ಮುಚ್ಚಿ**	[Score 0-1] ☐

LANGUAGE- Writing • Ask the subject to make up a sentence and write in the space below. ವ್ಯಕ್ತಿಗೆ ಒಂದು ವಾಕ್ಯ ರಚಿಸಿ, ಕೆಳಗೆ ಕೊಟ್ಟಿರುವ ಸ್ಥಳದಲ್ಲಿ ಬರೆಯಲು ಹೇಳಿ Score 1 if sentence contains a subject and a verb (see guide for example)	[Score 0-1] ☐

LANGUAGE- Repetition • Ask the subject to repeat: **'hippopotamus', 'eccentricity', 'unintelligible', and 'statistician'.** ವ್ಯಕ್ತಿಗೆ ಈ ಪದಗಳನ್ನು ಪುನರುಚ್ಚರಿಸಲು ಹೇಳಿ: ದುರಾಲೋಚನೆ, ಆತ್ಮಸ್ಥೈರ್ಯ, ವಿದ್ಯುತ್ ಸ್ಥಾವರ, ಧೃತರಾಷ್ಟ್ರ Score 2 if all correct; 1 if 3 correct; 0 if 2 or less. • Ask the subject to repeat: 'Above, beyond and below.' ಆಚೆ ಈಚೆ, ಸುತ್ತಮುತ್ತ • Ask the subject to repeat: 'No ifs, ands or buts' ಮೂರ್ತಿ ಚಿಕ್ಕದಾದರೂ ಕೀರ್ತಿ ದೊಡ್ಡದು	[Score 0-2] ☐ [Score 0-1] ☐ [Score 0-1] ☐

LANGUAGE – NAMING:

• Ask the subject to name the following pictures: ಈ ಕೆಳಕಂಡ ಚಿತ್ರಗಳನ್ನು ಹೆಸರಿಸಲು ಸೂಚಿಸಿ ----------[ ] ----------[ ] ----------[ ]    ----------[ ] ----------[ ] ----------[ ]    ----------[ ] ----------[ ] ----------[ ]    ----------[ ] ----------[ ] ----------[ ]   	[score 0-2] (Pencil + watch) [score 0-2]

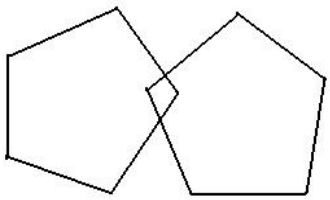
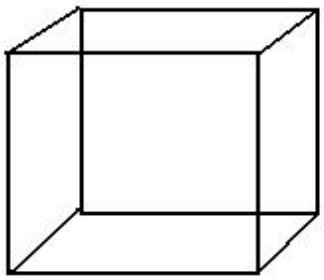
LANGUAGE - comprehension

Using the pictures above, ask the subject to: • Point to the one which is associated with the monarchy_____ • Point to the one which lives in a desert _____ • Point to the one which gives out light_____ • Point to the one which is used for writing_____ ಮೇಲೆ ಕೊಟ್ಟ ಚಿತ್ರಗಳನ್ನು ಆಧರಿಸಿ, ವ್ಯಕ್ತಿಗೆ ಈ ಪ್ರಶ್ನೆಗಳನ್ನು ಕೇಳಿ • ರಾಜನಿಗೆ ಸಂಬಂಧಪಟ್ಟ ಚಿತ್ರವನ್ನು ತೋರಿಸಿ • ಮರುಭೂಮಿಯಲ್ಲಿ ಇರುವ ಪ್ರಾಣಿಯನ್ನು ತೋರಿಸಿ • ಬೆಳಕನ್ನು ಬೀರುವ ವಸ್ತುವನ್ನು ತೋರಿಸಿ • ಬರೆಯಲು ಉಪಯೋಗಿಸುವ ವಸ್ತುವನ್ನು ತೋರಿಸಿ	[score 0-4]

LANGUAGE – Reading

• Ask the subject to read the following words: (score 1 only if all correct) ಕೆಳಕಂಡ ಪದಗಳನ್ನು ಓದಲು ಹೇಳಿ **Sew ಮಸಿ** **Pint ಹೆಟ್ಟು** **Soot ಸೂಜಿ** **Dough ಕಾರ್ಖಾನೆ** **Height ಎತ್ತರ**	[score 0-1]

VISUOSPATIAL ABILITIES:

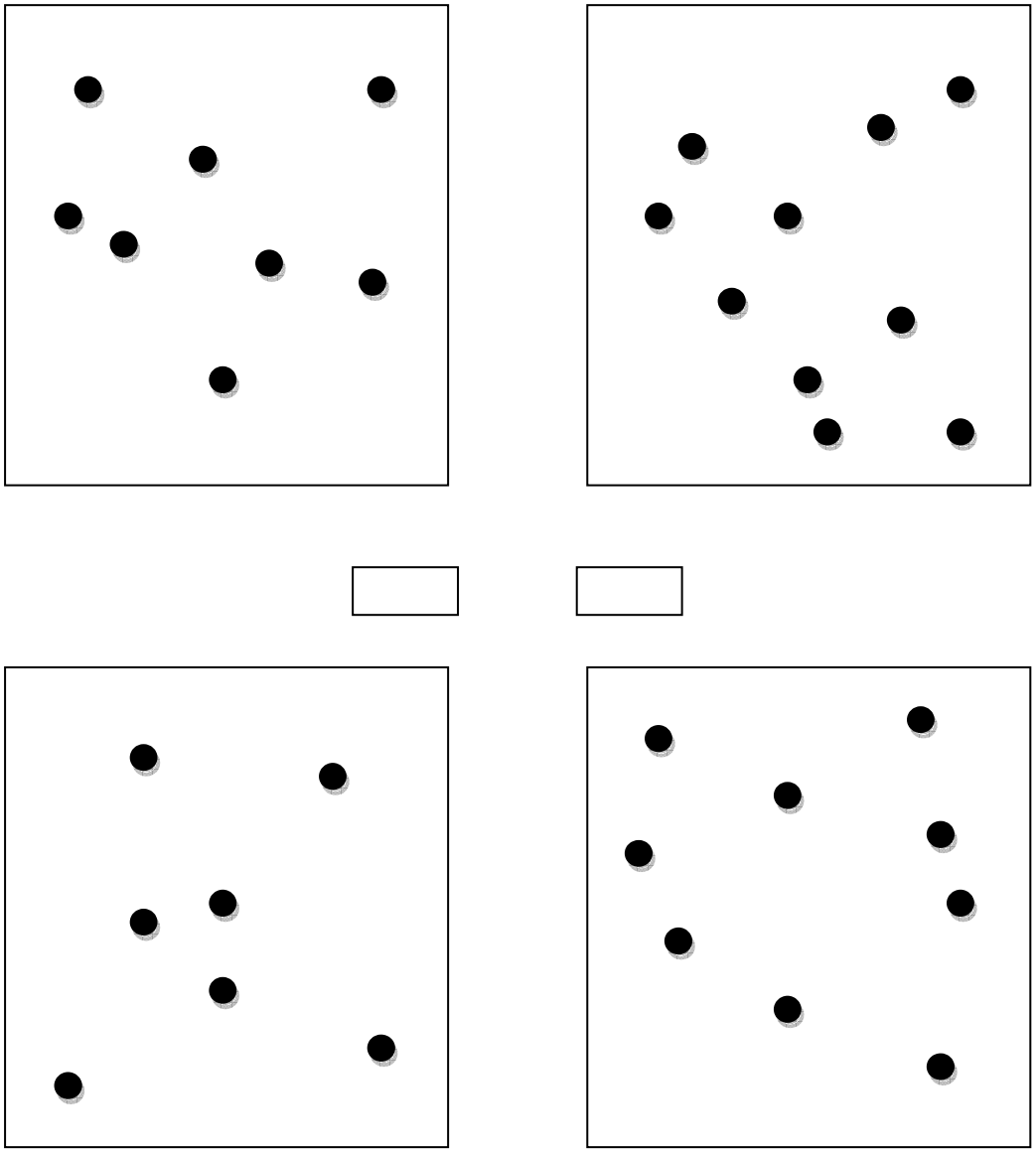
• Overlapping pentagons: Ask the subject to copy this diagram: ಕೆಳಕಂಡ ಚಿತ್ರವನ್ನು ನಕಲು ಮಾಡಿರಿ 	[score 0-1] ☐
• Wide cube: Ask the subject to copy this drawing (for scoring, see instructions guide) ಕೆಳಕಂಡ ಚಿತ್ರವನ್ನು ನಕಲು ಮಾಡಿರಿ 	[score 0-2] ☐
• Clock: Ask the subject to draw a clock face with numbers and the hands at ten past five. (for scoring see instruction guide : circle = 1, numbers = 2, hands = 2, if all correct) ಗಡಿಯಾರದ ಚಿತ್ರ ಬಿಡಿಸಿ, ಸಂಖ್ಯೆಗಳು ಇರಬೇಕು ಮತ್ತು ಅದರ ಮುಳ್ಳು 5 ಗಂಟೆ 10 ನಿಮಿಷ ಸೂಚಿಸುತ್ತಿರಬೇಕು.	[score 0-5] ☐

PERCEPTUAL ABILITIES

- Ask the subject to count the dots without pointing them.

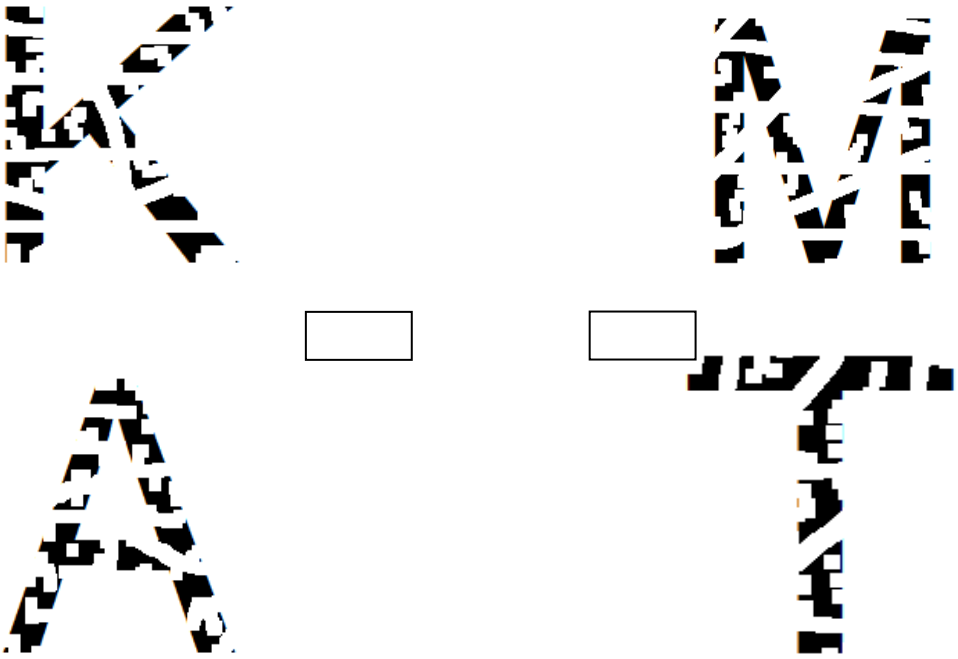
ಬೆರಳನ್ನು ಉಪಯೋಗಿಸದೆ/ ಬೊಟ್ಟು ಮಾಡದೆ ಇಲ್ಲಿ ಕಾಣುವ ಚುಕ್ಕಿಗಳನ್ನು ಎಣಿಸಿ/ ಕೂಡಿಸಿ ಹೇಳಿ.

[score 0-4]

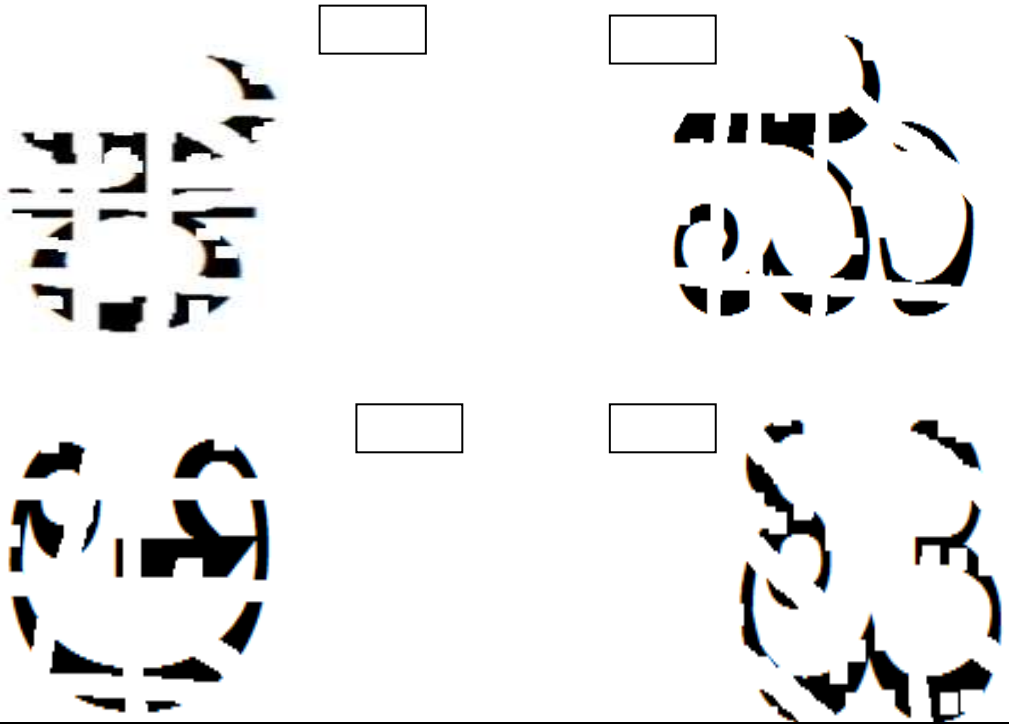


- Ask the subject to identify the letters

[score 0-4]



- ಕೆಳಗಿ ಕಾಣುವ ಅಕ್ಷರಗಳನ್ನು ಗುರುತಿಸಿ.



MEMORY

MEMORY- Recall

• Ask "Now tell me what you remember of that name and address we were repeating at the beginning. Sundara Murthy ……. 73 ……. Narayanashashtri Road …… Gandhinagara …… Bangalore …….. ಸುಂದರಮೂರ್ತಿ ……. 73, ನಾರಾಯಣಶಾಸ್ತ್ರಿ ರಸ್ತೆ ……. ಗಾಂಧಿನಗರ ……. ಬೆಂಗಳೂರು …….	[score 0-7]

RECOGNITION:

This test should be done if subject failed to recall one or more items, if all items were recalled, skip the test and score 5, if only part is recalled start by ticking items recalled in the shadowed column on the right hand side. Then test not recalled items by telling "ok, I'll give some hints : was the same X,Y,Z?" and so on. Each recognized item scores 1 point which is added to the point gained by recalling.	[score 0-5]

Ramu Prabhu ರಾಮು ಪ್ರಭು		Somakshekar Prabhu ಸೋಮಶೇಕರ ಪ್ರಭು		SundaraMurthy ಸುಂದರಮೂರ್ತಿ		recalled		
37		73		76		Recalled		
Mahatma Gandhi Road ಮಹಾತ್ಮಗಾಂಧಿ ರಸ್ತೆ		Narayanashashtri Road ನಾರಾಯಣಶಾಸ್ತ್ರಿ ರಸ್ತೆ		Muddana Road ಮುದ್ದಣ್ಣ ರಸ್ತೆ		Recalled		
Jayanagar ಜಯನಗರ		Rajivnagara ರಜೀವನಗರ		Gandhinagara ಗಾಂಧಿನಗರ		Recalled		
Bangalore ಬೆಂಗಳೂರು		Mangalore ಮಂಗಳೂರು		Madikeri ಮಡಿಕೇರಿ		recalled		

GENERAL SCORES:

MMSE	/30
ACE-R	/100
SUBSCORES	
Attention & Orientation	/18
Memory	/26
Fluency	/14
Language	/26
Visuospatial	/16

Normative values based on _____ normal elderly aged 55-75yrs and _____ dementia patients aged 50-90 yrs.

ADDENBROOKE'S COGNITIVE EXAMINATION - ACE-R (KANNADA)

Final Revised Version A (2005)

Name: _____ Date of testing: ____/_____/_____

Date of birth: ___/___/_____ Occupation: _____

Handedness: _____ Education: _____

Diagnosis: _____ Monolingual/Bilingual

Attention & Orientation:	
Orientation:	i) /5 ii) /5
Registration:	/3
Attention & Concentration:	/5
Memory	
Recall –I	
Anterograde memory:	/3
Retrograde Memory:	/7
Recall- II	/4
Recognition:	/7
	/5
Fluency	
Letter:	
Animals:	/7
	/7
Language	
Comprehension:	
	i) /1
Writing:	ii) /3
Repetition:	/1
	i) /2
	ii) /1
Naming:	iii) /1
Comprehension:	/12
Reading:	/4
	/1
Visuospatial Abilities	
Overlapping pentagons:	
Wire cube:	/1
Clock:	/2
Counting dots:	/5
Identifying letters:	/4
	/4

General Score:	/ 100
Subscores:	
Attention & Orientation	/18
Memory:	/26
Fluency:	/14

Grand total: _____

APPENDIX-III

WAB SCORE SHEET

Case Name:	Case No:		Age/Gender :
Education :	Date of Evaluation :		Language :
	Maximum	Patients scores	Total For AQ:
Spontaneous speech Information content Fluency Total	 10 10 20		
Comprehension Yes/No Questions Auditory word recognition Sequential commands Total (Divide by 20 for AQ) (Divide by 10 for CQ)	 60 60 80 10 20		
Repetition Total (Divide by 10)	100 10		
Naming Object Naming Word Fluency Sentence completion Responsive speech Total (Divided by 10)	 60 20 10 10 10		
Aphasia Quotient (Add totals and Multiply by 2 for AQ)			
Reading and Writing Reading Writing Total (Divided by 10)	 100 100 20		
Praxis Total (Divided by 6) *Construction*	 60 10		

Drawing Block design Calculation Raven's score Total (Divided by 10)	30 9 24 37 10	
Cortical Quotient Add Total	 100	