VERBAL PERSEVERATION AND ANTICIPATION IN MULTILINGUAL PERSONS WITH ALZHEIMER'S DISEASE

Register No: 06SLP014

A dissertation submitted in part fulfillment for the degree of

Master of Science (Speech - Language Pathology),

University of Mysore, Mysore

ALL INDIA INSTITUTE OF SPEECH AND HEARING

MANASAGANGOTHRI

MYSORE-570006

April 2008

The fear of the Lord is the beginning of wisdom.

Psalm 111:10

I will instruct you and teach you in the way you should go; I will guide you with My eye.

Psalm 32: 8

Dedicated with Devotion to

MY LORD GOD ALMIGHTY

&

MY LOVED ONES.....

Certificate

This is to certify that this dissertation entitled "Verbal Perseveration and Anticipation in Multilingual Persons with Alzheimer's Disease" is a bonafide work in part fulfillment for the degree of Master of Science (Speech Language Pathology) of the student Registration No. 06SLP014. This has been carried out under the guidance of a faculty of this institute and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

Mysore
April, 2008

V. Basavaraj
Dr. Vijayalakshmi Basavaraj
Director
All India Institute of Speech and Hearing
Manasagangothri, Mysore -570006

Certificate

This is to certify that this dissertation entitled "Verbal Perseveration and Anticipation in Multilingual Persons with Alzheimer's Disease" is a bonafide work in part fulfillment for the degree of Master of Science (Speech Language Pathology) of the student Registration No. 06SLP014. This has been carried out under the guidance of a faculty of this institute and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

Mysore
April, 2008

Dr. S. P. Goswami
Guide
Reader & Head
Department of Speech Language Pathology
All India Institute of Speech and Hearing
Manasagangothri, Mysore -570006

Declaration

This Dissertation entitled "Verbal perseveration and Anticipation in Multilingual Persons with Alzheimer's Disease" is the result of my own study under the guidance of Dr. S. P. Goswami, Reader and Head, Department of Speech Language Pathology, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier in any other University for the award of any Diploma or Degree.

Mysore
April, 2008

Register No. 06SLP014

TABLE OF CONTENTS

LIST OF TABLES

LIST OF GRAPHS

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

" without concepts, mental life would be chaotic,"

Smith and Medin, 1981

The remarkable capacity to communicate emerged in a gradual, evolutionary way for human species. Language was the first "higher" function to be correlated with brain pathology, and the study of language has led the way in mind and behaviour correlations. Variety of these cognitive- linguistic disturbances in persons with brain damage has opened new avenue for research among different professionals including Speech Language Pathologists. The new millennium bears witness to a spate of activities in such common cognitive- linguistic impairments such as **Anticipation and Perseveration.**

According to Allison (1966), perseveration refers to the repetitive production of the same response to different commands. This behaviour is frequently been associated with normal aging and neurological brain damage. Perseveration is such a pervasive and vexing problem that it has received much clinical attention for years. Any movement error in the fluent verbal production which included any future response was classified as anticipative error. In continuation of these investigations, recent outlook has been towards its presence and mechanism in Alzheimer's disease (AD) or Dementia of Alzheimer's Type (DAT) and Non-Alzheimer's types of dementia (e.g., Bayles, Tomoeda, Kasznick, Stern & Eagans, 1985).

In the last decade, AD has emerged from obscurity. News week magazine (1984) labeled AD, the most common form of dementia in the elderly, the "disease of the century". The definite cause of AD is not known, and a massive research effort currently is underway to determine its causes. Perseveration is a common phenomenon in this population (Bayles, Tomoeda, Kasznick, Stern & Eagans, 1985). These are found to occur with various verbal and non verbal tasks.

Perseveration is not a unitary phenomenon but rather manifests itself in various forms across all modalities of response output. Perseveration is broadly of three typologies (Mc Namara & Albert, 2004),

- **Continuous**
- **Recurrent**
- **Stuck-in-set**

Perseveration is perhaps one of the most interesting observations by clinicians. However it poses a great clinical challenge as it can interfere with assessment and treatment procedures and more importantly the functional activities. These error responses indirectly blocks and contaminates other partially preserved underlying skills. Presence of perseveration in verbal responses gives rise to abnormalities with naming, verbal working memory processing, and uninhibited postpriming (Plaut, & Shallice, 1993). Recent research within a cognitive neuropsychological framework has begun to explore more specifically the linguistic influences on perseverative errors in individuals with different levels of language processing breakdown (Moses, Sheard, & Nickels, 2004). Anticipative errors have been reported to be present in pathological brain damaged

condition. Modest information is known about this phenomenon as limited steps have been made to explore its mechanism.

The mechanism of perseveration has been explored intensively and many models and theories have been postulated. Failure to inhibit prior activation of responses in short term memory is been widely supported cause of perseveration (Sandson & Albert, 1984). Martin and Dell (1998) have provided a spreading activation account for whole word perseveration. Connectionists studies also provide supports for the mechanism of perseveration (Hirsh, 1998).

Perseveration is exhibited in various tasks and modalities. Repeated pointing to same (incorrect) item on an auditory comprehension task, repeated elements of writing or drawing that are carried over to other drawings, repeated utterance of previous word on a confrontation naming task, are all varieties of this phenomenon.

Verbal perseveration is the perseveration that occurs during verbal utterances. These have been reportedly found to be exhibited at various levels of language processing, such as

- Phonemic perseveration
- Whole word Semantic perseveration
- Whole word syntactic perseveration
- Phrase and sentence perseveration
- Perseveration of the idea (intrusions)

However, studies have explored more of word level perseveration. Verbal perseveration have been reported to be present in normal geriatrics but at a minimal level as compared to persons with brain damage. These distinctions prove clinical importance.

Perseveration has been explored greatly in aphasia. Other types of neurological disorders especially in degenerative and cognitive deficit disorders perseveration have been lacking in extensive studies. Thus its mechanism has remained unexplored in terms of its occurrence, pattern, type and mechanism in these populations. Few western studies have attempted to begin their search in perseveration in other neurological disorders other than aphasia. This has paved way for greater clinical differentiation between these populations. However, limited Indian studies have looked into linguistic errors in other population.

Study of perseveration in various neurological conditions for different tasks would provide an insight about the various neuro-behavioral aspects of language. These can then be further explored in detail to establish the cognitive-linguistic processing in a pathological brain as compared to normal aging brain.

As an outcome, the present study was intended to investigate the presence and nature of perseverations across different tasks in persons with AD and in normal aging individuals.

NEED FOR THE STUDY

Alzheimer's disease (AD) has been reported to be alarmingly increasing among the older population and there is a dearth of Indian studies regarding the nature of verbal perseveration and anticipation errors in persons with dementia.

Studies in Indian context are limited and have been conducted in Tamil, a classical language spoken in the state of Tamilnadu. Literature suggests that perseveration is an age related task specific phenomenon and that it would be useful indicator of localization of lesions in persons with brain damage. Thus an attempt was made to investigate the perseverative and anticipative errors in Malayalam speaking normal aging individuals and persons with Alzheimer's disease.

Theoretically, the analyzed results can heave sufficient light on to the various underlying language mechanism in individuals with brain injury. This may thereby corroborate or even controvert the existing theoretical models of language production, provided the results are taken with necessary caution.

Clinically, this study will help Speech Language Pathologist (SLPs) to screen and to evaluate based on the nature among persons with Alzheimer's disease and to chart out better rehabilitative strategies. A range of tasks can be used to elicit such responses in clinical settings. Further, these can be compared and differentially diagnosed with other brain damaged populations and between normal aging individuals.

Thus, a need arises to study these errors in clinical populations and to compare across normal individuals.

OBJECTIVES OF THE STUDY

The present study was conducted to compare the verbal perseverative and anticipative errors among normal individuals and persons with AD. Following were the objectives considered for the study,

- To find out for the presence of any perseverative and anticipative errors in Malayalam speaking normal aging individuals and persons with AD.

- The frequency and nature of anticipative errors (if any) was observed between the groups.

- The types (continuous, recurrent, stuck-in-set) of perseverative errors (if any) present in both the groups was also studied

- To compare and analyze the frequency of three types of perseverative errors:
    i. Between the two groups
    ii. Across and within tasks
    iii. Across and within each sub-task
    iv. Across the three types of errors

- Finally to compare and qualitatively explore the similarities and differences between the two groups.

CHAPTER 2

REVIEW OF LITERATURE

Human beings are exceptional with the proficiency of speech and language. These include a number of parameters which facilitates effective communication. Speech Language Pathologists have taken keen interest in exploring these parameters across the age groups and even in individuals with brain injury. Over the years language deterioration in normal aging population has been an interesting area of research and in the new millennium Alzheimer's disease has been widely explored in depth upon by different professionals.

Dementia of the Alzheimer's type (DAT) or Alzheimer's disease (AD)

The most common form of irreversible dementia is Alzheimer's disease also known as dementia of Alzheimer's type (DAT). Cummings (1990) estimated that DAT constitutes 25- 35 percent of all dementia and unto 50 % of chronic progressive dementia in western population. Prevalence approaches 20% of the population for those over 80 years of age (Bayles & Kaszniak, 1987). The World Health Organization estimates that globally AD and other dementias exceeded eleven million in 2005, with a projected 3.4% annual increase. In the 21st century, the prevalence of DAT is expected to climb to upward of seven million persons by the year 2020 as the aging population increases (Progress Report on Alzheimer's Disease, 1995).

Neuropathology of AD

AD is characterized by microscopic changes in the neurons of the brain, particularly in the cerebral cortex. These changes are detectable only by direct examination of brain tissue. At a macroscopic level, AD is characterized by loss of neurons and synapses in the cerebral cortex and certain sub-cortical regions. This results in gross atrophy of the affected regions, including degeneration in the temporal lobe and parietal lobe, and parts of the frontal cortex and cingulate gyrus (Wenk, 2003).

Course of AD

AD deteriorates gradually and does not exhibit a global decline from onset, rather a relatively predictable pattern through various stages. Most common presentation is with amnesia, in particular a failure of anterograde episodic memory. Delayed recall (e.g., name and address after five minutes) is the most sensitive measure of early AD. The early symptoms are subtle, and include lapses of memory, impairments in reasoning, periods of poor judgment, disorientation except in highly familiar environment and alterations of mood. At later stages intellect and cognition becomes increasingly impaired and disturbances of language and communication appear. The patient becomes agitated and restless. These symptoms generally worsen in the final stages. Figure-1 shows the various cognitive and linguistic changes occurring at different stages in persons with AD.

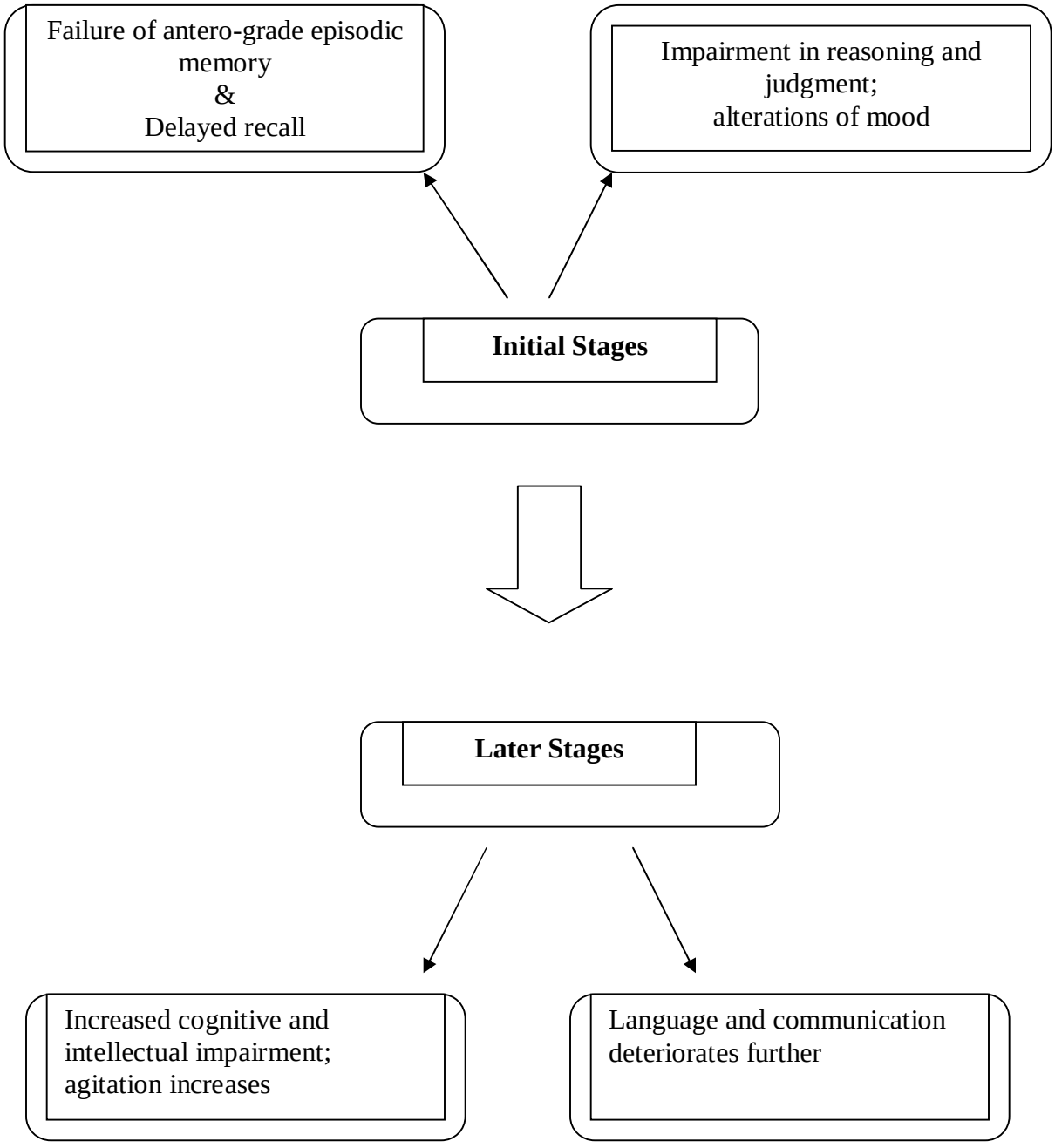


Figure: 1 Various stages of cognitive and language deterioration in AD.

Language and communication in AD

Early stages

Language is usually less affected than cognition and intellect in this stage of AD, although mild retrieval problems, verbal paraphasias, and subtle comprehension impairments may appear in early stages of AD. A progressive disturbance of semantic memory is seen as the disease advances and verbal fluency becomes impaired. Category fluency is more severely affected than letter based verbal fluency.

Middle stages

As the condition advances, perseverative responses and literal paraphasias appear and the content of the speech becomes empty, circumlocutory and littered with jargon.

Late stages

In the final stages, his/her speech becomes rapid and incoherent (flight of ideas) and echolalia (automatic and uncontrollable repetition of what others say) or pallilalia (uncontrollable repetition of what the patient has previously said) may appear.

The language characteristics of persons with AD in different stages are summarized in table -1.

Table: 1 Summary of the language characteristics exhibited in persons with AD

STAGES	LANGUAGE CHARACTERISTICS
MILD **(1-3 years)**	• More of conceptual errors mainly in discourse. • Ideational impoverishment, shrinking vocabulary, frequent irrelevancies, perseverations, and intrusions. • Syntax- unaffected
MODERATE **(2-10 years)**	• Prominent communication disorders • Poor generative naming, worsening confrontation naming, poor comprehension and expressive vocabularies, reasoning deficits, can read aloud effortlessly and speak fluently.
SEVERE **(> 8 years)**	• Disoriented for time, place and person. • Communication variation exists according to the pathological changes. • Linguistic output is typically incoherent. Limited access to lexical and semantic memory. • Perseveration, echolalia and palilalia are chronic in this stage.

Perseveration is one such common symptom that impedes the language fluency, leading to impaired speech production in brain damaged individuals.

Perseveration is described as any morbid tendency to maintain a mental set /or to report an act not appropriate to the situation to which a response is required (Eisenson, 1973).

[Latin *perseverare* to remain steadfast or to persist, from per through or thoroughly + *severus* strict + *-ation* indicating a process or condition]. Perseveration refers to a tendency to repeat a behaviour pattern over and over again irrespective of the context or stimulus and is common and major characteristics of brain damage manifested in all modalities (Allison 1966; Allison & Hurwitz 1967).

The term perseveration was first formulated by Neisser (1895) to indicate the persistent repetition/ continuation of an activity once started. Perseveration is accepted as a pathognomic sign of disturbed brain functioning and the recognition of its influence on the performance of persons with neurogenic disorders of speech and language.

Perseveration consists of inappropriate and unintentional recurrence or continuation of a previous response in the absence of the appropriate exciting stimulus. Perseveration is a common sequel of brain injury especially aphasia. Perseveration as reported by Morganstein and Certner-Smith (2001) is difficult to manage clinically. This phenomenon has been widely studied in demented and focally brain-injured patients. Perseveration has been observed in a wide variety of both physical and cognitive behaviours (Albert & Sandson, 1986; Helm-Estabrooks, Ramage, Bayles, & Cruz, 1998; Luria, 1965; Sandson & Albert, 1984). Perseveration can occur on a variety of behaviours and activities including writing, drawing, constructional tasks and speech (Helmick & Berg, 1976; Sandson & Albert, 1984). Such as in writing, a patient with perseveration may write ‘car’ to command correctly, but when asked to write ‘table’ produces ‘car’

again. In a more moderately affected case, the perseveration may be triggered by phonological similarity between the stimulus items, so that the writing of ‘car’ and ‘table’ may be correct, but if asked to write ‘cat’ for the third item in a list, the patient may write ‘car’. In severe cases the patient may be unable to write anything else but ‘car’ for the entire stimulus presented in a session.

Verbal perseveration is the inappropriate repetition of part or all of a previous response. It is observable at the level of the phoneme, syllable, word or phrase (Bayles, Tomoeda, Mcknight, Helm-Estabrooks & Hawley, 2004). Verbal perseveration is a common symptom in individuals with brain damage and it may occur at various levels of phonological, syntactic and semantic levels.

Types of Perseveration

Sandson and Albert (1984) noted that perseverations can occur in non-linguistic tasks as well as in language use, and drew a distinction between three different forms of perseveration. Three types of perseveration have been described in the literature in persons with brain damage (Liepman, 1905; Luria, 1966; Helmick & Berg, 1976; Sandson & Albert, 1984; Santo Pietro & Rigrodsky, 1986).

1) ***Continuous perseveration***
2) ***Recurrent perseveration***
3) ***Stuck- in- set perseveration***

Continuous Perseveration

This type of perseveration is defined as the inappropriate or continuation of a response beyond the point of completion and without interruption by any intervening event (Sandson & Albert, 1984). Continuous perseveration involves the inability to inhibit a motor act. There is an abnormal prolongation or continuation without cessation of a current behaviour.

This is associated with right hemisphere damage or sub-cortical structures of the brain. Perseveration is also observed in persons with aphasia following the left hemisphere lesions (Albert & Sandson, 1986; Papagno & Basso, 1996). Anterior and posterior site lesions in either hemisphere can also result in continuous type of perseveration (Sandson & Albert, 1986). Other terms are ***clonic*** (Liepman, 1965), ***efferent motor*** (Buckingham, 1985) and ***compulsive repetition*** (Freeman and Gatherok, 1966).E.g.: When asked to "draw a circle" an individual with motoric perseveration makes multiple circles and is unable to stop or when asked to name the picture of a watch, a person with verbal perseveration, may respond with "it's a watch, watch watch".

Recurrent Perseveration

Recurrent perseveration is defined as the inappropriate reproduction of a previous response following a subsequent stimulus (Sandson & Albert, 1984). This is the unintentional repetition of a response in the absence of the stimulus that was used initially to elicit a response. Recurrent perseveration involves the inappropriate production of an

action (or the production of words or segments) that has been previously activated, only to be produced again at some later point not too far down line, but where correct responses may well have been intervened. It includes three subtypes- **semantic selection** (whole word, semantically related perseveration), **plan-of-action** (whole word, phonologically related perseveration) and **phonemic carryover** (part word, phonemically related).

Recurrent perseveration is associated with damage to the left temporal and parietal regions of the brain, although it is also seen in persons with aphasia following sub- cortical damage (Moses, Nickels, & Sheard, 2004). Other terms include ***intentional*** (Liepman, 1905), ***repetitious*** (Buckingham, 1985) and ***ideational perseveration*** (Bayles et al, 1985). E.g. A subject names 'brown' then 'pink' correctly but repeats 'brown' when shown 'blue'; names 'ball' as correct response and for the following stimuli of 'flower' says it as 'ball' or 'blower' on a confrontation naming task.

Stuck- in- set Perseveration

This is an inappropriate maintenance of a framework of response after introduction of new tasks (Sandson & Albert, 1984). This is manifested as difficulty shifting from one idea or mindset to the next, reflecting impaired executive functioning. Usually patient is unable to switch from one approach or task to another. There is an inflexible maintenance of an inappropriate cognitive-behavioural response when a change in task is required. Individual may be aware of an alteration in the task demands but

either does not recognize the intended response or is unable to formulate a new category of response.

This form of perseveration is typically seen in persons with frontal lobe damage (Sandson & Albert, 1984), where patients have difficulty in shifting attention from one form of responding to another. Other terms are ***tonic perseveration*** (Liepmann, 1905), ***cortical perseveration*** (Luria, 1965) and ***impairments of switching*** (Freeman & Gatheralle, 1966). E.g., in a generative naming task an individual with stuck-in-set perseveration continues to name vegetables after being asked to name fruits.

Bayles and colleagues (2004) demonstrated that a principal biochemical breakdown in persons with Alzheimer's rests with acetylcholine and that perseveration is task sensitive, which in turn supports the findings in neuropsychology that perseverative behaviors must have a pre-existing weakening in some input domain. Table-2 provides a summary of the types of perseveration and its chief characteristics.

Another kind of error observed in fluent utterances on individuals with brain injury is **Anticipation**. Anticipatory errors are movement errors and occur in both normal and impaired speech although they are much more common in brain injured population. Anticipatory errors that may or may not be completed as full exchanges occur at the sound (e.g., 'tea kettle' ⟶ 'kea kettle' (or even 'tettle') or at word level (e.g., 'give the plant to the teacher' as 'teacher to the plant'). Yet studies exploring the nature and frequency of this type of error have been limited.

Table: 2 Different perseveration typology

Type	characteristics
Continuous E.g: Stimuli- name picture of a dog Response- "dog dog dog"	• abnormal repetition of a response token without cessation • right hemisphere damage • Norepinepherine depletion
Recurrent E.g. Stimuli- point to picture of table Response- points to picture of dog	• repetition of a previous response token to a subsequent stimulus within an established task set • left temporal or parietal damage • Acetylcholine depletion
Stuck-in-set E.g. Stimuli: point to picture of a dog Response: continues to name "dog"	• inappropriate maintenance of a response type even though task demands have changed • left frontal lobe and /or meso-limbic-frontal damage • Dopamine depletion

The phenomenon of perseveration and anticipation

Perseveration is said to be the result of impaired mobility, state of fatiguability or state of disinhibition of the nervous system. Jasper (1931) explained it as "the tendency of a set of neurons once excited, to persist in a state of excitation autonomously, showing resistance to any changes in this state". Goldstein (1948) argued that persistent

excitation is caused by an inability to inhibit a previous response. Wepman (1972) described perseveration as a shutter principle. Perseveration becomes manifest when the usual potentials for a given performance task are somehow blocked or diverted in some way by an inhibiting event or idea or completely overcome by an interfering act / idea (Eisenson, 1973).

Dell, Burger and Svec (1997) based on the model of serial order and interactive spreading activation theory of language production postulated that anticipations and perseverations are due to some disruption of the activation of the present intended utterance. For an anticipation to occur, weakness of the current target word must co-occur with primed activation of a planned future utterance. Contrary a perseveration occurs, when the current target's vulnerability co-occurs with persisting activation of a past utterance.

Cohen and Dehaene (1998) argued that verbal perseverative behavoiur is the result of "a given processing level being deprived of its normal input," i.e. "persistent activity inherited from previous trials is no longer overcome by current input, and is revealed in the form of perseverations.

Martin, Roach, Brecher and Lowery (1998) Martin and Dell (2004) hypothesized that perseverative and non-perseverative sound and word intrusions arise in part from the same mechanism i.e., a competitive activation process in which a non-target sound or word accumulates more activation than the target sound or word.

Perseveration impedes the fluency parameters thus leading to impaired speech production. This is the consequences of some sort of memory disorders such as breakdown in the retrieval process (Santo- Pietro & Rigrodsky, 1986). Post- activation of memory traces that are normally inhibited (Sandson & Albert, 1987) or lingering motor memory traces (Lundgren, Helm- Estabrooks, et al 1994). This suggests that this plays a role in the communication breakdown.

Studies on perseveration

Perseveration is an effective doorway to study the brain- language relationship. Though perseveration is a characteristic of fluent speech in normal speakers, clinicians are concerned about the manifestation of perseverative responses in brain injured adult. This is because perseveration has contaminating effects on test results, influences the clinical examination and is an obstacle to therapy. Motoric perseveration is noticed in the aging population of which predominant one is the verbal perseveration – which has been extensively studied in normal geriatric and also in persons with aphasia and of late in persons with dementia and Alzheimer's disease.

Perseveration is a well known sign of brain damage (Allison and Hurwitz, 1967; Freeman and Gathercole, 1966; Halpern, 1965; Helmick and Berg, 1976; Santo Pietro and Rigrodsky, 1982). Fuster (1980) stated that brain lesions are associated with perseveration. Sandson and Albert (1987), Santo Piero (1986), Helm-Estabrooks (1994) proposed that perseveration is the consequence of some sort of memory disorder, and

thus it plays a major role in the communication breakdown in persons with aphasia and dementia. Perseveration and susceptibility to proactive interference are related to frontal lobe lesions (Fuster, 1980), but they also appear in demented, aphasics and other brain damaged patients. The neurophysiological causes of perseveration are not known, although it is likely that perseveration may arise from a number of cognitive anomalies (Brookshire, 1992).

Despite the methodological differences, all strategies applied in these research domain share a common goal, viz., to understand the origin of the phenomenon of ‘‘perseveration’’ in healthy participants and persons with brain damage.

Literature on perseveration has been reviewed and is broadly classified under the following headings

- Studies on normal individuals
- Studies on persons with Aphasia
- Studies on person with Dementia

Perseveration in Normal Individuals

Verbal perseveration is noticed in normal aging, as normal aging is a dynamic series of biological, social and psychological changes. The elderly are more liable than the young to suffer from disease of a degenerative type and they are prone to accidents. When elderly persons become ill or injured there is a tendency for the conditions to become chronic. Perseverative phenomenon is also seen in normal persons when they are fatigued, they perseverate under conditions which demand more rapid and more frequent change than they can achieve. Epileptic persons increase twice the frequency of perseveration after seizures.

Over the decades researchers have investigated the type and frequency of perseverative errors in the speech of normal geriatric population and the individuals with brain damage. Western studies have revealed different variety and frequency of perseveration in normal individuals and brain injured. Goldstein (1916) reported that an individual perseverates because s/he can't make quick changes in attitude, which necessitates the shift from one performance to another.

Troster and Salmon (1989) studied using the ratios of perseveration to responses, and they observed more of perseveration in older than younger individuals.

Ramage, Bayles and Estabrooks (1999) determined the frequency of perseveration with respect to task in normal young and older individuals. Thirty young normal individuals between the age of 20 and 35 years and 30 older normal individuals between

the ages of 60 and 75 years were studied. Both age and gender effects were studied. They used four tasks, and their results revealed that 4% of all responses were perseverative. 93% of the subjects perseverated at least once. No significant difference was found between the age groups and gender.

However, of the four tasks, the Modified Wisconsin Card Sorting Test elicited the greatest number of perseverations. Stuck-in-set type of perseveration which were about 73%, were exhibited only in the card sorting test. Recurrent type resulted in 24% of the total responses. Continuous perseverations were not present. The results concluded that in normal aging individuals the frequency of perseveration was less and thus they can be differentiated from individuals with brain damage, who exhibit greater frequencies. The study used neuropsychological tasks and limited language tasks were used and no inter-judge reliability was considered.

Foldi, HelmEstabrooks, Redfield and Nickel (2003) administered three generative tasks (design generation, animal naming, words starting with “m”) from the Cognitive Linguistic Quick Test were administered to 73 healthy individuals in four age groups (18-39, 40-59, 60-74, 75-88) and scored for perseveration and productivity. Results highlighted that perseveration rates for design generation were significantly higher, and increased linearly as a function of age. The number of individuals who perseverated at least once on design generation also increased linearly, with highest prevalence in the oldest group. No age effects were found for perseveration on the verbal naming tasks. Perseverations across tasks were independent of one another. But the study used design

generation task that required multiple simultaneous processing skills and thus placing more demand on compromised executive processing in the elderly.

A study was done on 24 normal Tamil speaking geriatric population by Chandralekha (2001). The subjects were grouped into four groups across the age range of 60-80 years. Five language tasks were considered which included picture naming, picture description, description of function of picture, defining words and answering questions. Results revealed that perseveration is a phenomenon of geriatrics and that it increases with age in normal population. Continuous type of perseveration was found more frequent than other kinds of perseveration, and this was equally present in phonological, syntactic and semantic aspects of language.

The study was first of its kind in an Indian language and among the geriatric population. The study also revealed age and sex difference in the perseverative characteristics. However, the number of sample was limited to establish the normative trend.

Thus, studies on normal individuals show very minimal percentage of overall responses as perseverative and they were more of stuck in type of errors (non- verbal tasks). A positive correlation between the frequency of perseveration and increasing age has been reported.

Perseveration in Persons with Aphasia and other Brain damage

Verbal perseveration is most common behaviour phenomenon associated with aphasia (Albert & Sandson, 1986; Helmick & Berg, 1976; Yamadori, 1981; Shindler, Caplan & Hier, 1984; Santo, Pietro & Rigrodsky, 1986; Ludgren, 1994). Generally it is agreed that verbal perseveration is common symptom of individuals with brain damage. This occurs at various levels such as phonological, syntactic and semantic levels.

Helmick and Berg (1978), observed 18 aphasics, 12 right hemisphere damaged and 10 normal controls. The tasks included naming, reversing series, drawing designs, describing the function of an object, describing a picture, and answering questions. The results revealed that brain injured individuals perseverated on 10% of all trials. More perseveration was observed in language disturbed individuals than in non-language disturbed participants. 66% of the cases exhibited recurrent type and about 34% showed continuous type of error.

The errors were least on automatic tasks and more on reversing series, drawing designs, and less common on answering questions, defining words and describing pictures. The authors concluded that perseverative errors were more in brain injured individuals than in the normal group. Though the study attempted to observe perseveration as a whole, no separate analysis was made on linguistic perseverations.

Sandson and Albert (1984) used the confrontation naming task to elicit recurrent perseveration, and they observed recurrent perseverations more in individuals with posterior lesions.

Yamadori (1981) studied 38 persons with aphasia (24 anterior lesions, 14 posterior and 4 mixed. Tasks used included repetition of meaningful and non-meaningful stimuli varying in length. 33 patients perseverated out of 38. However, the perseveration did not correlate with the severity, duration and type of aphasia.

Mukunthan (2002) studied Broca's aphasia and normal controls (5 males in each group). The subjects were educationally and age matched. The tasks included picture naming, picture description, description of function of picture, defining words and answering questions. Study on aphasic population results indicated that perseveration is a phenomenon of Broca's aphasia and normal individuals.

Recurrent type of perseveration was seen in Broca's aphasia while continuous type was seen in geriatrics. Also, tasks like picture naming, defining functions, elicited more perseverations in aphasic population. This highlighted the importance of specific test for eliciting perseveration in these groups. It was highlighted that the aphasic population persevered on all components of language mainly, phonology, syntax and semantics. The bilingual geriatrics borrowed synonyms words from the second language but this was not considered as perseverations.

The continuous type of perseveration in geriatrics lead to the speculation whether degeneration begins in sub cortical areas as studies on individuals with brain damage have confirmed that continuous type is always associated with thalamic lesions. The results also revealed that picture naming task could be considered as a potential task to differentiate Broca's aphasia from normal geriatrics. However, no motoric tasks were included and the sample size was limited.

Studies on persons with Aphasia showed that perseverative errors were more often in individuals with brain damage than normal and that recurrent type of error was predominant.

Perseveration in Dementia and Alzheimer's disease

Several authors reported a significantly impaired naming ability in dementia patients (Bayles and Tomoeda, 1983; Kirshner, Webb and Kelly, 1984; Lawson and Braker, 1968; Overman, 1979; Rochford, 1971; Schmitt and Mitchell, 1984). Kirshner (1984), report that the naming errors in Alzheimer's disease are related to the word frequency and length, and to the degree of language and cognitive deficits in Alzheimer's.

The Chicago study (Kasznaik and Wilson, 1985) and the Tucson study (Bayles, 1985) were among the few longitudinal studies conducted to investigate the changes in communicative functions. The flow of speech in persons with AD was not found to be abnormal at any time during the course of the study. In relation to speech melody, phrase

length, articulatory agility, grammatical form, word finding and frequency of paraphrasic errors in running speech, patients with Alzheimer's disease demonstrated only mild to moderate impairment.

Severe impairment was observed in the ability to generate examples of a semantic category. Mild to moderate impairment was observed in the confrontation naming. Most confrontation errors were perseverations of previously correct naming responses or names semantically related to the target name (e.g. "lock" for "key"). Phonemic substitutions and neologisms were rare. Most linguistic errors made by dementia patients in the early stage are conceptual. Analysis reveals ideational impoverishment, shrinking vocabulary, frequent irrelevancies, perseverations, and intrusions. Syntax is essentially unaffected.

Perseveration affects language in dementia and normal aging

Evidence supports that perseveration is an integral part of language dysfunction in conditions of altered neural activity, and that perseveration is specifically linked to abnormalities of semantic memory, often manifested clinically as a disorder of naming or word finding. **(**Martin, 1989)

Bayles and Eagen (1985) studied the pattern of perseveration and frequency of carrier phrases in the verbal descriptive discourse of dementia patients and the results revealed that these patients perseverated more frequently than normal subjects and the

severity of dementia is associated with increase in perseveration. Discontinuous perseveration was more common than continuous perseveration.

Slauson and Bayles (1985) studied perseveration and intrusive responses of 35 AD and 24 stroke patients and 29 normal elderly individuals on the verbal description task. Perseverative responses included continuous, repetitions and ideational perseverations. Intrusion responses consisted of the repetition of an idea after an intervening stimulus. FAS verbal fluency test was used in the study. Higher rates of perseveration and intrusion in patients with focal brain lesions and aphasia than in those with mild AD were observed. The highest rate occurred in moderate persons with AD.

Patterns of perseveration and frequency of carrier phrases were studied in the verbal descriptive discourse of persons with dementia by Bayles, Tomoeda and Kaszniak (1985). Dementia patients were found to perseverate significantly more frequently than normal and severity of dementia was more strongly associated than etiology with increased perseveration. Discontinuous perseveration was more common than continuous perseveration and the perseveration of ideas after an intervening response was most typical of the dementia.

Vilkki (1989) investigated whether recurrent perseveration, i.e. the tendency to incorrectly repeat previous responses, is related to the site of cerebral lesion. Sixty-seven brain-damaged patients and 35 control subjects were studied with a modified Benton

Visual Retention Test. Patients with anterior lesions made a higher number of recurrent perseverations than patients with posterior lesions. The results were in disagreement with the hypothesis that recurrent perseveration is associated with left posterior lesions.

Sebastian, Menor and Elosua (2001) examined whether the low performance of 40 AD patients in the Brown-Peterson task could be explained by a pattern of errors that differed from 55 elderly control groups. The quantitative results showed that AD patients had a lower performance level in the three retention intervals than controls but a significant interaction between group and interval was not found, indicating that the rate of forgetfulness was similar in the two groups. The qualitative analysis, errors were categorized as confusions, perseverations, omissions, and order alterations. Contrary to other studies (Dannenbaum, Parkinson, & Inman, 1988; Kopelman, 1985) where an AD forgetfulness tendency of omissions was observed, this data showed an excess of perseveration (even more than five repetitions), indicating problems in the central executive. This could be interpreted in terms of problems in updating the contents of working memory.

Bayles, Tomoeda, Mcknight, Estabrooks and Hawley (2004) investigated the frequency of verbal perseveration in individuals with AD in relation to task type, mental status and performance on attention and memory tests. 30 AD and 40 healthy elders constituted the subject groups, and they were matched on the basis of age, education, IQ and mental status. All the participants were assessed based on standardized tests for attention span and episodic memory and also language tests. The language tests included

confrontation naming, generative naming, and picture description test. Data analysis revealed that individuals with AD perseverated more than normal individuals did, but variability was high.

Generative naming elicited more perseveration than either confrontation naming or picture description did. Contradictory results were obtained when overall frequency of perseveration was correlated with the mental status and performance on attention and memory tests which was attributed to the probable unique cognitive demands of each language tests affecting the probability of perseveration differently. The results further highlighted that frequency of perseveration is a function of the task (assuming that the individual can perform that task) difficulty. The frequency does not follow a linear relation with the severity. Conversely the authors commented that a linear relation can be expected between degree of cognitive impairment and performance on cognitive-linguistic tests

This study included a large group of Alzheimer's subjects, who were assessed on the cognitive aspects along with linguistic domains. Inter rater and intra rater reliability was also considered for the data analysis. But, the participants were not grouped into severity groups based on Clinical Dementia Rating Scale (CDRS). No gender differences across the subjects were reported.

Pekkala, Albert, Spiro and Erkinjuntti (2008) report that perseveration is common in Alzheimer's disease (AD). They document the type and quantitative burden of perseveration as cognitive decline progresses from normal aging (30) through mild AD (20) to moderate AD (20) by administering a semantic verbal fluency task. They found

perseveration to increase significantly with increasing severity of AD and different types of perseveration that distinguish the subject groups in a statistically significant manner.

Recurrent and continuous perseverations appear early in AD. As the disease progresses in severity into moderate stage, the number of recurrent and continuous perseverations increases, and stuck-in-set perseverations emerge. They concluded that the different types of perseveration are likely to reflect the progressive deterioration of different brain regions in AD.

Although aphasic adults and those with AD may both perseverate and circumlocute, the nature of these differ. The perseverative responses of patients with AD represent intrusion of unrelated thoughts rather than persistence of response sets as is true for perseverative responses of aphasic persons. An aphasic patient might say , 'that's a comb' to comb and that's a comb to fork in the next trial, whereas a patient with AD, might say, that's a comb- I lost my comb when I was four to comb on one trial and it was a pretty red comb to fork on the next trial . The thought is stuck in the mind of the patient with AD, and the word is stuck in the mind of the patient with aphasia. A patient with AD circumlocutes because he or she has forgotten the topic or lost his or her train of thought, whereas the patients with aphasia circumlocutes because of word- retrieval failure.

Studies on person with Dementia showed more errors than normal individuals especially who showed poor memory and attention, exhibited more perseverative errors, but no clear reports on the type of perserverative errors (Bayles, Tomoeda, McKnight, Helm- Estabrooks and Hawley 2004).

Task(s) used to study perseveration

Allison & Hurwitz (1967) used tests briefly non linguistic activities such as searching for objects, simple drawings and simple constructions, tests of gestures and pantomime, tests of simple spoken commands, naming sighted objects, naming from memory, spontaneous speech.

Albert and Sandson (1986) report that aphasics produce more perseveration than normal and right hemisphere damage individuals in confrontation naming and drawing task. Emery and Helm –Estabrooks (1980), reported that all 30 normal subjects demonstrated perseverative behaviour on the visual confrontation naming sub test.

Various tasks such as picture naming, describing the function, answering questions, description of pictures have been employed by investigators to tap perseveration.

While confrontation naming which is a verbal task has been the potential task often quoted as that which elicits perseveration. Certain motoric tasks have also been tried on individuals with brain damage and they have found to be interesting especially from the point of differentiating normal healthy geriatrics from those with subtle deficits/ degenerative changes in the brain.

Tasks such as object naming, picture description and generative naming vary when the severity is constant. Generative naming is the most difficult for the Alzheimer's

patient and is also one of the sensitive measures of that disease in its incipient stages. Tasks of confrontation naming and picture description were reported to have elicited perseveration responses more in individuals with brain injury (Sandson & Albert, 1984).

The studies reveal that a majority of individuals' exhibit variety of verbal perseverative and anticipatory errors in different verbal language tasks. Thus a study in an Indian set up in persons with Alzheimer's disease is of clinical importance.

CHAPTER 3

METHOD

This current study was taken up with the aim of comparing the verbal anticipative and perseverative errors between the individuals with normal aging and persons with Alzheimer's disease.

PARTICIPANTS

The study included two groups of participants.

- Group (A) included **normal geriatrics**.
- Group (B) comprised of persons with **Dementia of the Alzheimer's type** (DAT).
- Participants selected had **Malayalam** (a south Indian –Dravidian Language, state language of Kerala) as their mother tongue.
- They were grouped into age group between 60-85 years.
- Both males and females were included in the study.
- Group A consisted of ten individuals and the group B included nine subjects. Though ten participants were examined initially in the AD group, data of one participant was not included for analysis because of very poor intelligibility of responses.
- Participants of the experimental group were age, gender, socio-economic status and education matched with the control group.

Table-3 provides the number of normal and AD participants.

Table: 3 Number of normal and AD participants.

Groups	Age-range	Males	Females	Total participants
Group A	60-85 years	5	5	10
Group B	60-85 years	5	4	9

Ethical Standards used in this study for Participant selection

Participants were selected by ethical procedures. Participants and/or the caregivers (in case of the experimental group) were explained the purpose and procedures of the study, and an informed verbal and/or written consent was taken. They were selected based on the inclusionary criteria, which were as follows.

Group A - Inclusionary Criteria for normal geriatrics

- This group encompassed of ten normal aging individuals. Five males and five females were included in the study.
- The participants were in the age range of 60-85 years. All of them were right handed dominant.
- They had Malayalam as their mother tongue and were all multilingual (knowing more than two languages).
- Participants who had at least minimum ten years of formal high school education were considered for the study.

- All participants belonged to middle and above classes were considered for the study.
- The participants selected were ensured to have no significant history of any brain damage, stroke, metabolic, degenerative and/or psychological and psychiatric illness.
- The participants were corroborated that they had no history of any language disturbance and also no alcohol or drug abuse.
- All participants had adequate hearing and visual perceptions.

Group B - Inclusionary Criteria for persons with AD

The criteria followed here were based on the medical records from the hospitals and day care centers. Table-4 provides the demographic data of AD participants.

- Out of the nine right handed dominant individuals five were males and four were females.
- Participants who were diagnosed as having AD, based on medical, neuro-imaging, cognitive and neuropsychological tests by qualified neurologists were opted.
- Participants belonged to different stages (mild, moderate and severe) of Alzheimer's disease based on the Clinical Dementia Rating Scale (CDRS). (Hughes, Berg, Danzinger, Cohen, & Martin, 1982)
- The number of years for which the subjects had the illness varied from a minimum of 2 years to a maximum of 9 years.
- Malayalam was their mother tongue and they were all multilingual speakers.

- The literacy and socio-economic status were matched with that of the control groups i.e. all of them had a minimum of 10 years of formal education and they belonged to middle class and above class of families.

Table: 4 Demographic data of participants with AD.

Sl.No	**Age(yrs) /Sex (M/F)**	**Education**	**Severity of AD (Based on ¥CDRS)**	**Diagnosis**
1	75/ M	¤P.G	Severe	Alzheimer's Disease
2	66/ M	10th Std	Moderate	Alzheimer's Disease
3	78/ F	Graduate	Mild	Alzheimer's Disease
4	73/ F	§P.U.C	Mild	Alzheimer's Disease
5	85/ F	10th Std	Moderate	Alzheimer's Disease
6	80/ M	Graduate	Mild	Alzheimer's Disease
7	74/ M	P.G.	Severe	Alzheimer's Disease
8	60/ M	10th Std	Moderate	Alzheimer's Disease
9	76/ F	P.U.C	Mild	Alzheimer's Disease

.

TASKS

Four major tasks considered for this study were:-

Task 1- General Conversation

Task 2- Confrontation Naming

¥ CDRS-Clinical Dementia Rating Scale ; ¤ P.G. –Post graduate ; § P.U.C- Pre-University College

Task 3- Generative Naming

Task 4- Picture Description

According to Helmick and Berg (1976); Slouson and Bayles (1985); Albert and Sandson (1986) and Ramage, Bayles and Estabrooks (1999) some of the verbal tasks which are sensitive to elicit verbal perseverations includes confrontation naming, generative naming, picture description , answering questions, describing the functions, naming a reverse series. Thus similar sensitive measures were used in this study to elicit verbal perseveration.

Task1- General Conversation

This task included answering questions related to three domains-

a) ***Egocentric Questions*** – pertaining to an individuals self information and interests
b) ***Environmental Questions***- related to an individuals immediate environment
c) ***Relational Questions***- related to reasoning out the relation between items and incidents around.

Each of these sub-tasks had 14 questions. The questions were adopted from sub sections of the standardized language test manuals i.e. Malayalam version of Western Aphasia Battery (A Test of Aphasia in Malayalam, Philip.J.E, 1992) and Malayalam version of Linguistic Profile Test (Linguistic Profile Test –Malayalam, Asha.M.M, 1997) and these were appropriately modified. (Appendix 1)

Task 2- Confrontation Naming

Naming of the presented stimuli was another task. This was tested using two mode of presentation

a) Picture Naming

b) Object Naming

Each of the modes had 10 items each. The pictures were adopted from a standardized test material the Hundred Picture Naming Test (Fisher, Glenister and Jennifer M, 1992). The pictures selected were black and white line drawings. For the object naming task, objects selected were the one which were easily available and matched to the cultural background. The objects list was taken from Western Aphasia Battery and Linguistic Profile Test. Picture stimuli were presented initially and then the object stimuli. (Appendix 2).

Task 3- Generative Naming

This task includes the naming of a list of names belonging to a target category. In this study two types of generative naming category were considered.

a) Animal (Domestic) Naming - naming of a living category.

b) Vehicle Naming – non-living category naming was expected.

This was a self generated task and no specific stimulus was presented. However, a time limit of one minute was set.

Task 4- Picture Description

Four pictures adopted from the Binet Kamath Test (Kamath V.V, 1963) were used as the reference for this task. Selected pictures were black and white, depicting real life situations. For each picture description a maximum of three minutes were provided. (Appendix 3). Table-5 gives the information on the number of stimulus taken for each task

Table: 5 Details of the tasks, sub-tasks and number of stimulus.

Sl.No.	Tasks	Sub-tasks	No: of stimulus
1	General Conversation	Egocentric, Environmental, Relational	42
2	Confrontation Naming	Picture and Object Naming	20
3	Generative Naming	Animal and Object Naming	20
4	Picture Description	Picture Cards	4
		Total number of stimulus	**86**

METHOD

The participants were explained the tasks and they were encouraged to participate in the study. They were individually tested. Each participant was tested in a quiet surrounding (room set up) and was comfortably seated during the testing. Prior to the testing rapport was build with them and then the testing was initiated. The tasks were administered in a systematic manner. The stimulus was presented individually with

minimum distractors around. General prompts and feedbacks were as provided by the investigator to encourage the participant to respond appropriately.

The participants of the AD group were screened initially for the verbal output. The semantic expression sub-section (naming) of the Malayalam version of Linguistic Profile Test was administered. Only those individuals who were able to verbally express fluently were taken up for further testing.

The following procedure was maintained for each task-

1) General Conversation

Instructions

Participants were instructed to answer appropriately using full length utterances to the questions. Appropriate and timely prompts were used by the investigator to encourage them to speak.

They were not given any instruction regarding the language use during answering. Reminders and prompts for e.g. “yes, tell me more; where exactly were you working” and so on were provided especially to the experimental group subjects to answer elaborately in sentence forms. The questions were repeated at-least once when the subject failed to comprehend it in the first attempt.

2) Confrontation naming

Instruction

For both the picture and object naming, the subjects were asked to name the item that was visually presented. The subjects were given adequate time to answer. However, no feedback was given in this task regarding the response.

3) Generative Naming-

Instruction

Subjects were instructed to name as many items they can recall in a specific category in one minute. This was a timed task, and no cues or correction was provided.

4) Picture Description-

Instruction

The participants were instructed to elaborately describe the scene in the picture shown. The objects and individuals in the picture were encouraged to be described. They were provided with general prompts wherever needed.

RECORDING AND TRANSCRIPTION

Individual responses of all the participants for the tasks were audio recorded. Later the responses were transcribed verbatim using the broad phonetic transcription.

SCORING

The sample collected were scored and analyzed in the following steps.

I) The type of errors in both the groups

- Perseverative or Anticipative
- Stuck-in or recurrent or continuous type for the perseverative error

II) Frequency of Anticipative and Perseverative Error

The transcribed data were analyzed for the correct and incorrect responses. The tasks were analyzed individually. Each type of perseverative errors made in a particular utterance were scored as 1, and likewise all the errors were counted. Each type of perseveration were counted and grouped accordingly. They were also analyzed under specific type of task. The total number of utterances made in a response was also summed up.

For individual task, the percentages of errors for each type were estimated in the following manner.

$$\frac{\text{Total number of error (perseverative or anticipative) in a response}}{\text{Total number of responses (correct or incorrect) in a stimulus}} \times 100$$

Similarly the total percentages of each type of error were summed up for each sub-task. The mean scores were computed for each of the tasks and finally for each group.

III) In order to know the potential tasks to elicit the errors across groups

The errors were also calculated under three separate types of perseveration for individual tasks in both the groups.

Statistical Analysis

The obtained data were appropriately tabulated and subjected to statistical measures. SPSS software (version 10.0.) package (Garrett & Woodworth, 1979) was used for the statistical analysis. The tabulated percentage scores were used to obtain the mean (M) and standard deviation (SD).

Non-parametric tests were employed to obtain the significant difference measures. Mann-Whitney test was used initially to obtain the significance difference scores for each of the variables between the two groups.

Friedman test was used for those variables that were found significant in order to analyze the level of significance within each group. Later pair wise analysis using Wilcoxon Signed Ranks test was carried for each of the significant variables.

Computed data were then subjected to statistical analysis to calculate the following:

- Total Percentage frequency of Anticipative and Perseverative errors between the groups.
- Frequency of error scores between main four tasks in two groups.
- Frequency of error scores between each subtask and across error type (for perseverative errors).
- Total frequency of three error types (perseveration) between normal and AD groups.

CHAPTER 3

RESULTS AND DISCUSSION

The main aim of the study was to find out the presence and frequency of

- Anticipative error
- Perseverative error

The study included two groups consisting of

- Persons with AD
- Normal geriatrics

The data was tabulated and appropriate statistical evaluation was done for the four major tasks and the frequency measures of errors were compared. These raw data were calculated as percentage scores for each task and type of error for each participant. These were then subjected to statistical analysis for the calculation of mean (M) and standard deviation (SD). The variations in results were compared within and across tasks, between groups and across error types.

The data was transcribed for each individual and analyzed for the error patterns. Further data was computed for frequency of error type. These frequency measures were appropriately subjected to both quantitative and qualitative analysis. The outcomes are discussed on the following basis.

The following were the **four main tasks** consisting of sub tasks were considered for the analysis

1. General Conversation

- Egocentric
- Relational
- Environmental

2. Confrontation Naming

- Picture Naming
- Object Naming

3. Generative Naming

- Animal Generative naming
- Vehicle Generative Naming

4. Picture Description

The **type of errors** analyzed in the tasks were categorized as

- Continuous
- Recurrent
- Stuck-in-set

The findings of the present study have been broadly presented in the following sub-sections:

1. Anticipative versus perseverative errors in normal and AD
2. Quantitative analysis of anticipative and / or perseverative errors in normal and AD
3. Qualitative analysis of anticipative and / or perseverative errors in normal and AD

1. Anticipative Versus Perseverative Errors in Normal and AD

- Any movement error in the fluent verbal production which included any future response was classified as anticipatory error. E.g., /tʃuː tʃa/ for /puːtʃa/ (phoneme level).
- Any uncontrollable repetition of the previous response was categorized as perseverative type of error. E.g., /puːtʃa … kasɛːra… puːtʃa/ (word level).

In this study the frequency of anticipative error was not extracted for both the groups, as none of them made this kind of error for any of the tasks administered.

It can be assumed that this pattern exhibited could be based on the information from the interactive spreading activation model (Dell, & O' Seaghdha, 1992). Lack of familiarity with a sequence of words would be associated with weak connection strengths between semantics and the lexicon. Schwartz, Saffran, Bloch and Dell, 1994; Dell, Burger and Svec, 1997 reported that this condition was present in an adult while learning tongue twister. Proportionately higher rates of perseverations than anticipations was

documented before practice session and with practice perseveration reduced and instead anticipative errors became predominant, as the activations were strengthened.

Thus, frequency of anticipative errors was less predominant in persons with AD and normal geriatrics as a result of the weak connections and the type of task used. These findings were clearly evident in the current study and were in support with the western studies. Indian studies failed to study this issue in individuals with brain damage.

These findings could postulate that various language errors produced had different underlying phenomena. This need to be further substantiated with numerous evidence-based studies among different persons with brain injury. Further, data was analyzed for perseverative type of errors alone.

2. Quantitative Analysis of Perseverative Errors

Percentage data samples were analyzed and the measures were subjected to quantitative statistical analysis. Two main stages of analysis were carried out

Stage I: included the comparison of preservative errors across and within each type, sub-tasks and the groups.

Stage II: included the overall comparison of the there types of perseveration irrespective of the tasks and sub-tasks in both the study groups.

Following were the comparisons that were carried out using appropriate statistical measures.

Stage I

I. (a). Comparison of total percentage frequency of perseveration between Normal Geriatrics and Persons with AD

Two groups were compared for the overall perseverative errors. Overall total percentage of errors was summed up for all tasks and types of perseveration. For all the variables median and mode were also evaluated along with mean (M) and standard deviations (SD). Mode and median were found to be zero. If these were further considered for analysis, no statistical analysis would have been possible and hence the frequency of errors could not be studied. Thus, only mean and SD were considered for further analysis. Table -6 provides the mean and SD values for both groups.

Table: 6 Mean and SD of total percentage perseveration errors between normal and AD

GROUPS	N	Mean	Std. Deviation
Normal (N)	10	2.2303	4.7447
AD	9	11.8926	5.0788

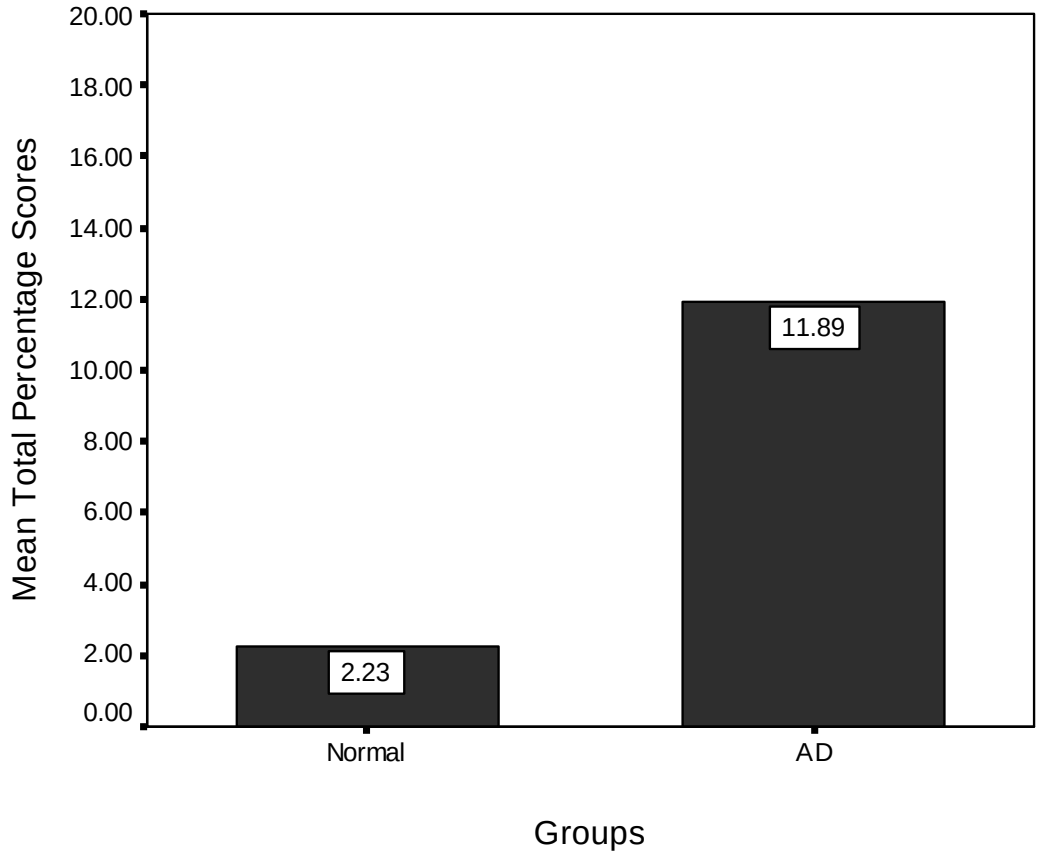
The normal group obtained a mean percentage of errors, [2.23 (SD= 4.7447)]; and persons with AD had a mean percentage of 11.89 (SD= 5.07). This clearly portrays that normal geriatrics in this study performed better.

Later non-parametric tests were carried out as the SD showed high variations. Mann-Whitney test was carried out to find the difference between the two groups. Total perseveration errors between normal aging group and Alzheimer's disease showed

significant difference (‗ z ‗ = 3.13, $p < .05$). Thus, suggesting that the frequency of perseveration was more in persons with Alzheimer's disease compared to normal aging population.

In view with the literature, AD has been reported to have progressive central nervous dysfunctions which give rise to diffuse impairments in memory, intellect, cognition and language [Diagnostic and Statistical Manual of Mental disorders-IV (DSM-IV; American Psychiatric Association, 1994)]. These neurological disturbances results more linguistic errors compared to normal aging. Similar reports have been advocated by Bayles, Tomoeda, Kaszniak, Stern and Eagans, 1985; Sandson and Albert, 1987; Shindler, 1984, Diagneault, Braun and Whitaker, 1992; Ramage, Bayles, Helm-Estabrooks and Cruz, 1999.

Thus the present study further strengthens the earlier research findings. The performances of both groups are also depicted in graph-l which shows the difference in frequency of errors expressed in percentage between normal participants and AD



Graph: 1 Mean total frequency percentage of errors between normal and AD

Further the present study does get evidence from the research findings of Ramage, Bayles, Helm- Estabrooks and Cruz (1999.) they studied perseveration in normal individuals across age range and the results revealed only about 4% of the overall responses were perseverative. This was however a lower rate than that was reported for brain- damaged subjects. Their research findings also stated that 93% of normal individuals perseverated at least once.

Like wise Bayles, Tomoeda, Patrick, Helm-Estabrooks, and Hawley (2004) also accounted that persons with AD perseverated (30%) significantly more than normal elders (8.5%).

However the results of current study contradicted the results reported by (Chandralekha, 2001) in which normal geriatrics obtained significant greater percentage of perseveration.

The factors of education, socio-economic status (SES) and multilingualism could be listed out to describe the difference. Schooling improves cognitive functioning (Garcia & Guerreiro, 1983). Similar results were noted by Rosselli, Ardila, and Rosas (1990), when they compared language variables affected in literate, illiterates individuals with brain damage. SES and cultural factors play a significant role in literacy and cognition (Reis & Castro- Caldas, 1997). In individuals who are bi/multilingual activation of lexicons are facilitated (Finkbeiner, Forster, Nicol, & Nakamura, 2004) and thereby gaining proficiency in both languages. Higher states of activation enhance accurate selection and thus diminish the chances of occurrence of perseveration or any other linguistic errors. Thus supporting the results of present study, that normal geriatrics had reduced percentage of perseveration.

Mann-Whitney test was administered to obtain the within group differences. Results showed no significance level at $|z| = 3.13$, $p > 0.05$. This could be the result of lesser number of cases included for this study.

Thus the results of this comparison of total perseverative error between normal aging group and persons with AD can be summarized as

- ✓ Person with AD have greater cognitive, intellectual and linguistic deficit, which is deteriorating in nature as compared to the normal aging population.
- ✓ Obvious and greater perseverative errors were present in persons with AD as compared to normal geriatrics.
- ✓ These results were statistically significant between the group
- ✓ Findings of the study were validated with the support of various studies.
- ✓ There were no significant differences when within group comparison was made, which could have resulted because of limited sample size.

I (b). Comparison of percentage Frequency of Perseveration across Four Main Tasks between and within the Two Groups

As total perseveration between the two groups were found to be significant, so the analysis was done to further find the significance difference for each of the four main tasks.

- General conversation
- Picture naming
- Generative naming
- Picture description.

Frequency of errors was compared across and within normal individuals and persons with AD. The mean and SD of the four main tasks are given in the table- 7.

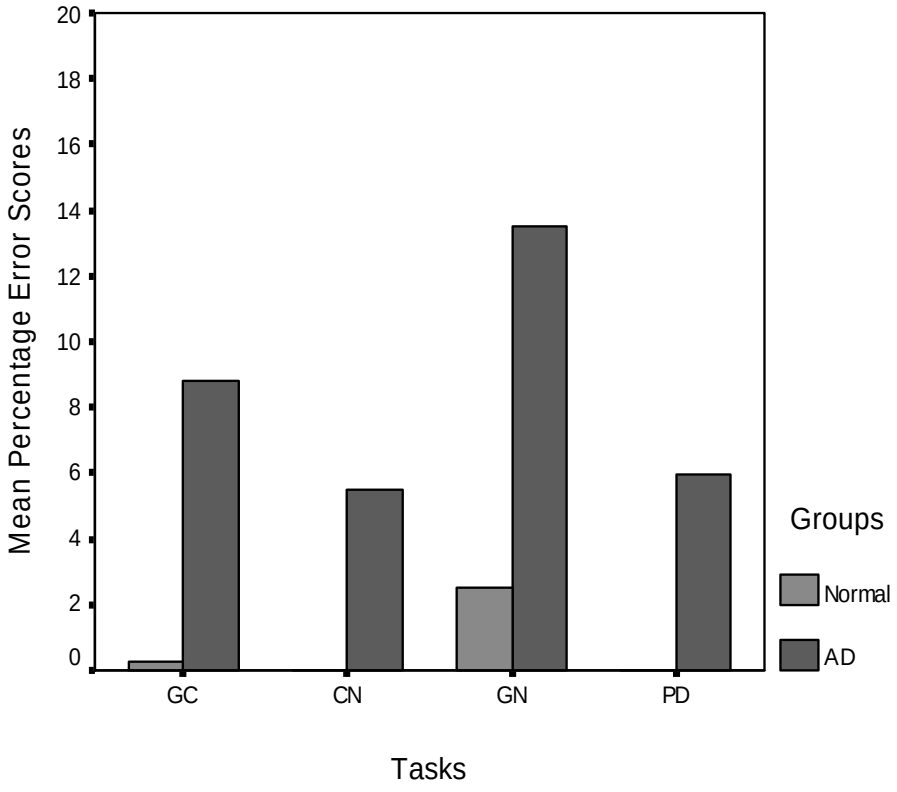
Table: 7 Mean percentage frequency and SD of the four tasks

GROUPS		**§GENCONVS (GC)**	****CONFNMG (CN)**	**††GENRNMG (GN)**	**‡‡PICDESP (PD)**
Normal (N)	N	10	10	10	10
	Mean (M)	.2850	.0000	2.5000	.0000
	SD	.9012	.0000	5.2705	.0000
AD	N	9	9	9	9
	Mean(M)	8.8120	5.4873	13.5059	5.9353
	SD	8.1241	5.4992	14.2510	6.6474

Table-7 clearly highlights that for the general conversation task, the normal geriatrics performed better with a mean of 0.2850 (SD = 0.90) compared to the mean of AD group, 8.81 (SD = 8.12). In the confrontation naming task the normal geriatrics presented with no error and so 0.00 mean was obtained when compared to the error percentage mean of AD of 5.48 (SD = 5.49). The generative naming task obtained maximum error percentage in the AD group having a mean of 13.50 (SD = 14.25) and the normal geriatrics obtained a mean of 2.5 (SD = 5.27). This shows that generative task could elicit maximum perseveration in both the groups, though the AD group was more impaired. Similarly for the picture description task, normal geriatrics attained no error scores, but the AD group had a mean of 5.93 (SD = 6.64). Graph- 2 illustrates the mean scores, the percentage of frequency for types of perseveration in different tasks.

§ GENCONVS (GC)- general conversation
§CONFNMG (CN)- confrontation naming
**GENRNMG (GN) – generative naming
**PICDESP – picture description.

Mann- Whitney test was further carried out to find the level of significance in each task between normal individuals and persons with AD. All tasks were shown to be significant at $p < 0.05$ level. General conversation yielded value of $\_z\_ = 3.09$, $p < 0.05$, confrontation naming, $\_z\_ = 2.64$, $p < 0.05$, generative naming $\_z\_ = 1.98$, $p < 0.05$ and picture description, $\_z\_ = 2.97$, $p < 0.05$. This implied that these tasks were good predictor of perseveration and could be used to differentiate normal geriatrics from persons with brain- damage.



[§§]Graph: 2 The total frequency percentage of perseveration across tasks

[§§] GC: general conversation; CN: confrontation naming; GN: generative naming; PD: picture description tasks

Thus, the overall findings were in confirmation with the findings reported by the earlier researchers. Bayles, Tomoeda, Patrick, Helm-Estabrooks, and Hawley (2004) reported that only generative naming produced the most perseveration in normal individuals and persons with AD.

Tasks of confrontation naming and picture description were reported to have elicited perseverative responses more in individuals with brain injury (Sandson & Albert, 1984). Generative naming elicited more perseveration than either confrontation naming or picture description in persons with AD (Bayles, Tomoeda, Patrick, Helm-Estabrooks, & Hawley, 2004)

Study on normal individuals (Ramage, Bayles, Helm- Estabrooks & Cruz, 1999) demonstrated more perseveration in generative naming (1%). Albert and Sandson (1986) reported a total of 2.1% for generative naming task in normal individuals. These research findings support the results of current study. Though the total percentage of perseveration is minimal in normal individuals for generative naming, but this task is the most potential task to elicit perseveration in verbal tasks. Slauson and Bayles (1985) also observed higher rates of perseveration in mild AD, aphasic and focal brain lesion group for the verbal fluency (generative naming) task.

Explanation as to why some tasks were more impaired than the other in persons with AD was substantiated in the light of earlier studies. Task difficulty influenced the rate of occurrence of perseveration (Bayles, Tomoeda, Patrick, Helm-Estabrooks, & Hawley, 2004). It was hypothesized that cognitive and language processes may vary according to changes in tasks, materials and strategies (Craik, 1984).

Perseverative errors produced by persons with aphasia reflected both the degree and level of reduced language proficiency in each task (Moses, Lyndsey, & Sheard, 2004). AD inevitably is documented to have both cognitive and linguistic mechanism breakdown at various levels of processing. Indian studies by Chandralekha (2001) and Munkunthan (2002) however did not include this (potential) task in their study. This current study assessed the task and had found confounding similar results to the results in most western studies. So, it could be predicted the change in cognitive and linguistic demand for various tasks would indirectly enhance perseverative errors and reduce correct utterances.

The poor performances of the AD compared to normal geriatrics in various task have been explained and justified by providing appropriate evidences as given below.

Generative naming, a harder task, demands more cognitive resources and thus was associated with more perseveration. In this study it was clear from the mean error scores obtained by AD group13.50 (SD = 14.25), and the normal group obtained around 2.5 (SD = 5.27). Generative naming requires the task of actively searching for the

lexicon in the semantic buffer, retrieving the target item and finally state the names of items and do so rapidly, Bayles, Tomoeda, Patrick, Helm-Estabrooks, and Hawley (2004). In AD, these cognitive processing was impaired thus resulting in more erroneous responses (Murdock, 1974) and poor generative capacity to create more item names (Slameck & Graf, 1978). This is clearly evident in the present study too. Generative task is a time constrained and as per Dell's Serial Model, if the linguistic items is to be produced quickly, then this results in lesser time for activation to flow, and therefore target items are less active (Martin & Dell, 2004). This further supported the current study in which similar finding were displayed. So, generative naming was found to have more perseverative errors compared to other tasks.

Thus there were increased perseverative responses in normal and AD participants. Generative task were a better predictor of inefficient generation of responses and underlying brain damage (Bayles & Tomoeda, 1983). Generative naming, compared to confrontation naming is more sensitive to the effects of dementia (Benson, 1979). Generative task can result in increased perseverative errors. This can be used as a differentiating factor during assessment across different brain pathology cases.

Confrontation naming involves both objects and picture naming. Confrontation naming required less effort. The AD group in this study obtained a mean of 5.48 (SD = 5.49). Only two processes were involved – object or picture recognition and name retrieval. As the stimulus of the item remains visible, they provide a perceptual additional cue for the lexicon retrieval from the memory, Bayles, Tomoeda, Patrick, Helm-

Estabrooks, and Hawley (2004). This cue offers increased activation in the semantic system and reduces the stress on the working memory during the retrieval. This plausibly explained as to why confrontation naming resulted in lesser perseverative errors in this study.

Hence, this task resulted in comparatively fewer perseverative errors in confrontation than generative naming.

Picture Description also required less effort. Here again only the AD group obtained a higher scores of 5.93 (SD = 6.64). The picture stimulus was present and the individuals had sufficient time to recognize and generate ideas. These individuals could have problems of language formulation, thinking and visual perception. Most often, it was observed, that they avoided these tasks and responses were in the form of "that's all, nothing more; I don't know; I can say only that much". This indicted their intent to speak was limited. This greatly affected their overall frequency scores, Bayles, Tomoeda, Patrick, Helm-Estabrooks, and Hawley (2004).

Also this task was not a speeded task, hence increased activation of the target items could be possible and resulting in decreased frequency of perseveration. For this reason, picture description yielded poor scores in this study.

General conversations included answering questions regarding their self, environment and certain reasoning question. From the present study it was contemplated that there was poor discourse and language production by persons with AD, as seen from

their mean scores of 8.81 (SD = 8.12). Similar reports have been advocated by (Bartol, 1979; Bayles, 1982; Ripich, Spindli & Terrell, 1983; Santo Pietro & Berman 1984). Sentence productions were characterized by reduced phrase length, increase number of repeated previous utterances, irrelevancies and intrusions, diminished vocabulary diversity, and content (Horner, 1983; Bayles, 1986). These were all exhibited by the participants of this study. Spontaneous speech is not stimulus dependent as that in picture description and involves less generative and narrative skills. As a result, general conversation was found to have more perseverative errors than picture description and naming.

Mukunthan (2002) reported that picture description and picture naming elicited more perseverative errors in individuals with aphasia. This result could provide a differentiating factor between aphasia and AD. Aphasia being a more focal and greater linguistic based disorder would throw insight about a different underlying mechanism, as compared to AD which is a more diffuse and cognitive based disorder. Thus general conversation would result in varied perseverative errors and this would increase with the increase in severity.

The cognitive-linguistic mechanism differed greatly thus resulting in varied results across tasks when the two groups were compared. So, it was also essential to look into the significance of these tasks within a group.

However when the Friedman test was done to find out significance level of these four tasks within each of the groups, results were found to be quite surprising. Both the groups displayed no significant difference. Within normal group, the values obtained were $\square^2$ (3) = 5.4, p> 0.05 and within AD group it was $\square^2$ (3) = 1.902, p>0.05. This could be speculated because of the limited sample size in both the groups and possibly due to heterogeneity of the AD group, in terms of severity.

Study done by Ramage, Bayles, Helm- Estabrooks & Cruz, 1999, included 60 normal individuals, and yet obtained just a 4% of error in all responses. Bayles, Tomoeda, Patrick, Helm-Estabrooks, and Hawley (2004) included 30 persons with AD. Results showed significant difference between the tasks within AD group. Thus highlighting that limited number of samples could have greatly affected the scores in this present study.

To summarize the above findings

- ✓ Performances of individuals with brain damage have been reported to vary with different tasks and stimuli.
- ✓ Comparison between the normal aging and persons with AD was done to find the difference in percentage of error responses across tasks.
- ✓ Significant difference was noticed between the groups for all four tasks viz., general conversation, confrontation naming, generative naming, and picture description.

- ✓ All the tasks showed a comparatively greater percentage of error in persons with AD.
- ✓ Generative naming yielded highest mean percentage of errors. This was explained in terms of increased cognitive demand.
- ✓ General conversation obtained the next higher scores in persons with AD. This was attributed to the nature of question and deficits these individuals in processing.
- ✓ Both picture naming and picture description showed a similar lower percentage of error scores. This was assumed to be due to the additional perceptual cue provided.
- ✓ Generative naming was the most potential task to elicit perseveration.
- ✓ However, no statistical difference was shown when the tasks were compared within each group probably due to the small sample size.

I (c). Comparison of the Total Percentage of Perseveration in all Eight Subtasks Between and Within the Two Groups

Next step of analysis was to compare the total perseveration scores across each sub tasks between the two groups. There were eight sub tasks viz.,

- Three in general conversation
- Two in generative naming
- Two in confrontation naming
- One picture description

The mean and SD was computed across the eight sub tasks as shown in table -8.

Table- 8 shows the increased values for all the sub tasks in persons with AD. Normal geriatrics performed equally well in almost all the sub tasks except in egocentric question, environmental, and animal generative naming task. They obtained a mean value of 0.28 (SD = 0.90) in the egocentric questions whereas persons with AD obtained a higher mean value of 2.75 (SD = 3.29). In the environmental questions AD group obtained a mean of 9.86 (SD = 9.82) as opposed to normal group [M= 6.9 (SD = 21.81)].

Table: 8 Mean percentage frequency and SD of total perseveration in normal and AD

GROUPS				
	Normal		**AD**	
	Mean	**SD**	**Mean**	**SD**
[f] EGOCTRC	.2850	.9012	2.7578	3.2972
ENVRTL	6.9000	21.8197	9.8677	9.8230
RELATNL	.0000	.0000	8.6244	10.0785
PICNAMG	.0000	.0000	5.4033	5.4432
OBJNAMG	.0000	.0000	2.2222	4.4096
ANIGENMG	2.5000	5.2705	14.1062	14.9767
VEHGENMG	.0000	.0000	8.1744	10.1964
PICDESP	.0000	.0000	5.9351	6.6473

However in tasks like relational questions, picture naming, object naming, vehicle generative naming, and picture description, only person with AD made significant errors, showing mean values of 8.62 (SD = 10.07), 5.40 (SD = 5.44), 2.22 (SD = 4.40), 8.17 (SD = 10.19), and 5.93 (SD = 6.64) respectively. In the picture description task both the

[f] EGOCTRC- egocentric; ENVRTL- environmental; RELATNL- relational; PICNAMG- picture naming; OBJNAMG- object naming ; ANIGENMG- animal generative naming; VEHGENMG- vehicle generative naming; PICSESP- picture description.

groups made error and the mean scores in normal group, 2.5 (SD = 5.27) and that of AD group 14.10 (SD = 14.97) confirmed that persons with AD had greater perseverative error than normal geriatrics. Graph -3 provides a better depiction of these results.

Later, the non-parametric measure Mann Whitney test was done between the two groups for these sub tasks to obtain the level of significance. Table- 9 displays the sub tasks and the levels of significance.

Table: 9 Level of significance value for the various subtasks.

Sub-tasks (parameters)	**|Z|**	**[7]Asymp. Sig. (2-tailed)**
EGOCTRC	1.843	0.065
ENVRTL	2.455	0.014 *
RELATNL	2.633	0.008**
PICNAMG	2.635	0.008**
OBJNAMG	1.534	0.125
ANIGENMG	1.983	0.047*
VEHGENMG	2.291	0.022*
PICDESP	2.971	0.003**

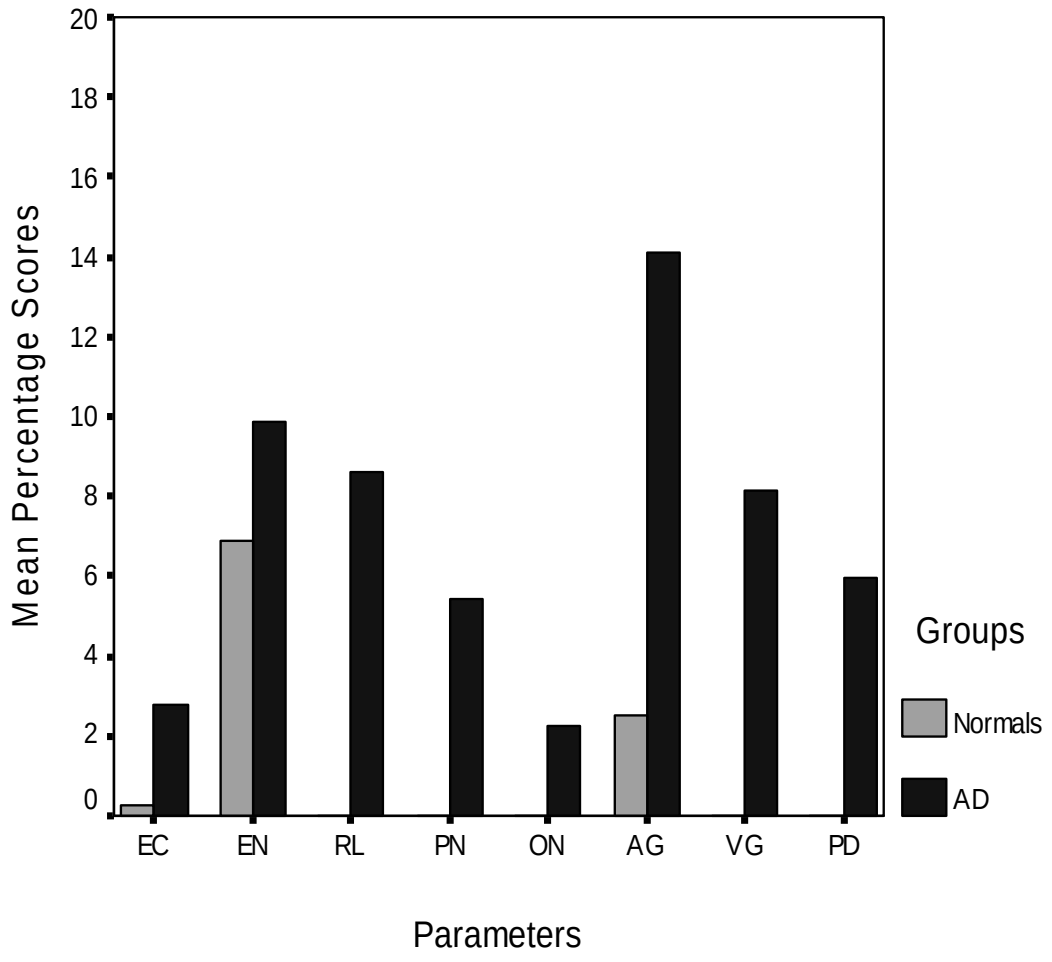
These findings were interpreted as -

- In general conversation, relational and environmental types of questions generate more perseverative errors in persons with AD compared to normal group.

[7] * Significant at 0.05 level of significance

**Significant at 0.01 level of significance

- Picture naming task as opposed to object naming produced more errors.
- As generative naming task was a very potential task, both animal (animate) and vehicle (inanimate) naming were found significant.
- Picture description was also significant.



[Y]Graph: 3 Mean of perseveration errors in percentage between groups for each sub task.

Results of this study can be compared with earlier researches. Studies have looked into various tasks generally and have found results indicating significant differences among them [e.g., Mukunthan (2002); Bayles, Tomoeda, Patrick, Helm-Estabrooks, & Hawley (2004)]. Limited studies are available that had looked into perseveration in such sub tasks in persons with brain injury.

[Y] EC- Egocentric ; EN- Environmental; RL- Relational; PN-picture naming; ON-Object naming; AG-animal generative naming; VG-vehicle generative naming; PD-Picture description.

Hence the results of this current study have opened an insight into the varied responses possible. This would encourage the researchers to further look into the mechanism breakdown possible in each type. Speculative interpretations can be made from the viewpoint of prior studies for each of the sub tasks

Egocentric vs. Environmental vs. Relational

In this study the AD group obtained a mean of 2.75 (SD = 3.2972) and normal group obtained 0.28 (SD = 0.90). Egocentric questions which include questions related more towards an individual's interest. These are less specific, more automatic, and highly redundant in nature in terms of the response (Beekman, 1985). They required less taxing of the episodic, working memory, and linguistic formulations in an individual as compared to environmental and relational type.

The findings of this present study also receive support from the Bacon, Potter and Seikel (1992) study, where they reported that relational questions were significantly more difficult than egocentric and environmental questions and environmental questions were more difficult than egocentric questions. Hence as egocentric questions are more familiar and redundant, would probably be retained better than other two types of questions. Similar results have also been reported by Goswami (2004). Yet, egocentric task would indeed be impaired in persons with brain damage because of the lack of appropriate inhibitory action during the processing but to a lesser extent as compared to other types of questions.

In environmental and relational types of questions the tasks would be more specific, accuracy-targeted, and less automatic in nature. They would require more of thinking, problem solving skill, and higher processing skills. Normal participants in this study obtained a mean value 6.9 (SD = 21.81). This shows an increased score comparatively to other types of questions. This could be contemplated as that in normal aging most probably language and cognitive deterioration could begin at this level. In other word, their visuo-spatial and orientation skills may begin to deteriorate earlier than reasoning and personal facts. While in relational type there were no errors as their language and cognitive processing at this level were relatively preserved. In persons with AD these higher cognitive, abstract thinking, problem solving, and formulation process are greatly impaired (Cummings & Benson, 1983). This further supports the observations and findings of this present study as persons with AD performed poorly in environmental and egocentric types [Mean= 9.86 (SD = 9.82) and 8.62 (SD = 10.07), respectively]. Impaired processing results in weakened connections and thereby resulting in greater perseverative errors.

Friedman test was used to find the significance across the egocentric, environmental, and relational sub tasks. However, no significance difference was obtained, $\square^2$ (2) = 1.0, p> 0.05.

Thus, it can be proposed that environmental and relational types of questions can be used as tasks to extract perseverative errors in general conversations.

Picture vs. Object Naming

Compared to object naming, picture naming was more perseverated in AD group in this study [M= 2.22 (SD = 4.40); M= 5.40 (SD = 5.44) respectively]. The underlying perceptual and cognitive deficits can be looked upon to explain this difference.

Most studies have reported that picture confrontation naming elicit more perseverations in persons with brain injury (Martin, & Sandson, 1986; Moses, 2004). Numerous authors report a significantly impaired naming ability in persons with dementia (Bayles & Tomoeda, 1983; Schmitt & Mitchell, 1984). This could possibly be explained in terms of nature of stimulus used. The stimuli play an important role to strengthen and arouse concepts (Goodglass, 1980). Kirshner (1984) commented that significant picture naming errors were due to perceptual degraded stimuli. Picture stimuli, as opposed to object naming are perceptually a weaker stimulus in terms of dimensionality, originality, shape, colour, size and texture. Thus weaker stimuli make retrieval arousal harder in a naming task, especially in persons with brain damage, Goswami (2004). This is well revealed in the present study. This also supports the findings of Yonelinas (2002), where it was reported that low frequency words are more easily recalled than high frequency words.

These findings may lead to the speculations that stimulus-specific processing was a possibility in a task. They would pose different demands for the language system and hence varied results are generated. These explanations support the result that picture

naming was more impaired than object naming in persons with AD. To strengthen the findings further research is warranted.

Wilcoxon Signed Rank test was further carried out, to find the difference between the pairs and the results showed no significant difference between the two sub tasks, z = 0, p> 0.05.

Animal (animate) vs. Vehicle (inanimate) Generative Naming

The current study depicted more perseveration errors in both sub tasks of generative naming. Both animate and inanimate categories of generative naming were impaired. Normal aging participants as shown in table- 8, had a mean of 2.5 (SD = 5.27) in animal generative naming and made no errors in that of vehicle generative naming. On the other hand persons with AD in this study produced more perseverative errors in animal (animate) [M= 14.10 (SD = 14.97)] than in vehicle (inanimate) [M= 8.17 (SD = 10.19) naming. To find the difference between the two, Wilcoxon Signed Test was carried out, and the results revealed no significant difference z = 1.41, p> 0.05.

This can be justified as there could be category specific activation of the neural systems. Neural network for naming animate and in animate could have discrete category-dependent nodes through which related conceptual knowledge may be mediated. Though not much has been explored regarding such differences in individuals with brain damage especially in persons with AD. Dennis (1976) McKenna and Warrington (1978); Warrington and McCarthy (1983); Goswami, (2004), have reported

selective impairments in the comprehension of body part names and inanimate object names.

Recent functional neuroimaging studies have identified more activation of the bilateral right visual cortex and occipital and temporal lobe for animal (animate) naming, whereas, more activation of the left tempo-parietal lobe for the inanimate naming (Okada et al 2000) . However these findings have been questioned by the results of the present study. Thus gives insight into the fact that disparity between the site and its behavioral function especially in persons with brain damage.

Picture descriptions

These were also significantly different between the two groups. This can be supported with the fact that normal participants performed well (M= 0) and thus resulted a significant difference between the groups. Though there are limited utterances in persons with AD, they were highly prone to perseverate more [M= 5.93 (SD = 6.64)] compared to normal group. These individuals tend to use repeated utterances when encouraged to speak more. These findings have been provided with supportive evidences by Bayles, Tomoeda, Patrick, Helm-Estabrooks, and Hawley (2004).

Thus results of comparison across each sub task between the normal and persons with AD group can be put forth as follows-

- ✓ Perseverative errors vary with each type of task and stimuli.
- ✓ Studies done earlier have provided the view that persons with brain damage have increased perseveration in task that require higher cognitive processing
- ✓ Results of this present study are in accordance with the earlier studies. Persons with AD were found to have increased perseverative errors in all sub tasks as compared to normal individuals.
- ✓ Egocentric type of question was found to have lesser frequency of perseveration as compared to environmental and relational types in both the groups.
- ✓ Environmental types yielded highest perseverative errors in both the groups compared to egocentric and relational questions.
- ✓ Picture naming task obtained more perseverative error than object naming task. Normal individuals were found to have no errors in these tasks.
- ✓ Animal generative naming task marked the highest frequency of perseveration in persons with AD. Normal geriatrics was also found to have perseverative errors in this sub task.
- ✓ In persons with AD vehicle generative naming task resulted in perseverative errors
- ✓ Similarly in picture description AD group obtained perseverative errors.

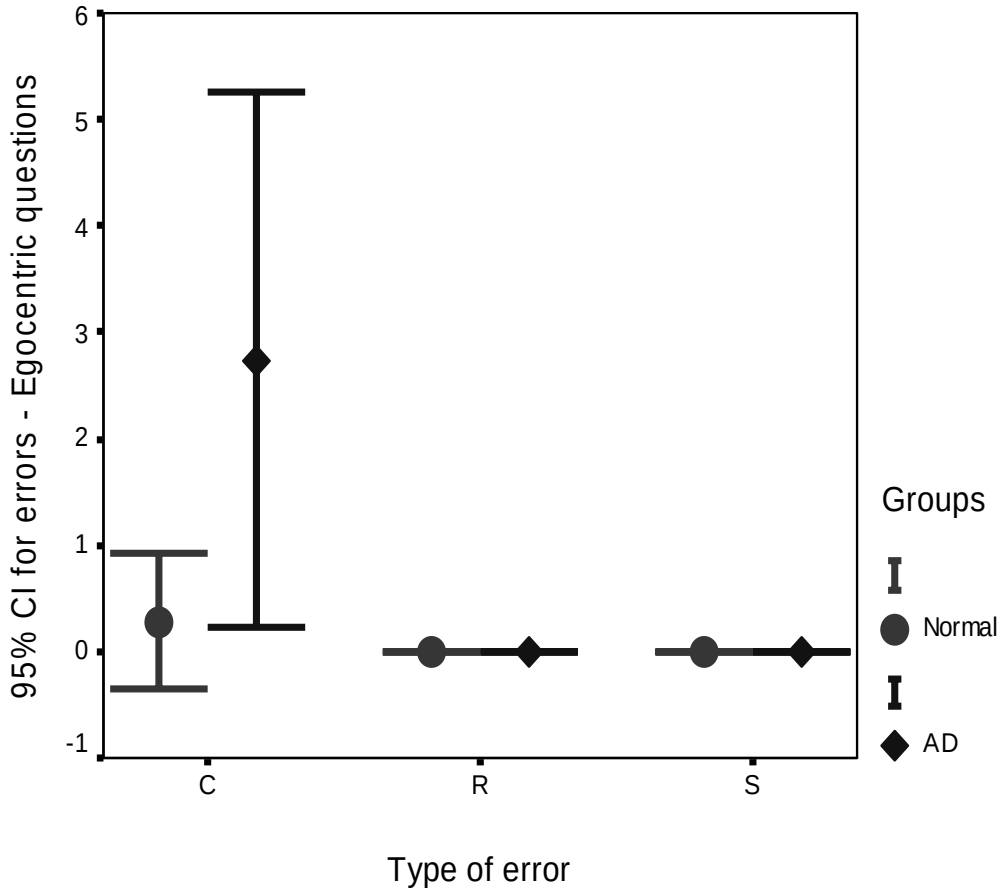
I. (d). Comparison of the Percentage of Three Types of Perseveration in all the Eight Subtasks Between and Within the Two Groups

Analysis was further continued and the three types of perseveration viz., continuous, recurrent, and stuck-in-set were individually computed for each of the eight subtasks. Initially the mean and SD was calculated for all the variables. These were tabulated and are as shown in table-10.

Persons with AD had significantly more errors in all the sub tasks than normal group, so the mean in this analysis was also found to be increased in all types of perseveration for AD group. Both the groups showed no errors (hence M = 0), for few types and tasks. These included, egocentric recurrent type, stuck-in –set in all three types of questions (egocentric, environmental, and relational). Stuck-in-set type of perseveration was also absent in picture naming, object naming, vehicle generative, and picture description tasks.

Continuous type of perseveration in egocentric type of questions had a mean of 2.73 (SD = 3.26) and 0.28 (SD = 0.90) in the AD group and normal group respectively; in environmental AD group had 7.28 (SD = 9.66) and normal group made no errors; and in relational, AD group scored 8.21 (SD = 19.16). Similarly continuous perseveration in picture naming and object naming were not present in normal group but AD group obtained a mean of 4.25 (SD = 5.07) and 7.77 (SD = 13.01) respectively. For animal generative naming AD group had a mean of 2.02 (SD = 6.06) and normal group with a mean of 1.25 (SD = 3.95). And in vehicle generative naming, normal group performed

well, but AD group obtained mean of 7.14 (SD = 13.43). For the final task, picture description, AD group obtained mean of 1.158 (SD = 2.31). Graphical representation of each type of perseveration in egocentric question is shown in graph- 4.



♣Graph: 4 Mean percentage error scores for types of perseveration in egocentric task between normal and AD group.

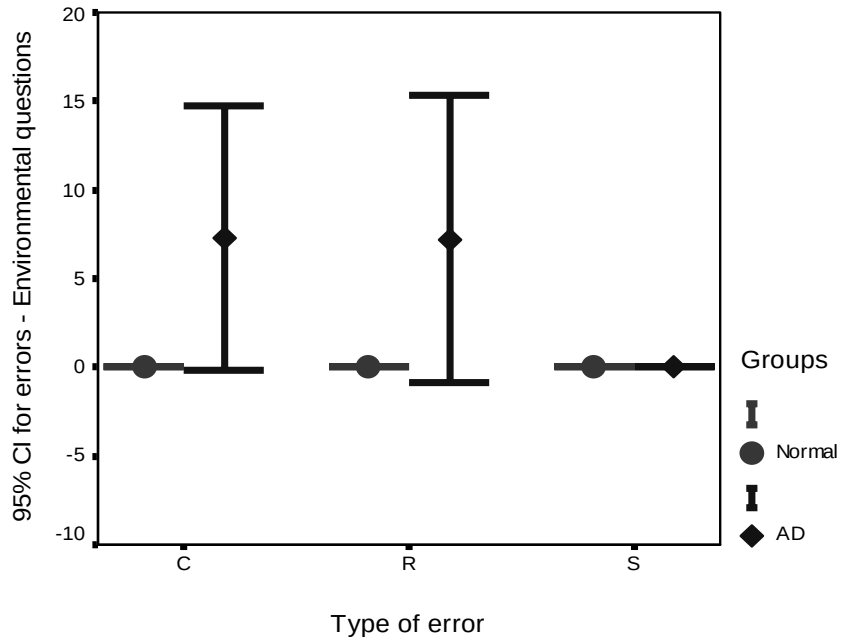
Overall, in continuous type, the scores were comparatively greater in environmental and relational type of question than in egocentric type. These were also

♣ C- Continuous; R- recurrent; S-Stuck-in-set

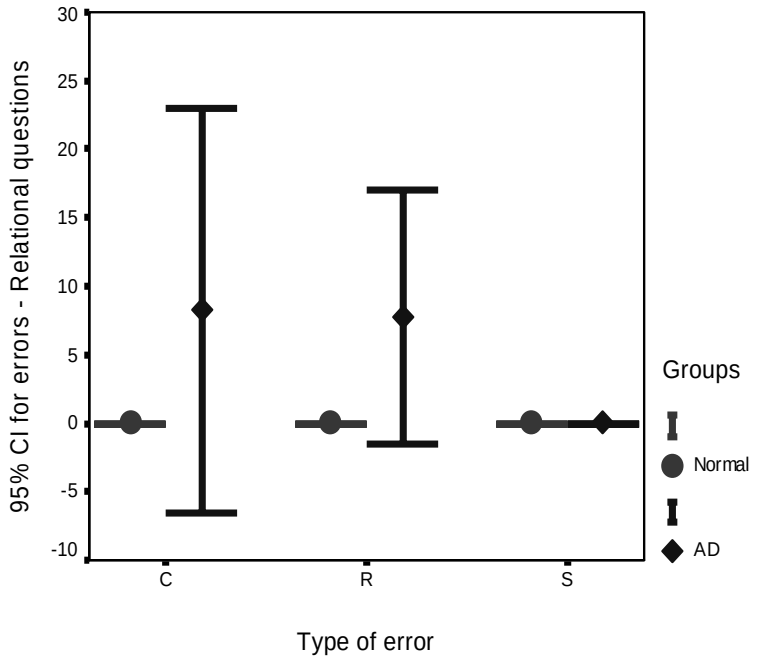
found in picture and object naming tasks. Vehicle generative naming also generated more continuous type of error.

Recurrent type of perseveration in environmental AD group had mean of 7.21 (SD = 10.57) and normal group made no errors, and in relational questions AD group scored 7.74 (SD = 12.03). Recurrent perseveration in picture naming and object naming were absent in normal group but AD group obtained an equal mean of 1.11 (SD = 3.33) in both the tasks. For animal generative naming, normal group obtained a mean of 1.25 (SD = 3.95) and AD group, a mean score of 15.94 (SD = 18.56). In vehicle generative naming, normal group performed well, but AD group obtained mean of 9.84 (13.85). For the final task, picture description, AD group obtained mean of 1.85 (SD = 5.55). Graph -5 provides the mean percentage frequency scores for three types of errors in environmental types of questions for the two groups.

Thus, in recurrent type the mean scores indicated that animal generative naming obtained the highest mean scores. The scores were comparatively greater in environmental and relational type of question than in egocentric type, and also in vehicle generative naming. Comparatively lesser scores were also obtained for picture naming and description and also for object naming. Graph- 5 and 6 shows each type of perseveration in environmental and relational types of questions.



♠Graph: 5 Mean percentage error scores for types of perseveration in environmental task between normal and AD group.

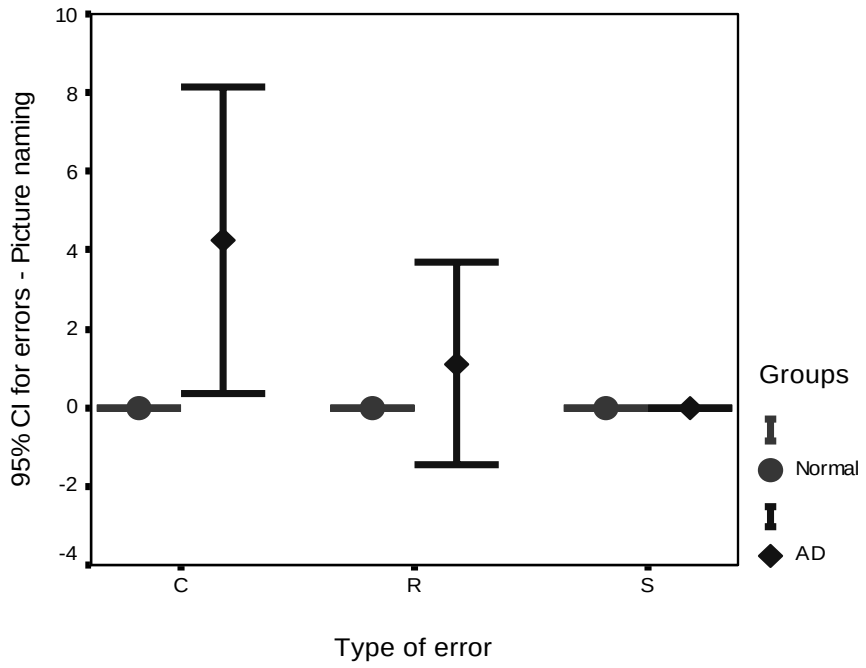


♠Graph: 6 Mean percentage error scores for types of perseveration in relational task between normal and AD group.

♠ C-continuous; R-Recuurent; S-Stuck-in-set.

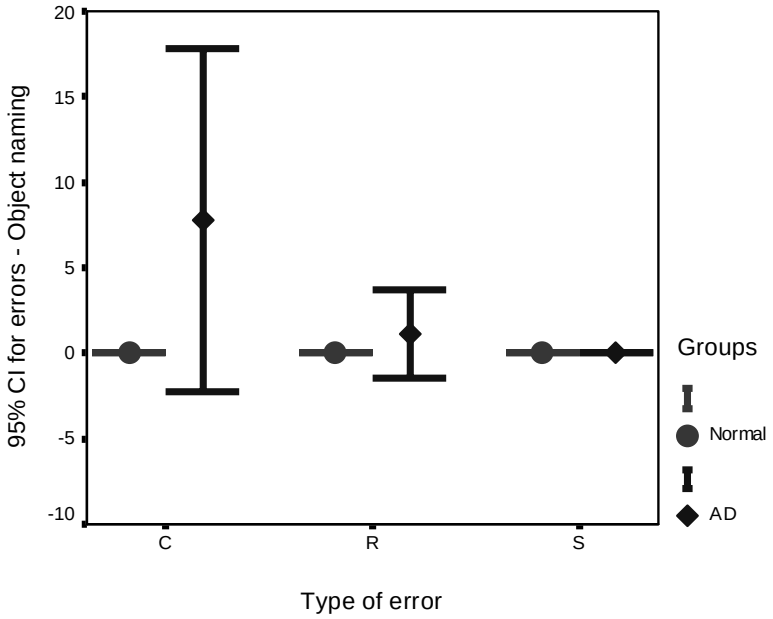
Stuck-in-set type of perseveration displayed that more or less none of the sub tasks obtained any mean scores. In animal generative task alone, AD group showed a mean score of 6.54 (SD = 9.91). Graph- 6 provides the mean percentage frequency scores for three types of errors in relational types of questions for the two groups. The graph displayed clearly illustrates that individuals in both the normal geriatric had better scores than persons with AD who showed higher percentages of error

Graph-7, 8, 9, 10, 11 shows the type of errors across picture, object naming, animal, vehicle generative naming, and picture description sub tasks respectively.

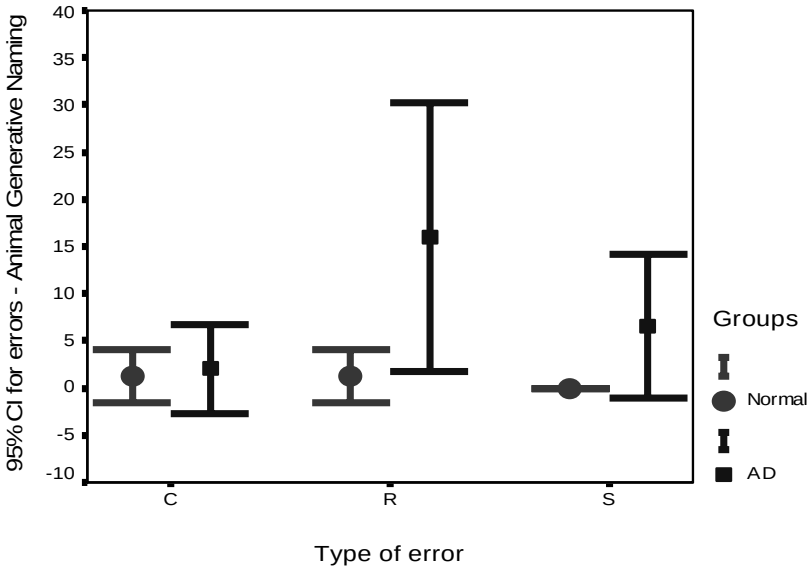


♦Graph: 7 Mean percentage error scores for types of perseveration in picture naming task between normal and AD group.

♦ C-continuous; R-Recuurent; S-Stuck-in-set.

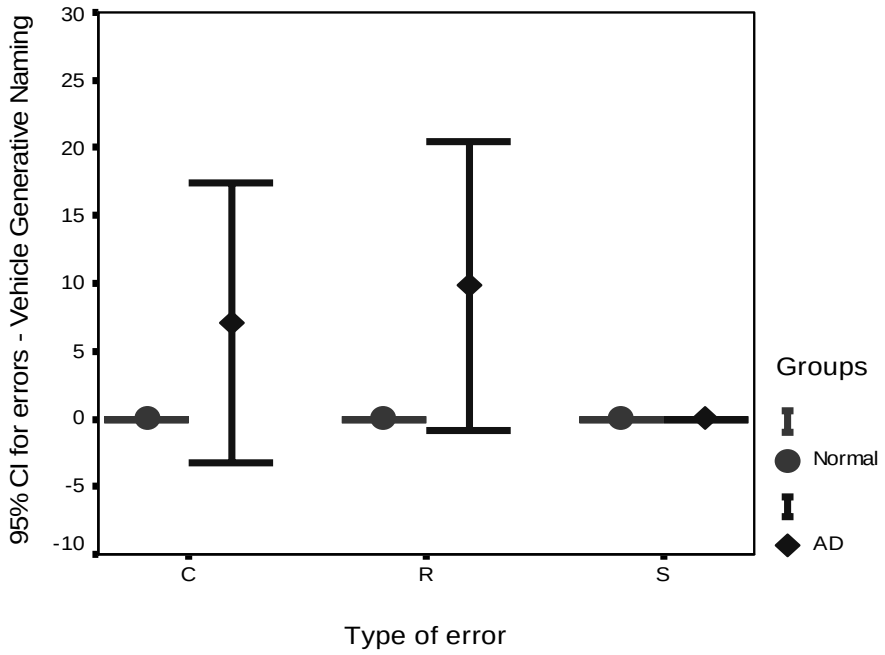


♦Graph: 8 Mean percentage error scores for types of perseveration in object naming task between normal and AD group.

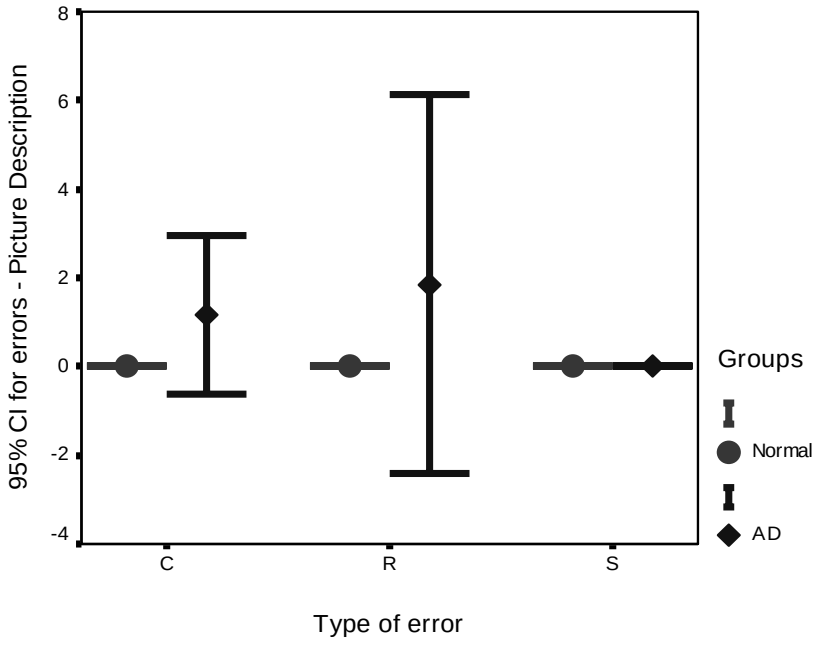


♦ Graph: 9 Mean percentage error scores for types of perseveration in animal generative naming task between normal and AD group.

♦ C-continuous; R-Recuurent; S-Stuck-in-set.



♦ Graph: 10 Mean percentage error scores for types of perseveration in vehicle generative naming task between normal and AD group.



♦Graph: 11 Mean percentage error scores for types of perseveration in picture description task between normal and AD group.

♦ C-continuous; R-Recuurent; S-Stuck-in-set.

Following which the Mann-Whitney a, non- parametric test was administered as the variations in SD were very high. Some of the variable were found to be significant at, $p< 0.05$ and some were at, $p< 0.1$ and $p<0.01$. Table 10 provides the mean, SD, Z and p level of significance for all the variables considered.

The analysis revealed that only few of the many variables showed significance value when compared across type of perseveration and each sub task between the groups. Friedman test was done to find the significance level and if found significant then pair wise comparison was done using Wilcoxon Signed Ranks test. Table 11, 12, and 13 displays the summary of this analysis.

Further Analysis was done based on two main categories

a. Each sub task wise across types - **Based on sub tasks**

b. Each type wise across sub task- **Based on type of error**

Table: 10 Mean, SD, Z and p values between the two groups for all the variables.

	Normal			AD				
[b]Variables	N	Mean	SD	N	Mean	SD	Z	[a]p value
EGCONT	10	.2850	.9012	9	2.7339	3.2695	1.843	<0.1*
EGRECR	10	.0000	.0000	9	.0000	.0000	0.00	>0.05
EGSTUK	10	.0000	.0000	9	.0000	.0000	0.000	>0.05
ENCONT	10	.0000	.0000	9	7.2832	9.6680	2.633	<0.01***
ENRECR	10	.0000	.0000	9	7.2180	10.5735	2.291	<0.05**
ENSTUK	10	.0000	.0000	9	.0000	.0000	0.000	>0.05
RECONT	10	.0000	.0000	9	8.2153	19.1694	1.532	>0.05
RERECR	10	.0000	.0000	9	7.7492	12.0322	2.289	<0.05**
RESTUK	10	.0000	.0000	9	.0000	.0000	0.000	>0.05
PNCONT	10	.0000	.0000	9	4.2589	5.0762	2.297	<0.05**
PNRECR	10	.0000	.0000	9	1.1111	3.3333	1.054	>0.05
PNSTUK	10	.0000	.0000	9	.0000	.0000	0.000	>0.05
ONCONT	10	.0000	.0000	9	7.7778	13.0171	2.297	<0.05**
ONRECR	10	.0000	.0000	9	1.1111	3.3333	1.054	>0.05
ONSTUK	10	.0000	.0000	9	.0000	.0000	0.000	>0.05
AGCONT	10	1.2500	3.9528	9	2.0200	6.0600	0.153	>0.05
AGRECR	10	1.2500	3.9528	9	15.9467	18.5652	2.177	<0.05**
AGSTUK	10	.0000	.0000	9	6.5422	9.9126	1.928	<0.1*
VGCONT	10	.0000	.0000	9	7.1422	13.4388	1.928	<0.1*
VGRECR	10	.0000	.0000	9	9.8411	13.8586	2.291	<0.05**
VGSTUK	10	.0000	.0000	9	.0000	.0000	0.000	>0.05
PCONT	10	.0000	.0000	9	1.1581	2.3190	1.532	>0.05
PRECR	10	.0000	.0000	9	1.8511	5.5533	1.054	>0.05
PSTUK	10	.0000	.0000	9	.0000	.0000	0.000	>0.05

[a] Level of significance at * p< 0.1; ** p< 0.05; *** p< 0.01.

[b] [EGCONT- egocentric continuous; ENCONT- continuous; RECONT- relational continuous; EGRECR- egocentric recurrent; ENRECR- environmental recurrent; RERECR- relational recurrent; EGSTUCK- egocentric stuck-in-set; ENSTUCK- environmental stuck-in-set; RESTUCK- relational stuck-in-set; PNCONT-picture naming continuous; ONCONT-object naming continuous; PNRECR- picture naming recurrent; ONRECR- object naming recurrent; PNSTUCK- picture naming stuck-in-set; ONSTUCK- object naming stuck-in-set; AGCONT-animal generative naming continuous; VGCONT- vehicle generative naming continuous; AGRECR- animal generative naming recurrent; VGRECR- vehicle generative naming recurrent; AGSTUCK- animal generative naming stuck-in-set; VGSTUCK- vehicle generative naming stuck-in-set; PCONT-picture description continuous; PRECR- picture description recurrent; PSTUCK- picture description stuck-in-set]

a. Based on sub tasks

Table: 11 Pair wise comparison across sub tasks

Variables	**Chi-square(df)** (df-degrees of freedom)	**p value**	**[8]Pairs that are significant from Wilcoxon test at 5% level of significance**
[9]EGOCTRC	8.00 (2)	<0.05*	EGCONT- EGRECR; EGCONT- EGSTUK:p<0.1
ENVRTL	5.30 (2)	>0.05	NS
RELATNL	5.37 (2)	>0.05	NS
PICNAMG	6.50 (2)	<0.05*	PNSTUK- PNCONT : p< 0.1
OBJNAMG	6.50 (2)	<0.5*	ONSTUK- ONCONT : p<0.1
ANIGENMG	4.33 (2)	>0.05	NS
VEHGENMG	5.76 (2)	>0.05	NS
PICDESP	2.00 (2)	>0.05	NS

b. Based on type of error (For task 1 Friedman Test was carried out)

Table: 12 Pair wise comparison across types of perseveration (task 1).

Variables	**Chi-square(df)** (df- degrees of freedom)	**p value**	**[10]Pairs that are significant from Wilcoxon test at 5% level of significance**
Cont Task1	1.18 (2)	>0.05	NS
Rec Task1	4.80 (2)	>0.05	NS
Stuk Task1	0.00 (2)	>0.05	NS

[8] Data entered as: - pair1; pair2….pair n: p< 0.1/0.01/0.05. NS - not significant.
[9] EGOCTRC- egocentric; ENVRTL- environmental; RELATNL- relational; PICNAMG- picture naming; OBJNAMG- object naming ; ANIGENMG- animal generative naming; VEHGENMG- vehicle generative naming; PICSESP- picture description.
[10] Data entered as: - pair1; pair2….pair n: p< 0.1/0.01/0.05. NS - not significant.

b. Based on type of error. (For task 2 and 3 Wilcoxon Signed Rank test was done)

Table: 13 Pair wise comparison across types of perseveration (task 2, 3).

Variables	**__ z __**	**p value**	**[11]Pairs that are significant from Wilcoxon test at 5% level of significance**
[12]Cont Task2	0.41	>0.05	NS
Rec Task 2	0.00	>0.05	NS
Stuk Task2	0.00	>0.05	NS
Cont Task 3	1.06	>0.05	NS
Rec Task 3	1.09	>0.05	NS
Stuk Task 3	1.60	>0.05	NS

To encapsulate, the type of errors exhibited across the tasks were varied and no statistical difference or very minimal difference across them in the AD group. Although, the percentage of each type of errors were higher in persons with AD as compared to normal geriatrics, therefore providing advanced levels of differentiating normal and pathological populations .

Afresh, these insignificant pattern and results would have been the repercussion of limited number of participants. Moreover, no regular patterns of error scores were

[11] Data entered as: - pair1; pair2….pair n: p< 0.1/0.01/0.05. NS - not significant.

[12] Cont- continuous; Rec –recurrent ; Stuk- stuck-in-set.

unfolded in the scores between the groups thus no conclusive speculations could be made at this point. The study at this preface level however puts forth a notion that there could be different nodes of cognitive and linguistic processing for each finer level of tasks and type of stimuli used. These views needs studies in greater depth using computational and neuroimaging studies in larger group of populations.

In Bayles, Tomoeda, McKnight, Helm-Estabrooks, and Hawley (2004) study the types of perseveration were not studied across the task. Consequently limited information supports the nature exhibited by persons with AD on the type of perseveration across each sub tasks. This strengthens the nature of the present study in providing preliminary data on the nature of type of perseverations exhibited across each of the sub tasks in persons with AD and normal geriatrics. This could be further explored to investigate the rationales and outlook of underlying processes involved in cognitive-linguistic tasks.

The outcomes of the analysis done on types of perseveration across sub tasks can be put across as-

- ✓ The normal geriatrics performed better overall in all the tasks.
- ✓ Only few of the variables were found to be significant with respect to each sub task and types of perseveration between the normal group and AD group.
- ✓ However, these variables were found to be significant at lower levels of significance.
- ✓ Normal geriatrics showed less percentage of continuous type of error in egocentric questions and animal generative naming. Animal generative naming also showed recurrent type of perseveration, but to a lesser extent.

- ✓ In AD group, both continuous and recurrent types of perseverations were exhibited to an equal extent in environmental, relational, picture naming, vehicle generative naming, and picture naming tasks.
- ✓ Recurrent type was found to have higher scores in animal generative tasks and object naming tasks as compared to continuous type of perseveration in persons with AD.
- ✓ Stuck-in-set type of perseveration was displayed only in animal generative naming task in the AD group.
- ✓ Yet, no general pattern was observed and the assumptions made need to be viewed with caution and need further research involving larger samples.

Stage 2

Comparison of the Total Percentage of three Types of Perseveration between Normal and AD Group Irrespective of the Tasks

Second stage of statistical analysis was carried out to compare the overall mean percentage of continuous, recurrent and stuck-in-set types of perseverations between the two groups.

This was computed by summing up the individual type of perseveration present in all the tasks for each individual in group. Then the mean and SD of this was calculated. Mann-Whitney test was done to find the level of significance for the three types.

The extracted mean values, showed a higher percentage error scores for both continuous and recurrent types between the two groups. Continuous obtained a mean of

1.53 (3.95) in normal group and the persons with AD showed a higher mean value of 5.92 (4.17). Normal geriatrics in recurrent type of perseveration obtained a score of 1.25 (3. 95), on the other hand, persons with AD showed an obvious higher scores of 17.11 (13.21). Stuck-in-set type of perseveration displayed a mean of 0.00 in normal group and a minimal mean value of 4.32 (8.68) in the AD group. Table- 11 depicts the findings of this analysis.

Non parametric test depicted that continuous and recurrent types were significant at $p< 0.05$. When Friedman test was done within normal group, no significant difference, $\chi^2 (2, 10) = 2.000$, $p> 0.05$ was obtained. When this was calculated for the AD group, significant difference $\chi^2 (2, 9) = 9.235$, $p> 0.05$ was obtained. The Wilcoxon Signed Ranks test was then carried out to obtain the pair wise level of significance. Significant difference was obtained for the stuck-in-set, $z = 0.42$, $p < 0.05$ and recurrent type of errors, $z = 2.52$, $p <0.05$

The illustrated scores evidently shows higher perseverations in persons with AD as opposed to normal aging group. Recurrent type of perseveration in persons with AD presented with the highest percentage of errors compared to continuous and stuck-in-set type of perseverations.

Table: 14 The mean, SD, Z and p level of significance for 3 types of errors between normal geriatrics and persons with AD.

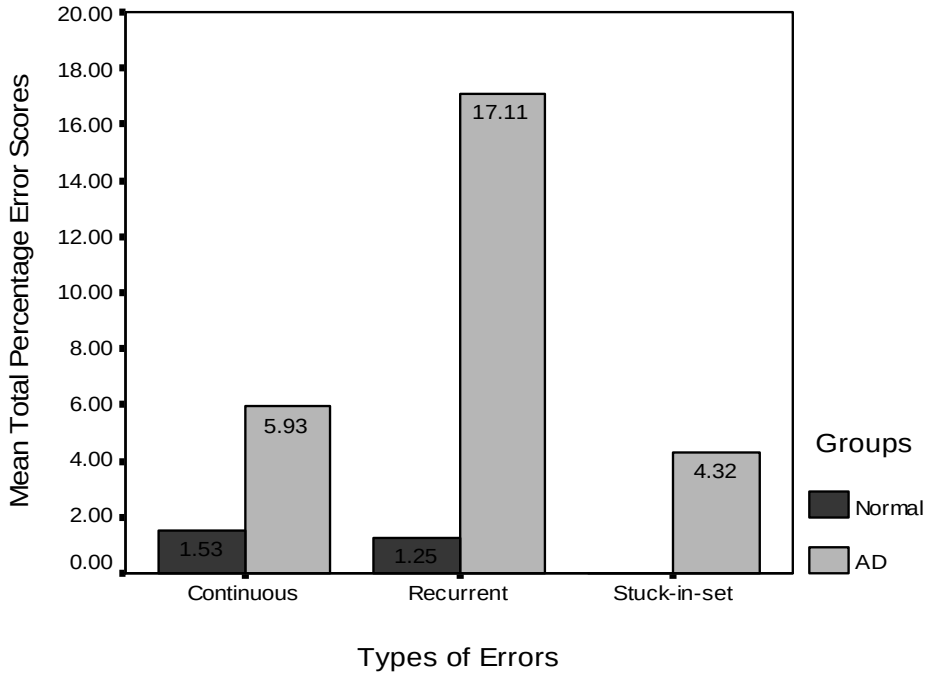
GROUPS		CONTNOUS		RECURNT		STUKSET	
Normal (N)	N	10	Z= −2.296 P < 0.05*	10	Z= −3.223 P< 0.05*	10	Z= −1.532 P> 0.05
	Mean	1.5350		1.2500		.0000	
	SD	3.9554		3.9528		.0000	
AD	N	9		9		9	
	Mean	5.9288		17.1101		4.3200	
	SD	4.1775		13.2151		8.6842	

This highlighted that recurrent type of perseveration was predominant in the AD group, followed by continuous type and then stuck-in-set. This is being illustrated in graph -12. Increased frequency of perseveration in an individual indicated the presence of brain injury. The types of perseveration exhibited are explained on the basis of site of lesion, type of task, and underlying mechanisms.

Continuous type of perseveration is explained as a phenomenon of pathological inertia of movement or a failure to stop an activity once begun (Luria, 1965). Most of the literatures opine that continuous perseveration is increasingly observed in non verbal motor tasks such as drawing, and writing tasks and for few naming tasks (Helm-Estabrooks, Ramage, Bayles, & Cruz, 1998). In the present study too, there were presence of lower percentages of continuous perseveration in persons with AD. This

could again support the prior studies that continuous perseveration is a mark of non verbal tasks. However, as the present study included verbal tasks this fact could not be further confirmed. Reason as to why this type is exhibited more in motoric task could be based on the presence of its site of lesion. Studies done on persons with aphasia have put forth that continuous perseveration occurs as a result of damage more of the frontal lobe (Martin & Sandson, 1986; Hotze & Helm-Estabrooks, 1995). Motor activities as they are majorily controlled by the frontal motor areas; tend to explain the presence of more non verbal motor continuous perseveration is present if these areas are damaged.

Thus it could be assumed that as persons with AD, included frontal lobe as one of the sites of lesion affected, resulting in continuous type of perseveration in some of the verbal tasks. This is seen in the present study, as the AD group had continuous perseveration more in confrontation naming and generative naming.



Graph: 12 Total percentage of the three perseveration types between normal and persons with AD.

Recurrent type of perseveration is a mechanism where there is failure in the inhibition of a previous target appropriately. The lingering memory traces inhibit the stimulation of the new target and thus inappropriate production of the new stimuli. This is generated more in verbal tasks and is evident in most of the verbal tasks (Albert & Sandson, 1986; Ramage, Bayles and Estabrooks, 1999).

This fact is shown in the present study. Persons with AD were found to have highest recurrent type of perseverations in most of the linguistic tasks. Recurrent perseveration is the result of both motor and semantic memory traces. The present study supports the fact that major semantic and episodic memory impairment occurs in persons with dementia (Murdock, 1974). As a result, supporting studies have commented that recurrent perseverations are exhibited in persons with brain lesions in the temporal-parietal lobes i.e. within the zone of language (Martin & Sandson, 1986). This further strengthens the results of the present study in which persons with AD demonstrated higher percentage scores in recurrent type of perseveration. This implies that greater impairment occurs at the temporal- parietal lobes in persons with AD giving rise to greater percentage error scores of perseveration. This viewpoint is further verified by the reports of Terry (1981) and Lauter (1985) that major neuronal loss in AD occurs in the superior temporal gyrus and anterior temporal lobes.

Stuck-in-set type of perseveration is found to be least in persons with AD in parallel with the findings in aphasic populations. This type of perseveration is more likely to occur in tasks like generative naming tasks (Helm-Estabrooks, 1998). In this study also these errors were observed for persons with AD in generative tasks. Higher percentages of stuck-in-set perseverations were also found to be observed in non-verbal tasks in (Ramage, Bayles & Estabrooks, 1999). The site of lesion attributed to this type of perseveration is in the prefrontal areas (Luria, 1965). This finding was further supported by lower percentages obtained in person with AD, where probably higher neuronal loss occurs in the temporal lobe.

An overall scenario observed in the type of perseverations in persons with AD, depict that site of lesion and type of perseveration can be correlated. Greater impairment in the temporal and parietal lobes could result in higher recurrent type of perseveration. As AD includes diffused lesions also in the frontal lobes, confirm the presence of continuous perseverations.

The results of this stage can be outlined as:

- ✓ Overall both normal geriatrics and persons with AD showed occurrence of continuous and recurrent types of perseverations.
- ✓ Normal geriatric group scored significantly lower percentage frequency of errors when compared to persons with AD.
- ✓ Normal geriatrics performed better than persons with AD with respect to types of perseveration.

- ✓ Stuck-in-set type of perseveration was only made known in the persons with AD.
- ✓ In persons with AD, recurrent type of perseverations was found to exhibit highest scores of percentage frequency of errors. Continuous type of perseveration displayed the next higher scores and the least was shown by stuck-in-set type of perseveration.

3. Qualitative Analysis of types of perseveration.

Qualitative analysis was further carried out to study the nature of perseveration errors exhibited by the persons with AD and normal individuals.

Increased percentages of perseveration in persons with AD indicate the nature of impairment and severity of brain damage compared to normal individuals.

Perseverations exhibited were mainly studied for their nature in the following manner:

- ➢ Phoneme, Word, or Phrase level
- ➢ Syntactic, Semantic, and Pragmatic level
- ➢ Nature of the output utterance

1. Phoneme, Word, or Phrase level

The perseverated utterances were verified as at what linguistic structure level these perseverations occurred. Perseverations were observed more at word level followed by phonemic perseverations. These patterns of utterances are corresponding to there level of linguistic processing breakdown. As reported by Cohen and Dehaene, 1998; Hirish, 1998; Moses, 2003; Moses, Sheard and Nickels, 2004, whole word perseveration occurs when there is a breakdown at the lexical – semantic level whereas phonemic

perseveration occurs more when there is breakdown at the phonological level of processing. This pattern observed further supports the findings of the present study, that greater semantic level memory impairment is observed in persons with AD.

It has also been reported that in persons with AD, deterioration begins at the word level and at later severe stages, phonemic errors are predominant. They were found to perform better in word fluency naming in the mild stage and increased perseveration in letter fluency in moderate to severe stages of AD (Slauson & Bayles, 1985). Phrase level and sentence perseverations were rare.

Thus study of perseveration would indicate the severity of language deterioration in these individuals and the level of breakdown this would further help in clinical researches.

2. Syntactic, Semantic and Pragmatic level of perseveration

Responses made by persons with AD were analyzed to observe for the level of language level breakdown. As the semantic memory was greatly affected, most participants were found to exhibit more of perseverations at the semantic category. Pragmatic level perseverations were seen in the form of intrusion of previously mentioned ideas and topics. Topic shifts, were predominantly seen. Syntactic perseverations were rarely observed.

3. Nature of the output utterance

Persons with AD were found to give varied responses for the stimuli. Majority of them spoke spontaneously during the general conversation at sentence level. But in the picture description task, limited utterances, and limited ideas were observed. No positive correlation was found, subjectively, between the severity of AD and level of utterances.

Thus, the qualitative analysis highlighted the nature and level of processing breakdown. And quantitative analysis revealed that person with AD had greater percentage frequency of errors than normal geriatrics. Recurrent type of perseverations was predominant in this pathological condition.

CHAPTER 4

SUMMARY AND CONCLUSION

The present study intended to investigate on the frequency and nature of verbal perseverative and anticipative errors in the verbal productions of persons with AD and normal aging population. The objectives of the study included to,

- Find the presence of anticipative and perseverative errors
- Quantitatively analyze for the frequency of percentage of errors
- Analyze and compare the findings for the task wise perseverations obtained
- Compare and analyze the types of perseverations obtained
- Qualitatively study the nature of errors

Researches over the years have revealed that anticipation and perseveration is a clinical manifestation in persons with brain damage. Most studies done in normal aging population have concluded that perseverations were present in lesser frequencies as compared to the pathological conditions. Thus, frequency of perseverations was found to be a significant measure to differentiate between normal aging and brain damage. Perseveration has been categorized into three typologies: Continuous, Recurrent, and Stuck-in-set. These types vary in their manifestation, site of lesion and mechanism exhibited. Their occurrences also vary with the type of brain

damage. Perseverations were studied in aphasia populations and the findings revealed greater frequency of perseverations. Different tasks have been adopted to elicit different types of perseveration. Some are non-verbal and some verbal. Limited and scattered western studies over the past years have been reported to study the nature of verbal perseveration in persons with AD.

Hence, this study was taken up in order to investigate the frequency of linguistic errors such as anticipation and perseveration in person with AD and normal aging group in an Indian context.

The study incorporated nine persons with AD and ten normal geriatrics as participants. They were age, language, handedness and education matched.

Tasks and sub tasks included were:

General conversation (Egocentric, Environmental, and Relational)

Confrontation naming (Picture and Object)

Generative naming (Animal and Vehicle)

Picture naming

Types of perseveration included- Continuous, Recurrent and Stuck-in-set.

Anticipative errors were not present in any of the groups, so further perseverative errors were only calculated. The percentage scores for each individual were tabulated and appropriate statistical analyses were performed using SPSS (version 10.0.)

statistical package. Following the mean and SD were computed across each task, sub task and type of perseveration between persons with AD and normal aging group. As the SD obtained were found to be highly varying, non-parametric measures were used for further analysis. To verify the differences between and within groups, Mann-Whitney test and Friedman test was done respectively. Wilcoxon Signed Ranks test was done to obtain pair wise significance for all the tasks. Stage 1 included to compare the frequency percentage across the tasks and sub tasks for the two groups. Stage 2 included to compare the frequencies of types of perseverations between persons with AD and normal geriatrics. Qualitative analysis was also carried out to find the nature of perseverative errors made by persons with AD.

Overall the important findings of the present study can be encapsulated as follows:

- ✓ Persons with AD obtained higher percentage frequency of perseverative errors as compared to normal geriatric participants.
- ✓ Generative task and general conversation were found to be potential tasks to elicit perseveration in both the groups.
- ✓ Environmental and relational type of questions generated higher frequency of total perseverations in persons with AD.
- ✓ Picture naming task obtained poorer scores as compared to object naming.
- ✓ Animal (animate) generative naming was found to yield higher percentage of frequency errors in persons with AD as compared to vehicle (inanimate) generative naming.

- ✓ Normal geriatrics obtained lesser percentage of perseverative frequencies for the animal generative naming and environmental type of questions.
- ✓ Picture description task was least potential in eliciting perseveration.
- ✓ Overall Recurrent type of perseverations obtained highest percentage frequency than Continuous type and Stuck-in-set type. Stuck-in-set had the least scores.

IMPLICATIONS OF THE STUDY

There is an obvious and statistical difference in the frequency percentage of perseverative errors in persons with AD as compared to normal geriatrics. Perseveration is thus a pathognomic sign of injured brain.

Results of this study are of clinical importance as increased perseveration can thus be used as a differentiating factor between normal and pathological conditions. Differences in the type of task used and type of perseverations were also observed that can be employed to differentiate between Aphasia and AD. Likewise it offers evidences for better treatment management. For, e.g., reducing the rate of speaking, providing sufficient time between the stimuli presentation, are some of the strategies that can be employed for treating perseveration.

Task wise analysis has paved way for in depth understanding of the underlying mechanism of the language processing. Type of perseveration observed provided far

reaching perspectives regarding the sites of lesions and the cognitive-linguistic task demands.

Future Implications

More systematic and in depth analysis of perseverative errors is needed across a wide range of tasks and samples size to tap the different levels of processing and demands. Severity, gender, verbal, non verbal, bilingualism and sites of lesions are some of the variables that can be taken up in detail to study the relation with respect to perseveration.

REFERENCES

Ackerman, T. (2007). Case study: Where do aphasic perseverations come from? *Aphasiology, 21 (11),* 1018-1038.

Albert, M.L. (1989). The role of perseveration in language disorders. *Journal of Neurolinguistics, 4 (4),* 471-478.

Albert, M.L., Sandson, J. (1986). Perseveration in aphasia. *Cortex, 22,*103-115.

Allison, R. S. (1966). Perseveration as a sign of diffuse and focal brain damage. *British Medical Journal, 2,* 1095–1101.

Allison, R., & Hurwitz, L. (1967). Cited in T. Sandson & M.L. Albert (1984). Varieties of Perseveration, *Neuropsychologia, 22 (6),* 715-732.

Allison, R., & Hurwitz, L. (1967). On Perseveration in Aphasics, *Brain, 90,* 429-448.

Astell, A.J. & Harley, T.A. (1998). Naming problems in dementia: semantic or lexical? *Aphasiology, 12(4),* 357-374.

Basso, A. (2004). Perseveration or the Tower of Babel. *Seminars in Speech and Language, 25(4),* 375-390.

Bayles, K.A., Tomoeda, C.K. (1994). Repetition and Memory in Alzheimer's disease Patients. *Brain and Language, 47,* 373-376.

Bayles,K.A., Kaszniak, A.W., Tomoeda, A.W. (1987) *Communication and cognition in normal aging and dementia*. Texas: Pro.ed.

Bayles, K.A., Tomoeda, C.K., Kasznigk, A.W. Stern, L.Z., & Eagans, K.K. (1985). Verbal Perseveration of Dementia Patients, Brain *and Language, 25,* 102-116.

Bayles, K.A., Tomoeda, M.S., McKnight, P.E., Estabrooks, N.H., & Hawley, J.N. (2004). Verbal Perseveration in Individuals with Alzheimer's disease. *Seminars in Speech and Language, 25(4),* 335-348.

Beasley, D.S., Davis, A.G. (1981). *Aging: Communication Processes and Disorders*. NY: Grune & Stralton, Inc.

Blesser, R., & Poeck, K. (1985). Cited in C.W. Wallesch and C. Papagno. Subcortical Aphasia. In F. Clifford Rose, R. Whurr and M.A. Wyke. (1993). (Ed.). *Aphaisa.* London: Whurr Publishers.

Brookshire, R.H. (2007). *Introduction to Neurogenic Communication Disorders:* Philadelphia, P.A.: Mosby Elsevier.

Bryan, K. and Maxim, J. (2006). *Communication Disability in the Dementias*. Philadelphia: Whurr Publishers.

Buckingham, H.W. (2007). Introductory essay: Perseveration happens! *Aphasiology, 21(11),* 916-927.

Buckingham, H.W. (1985). Perseveration in aphasia. In S. Newman & R. Epstein (Eds.) Current Perspectives in Dysphasia. Edinburgh; Churchill: Livingstone. Cited in Ramage, A., Bayles, K., Helm-Estabrooks. N., & Cruz, R. (1999). Frequency of Perseveration in Normal subjects. *Brain and Language,* 66, 333-340.

Buckingham, H.W. (2000). Perseveration in Y2K. *Brain and Language, 71,* 36-38.

Buckingham, H.W., & Christman, S.S. (2004). Phonemic Carryover Perseveration: Word Blends. *Seminars in Speech and Language, 25(4),* 363-373.

Buckingham, H. W., Jr., Whitaker, H. A., & Whitaker, H. A.(1978). Alliteration and Assonance in neologistic jargon aphasia. *Cortex, 14,* 365–80.

Buckingham, H. W. Jr., Whitaker, H. A., & Whitaker, H. A. (1979). On linguistic Perseveration. In H. Whitaker & H. A. Whitaker (Eds.), *Studies in neurolinguistics,* vol. 4., (pp. 328–352). New York: Academic Press.

Butterworth, B. (1979). Hesitation and the production of verbal paraphasias and Neologisms in jargon aphasia. *Brain and Language, 8,* 133–61.

Butterworth, B. (1992). Disorders of phonological encoding. *Cognition, 42,* 261–286.

Caplan, D. (1990). *Neurolinguistics & Linguistic Aphasiology*. NY: Cambridge University Press.

Cohen, L., & Dehaene, S. (1998). Competition between past & present: Assessment and interpretation of verbal perseverations. *Brain, 121,* 1641-1659.

Chandralekha, C. (2001). *Verbal Perseveration in Normal Geriatrics: A Study on Tamil Speakers*. Unpublished Master's Dissertation, University of Mysore.

Christman, S.S., Boutsen, F.R., & Buckingham, H.W. (2004). Perseveration and Other Repetitive Verbal Behaviors: Functional Dissociations. *Seminars in Speech and Language, 25(4),* 295-306.

Doyle, P.J., McNeil, R., Spencer, K.A., Goda, A. J., Cohsell, K., & Lustig, A.P. (1998). The Effects of Concurrent Picture Presentations on Retelling Of Usually Presented Stories by Adults with Aphasia. *Aphasiology , 12 (8),* 561- 574.

Dressler, W.V. (1998). A Linguistic Classification of Phonological Paraphasias. In W.V. Dressler., & Stark, J.A. *Linguistic Analysis of Aphasia Language*. New York: Spriger- Verlag.

Eisenson, J. (1973). *Adult Aphasia: Assessment and Treatment*. New Jersey: Prentice Hall, Inc.

Emery, P.A., & Helm-Estabrooks, N. (1989). The Role of Presentation in Aphasic Confrontation Naming Performance. In Prescott, T.E. *Clinical-Aphasiology*. London: A College- Hill Publication.

Foldi, N.S., Helm-Estabrooks, N., Redfield, J., & Nickel, D.G. (2003). Perseveration in Normal Aging: A Comparison of Perseveration Rates on Design Fluency and Verbal Generative Tasks. *Aging, Neuropsychology, and Cognition, 10 (4),* 268-280.

Frankel, T., & Penn, C. (2007). Perseveration and conversation in TBI: Response to pharmacological intervention. *Aphasiology, 21(11),* 1039-1078.

Freeman, T., & Gethesole, C.E., (1966). Cited in Ramage, A., Bayles. K., Helm-Estabrooks, N., & Cruz, R. (1999). Frequency of Perseveration in Normal subjects. *Brain and Language, 66,* 333-340.

Friedesci, A. (1995). The Time Course of Syntactic Activation during Language Processing. *Brain and Language, 50,* 259-281.

Gellin, A., Shindler., Caplan, L.R., & Hier, D.B. (1984). Intrusions and Perseverations. *Brain and Langauge, 23,* 148-158.

Goodglass, H. (1998). Stages of lexical retrieval. *Aphasiology, 12 (5),* 287-298.

Goodglass, H., Wingfield, A. (Eds.), (1997). *Anomia: Neuroanatomical and cognitive correlates*. USA: Academic Press.

Goswami, S. P. (2004). *Comprehension deficits in aphasia.* Unpublished doctoral thesis, University of Mysore, Mysore, India.

Gotts, S.J., & Plaut, D.C.(2004). Connectionist Approaches to Understanding Aphasia Perseveration. *Seminars in Speech and Language, 25(4),* 323-334.

Gotts, S.J., Rocchetta, A.I., & Cipolotti, L. (2002). Mechanisms underlying perseveration in aphasia: evidence from a single case study. *Neuropsychologia, 40 (12),* 1930-1947.

Harley, T.A. (1998). The semantic deficit in dementia: connectionist approach to what goes wrong in picture naming. *Aphasiology, 12 (4),* 299-318.

Helmick, J., & Berg, E. (1976). Perseveration in Brain- Injured Adults. *Journal of Communication Disorders, 9,* 571-582.

Helm-Estabrooks, N., Emery, P., & Albert, M. L. (1987). Treatment of Aphasic Perseveration (TAP) Program. A new approach to aphasia therapy. *Archives of Neurology, 44,* 1253–1255.

Helm-Estabrooks. N., Ramage. A., Bayles. K. A., & Cruz, R. (1998). Perseverative behaviour in fluent and non-fluent aphasic adults. *Aphasiology, 12, (8),* 689-698.

Henderson, L.W., Frank, E.M., Pigatt, T., Abramson, R.K., & Houston, M. (1998). Race, Gender, and Educational Level effects on Boston Naming Test Scores. *Aphasiology, 12 (10),* 901-911.

Hillis, A. E., & Caramazza, A. (1991). Mechanisms for accessing lexical representations for output: Evidence from a case with category-specific semantic deficit. *Brain and Language, 40,* 106-144.

Hirsh, K. W. (1998). Perseveration and activation in aphasic speech production. *Cognitive Neuropsychology, 15,* 377–388.

Holland, A.L. (1991). Langauge and aging. In Ripich, D. (Ed.), *Handbook of geriatric communication disorder*. Texas: Pro.ed.

Howard, D., Patterson, K., Franklin, S., Morton, J., & Orchard-Lisle, V. (1984). Variability and consistency in picture naming by aphasic persons. In F.C. Rose (Ed.), *Advances in Neurology: Progress in Aphasiology* (Vol. *42*, pp. 263-276). New York: Raven Press.

Hudson, A. J. (1969). Perseveration. *Brain, 91,* 571–582.

Judit, D., Jackie, M., Michael, K., Linda, C., Anita, R., & Gucharan, R. (2006). Is action naming better preserved (than object naming) in Alzheimer's disease and why should we ask? *Brain and Language, 98(3),* 332-340.

Kawashima, R., Hatano, G., Oizumi, K., Sugiura, M., Fukuda, H., Itoh, K.,Kato,T., Nakamura,A., Hatano, K., & Kojima, S. (2001). Different neural systems for recognizing plants, animals, and artifacts. *Brain Research Bulletin, 54 (3),* 313-317.

Kirshner, H., Webb, W. G., & Kelly, M. P. (1984). The naming disorder of dementia. *Neuropsychologia, 22,* 23-30.

Kohnert, K. (2008). *Language Disorders in Bilingual Children & Adults.* San Diego. C.A.: Phural Publishers.

Kohn, S.E., & Melvold, J. (2000). Effects of Morphological complexity on phonological output deficits in fluent & non fluent aphasia. *Brain and Language , 73,* 323-346.

Kolk, H. (1995). A time- fused approach to agrammatic production. *Brain and Langauge, 50,* 282-303.

Kremin, H. (1988). Naming and its disorders. In F. Boller & J. Grafman (Eds.), *Handbook of Neuropsychology* (pp. 307-328). Amsterdam: Elsevier Science.

Kremin, Deloche, Metz-Lutz, Hannequin, Dordain, Perrier et al. (1991). The effect of age, educational background and sex on confrontation naming in normals: Principles for testing naming ability. *Aphasiology, 5 (6),* 579-582.

Kridler, A., & Fradis, A., (1968). Cited in Lesser, B. (1989). *Linguistic investigations of aphasia*. Wiltstire: Antony Rowe Ltd.

Laatu, S., Revonsuo, A., Jäykkä, H., Portin, R., & Rinne,J.O.(2003). Visual object recognition in early Alzheimer's disease: deficits in semantic processing. *Acta Neurologica Scandinavica, 108 (2),* 82-89.

Lesser, R. & Perkins, L. (2001). *Cognitive Neuropsychology & Conversation Analysis in aphasia: an introductory casebook*. London: Whurr Pubishers.

Leichester, T., Sidman, M., Stoddart, L.T., & Mohr, J.P. (1971). Cited in H.W. Buckingham, H.W. Whitaker., and H.A. Whitaker. On linguistic perseveration. In H.W. Whitaker., & H. A. Whitaker. (1979). (Ed.) *Studies in Neurologuistics*. London: Academic Press.

Ludgren, K., Helm-Estabrooks, N., Magnusdottri, S., & Emery, P. (1994). Exploring mechanisms underlying recurrent perseveration: An aphasic naming study. *Brain and Langauge, 47,* 370- 373.

Lubinski, R.(Ed.). (1995). *Dementia and Communication.* San Diego, C.A.: Singular Publishers.

Luria, A.R.(1965). Cited in J. Sandson and M.L. Albert. (1984). Varieties of Perseveration. *Neuropsychologia, 22 (6),* 715-732.

Martin,N. (2007). Common mechanisms underlying perseverative and non-perseverative sound and word substitutions. *Aphasiology, 21(11),* 1002-1017.

Martin, N., & Dell, G.S. (2004). Perseverations and Anticipations in Aphasia: Primed Intrusions From the Past and Future. *Seminars in Speech and Language, 25(4),* 349-374.

Martin, N., Roach, A., Brecher, A., & Lowery, J. (1998). Lexical retrieval mechanisms underlying whole-word perseveration errors in anomic aphasia. *Aphasiology, 12 (4),* 319–333.

McNamara, P., & Albert, M.L. (2004). Neuropharmacology of Verbal Perseveration. *Seminars in Speech and Language, 25(4),* 309-321.

Milner, B. & Petrida, M. (1982). Cited in J. Sandson & M.L. Albert (1984). Varieties of Perseveration. *Neuropsychologia, 22 (6),* 715-732.

Morganstein, S., & Certner-Smith, M. (2001). Thematic language stimulation therapy. In R. Chapey (Ed.) *Language intervention strategies in aphasia and related language disorders* (pp. 383–396). Philadelphia: Lippincott, Williams & Wilkins.

Moses, M.S., Nickels, L.A., & Sheard, C. (2007). Chips, cheeks and carols: A review of recurrent perseveration in speech production. *Aphasiology*, 21(11), 960-974.

Moses, M.S., Nickels, L.A., & Sheard, C. (2004). "I'm sitting here feeling aphasic!" A study of recurrent perseverative error elicited in unimpaired speakers. *Brain and Language*, 89, 157-173.

Moses, M.S., Nickels, L.A., & Sheard, C. (2004). That Dreaded Word Perseveration! *Acquiring Knowledge in Speech, Language and Hearing*, *6*, 70-74.

Moses, M.S., Sheard, C., & Nickels, L.A. (2007). Insights into recurrent perseverative errors in aphasia: A case series approach. *Aphasiology, 21(11),* 975-1001.

Mukunthan, S. (2002). *Verbal Perseveration in Broca's Aphasics: A Study on Tamil Speakers.* Unpublished Master's Dissertation, University of Mysore.

Okada, T., Tanaka, S., Nakai, T., Nishizawa, S., Inui, T., Sadato, N., Yonekura, Y., & Konishi, J. (2000). Naming of animals and tools: a functional magnetic resonance imaging study of categorical differences in the human brain areas commonly used for naming visually presented objects. *Neuroscience Letters, 296 (1),* 33-36.

Papagno, C., Basso,A. (1996). Perseveration on two aphasic patients. *Cortex, 32,* 67-82.

Pekkala, S., Albert, M.L., Spiro, A., Erkinjuntti, T. (2008). Perseveration in Alzheimer's Disease. *Dementia and geriatric cognitive disorders, 25,* 109-114.

Pietro, M.J.S., Rigrodsky, S. (1986). Patterns of Oral-Verbal Perseveration in Adult Aphasics. *Brain and Language, 29,* 1-16.

Possin,K.L., Filoteo, J.W., Roesch, S.C., Zizak, V., Rilling, L.M., & Davis, J.D. (2005). Is a Perseveration a Perseveration? An Evaluation of Cognitive Error Types in Patients with Subcortical pathology. *Journal of Clinical Experimental Neuropsychology, 27,* 953-966.

Philip, J. E. (1992). *A Test of Aphasia in Malayalam.* Unpublished master's dissertation, University of Mysore, Mysore, India.

.

Ramage, A., Bayles, K., Helm-Estabrooks, N., & Cruz, R. (1999). Frequency of perseveration in normal subjects. *Brain and Langauge, 66,* 333-340.

Sandson, J. & Albert, M.L. (1984). Varieties of Perseveration. *Neuropsychologia, 22 (6),* 715-732.

Sandson, J., & Albert, M. L. (1987). Perseveration in behavioural neurology. *Neurology, 37,* 1736–1741.

Santo- Pietro, M.J. (1986). Patterns of Oral- Verbal Perseveration in Adult aphasics. *Brain and Langauge, 29,* 1-17.

Santo-Pietro, M. J., & Rigrodsky, S. (1982). The effects of temporal and semantic conditions on the occurrence of the error response of perseveration in adult aphasics. *Journal of Speech and Hearing Research, 25,* 184–192.

Santo- Pietro, M.J., & Rigrodsky, S., (1986). In J. Vilkki. (1989). Differential diagnosis in verbal retrieval to anterior posterior left hemisphere lesions. *Brain and Language, 36,* 543-554.

Sirigu, A., & Grafman, J. (1996). Selective Impairments within Episodic Memories. *Cortex, 32,* 83-95.

Schwartz, M. F., Saffran, E. M., Bloch, D. E., & Dell, G. (1994). Disordered speech production in aphasic and normal speakers. *Brain and Language, 47,* 52–88.

Shindler, A.G., Caplan, L.R., & Hier, D.B. (1984). Intrusions and Perseveration. *Brain and Langauage, 23,* 148-155.

Shindler, A., Hier, D., & Caplan, L. (1983). Cited in Troster, A.J., salmon, D.P., McCullough, D., & Butters, N. (1989). A comparison of category fluency deficits associated with Alzheimers and Huntington's Disease. *Brain and Language, 37,* 500-513.

Stark, J. (2007). A review of classical accounts of verbal perseveration and their modern-day relevance. *Aphasiology, 21(11),* 928-959.

Stark, J. (2007). Syntax detached from semantics: Qualitative analysis of examples of verbal perseveration from a transcortical sensory aphasic patient. *Aphasiology, 21(11),* 1114-1142.

Stark, J., Kristoferitsch, W., Graf, M. (2007). Verbal perseveration as the initial symptom in a case of Creutzfeldt- Jakob disease. *Aphasiology, 21(11),* 1079-1113.

Taylor, K.I., Brngges, P., Weniges, D., & Regard, M. (1999). Quantitative Hemispheric Differences in Semantic Category Matching. *Brain and Language, 70*, 119-131.

Thompson, S.B. (2006). *Dementia and Memory: A Handbook for Students and Professionals*. Hampshire, London: Ashgate Publishers.

Vilkki. J. (1989). Differential diagnosis in verbal retrieval to anterior posterior left hemisphere lesions. *Brain and Language, 36*, 543-554.

Vilkki, J. (1989). Perseveration in memory for figures after frontal lobe lesion. *Neuropsychologia, 27(8)*, 1101-1104.

Wallesch, C.W.(1990). Repetitive verbal behaviour: Functional and neurological considerations. *Aphasiology*, 4, 133- 154.

Warrington, E. K., & McCarthy, R. (1983). Category specific access dysphasia. *Brain, 106*, 859-878.

Watamori, T.S., Fukusako, Y., Monoi, H., & Sasanuma, S. (1991). Confrontation naming performance in dementia and aphasia. In T.E., Prescott (Ed.), Clinical Aphasiology (Vol. 20, (pp.221-221). U.S.A.: Pro-ed .

Wenk, G.L. (2003). Neuropathologic changes in Alzheimer's disease. *Journal of Clinical Psychiatry*, 64(9), 7–10.

Whitehouse, P., Caramazza, A., & Zurif, E. (1978). Naming in Aphasia: Interacting effects of form and function. *Brain and Language, 6*, 63-74.

Whitaker, H.A. (1979). *Studies in Neurolinguistics*. London: Academic Press.

Yamadori, A. (1981). Cited in J.Sandson amd M.L. Albert (1984). Varieties of Perseveration. *Neuropsychologia, 22 (6),* 715-732.

Yonelinas, A. P. (2002). The Nature of Recollection and Familiarity: A review of 30 Years of Research. *Journal of Memory and Language, 46*, 441-517.

APPENDIX I

GENERAL CONVERSATION

a. Egocentric Questions

1. dyµn¡¤U ¥ek§ FÇxY§?

   (Niŋəludɛ pɛ:rə ɛnda:nə?)

2. dyµ¬¯§ CË§ Fµ¤d ¥ZxË¡Ë¡?

   (Niŋəlkkə innə ɛŋənɛ to:nnunnu?)

3. dyµ¬ Fpy¤UjxY§ Zxisy¯¡ËZ§?

   (Niŋəl ɛvidɛja:nə taməsikkunnədə?)

4. dyµn¡¤U hxkõj¡¤U/hªÀxpy¤◊÷ ¥ek§ FÇxY§?

   (Niŋəludɛ b^{h}a:rjəjudɛ/b^{h}arttavintɛ pɛ:rə ɛnda:nə?)

5. dyµ¬ h±YI Koy¥¶x?

   (Niŋəl b^{h}akʃənəm kazhitʃo:?)

6. dyµ¬ C¥eðx¬ ¥Rxmy ¤PÐ¡Ë¡¥½x C¤mø¥jx?

   (Niŋəl ippo:l ʤo:li tʃɛjjunundo:?)

7. dyµ¬¯§ Pxjjx¥Yx Kxeðyjx¥Yx Crælʔ

   (Niŋəlkkə tʃa:jaja:no: ka:ppija:no: iʃtəm?)

8. dyµ¬¯§ FöZ pjsþ¡½§?

   (Niŋəlkkə ɛtra vajɛsundə?)

9. dyµ¬¯§ FöZ K¡¼yK¬ D½§?

(Niŋəlkkə ɛtra kuttigəl undə?)

10. dyµn¡¤U ¥Rxmy FÇxjyk¡Ë¡?

(Niŋəludɛ ʤo:li ɛnda:jirunnu?)

11. dyµn¡¤U py¥dxbµ¬ F¤ÇmøxI? bydPxkõµ¬ F¤ÇmøxI?

(Niŋəludɛ vino:dəŋəl ɛndɛlla:m? dinatʃarjəŋəl ɛndɛlla:m?)

12. dyµ¬¯§ ssõxtxkix¥Yx A¥Zx ixlsxtxkix¥Yx Cræl?

(Niŋəlkkə sasjaharəma:no: ado: ma:msaharəma:no: iʃtəm?)

13. dyµ¬¯§ öKy¯ll§ KxYxdx¥Yx f¡U§¥gx¬ KxYxdx¥Yx Cræl?

(Niŋəlkkə krikɛt ka:na:na:no: futbo:l ka:na:na:no: iʃtəm?)

14. dyµ¬¯§ sydyi KxYx© Cræix¥Yx?

(Niŋəlkkə sinima ka:na:n iʃtəma:no:?)

b. Environmental Questions

1. dyµ¬ C¥e©x¬ Fpy¤U BY§?

(Niŋəl ippo:l ɛvidɛ a:nə?)

2. dyµn¡¤U P¡l÷¡i¡× psë¡¯n¡¤U ¥ek§ elj¢?

(Niŋəludɛ tʃuttumulla vastugəludɛ pɛ:rə parəju?)

3. CË¤À KxmxpÓ Fµ¤dj¡½§?

(innətɛ ka:lavasta ɛŋɛnɛjundə?)

4. Cpy¤U dyË§ gs§ Ôx©ly¥m¯§ FöZ b¢ki¡½§?

(ividɛ ninnə bəs sta:ndilɛ:kkə ɛtra du:rəmundə?)

5. C¦ i¡lyjy¤m KZK§ Z¡lËx¥Yx A¥Zx AU»x¥Yx?

(i: murijilɛ katəkə turənna:no: ado: adəɳa:no:?)

6. CZ§ Hk¡ i¡lyjx¥Yx A¥Zx ¥tx¼mx¥Yx?

(idə oru murija:no: ado: ho:tɛla:no:?)

7. C¦ i¡lyjy« Hk¡ ¥fxY¡¥½x?

(i: murijil oru fo:nundo:?)

8. C¥eðx¬ RdxmK¬ Z¡lË§ KyU¯¡Kjx¥Yx A¥Zx AU»§ KyU¯¡Kjx¥Yx?

(ippo:l ʤɛna:lugəl turənnə kidəkkukəja:no: ado: adɛɳə kidəkkukəja:no:?)

9. dyµ¬ PÇjy« Fµ¤djxY§ ¥exK¡ËZ§?

(Niɲəl tʃandəjil ɛngɛnɛja:nə po:gunndə?)

10. Cpy¤U Gl÷p¡l AU¡À¡× e¼Yl GZxY§?

(ividɛ ɛ:ttəvum aduttulla pattənəm ɛ:da:nə?)

11. dyµ¬ GZ§ Rymøjymx Y§ Zxisy¯¡ËZ§?

(Niɲəl ɛ:də ʤilləjila:nə tamasikunntə?)

12. C¦ i¡lyjy¤m ¤¤ml÷¡K¬ KÀy¯yU¯¡Kjx¥Yx A¥Zx AY»¡ KyU¯¡Kjx¥Yx?

(i: murijilɛ laittugəl kattikidəkkukəjano: ado: anəɳukidəkkukəjano:?)

13. C¥eðx¬ io ¤ejë¡¤Kx½yky¯¡Kjx¥Yx?

(ippo:l mazha pɛidukondirikkukəja:no:?)

14. dyµ¬ K¥skjymx¥Yx Cky¯¡ËZ§?

(Niŋəl kasɛ:rəjila:no: irikkunnədə?)

c. Relational Questions

1. eol ¤ Zxmy ¤exny¯x¤ Z ZyË¡¥ix?

(pazhəm toli polikka:dɛ tinnumo:?)

2. e¶¯lyKn¡l KÀyj¡l ZÏym¡× gÊl FÇ§?

(patʃtʃəkarigəlum kattijum tammilulla bɛndhəm ɛndə?)

3. sûx ZöÇõbydl GZ¡ ixsixY§?

(sva:tandrijədinəm ɛ:du masəma:nə?)

4. ¥eeðl¡l ¥edj¡l ZÏym¡× gÊl FÇ§?

(pɛ:ppərum pɛ:nəjum tammilulla bɛndhəm ɛndə?)

5. ixª¶§ pk¡Ë Z§ R¢Yyd¡ i¡Ìx¥Yx?

(ma:rtʃ varunnədə ʤu:ninu mumba:no:?)

6. s¢kõ© Kyo¯x¥Yx A¥Zx eUy»xlx¥Yx Dby¯¡Ë Z§?

(su:rjən kizhəka:no: ado: padiŋa:ra:no: udikunndə?)

7. öKysë¡is§ WyslglymxY¥Yx A¥Zx ixª¶ymx¥Yx?

(kristumәs disəmbərila:no: ado: ma:rtʃila:no:?)

8. ¥eeðly« Zz KÀ¡¥ix?

(pɛ:ppəril ti: kattumo:?)

9. ¥exÔ§ Hxfzs¡l ÔxÌ¡l ZÏym¡× gÊl FÇ§?

(po:st o:fi:sum sta:mbum tammilulla bɛndəm ɛndə?)

10. K¡Uj¡l ioj¡l ZÏym¡× gÊl FÇ§?

(kudəjum mazhəjum tammilulla bɛndəm ɛndə?)

11. e¼yj¡l pzU¡l ZÏym¡× gÊl FÇ§?

(pattijum vi:dum tammilulla bɛndəm ɛndə?)

12. Zy´¬ pk¡ËZ§ g¡cd§ i¡Ìx¥Yx?

(tiŋgəl varunnədə bud^{h}ənə mumba:no:?)

13. e⁰sxkj§¯§ ic¡kix¥Yx e¡nyjx¥Yx?

(pantʃəsarəjkkə mad^{h}urəma:no: pulija:no:?)

14. K¡Zyk e¼y¥j¯x¬ pm¡Zx¥Yx?

(kudira pattijɛ:kka:l valuda:no:?)

APPENDIX II

CONFRONTATION NAMING

a. Picture Stimuli

1.	e¤l	(pazhəm)
2.	e¢¶	(pu:tʃa)
3.	K¡U	(kuda)
4.	KYê§	(kannə)
5.	KykzUl	(kiri:dam)
6.	sylt l	(simham)
7.	K¥sk	(kasɛ:ra)
8.	ikl	(marəm)
9.	e¼l	(pattəm)
10.	Bd	(a:na)

b. Objects

1. KYêxUy (kanna:di)
2. e¡së KI (pustəkəm)
3. Zx¥¯x« (ta:ko:l)
4. eÇ§ (pandə)
5. ¤i¡K¡Zyky (mɛzhugutiri)
6. BYy (a:ni)
7. KÀy (katti)
8. K¡Zyk (kudira)
9. Cm (ila)
10. i¡Çyky (mundiri)

APPENDIX III

PICTURE DESCRIPTION

Card 1

Card 2

Card 3

Card 4