Design fluency and Macro-linguistic aspects of narratives in elderly individual with and without MCI.

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CERTIFICATE

This is to certify that this dissertation entitled **"Design fluency and Macro-linguistic aspects of narratives in an elderly individual with and without MCI."** is a bonafide work submitted in part fulfillment for the degree of Master of Science (Speech-Language Pathology) of the student Registration No: 17SLP012. 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 diploma or degree.

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CERTIFICATE

This is to certify that this dissertation entitled **"Design fluency and Macro-linguistic aspects of narratives in an elderly individual with and without MCI."** has been prepared under my supervision and guidance. It is also certified that this dissertation has not been submitted earlier to any other university for the award of any diploma or degree.

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DECLARATION

This is to certify that this Master's dissertation entitled **"Design fluency and Macro-linguistic aspects of narratives in an elderly individual with and without MCI."** is the result of my own study under the guidance of Dr. Hema. N, Assistant Professor of Speech Sciences, Department of Speech-Language Sciences, All India Institute of Speech and Hearing, Mysuru and has not been submitted in any other University for the award of any Diploma or Degree.

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Dedicated to……

I dedicate this dissertation to my Almighty my strong pillar, my source of inspiration my **mummy and papa**. You have been the source of my strength throughout this programme. Actually your journey of education inspired me a lot. And you have encouraged me all the way and your encouragement has made sure that I give it all it takes to finish that which I have started.

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ABSTRACT

Individuals with MCI portray impairments in linguistics aspects which is subserved with decline in cognitive aspects. Many studies have been conducted to study the cognitive linguistic impairments, but the studies have failed to tap the subtle declines in linguistic abilities among individuals with MCI. Hence the present study aimed to study narrative discourse production and their executive function using verbal and design fluency task in individuals with MCI. It is assumed that decrease in complex narrative discourse production in MCI is reflected from decline in planning and cognitive flexibility components of executive function. Ten individuals with MCI and twenty one age matched elderly individuals without MCI participated in the present study. Participants were assessed for general cognition using MOCA, complex narrative discourse production ability and executive function abilities using (1) Verbal Fluency and (2) Design Fluency Tests of Delis – Kaplan Executive Functions Scale (D-KEFS- Delis et al., 2001). Performance on complex discourse production by MCI participants varied qualitatively from that of elderly individuals without MCI. Poor performance on discourse production was found to be clear reflection of decline in executive functions among MCI and this complex discourse production task coupled with executive function tasks (verbal and design fluency) can be an efficient tool in early detection of MCI. Since the clinical findings of the present study found an association between the complex narrative discourse production with the good executive functional scores. Hence results of present study aided in use of discourse production which require higher-order abilities such as planning, problem-solving, and cognitive flexibility as a tool for early detection of MCI.

Keywords: MCI, discourse, executive functions, verbal fluency, design fluency.

CHAPTER I

INTRODUCTION

1.1 Language and Cognition

Communication skills have immense importance in the history of mankind. In the modern society, there is enormous social pressure on communication skill at all stage of life. Cognitive abilities are important in recalling a linguistic code, acquiring and using the code, organizing and for other processing involved in speech and language components of human communication. Thus communication results from the interaction of cognition and language and the cognitive processes shape the use of language skills for communicative function. For example, Clark (1998) emphasizes the in several ways cognition support language like varying from listing items to reminders, memos, reminiscent, memorizing instructions, to the performance of complex amnesic calculation on the piece of paper and narrating a past event, etc. Therefore, language and cognition could be interlinked with each other. Jones and Peters (1999) have affirmed language to be an integral part of the cognitive processes.

Language is at the heart of daily communication. Problem solving and memory are nothing but the cognitive skills are highly confined to language and it cannot function adequately in its absence. While cognition and language are discussed as a distinct process, the reality is that language is one component of cognition, and what we know about cognitive aging often comes from studies of language. Like cognition, language is incredibly complex and undergoes many changes across the lifespan. Some of these changes are predictably related to aging processes; others are the result of the unique characteristics of the individuals, including intelligence and its

component cognitive skills, education, physical health, personality, and life experience and current circumstances.

Cognition and language undergo changes throughout life time. This process begins at birth and continues all through life. The decline in the ability to process, understand and use language abilities like vocabulary and discourse. Some cognitive changes can have an impact on linguistic abilities like word retrieval process, decline in complex discourse processes, diminution in language performance in term of use of semantic information, structures, errors of reference, etc. are associated with normal aging. The effect of these cognitive abilities showing declines on the linguistic performance has been minimally probed.

In cognition, several age-related changes occur like enhanced wisdom, broader life experience, greater cultural understanding, and creativity. However most normally aging individuals also show few cognitive functions being declined and the noted ones are like memory, the efficiency of information processing and sensory processing. These primary aging factors are usually subtle and do not generally affect the person's ability to engage in activities of daily routines. Unfortunately, as person age, they are also more likely to experience secondary disorders of cognition. Some develop progressive brain disease known as dementia which gradually degrades cognitive functioning. Secondary problems to communication are like attention, distrusted memory, mental processing speed, and executive functioning.

Further, it is difficult to separate the changes in the cognitive process from the changes in linguistic processes. Research is affirmed that aging may be associated with deterioration in cognitive and linguistic skills (Schaie & Hertzog, 1983). This cognitive decline occurs in a linear fashion and/or this may not be the case according to the majority of the natural history. For

example, individuals could show a pattern like the stage of stable and static performance which is followed by increased decline followed by stable and static performance, and the cognitive trajectories may differ from one cognitive domain to the other. The contributing factors could be the episodic memory (Solman & Bondi, 2009), compensatory mechanism becoming compromised (Clemente & Bellivelli, 2010), Plateau model for episodic short term/working memory (Bäckman, Small & Fratiglion, 2001) but not for other cognitive domain. It is important to distinguish MCI as a function of future decline to Dementia. And it is also informative to describe what happens in patients that do not progress to dementia (Geriatrics with normal aging).

Studies relied on overall or specific cognition measures showing a decline and there is also an instance with the non-memory deficits (Ex: Executive Functions and Language) emerging in geriatrics-MCI-dementia continuum. It is important to assess non-memory domains as the occurrence of dementia as an occurrence of executive deficits. (Belleville, Gauthier, Lepage, Kergoat & Gilbert, 2014). Thus, research in cognitive aging and related behavioral symptoms of language attrition is becoming an area of growing concern.

1.2 Discourse and Dementia

There are different types of discourse aspects based on the goals or functions served by the language. Discourse types include a narrative (stories), procedural (instructions), expository (informing) and conversation (social interaction). Older adults typically understand and use narratives (stories) better than expository (e.g., instructions, medical information) discourse. They also retain basic pragmatic conversational skills well into old age. They do well when asked about the basic themes or moral of the story, which is referred to as *macrostructure.* They

are more likely than younger adults to be creative in interpreting narrative, although they are also more likely to interpret stories in the context of their own life experiences (Adams, Smith, Nyquist, & Perlmutter, 1997). The syntactic complexity used in spoken and written discourse declines in later years and is tied closely to working memory and education. Syntactic complexity in written discourse actually differentiates low- and high- ability adults, as well as normal elderly from those with mild cognitive impairment (Fleming & Harris, 2008; Mitzner & Kemper, 2003). Reduced complexity may be a strategy used to preserve the quality of communication. When older adults use less complexity, their narratives are often judged to be clearer and more interesting than those of younger adults (Kemper, 2006). Older adults also experience declines in semantic performance for discourse tasks. The decline can be explained by underlying word retrieval difficulties functions (Fleming, 2009).

In general, the language of normally aging adults is less fluent than that of younger adults. The most common disfluencies are interjections, followed by revisions and repetitions. These breaks in fluency (verbal fragmentation) are interpreted as uncertainty behaviors, probably related to word retrieval problems or to cognitive organizational demands (Schiller, Ferreira, & Alario, 2007).

With reference to discourse, individuals with dementia show difficulty in topic maintenance when compared to neurotypical healthy individuals. The difficulty in discourse depends on the type, severity, course and the stage of dementia. Their discourse can be characterized as empty phrases in the early stages of Alzheimer's disease (Dijkstra, Bourgeois, Petrie, Burgio, & Allen-Burge, 2002). This impairment indicates cognitive status/functioning

which is also knows as semantic memory deficits in dementia (Orange & Purves, 1996) and reductions in working memory capacity (Waters, Caplan, & Rochon, 1995).

It is also reported that, in various disorders like Alzheimer's disease or non-stroke related dementia, the performance of discourse such as conversation plays an important role in the performance of their linguistic abilities. The analysis of their discourse abilities involves specific procedures where it identifies the cognitive and linguistic processes and its association which would be studying at a different level of discourse genres (Cherney, 1998). The existing discourse impairment interferes with the communicative purpose of conversation and will make it harder for the communicative partners. For example, it is characterized by aborted phases, empty phrases, repetitions, revisions, disruptive topic shifts, and indefinite words. In addition, the poor coherence and cohesion is the building feature which is also being affected (Dijkstra et al., 2002).

1.3 Mild Cognitive Impairment

Normal age-associated cognitive decline is often very difficult to distinguish from the initial stages of dementia; however, it is important to identify this subtle form of secondary cognitive aging as early as possible. Mild Cognitive Impairment (MCI) is a diagnostic category for those individuals whose cognitive difficulties appear more serious enough for a diagnosis of dementia. It is a boundary category that does not differentiate between primary and secondary aging. Many individuals who are categorized as having MCI are experiencing a normal, age-related decline, or are normally aging individuals who have performed a lower level on cognitive tests throughout their lifespan. However, some persons with MCI are in the early stage of care

and elderly individuals should monitor those classified with MCI for the cognitive or behavioral decline.

To be categorized as having MCI, individuals must present with normal general cognitive function, normal activities of daily living and no diagnosis of dementia, while demonstrating abnormal difficulty in at least one cognitive domain: memory, attention, language, executive function, or visuospatial ability (Peterson et al., 2001). MCI may also be diagnosed if a person has impairment in two cognitive domains but continues to function well in daily life.

In general, MCI has been described as a transitional diagnostic condition between normal cognitive aging and dementia according to Holsinger, Deveau, Boustani, and Williams (2007). As mentioned earlier, MCI appears to be at an increased risk of developing Alzheimer's disease, they experience memory loss that is significantly diverse from normal aging individuals. Additionally, these individuals do not fall into the criteria of dementia specifically due to their usually preserved overall cognitive functions and Activities of Daily living (ALDs). But, studies report of episodic memory deficits as a preclinical sign anywhere between 3 to 8 years earlier to a formal diagnosis of AD. Therefore, early detection of cognitive- linguistic changes may aid in faster recognition of Mild Cognitive Impairment or Alzheimer's Disease (Fleming & Harris, 2008; Harris et al., 2008). Presently, the accepted criteria include the following: (a) reported change in cognition (preferably corroborated by an informant), (b) one or more impaired cognitive domains for age and education, (c) not normal, not demented (i.e., does not meet criteria for dementia syndrome according to *Diagnostic and Statistical Manual of Mental Disorders* [4th ed.; *DSM-IV*, American Psychiatric Association, 1994], ICD 10, and (d) intact activities of daily living (Albert et al., 2011).

Thus, According to Chapman et al., 2002, MCI and Aging differentiation are difficult because In both conditions we can expect a decline in executive function, speed of processing, sensory acuity. Aside from this, early identification of MCI can increase the delay in the progression of symptoms. Modrego (2006) given a measurement of sensitivity and specificity on the basis on cognitive measures which is ranging from 76%-97% and 64%- 89% respectively. Along with these measures of memory has importance to distinguish normal aging and MCI (Collie & Marruff, 2000). According to de Jager, Hogervorst, Combrinck, & Budge, 2003 few tests which are widely used Mini-Mental Status Examination (MMSE) and Mattis Dementia Rating Scale- 2 (DRS- 2) shows some ceiling effect thus it makes difficult to differentiate MCI and normal aging. Hence, the development of indicator which is sensitive, reliable which differentiates MCI and normal aging takes on pressing social, clinical, and scientific significance.

Therefore, speech-language pathologist faces a major challenge in the assessment of individuals with cognitive-communication disorders. Usually, it is heterogeneous group individuals with complex constellations of strengths and limitations, and their formal inclusion in our scope of practice is relatively recent. The most commonly assessed cognitive communication measures in major standardized tests include orientation/ attention, command comprehension, linguistic organization, discourse (narrative, conversation and picture description), reading comprehension, naming, memory, verbal fluency, constructional ability (drawing), also known to be visuospatial processing and executive skills (reasoning and judgment).

Among these cognitive communicative measures, the discourse production and comprehension tasks are essential to the diagnostic repertoire of clinical speech-language

pathologists precisely, because discourse behaviors provide a rich corpus for a wide variety of cognitive-linguistic analyses. These cognitive – linguistic aspects include planning the utterance, sequencing words, knowledge of linguistic rules of his/ her language, application of these rules, a memory of past and present events, analyzing the spoken utterance, thinking, reasoning, problem- solving and comprehending others speech, etc. The inevitable link to social purpose is the use of language and discourse and is referred to as "language in use" according to Goffman (1981). The discourse production in general activates and highlights the interrelatedness of multiple cognitive processes, and various discourse genres like conversation, narration and picture description that seem to require different cognitive processes and varied degrees of cognitive effort (Coelho, Liles, & Duffy, 1991; Harris, Rogers, & Qualls, 1998; Hartly & Jensen 1991; Ultowska Allard, & Chapman, 1990). Thus, an elicited discourse sample seems especially well suited for taxing and assessing the cognitive-communicative abilities of individuals with aphasia, dementia, and MCI.

CHAPTER II

REVIEW OF LITERATURE

In recent years special attention is given to the cognitive spectrum of normal aging to Alzheimer's disease (AD). And this transitional period between normal aging and very early AD is termed as mild cognitive impairment (MCI), isolated memory, incipient dementia, dementia syndrome (Petersen RC.,1985–92.).

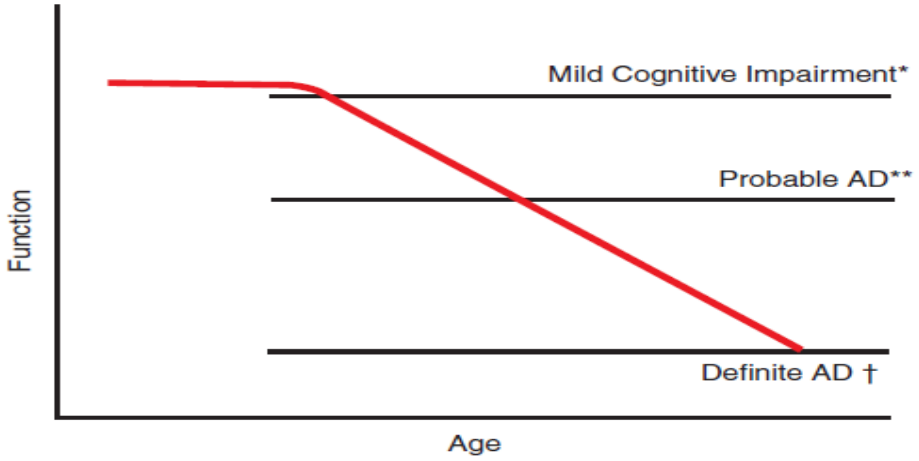

Figure 2.1 Hypothetical changes in function as an individual Develops Alzheimer's disease.

In Figure 1, there is a change in function as an individual develops Alzheimer's disease. Cognitive decline is present in the individuals who are definitely going to develop AD. Presently the criteria to diagnose AD is the massive cognitive decline. The awareness of MCI has come up with where we can identify these people at an earlier point whenever there is cognitive decline so appropriate intervention can be involved. This diagram shows MCI intervene between normal aging and very early dementia. The distinction could be challenging between normal aging and

MCI can be a quite subtle and specific transition between MCI and early dementia. The measures considered to identify this transition would be the neuropsychological testing, neuroimaging or biomarkers. National Institute of mental health (NIMH) has given a term, age-associated memory impairment (AAMI) where it describes changes in aging with the manifestation of normal cognition (Crook T, 1986). The most recent term is 'age-associated cognitive decline'(AACD) given by International Psycho Geriatric Association (Levy R.,1994), they refer to multiple cognitive domains presumed to decline in normal aging. In literature, there are several terms which describe a transitional stage between normal aging and dementia. MCI has accepted as pathological condition i.e, not a phenomenon of normal aging, and has received attention as a clinically useful entity. And many studies say it appears as an increased risk of dementia (Petersen RC, 2003).

2.1 Discourse analysis in MCI

Efficiently formulating an execution of the plan is the central part of everyday life. Discourse is produced according to the unique communication requirements in numerous domains of social life (Fergadiotis et al., 2011). The cognitive communicative measures in terms of the task of discourse comprehension and production are essential to the diagnostic repertoire of clinical speech-language pathologist precisely because it provides a rich corpus for a wide variety of cognitive linguistic analysis. These cognitive – linguistic aspects include planning the utterance, sequencing words, knowledge of linguistic rules of his/ her language, application of these rules, the memory of past and present events, analyzing the spoken utterance, thinking, reasoning, problem-solving and comprehending others speech, etc. The inevitable link to social purpose is the use of language and discourse and is referred to as "language in use" according to

Goffman (1981). The discourse production in general activates and highlights the interrelatedness of multiple cognitive processes, and various discourse genres like conversation, narration and picture description that seem to require different cognitive processes and varied degrees of cognitive effort (Coelho, Liles, & Duffy, 1991; Harris, Rogers, & Qualls, 1998; Hartly & Jensen 1991; Ultowska Allard, & Chapman, 1990).

The most commonly studied discourse parameter is coherence and cohesion. Effect of coherence is sustained by theme and express it through the cohesive device. These devices are nothing but the coreference and anaphora which serve to provide the effect of meaning. Which act like a 'glue' which bind the elements together to achieve overall impression. This device also provides an interpretation of linguistic elements, such as a pronoun, depends on or presuppose another linguistic element. Mentis and Prutting (1987) explained the most common types of cohesive devices as referential and lexical types of cohesion. Impaired discourse production can be associated with age-related factors and the decline in discourse abilities were reported in various levels of processing. In order to determine the effect of age on discourse two interacting levels of text processing can be analyzed such as microlinguistic level and macrolinguistic level. In addition to this, the assessment of the informativeness of the text would provide further information on lexical and conceptual ability (Marini *et al*., 2005).

Micro-linguistic processes govern the formation of morphological strings through the organization of phonological or graphical patterns and determine the context at the level of syntax for the generation of well-formed sentences. Macro-linguistic processes underline the formation of local and global coherence between the utterance in order to make a meaningful proposition (Kintsch, 1994).

Furthermore, the proper realization of themes and gist of the story are important to make a well-connected discourse at the level of macro-propositions. Kintsch and van Dijk (1978), they ask listeners and speakers to produce coherent discourse, the macro-propositions production rule was applied under structural level in the form of a schema. These schemata was an abstract mental construction which organizes information and studies the relationship between elements which make though repeated exposure of experience (Brown & Craik, 2000). The analyses of the macrostructural characteristics were carried out by the assessment of the informative contents in an individual's discourse, such as the number of coherent propositions uttered in a discourse formed with a well-connected meaning from one sentence to the next (local coherence). And for the analysis of the global coherence, the number of empty emissions, the total ideas density feature, and the latent semantic analysis features were probed. The present study is planned to assess these abilities in individuals with MCI and geriatric population.

The individuals with MCI exhibit primary language difficulties at pragmatic and semantic levels of processing (Barbeau, 2012). In this early stage of MCI, discourse analysis is the sensitive means to identify these language deficits (Lewis, 2016). Since the discourse of individuals with MCI is described as the presence of non-meaningful enormous infinite points and phrases, their discourse is disorganized and empty. This type of discourse analysis comes under the category of micro-linguistic level and the other category is called the macro-linguistic level. The well-rounded theory of Kintsch and van Dijk (1978) discourse of individuals with Alzheimer's disease supported the analysis model of micro-structure and macro-structure study. Therefore, it is important to identify the language traits in the preclinical stages like in MCI and geriatrics.

Apart from the level of discourse analysis, the specific discourse genre is the conversational discourse. At this conversational discourse level, the elderly population show some significant decline in terms of decreased efficiency increased ambiguity, increased the degree of topic maintenance, decreased cohesion, decreased rate, increased number of words per clause (Gracia & Orange, 1996). At the sentence level, there is some impairment if the sentence becomes syntactically more complex and longer. At the discourse level, the complexity of the material plays a major role. It has been widely agreed that the impairment in discourse comprehension is mainly due to a decline in the working memory (Ska & Joanette, 1997). Discourse analysis provides a rich corpus for the study of language and communicative effectiveness in MCI.

The group of authors like Harris, Kiran, Marquardt, and Fleming (2008) has found that thematic analysis of discourse as well as proportions of linguistic markers such as pronouns and modifiers differentiated participants with MCI from normal controls. Hence, discourse analysis potentially provides an ideal opportunity for early diagnosis of dementia as well as MCI, which is a known risk factor for AD (Levey, Lah, Goldstein, Steenland, & Bliwise, 2006).

Discourse holds great promise as a potential functional medium for early assessment and intervention, as it provides powerful information about people's abilities to engage in everyday interactions. Effect of discourse type on the efficiency and effectiveness of expressive communication in individuals with MCI and early dementia; and to determine whether any discourse characteristics are predictive of cognitive performance. Seven adults (3 females; 4 males; age range: 59-79) representing several dementia diagnoses as well as MCI were administered six discourse tasks: a personal narrative, an advice question, single-paneled, and

multiple-paneled picture descriptions, a story retell, and a procedural discourse task. Hypotheses were formulated based on a presumed hierarchy of cognitive difficulty for the six discourse tasks. The discourse was analyzed for the occurrence of discourse-enhancing and discourse-impairing characteristics. Discourse-enhancing characteristics included the mean length of utterance, verbal facility, the occurrence of modifiers, vocabulary diversity, and type-token ratio. Discourse-impairing characteristics included the occurrence of pronouns, repetitions, revisions, and incomplete utterances (Jenni, 2012).

2.2 Cognitive processes in MCI

It is reported that individual with MCI exhibits impairment in instrumental activities of daily living and these changes are observed when their cognitive deficits are greater than the expected decline for an individual's age and educational background (Petersen et al., 2001). Distinguishing MCI from healthy normal cognition in aging is challenging. MCI is a psycho-geriatric disorder affecting between 3% and 19% of individuals over age 65 (Gauthier et al. 2006). Individuals with MCI undergoes a gradual decline in cognitive-linguistic abilities.

There is evidence in the literature which states that there is deterioration in sustained and selective attention (Hochandel & Kaplan, 1984), Episodic memory (Light, 1991; Nilsson, 2003), attention (Pessoa et al., 2002) cited by Jones & Peters), problem solving (Denney, Pearce, & Palmer, 1982) and language (Riegel, 1968; Cohen, 1979& Light,1990) abilities in Alzheimer's Disease (AD). In AD episodic memory is supposed to be first and severely affected cognitive domain (Backman, Jones, Berger, Laukka, & Small, 2005). Where episodic memory is defined as the ability to recall explicit past events or experiences. In Dementia, episodic memory deficits

are a key indicator of the prodromal stage where the symptoms of Dementia may not be very specific or severe, specifically for amnestic MCI and they show changes in hippocampal and entorhinal cortices known as early neuropathological changes. (de Jager & Budge, 2005; Ganguli, Dodge, Shen, & DeKosky, 2004; Kave & Heinik, 2004; Marruff et al., 2004).

Few recent studies have suggested that at a rate of approximately 10% to 15% per year individuals with amnestic MCI tend to progress to probable Alzheimer's disease. But the fact is MCI individuals can remain stable or restore its normal status over time but around 50% of individuals can develop Dementia over a 5-year period (Gauthier, 2016). Therefore linguistic deficits in MCI have been an objective in the scrutiny of the literature; hence there is a need to analyze their discourse ability. Discourse is identified as essential and fundamental constitute in assessments of language in which assessment should be considered for the detection of language disorders in dementias, as well as in the follow-up for these individuals.

According to Andrea et al (2005) in the Italian context, age-related changes of macro-linguistic in narration task was studied by using narration in 69 adults and five age groups those are 20-24, 25-39, 40-29, 60-74, 75-84. In the material section, two cartoon sequences and picture stimulus were taken. To investigate age-related differences in discourse sample, Macro, as well as the micro aspect of linguistics, was assessed. Macro-linguistic processes found locally the conjunction between sentences, phrases and all over the connections between all the propositions consisting of in the message by means of cohesive and coherent ties. (Kintsch, 1994; Kintsch & van Dijk, 1978; van Dijk & Kintsch,1983). Semantic paraphasias, paragrammatism, syntactic complexity, degree of both local and global coherence, local coherence errors (like ambiguous citing) and some null effects of age, in the oldest group sharp drop in execution, were seen. In

order to assess the number of details vs. main themes, in terms of description construction ability were seen better in the (40–59) middle-aged and (60–74) young elderly groups than the younger or the oldest group. And even Single Picture and picture sequence these types of story type had a significant influence on some macro-linguistic part.

2.3 Executive Functions in MCI

Executive function it's not just a cognitive process but also a clinical measure for the frontal cortex behavior. So this executive function and its anatomical correlation have well understood in the broad-brain system. The frontal lobe has functions like arrangement of attention and the knowledge acquiring to the behavioral control system, which is also controlled the impact of reducing brain activities in dementia and the normal aging conditions. The frontal lobe is also responsible for some functions like social processing inhibitory control and working memory (Fuster, 2002; Pellis et al., 2006; Robbins, 2000). Many recent studies documenting the same. Even prefrontal cortex shows an important role in an executive function where executive function requires more integrity of the whole brain (Anderson, Jacobs, & Harvey, 2005; Grady, McIntosh, & Craik, 2005; Jacobs & Anderson, 2002).

The emergence of the executive function, it has parallel maturation sequences in the age spectrum. We can see more disturbing activation pattern of the brain when it gets older through imaging study (Grady et al., 2005; Wood et al., 2004).

So this executive function reflects human functioning such as thought, self-control, social interaction and intellect (David, 1992). Luria, 1973 says an executive function is not only responsible for the external stimuli synthesis but also responsible for action and formation of programs, and also important for verification of action. According to Lezak (1982), executive processes act as mental capacities for formulating goals. And it is also an act of planning for execution effectively. Also says its constructive, creative activities. In same Welsh and Penningoton (1998) has defined executive function- "the ability to maintain an appropriate problem-solving set for the attainment of a future goal,".

Executive function also characterized by “cool” and “hot” executive process. Where cool is referred to as purely cognitive and tapped during abstract and decontextualized problems. Whereas the hot executive process refers to affective aspects of executive functioning and is required when a situation is meaningful and involves the regulation of affect and motivation. And executive function also characterized by “conductor” which organizes, controls directs emotional responses, behavior and cognitive activity (Gioia. Isquith, & Guy, 2001). Few key elements of the executive functions are a) working memory; b) anticipation and deployment of attention; c) planning ability and organization; d) initiation of activity; e)selection of efficient problem-solving strategies f) mental flexibility and utilization of feedback, and g) impulse control and self-regulation.

Executive dysfunction is impaired executive functioning. Which includes the inability to sustain attention, disinhibition, impulsivity, reduced working memory. Difficulties in implementing or generating strategies, regulating or monitoring performance, disorganization, inability to plan actions, poor reasoning ability, perseverative behavior, difficulties generating

and/or implementing strategies, a resistance to change activities. And also difficulties in shifting between conflicting demands and a failure to learn from mistakes is also listed as a feature of executive dysfunctions. And this executive dysfunction is associated with initiative moral, maladaptive effect, energy level, and social behavior, (Anden, Bechara, Damasio, Tranel, & Damasio, 1999). De Luca et al., 2003 has reported a pronounced decline in the executive function of 50-64-year-old adults. Forgetting, inability to retrieve or access the information were seen in age after 65.

In normal aging slight cognitive deterioration is seen like reduction in 1anguage complexity, slowed performance of complex tasks, increased time to grasp new activities and forgetfulness in noncritical areas (Storanctt, Grant. Miller, & Morris, 2006). Due to the degenerative brain, these changes are obvious after the age of 80. Anatomically many changes are seen like brain weight dropping by 10% at the age 90 (Brickman et aI., 2006), preferential white matter loss in the prefrontal regions (Salat et al., 2005), loss of neurons or reduction in synaptic connectivity. Other changes like the appearance of senile plaques, neurofibrillary tangles (Braak & Braak, 1997), deposition of lipofuscin pigment in nerve cells, decrease in cerebral blood flow (de Leon, 2001) and reduction in certain neurotransmitters. These are considered in normal aging. In other hand in pathological condition like frontotemporal dementia, Parkinson's disease and Alzheimer's disease acceleration in some of these processes with a propensity to target certain areas such as the frontal and temporal lobes in Alzheimer's disease and the dopaminergic system in Parkinson's disease.

Findings from the literature on cognitive decline raise an important issue: whether all areas of the brain are affected equally, or if specific areas such as the Pre Frontal Cortex are in

fact more vulnerable to age-related processes. Salthouse (2000) provides the main impetus for the 'global-speed hypothesis,' which contests that most age-related discrepancy in task performance can be accounted for by a general decline in processing speed. He has recently adjusted the focus of this argument to suggest that while the decline in the elderly is due to a common variable, the nature of this remains questionable (Salthouse, 2002), and may actually represent a change in information processing capacity rather than simply slowed performance speed (Salthouse, 2001).

In general, tools available to assess cognitive-communicative abilities are "Mini-Mental Health Examination" (MMHE) (Folstien,Folstien & McHugh, 1975), Measure of cognitive Linguistic abilities (MCLA) (Ellmo, Graser, Krehnavek, Hauck & Calabres, 1995), Scale of cognitive ability for Traumatic Brain Injury (SCATBI) (Admovich & Henderson, 1992), Montreal Cognitive Assessment (MoCA) (Nasreddine, Philips et al,.), Addenbrookes cognitive Examination Revised (ACR-R) (Miloshi, Dawson, Mitchell, Arnold & Hodges, 2006) among others. Instruments for general cognitive abilities are Mini-mental State Examination (MMSE; Folstein, Folstein & McHugh, 1975) with age range 18-85 years which measures Orientation, attention, calculation, immediate memory, delayed memory, visuospatial construction. Modified Mini-mental scale examination (3MS; Jones et al, 2002) with age range 60-84 years assess Orientation, attention, calculation, immediate memory, delayed memory, visuospatial construction, object relations. Cognitive linguistic Quick test (CLQT; Helm-Estabrooks, 2001) with age range 18-89 will assess Orientation, Attention, verbal memory, visual memory, naming, auditory comprehension, and executive functions. These tests are standardized to assess specific cognitive-communicative problems in the patient with traumatic brain injury or dementia, and

tap out one or few cognitive-linguistic domains, or test the global linguistic domain. Their norms are also restricted to the western population.

Executive functioning is a potential mediator in any type of population including geriatric. EF shows definite compose and aging effects on cognitive functioning and seem to show declined when EF' measure is statistically controlled. This issue was studied by including 261 adults between 18 and 84 years population by Timothy (2003). Aging effects on many cognitive abilities were remarkably declined even after statistical control of the variance in measures. Speculate to shows executive functioning, the existence of definite constructs corresponding to executive functioning or to aspects of executive control concerned with inhibition, updating, or time sharing it shows only one weak proof.

In the Indian context, very few studies have been done to explore the language abilities in the elderly (Nidhi, 1996). Kamath (2001) developed a "Cognitive-Linguistic assessment protocol for adults"(CLAP) in Kannada. It measures enormous cognitive processes under four areas a), discrimination, attention, and perception; b) organization; c) problem solving; d) memory on normal young elderly subjects in the age range of 40-70 years. All the domains are divided into various test items. The result indicated no statistical difference but there were slight changes in each sub-test across each age group. Later it has been adopted in Malayalam (Lakshmi, 2010) and Telegu (Veena, 2010). The Cognitive Linguistic Assessment Protocol For Children (CLAP-C) is developed by Anuroopa (2006). There is no test to assess specifically the executive function in older age group and population with the cognitive-communicative disorder.

2.3.1 Design fluency

Apart from this list of executive functions, Delis, Kaplan and Kramer (2001) used Delis-Kaplan Executive Function system (D-KEFS) for the age range 8-89 years which measured Verbal and nonverbal fluency, inhibition, mental flexibility, problem-solving, categorical processing, deductive, reasoning, planning, rule use, metaphors as part of executive function. Thus, there is a list of tasks/skills assessed under the category of executive functions with reference to a different set of authors. Along with tests of verbal fluency, D-KEFS are one of the most commonly used measures of "frontal lobe functioning" employed in neuropsychological research (Anderson, 1998). The Design Fluency Test (DFT) is the nonverbal fluency test which is designed to tap the performance of anterior right cerebral hemisphere is equivalent to verbal fluency task. (Jones-Gotman & Milner, 1977). A study by Jones-Gotman and Milner (1977) showed that participants with right frontal and right fronto-central lesions demonstrated impaired execution compared to the healthy population. There are many studies which have demonstrated that performance on the D-KEFS declines in older adulthood.

Thus although there is substantial evidence of an age-related decline in D-KEFS performance, it remains unclear whether this is attributable to executive impairment (Rhodes. 2004). Indeed. It has been argued that age changes in D-KEFS performance might instead reflect declines in working memory (Hartman. Bohon, & Fehnel, 2001) or processing speed (Fristoe et al.. 1997). which is sensitive- too many types of cognitive impairment, but it does not provide information as to the processes that under1ie an observed deficit for a given individual.

Studies showed a decline in DFT performance with age (Axelrod, 1989; Mittenberg, Seidenberg, O'Leary, & DiGiulio, 1989). The broad research in DFT sub served as a potential

and useful clinical tool to assess the executive function (Jones-Gotman and Milner's (1977). DFT is a sensitive test to measure functions which are associated with right frontal lobe lesions, which often confound neuropsychological tests (cf., Ruff, Light, & Evans, 1987; Stuss & Benson, 1984). Qualitative aspects of design production allow reliable scoring by perseverative responses of DFT. Definite instructions were chosen and developed for scoring for analysis those are (a) number of naive abstract designs, (b) complexity, (c) "variations on a theme," (d) drawing quality, (e) perseverative responses, (f) concrete responses, and (g) random, scribbled responses. The DFT was administered to a college sample and to a diverse clinical sample referred for neuropsychological assessment. Here is an attempt to use the same method to assess the executive functions of individuals with MCI and elderly population.

Involvement of frontal cortex has been reported for the verbal fluency task (which is the ability to produce items from categories), whereas the functions of right hemisphere or right frontal cortex have been attributed for nonverbal fluency task that is DFT. Juliana et al (2000) studied the verbal and nonverbal fluency on a single group of patients with focal, frontal lobe lesion and age and education-matched controls. In verbal fluency tasks subjects has to generate items belonging to letter cues those are *F, A,* and *S* and category cues those are animals and boys names. And in the nonverbal fluency, DFT task was included where subjects have to generate novel designs by joining filled unfilled and switching join dots. Patients with frontal lobe lesions performed poorer than control participants on both verbal and design fluency tasks. Patients with Right frontal lesion were better than left frontal lesion group, but these two groups performed comparatively better in design fluency task. Patients and control group performed better in switching task conditions. The study demonstrated the influence of left frontal cortex on verbal fluency task and both right and left frontal cortex on design fluency task.

2.3.2 Verbal fluency

Verbal fluency test is the measure of the executive function which provides a good index of frontal lobe function. These measures are time bounded where individuals have to produce multiple alternatives under constrained conditions, which involve retrieval of the words. Like if it is phonemic criteria then the task will be phonemic or initial letter fluency for ex. Words beginning with a certain phoneme or semantic fluency or under certain semantic criteria. Other tasks could be switching like vehicles and flowers switching task for ex.vehicles and flowers switching.

Mayake et al, 2000 reported, shifting attention between different task are consider as an element of executive functioning. Many task demands influence the magnitude of age effects in switching. As shifting attention task level increases, working memory demand load also increases and older adults perform poorly. Global switch cost indicates that older people may have difficulty in maintaining multiple actions. This is how it implies in the daily situations where, in complex setting attention focus required. So far only a little evidence available to evaluate in daily situations where task switching is important.

For example, Stuss et a1., (1998) reported that pathology in left dorsolateral, and left or right medial frontal regions results in impaired aspects of verbal fluency performance along with other regions in the parietal lobes and left striatum. In contrast, pathology in the right dorsolateral frontal cortical or the medial inferior lobe of either hemisphere was not associated with impaired phonemic fluency. Converging results from functional imaging paradigms show activation within the left prefrontal cortex, and most commonly the left medial frontal gyrus in letter fluency (Wood, Saling, Abbott. & Jackson. 2001).

Henry and Crawford 2004, validate fluency task which are indicators of frontal lobe dysfunction, where they have done metanalytic integration of the research. They have found that deficits on the measure of semantic and phonemic fluency. Compared with a frontal, temporal lesion which was associated with smaller deficits in phonemic fluency, but a comparatively larger deficit in semantic fluency. Thus, if it could be demonstrated that aging is associated with comparable deficits across tests of phonemic and semantic fluency this would be consistent with the pattern associated with frontal dysfunction.

However, the existing literature that has investigated age effects on fluency is inconsistent. A number of researchers have documented age deficits in fluency (Capitani, Laiacona, & Barbarotto, 1999: Kempler, Teng, Dick, Taussig, & Davis, 1998; Parkin & Lawrence, 1994; Phillips, 1999; Prinz et aI., 1999; Schaie & Parham, 1977; Tombaugh, Kozak, & Rees, 1999), while in other studies, no such age effects have been described (Bolla, Lindgren, Bonaccorsy, & Bleecker, 1990; Crawford, Bryan, Luszcz, Obonsawin, & Stewart, 2000). Further, some studies describe greater word production among older adults compared to young adults (Henry & Phillips, 2006; Parkin & Walter. 1991; Veroff. 1980; Yeudall, Fromm, Reddon. & Stefanyk, 1986).

While the presence and direction of the age effects have proven inconsistency, individual studies have only rarely demonstrated the presence of large age effects, and in the few studies that have done so, this has often been attributed to nonexecutive deficits. Phillips (1999), for instance, found that older adults produced considerably fewer words than a middle-aged group on a written fluency task, but this was attributable to a reduction in motor speed, indicating the importance of considering nonexecutive contributions to test performance.

Where studies have investigated semantic and phonemic fluency in healthy aging. And they have performed poor on semantic fluency than phonemic fluency as compared to young age group(Crawford et al., 2000; Keys & White, 2000; Kozora & Cullum, 1995; Libon et aI., 1994; Parkin, Hunkin, & Walter, 1995). The same pattern observed in Alzheimer's disease (Henry, Crawford, & Phillips, 2004) and in focal temporal lobe lesions (Henry & Crawford, 2004). Relative performance on tests of phonemic and semantic fluency, therefore, does not suggest that the major factor underlying fluency performance in old age is frontal lobe change. But rather implicates age-related temporal lobe atrophy according to IRaz, Rodrigue, Head, Kennedy, and Acker (2004).

Henry and Phillips (2006) have suggested that age-related deficits in fluency may only reflect distinctive executive dysfunction where fluency paradigms that load more heavily on retrieval switching were used as test stimuli. Alternating fluency tasks require the generation of one word from a specific category (e.g., words beginning with A), then a word from a second category (e.g., type of animal). These two category prompts are then alternated (e.g., for the example noted, participants would be required to alternate between A and animal). The authors found that while performance on a standard measure of semantic fluency did not differentiate younger and older adults. The capacity to alternate between semantic dimensions was particularly impaired with age. Since standard tests of semantic fluency and semantic alternating fluency tasks presumably impose comparable demands upon semantic memory (for both tasks, participants are requested to find words belonging to a specified semantic category), and are equally constrained by speed, the larger deficit for the alternating fluency measure suggests that retrieval switching may be particularly impaired in aging. Such manipulations of standardized clinical measures assist in focusing on specific executive elements of a performance.

Verbal fluency tasks involve a range of cognitive skills, in addition to executive skills. There are demands on vocabulary and semantic knowledge, which are aspects of cognition that are often unimpaired in old age. Older adults seem to be able to retrieve knowledge relatively effectively, even if the criteria for retrieval are unusual (producing words beginning with a specified letter). The contradictory findings in the literature on age changes in fluency suggest that it would be unwise to use standard fluency measures as an indicator of executive deficits in relation to age changes in cognition. Hence in the present study, a combination of discourse assessment in association with the executive function assessment is considered as a clinical methodology in evaluating age-related decline in geriatric population and early identification of MCI.

2.4 Need for the study:

It is well established that patients with AD exhibit a decline in discourse content and informativeness when compared to normal aging elderly. The healthy control varies from AD patients in terms of cohesion, type of discourse and overall coherence. Performance in narrative production shows uneven differences in a subject throughout life and a certain unit of language tends to be more sensitive to see age effects. Executive control decreases as age advances reflecting slowing general cognitive abilities (Connor, 2001; Wingfield & Tun, 2001). Measures Used to quantify these changes are those design fluency and macrolinguistic aspect of narratives which show that some aspects of linguistic aspects vary across lifespan. Many studies have focused on discourse analysis but we are looking for macrolinguistic aspects as well as design fluency to measure executive function in the aged population in comparison with individuals with MCI.

In certain clinical populations the impaired executive and disrupted spoken discourse production abilities are well established. Studies have reported an impairment of EF in individuals with traumatic brain injury (Coelho, 2002). This clinical population with reference to adult with cognitive-communicative impairment, therefore "talk better than they communicate" according to Milton, Prutting, and Binder (1984). As aging sets in with an individual, his/ her social, clinical needs require formulation and innovation of diagnostic tools that can tap minute changes in adult cognitive- linguistic ability (Fleming & Harris, 2008). In this context, the speech-language pathologists are actively involved in the identification and assessment of a person with cognitive-communicative impairments involving Mild Cognitive Impairment. The objective of any study focusing on discourse analysis for example, while assessing the discourse production, the cognitive-linguistic ability of any individual will facilitate in addressing the issue or factor related to its association with the executive functions. This positive association might serve as a clinical implication in deriving an early detection tool for clinical practice on individuals with MCI and can serve as a key to increase the insight of normal and pathological aging effecting on narrative skills. Hence, there is a need for the present study. Discourse analysis is a keen and precise means to identify linguistic difficulties in person in the early stages of the disorder. So clinically we can study that, what are the aspects of normal aging and pathological aging in term of executive function by using design fluency and macro-linguistic aspect of narratives.

CHAPTER III

METHOD

3.1 Aim

To study the design fluency performance and macro-linguistic aspects of narrative discourse in elderly individuals with and without mild cognitive impairment.

3.2 Objectives of the study

1) To examine the design fluency performance in elderly individuals with and without mild cognitive impairment.
2) To examine the macro-linguistic aspects of narrative discourse in elderly individuals with and without mild cognitive impairment.
3) To study the association between discourse production and executive functions among elderly individuals with and without mild cognitive impairment.

3.3 Hypothesis

3.3.1 Null Hypotheses

- There is no significant effective association between design fluency performance and macro-linguistic aspects of the narrative discourse of elderly individuals with and without Mild Cognitive Impairment.

3.4 Research Design

The present study was a standard group comparison with two groups-clinical groups (an individual with MCI) and control group (elderly individuals MCI).

3.5 Participants

Thirty-one elderly individuals participated in the present study among them, 10 individuals were diagnosed as MCI and twenty-one individuals were age-matched elderly neuro-typical individuals without the diagnosis of MCI. These individuals with MCI were assessed for cognitive abilities and diagnosed with MCI by Speech Language Pathologist. In this process, initially detailed general case history was noted and sections of Montreal Cognitive Assessment (MoCA version 7.0; Z. Nasreddine, 2005) namely; attention, recall, registration, calculation, orientation, and language was assessed. All the participants belonged to the age range of 60 and above years. All were native Kannada speakers with the formal education of minimum 10-12 years. The caregivers had not reported of any premorbid neurological injury or psychiatric illness apart from symptoms of MCI among all the participants.

The inclusionary criteria for the selection of individuals with MCI as participants for the present study were as follows: a). Fail (score between 19-25) on the administration of Montreal Cognitive Assessment (MoCA version 7.0; Z. Nasreddine, 2005).

Inclusive criteria for the selection of elderely individuals with MCI and without MCI as participants for the present study were as follows: a) Formal education minimum for 12 years, b) Hearing and vision thresholds near normal limits or corrected to normal, c) Kannada was their first language, d) No history or present diagnosis of dementia, neurological injury or psychiatric illness, convulsion, stroke, traumatic brain injury, road traffic accidents, chronic alcoholism and drug abused, e) Pass (score >25) on the administration of Montreal Cognitive Assessment (MoCA version 7.0; Z. Nasreddine, 2005).

The demographic details and the MoCA scores of the elderly individuals with and without MCI who were selected as participants for the present study are tabulated in Table 3.1. Informed consent was obtained from each participant. Following the questionnaire (Appendix A) was filled by participants or caregiver. This questionnaire included the demographic data and brief history which includes age, gender, date of birth, employment status, educational history, MCI duration how and who diagnosed, probable etiology, any past/presence history of neurological conditions/ medical conditions, medication was taken.

The participants were selected from different old age home in and around Mysuru, and screening at different localities like a park, shops, homes, and grandparents of therapy children at AIISH was also considered for participant selection. Two elderly individuals with MCI were selected from AIISH and the remaining eight participants were selected from Bapuji Aanand Ashram and Sree Sainatha old age homes on the administration of Montreal Cognitive Assessment (MoCA version 7.0; Z. Nasreddine, 2005). Thus, all the participants with a mean age range of 61-90 years were screened by MOCA and the participants on fulfilling the inclusionary criteria for MCI group were only selected. Total 52 individuals were screened at old age home, among them only 9 individuals scored in the range of 19-25 on MOCA which facilitated the diagnosis of MCI. Information from the AIISH ethical committee consent form was briefly explained to the clients and/or the guardians and signature was taken before enrolling in the present study (Appendix B). The elderly neuro-typical individuals were included from different localities in and around Mysuru city.

Participant	Age	Sex	Education Underpost graduation	Diagnosis	MoCA
1	66	Male	UG	MCI	19
2	68	F	UG	MCI	22
3	69	M	UG	MCI	19
4	72	F	PG	MCI	19
5	72	M	UG	MCI	20
6	75	F	PUC	MCI	20
7	75	F	PUC	MCI	19
8	76	M	UG	MCI	19
9	80	M	PUC	MCI	21
10	84	F	PhD	MCI	20
11	62	F	PUC	NCF	28
12	63	F	UG	NCF	29
13	65	F	UG	NCF	27
14	68	M	UG	NCF	30
15	68	M	PUC	NCF	30
16	69	F	PG	NCF	28
17	69	F	PG	NCF	29
18	71	M	PUC	NCF	25
19	74	F	PUC	NCF	27
20	75	M	UG	NCF	25
21	75	F	UG	NCF	27
22	76	F	UG	NCF	28
23	76	F	PUC	NCF	27
24	77	F	UG	NCF	26
25	77	F	PUC	NCF	27
26	78	F	UG	NCF	26
27	80	F	UG	NCF	27
28	80	M	PUC	NCF	24
29	81	F	PG	NCF	25
30	84	F	UG	NCF	27
31	85	F	UG	NCF	25

Table 3.1. Demographic data and MOCA score of MCI and elderely Individuals without MCI.

3.6 Procedure

3.6.1 Executive functions

The executive functions were assessed using the (1) Verbal Fluency and (2) Design Fluency Tests of Delis – Kaplan Executive Functions Scale (D-KEFS- Delis et al., 2001). In the Verbal Fluency Test the participants were asked to produce words in three conditions: (a). Letter

Fluency (A letter was given and the participant had to name as many words as possible in 60 seconds, words only starting with the given letter), (b). Category Fluency (A category was given, for example: "animals" and the participant had to name as many category members as possible in 60 seconds) and (c). Category Switching (Two categories were given, for example: "furniture and fruits", the participant had to name one furniture member and fruit member alternatively within 60 seconds).

In the design fluency test, the participants had to draw different patterns of design from the given dots as many as possible within a time span of 60 seconds in three conditions: (a). Filled Dots (Design by connecting five filled dots), (b). Empty Dots Only (Design by connecting five unfilled dots) and (c). Switching Dots (each box contained both filled and unfilled dots, and the participants had to draw patterns by alternating connections between filled and unfilled dots). Few examples are given in the following Figure 1.

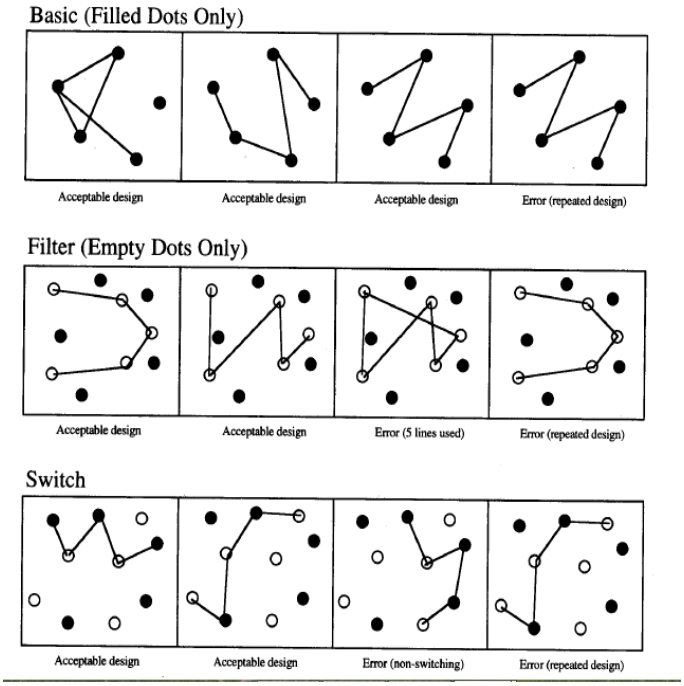

Figure 3.1: Examples of Design fluency tasks.

Thus, the material used was the Design Fluency Tests of Delis – Kaplan Executive Functions Scale (D-KEFS- Delis et al., 2001) for design fluency assessment, design Fluency Response Sheet, Pen (so examinee cannot erase) and Stopwatch.

3.6.2 Complex discourse productions analysis

Here the discourse genre involved was a narration task on a given topic (for example- "Journey to a place"). The specific instructions were as follows:

Instruction: "Imagine/pretend your past/future journey to a place and narrate the same in past or future tense."

All the participants were provided prior notice that the discourse samples will be video recorded and the recording will be started when they will be ready for the same. The recordings for the narration task was done in two phases: Phase- I and Phase-II. In Phase-I, 4 to 5 minutes' interaction was recorded which aimed to improve interaction and build rapport between the investigator and the participants. In Phase- II, to obtain discourse samples of all the participants the recordings were done in one or two sessions according to the convenience of the participants. Here the participants showed less inhibition in their discourse since they became quite accustomed to the investigator, only fifteen to twenty minutes speech samples of these sessions were selected for the final analysis. Before recording, the participants were instructed to talk in a casual way. In the first session recording, the participants had to use only L1 (for example- Kannada language) for narration task. Subsequently, after a few days, same participants had to complete the remaining tasks which were pending from the first session. This was mainly done for the participants above 60 years of age. An attempt was made to complete the entire task in one session itself for the participants below 60 years of age. All the recordings were carried out

in a quiet room with no distraction during or in between the recordings at All India Institute of Speech and Hearing, Mysore or residential places of the participants. The participants were aware that their speech was being recorded and was also informed that they were free to ask any questions related to the topic to the examiner during the narration. Handy cam (Sony digital recorder H302233) was used to video record each session.

3.7 Scoring and Analysis

The discourse samples were analyzed qualitatively for narration task. Qualitative rating of discourse was carried out using Discourse Analysis Scale (Hema & Shyamala, 2008) developed as a part of a thesis titled 'Discourse Analysis in Kannada- English individuals with Traumatic Brain Injury'. (Appendix C)

Discourse Analysis Scale analyses the discourse samples qualitatively using a perceptual rating scale. It consists of a set of parameters and a list of skills under each parameter. Each skill will be rated separately and a final index is obtained for them. It measures the propositional and non-propositional aspects of narration. The propositional aspects of discourse include discourse structure, communication intent, coherence, information adequacy, information content, message accuracy, temporal and causal relationship, topic management, vocabulary specificity, linguistic fluency, speech styles, intonation, gaze efficiency and response time. The non-propositional (interactional) aspect of communication includes turn taking, revision behaviors, and conversational repair/repair strategy. These parameters have been described and statements were framed to rate them. The (three-point perceptual) rating scale consisted of the uniform rating of 0, 1 and 2 where '0' represented the behaviors that were poor, '1' represented behaviors that were fair (at least 50% of the time there is positive response) and '2' when the behaviors were good.

The rating scale was used for scoring. Thus, total scores of the Discourse Analysis Scale (DAS) for narration could be obtained. These total scores of DAS for these tasks have been further divided into two sub-levels, the propositional and non-propositional total and Discourse Quotients were the levels of narrative discourse assessment. Thus, after the completion of the rating, the scores of only these three levels were entered and tabulated for the statistical analysis (Appendix D). The statistical analysis of the data was carried out using the *Statistical Package for Social Sciences (SPSS) software (version 19.0)* as described in the following results section.

For the executive function, the scoring procedure was by the observation of the participant's response to the design fluency task and recording of participants response for the verbal fluency task. In design fluency task, the design had to be constructed with only four lines. Each line connects two dots, one at each endpoint. Each line touches at least another line at one of its endpoints. The design is novel for that condition; that is, it is not a repetition of an earlier design drawn in that condition were considered for scoring. Designs that begin after the time limit has lapsed were not scored, regardless of whether they are correct or incorrect. A score of "1" was given for the correct design and the total number of correct designs within a minute for each participant were noted. In a verbal fluency task, the investigator had to mark a score (1) for each word told by the participants within 60 secs. Thus, the number of words uttered by the participants with the starting letter "P" for verbal fluency and semantic category "Animal" for category fluency and the category switching "Flowers and vehicles" were given a total score. This raw score was tabulated and considered for the statistical analysis (Appendix E). There were certain general instructions/promts given by the examiner for some participants like stating that he or she has made a mistake, the clinician would say "That's okay. Try to get the next one right". If the participants fail to respond after the 15-second interval, the clinician would say

"Keep going". They were strictly told to watch the stopwatch running when providing prompts and during their execution of verbal and design fluency task. The focus of the present study was to consider participants who do not require any prompts, however, the participants who required these prompts were also considered for the study.

CHAPTER V

RESULTS

SPSS (PASW) Version 18 was used to carry out the statistical analysis. The mean, median, standard deviation of discourse parameters under the propositional and non-propositional aspects of participants with the diagnosis of MCI and neuro-typical individuals on narration task in Kannada language and the scores of executive functions was calculated using descriptive statistics. The same is tabulated and described in the following sections.

4.1 Descriptive statistics:

4.1.1 Complex Narration Discourse

The complex discourse production scores were scored at propositional and non-propositional aspects of discourse for narration task as seen in Table 4.1. From Table 4.1, the mean, median and standard deviation scores of neurotypical individuals and Mild cognitive impaired adults were compared. Results revealed MCI individuals performed poor in the narrative discourse task compared to elderely Individuals without MCI.. Specifically, the mean and median scores were noted to have the highest disparity in the narration task, where normal individuals performed best compared to MCI individuals. Among the aspects of discourse within this narrative task, MCI individuals had better mean and median scores in propositional speech when compared to non-propositional speech. But in elderely Individuals without MCI. this

disparity was not noted, they performed equally well in both prepositional and non-prepositional aspects of discourse.

Table 4.1: *Mean scores of narrative complex discourse production of MCI elderely Individuals without MCI.*

Discourse aspects	**MCI (10)**			**Normal (21)**		
	Mean	**Median**	**S. D**	**Mean**	**Median**	**S.D**
Propositional	40.95	41.66	21.81	96.37	95.23	2.67
Non-propositional	40.00	35.00	22.60	98.57	100.00	3.58
Discourse Quotient of Narration	27.17	26.91	14.37	64.52	64.10	1.53

4.1.2 Executive function

The executive functions were analyzed through tasks of verbal fluency and design fluency. The verbal fluency ability was assessed through Letter fluency, Category fluency and Category switching fluency tasks. Similarly, design fluency was examined through Basic design fluency, Filter design fluency and Switch design fluency. The scores of verbal fluency and design fluency of individuals with MCI and elderely Individuals without MCI. are represented in Table 4.2.

Table 4.2: *Mean scores of Verbal fluency and Design fluency of MCI and elderely Individuals without MCI.*

Executive Functions	Task	MCI (10)			Normal (21)		
		Mean	**Median**	**S. D**	**Mean**	**Median**	**S.D**
Verbal Fluency Tasks	Letter Fluency	7.70	8.00	1.76	14.54	14.50	3.44
	Category fluency	11.00	11.00	1.76	16.86	17.00	3.82
	Category switching	2.70	2.50	0.82	5.86	6.00	1.12
Design Fluency Tasks	Basic design fluency	5.10	5.00	1.10	14.72	14.50	2.49
	Filter design fluency	4.30	4.00	0.94	13.22	13.00	2.06
	Switch design fluency	2.00	2.00	1.41	7.31	7.00	1.39

4.2 Between-group comparisons

4.2.1.Complex narrative discourse production and executive function task

None of the parameters related to narrative discourse task exhibited normal distribution on the administration of Kolmogorov–Smirnov, and Shapiro–Wilk tests, with the exception of executive functions (verbal and design fluency). Hence for the parameters of discourse in narration task, the non-parametric Mann-Whitney test was administered. Thus, the group effect

was studied using p< 0.05 level of significance and the results for the complex discourse production and executive functions are represented in Table 4.3 and Table 4.4 respectively.

Table 4.3: *Results of Mann-Whitney test for Complex Narrative Discourse Production task*

Complex Discourse Production Task	**Task**	**|Z|**	**p (<0.05)**
Narration	Propositional score	4.507	0.000*
	Non propositional score	4.951	0.000*
	Discourse Quotient (Narration)	4.491	0.000*

Note: * p< 0.001 level of significance.

From the above Table 4.3, there was a significant difference across the participants with MCI group and elderely Individuals without MCI, where the neuro-typical individuals outperformed from individuals with MCI on the propositional, non-propositional aspects of narrative discourse and the discourse quotient at p<0.001 level of significance.

Table 4.4: *Results of the Mann-Whitney test for Executive Functions*

Executive Functions	**Task**	**Z**	**p (<0.05)**
Verbal Fluency Tasks	Letter Fluency	4.407	0.000*
	Category fluency	3.938	0.000*
	Category switching	4.467	0.000*
Design Fluency Tasks	Basic design fluency	4.493	0.000*
	Filter design fluency	4.500	0.000*
	Switch design fluency	4.473	0.000*

Note: * p< 0.05 level of significance.

From the above Table 4.4, there was significant difference noted between the individuals with MCI and neuro-typical individuals for the executive functions, where the neurotypical individuals outperformed from individuals with MCI on the verbal fluency and design fluency tasks of executive functions at $p<0.001$ level of significance.

4.3 Within-group comparisons

To check the significant difference between the propositional and non-propositional aspects of complex narrative discourse production within the MCI group and elderely Individuals without MCI group, the Wilcoxon Sign Rank test was administered. A significant difference ($p< 0.05$) was noted between propositional and non-propositional aspects of narrative discourse genres in Mild Cognitive Impaired individuals' group and no significant difference ($p> 0.05$) was seen in the group with elderely Individuals without MCI group. Thus, pair wise comparison was done to study the within-group differences among propositional and non-propositional aspects of narration and the same results are represented in Table 4.5.

Table 4.5: *Results of Wilcoxon Sign Rank test for MCI group and elderely Individuals without MCI.*

Tasks	**Pair-wise comparisons**	**Neuro-typical** (*p* value)	**MCI** (*p* value)
Narration	Proposition vs Non propositional	0.117	0.721

Note: * $p< 0.001$ level of significance.

From the above Table 4.5, it was evident that among individuals with MCI, the propositional and non-propositional aspect of narration was not significantly varying at $p< 0.001$

level of significance. Specifically, on comparing the mean scores of these aspects, it was noted that individuals with MCI had better propositional discourse than non-propositional discourse.

To check the significant difference for verbal fluency and design fluency within MCI and neurotypical group, the Friedman test was administered. A significant difference ($p< 0.05$) was noted between phoneme fluency, category fluency and category switching of verbal fluency in a group with Mild Cognitive Impairment and elderely Individuals without MCI.. Similarly, the Friedman test was administered for design fluency with categories like filled dots, unfilled dots, and alternative conditions. A significant difference ($p< 0.05$) was noted and the same is shown in Table 4.6.

Table 4.6: *Results of Friedman test for MCI group and elderely Individuals without MCI.*

Executive Function	**Task**	**|Z|**	**p (<0.05)**
Verbal fluency	Phoneme fluency vs Category fluency	4.348	0.000*
	Phoneme fluency vs Category switching	4.867	0.000*
	Category vs Category switching	4.869	0.000*
Design fluency	Filled dots vs Unfilled dots	2.816	0.005*
	Filled dots vs Alternative	4.872	0.000*
	Unfilled dots vs Alternative	4.874	0.000*

Note: * $p< 0.05$ level of significance.

4.4. Comparison of performance between complex narrative discourse production & executive function task of individuals with and without MCI.

Discourse production and executive function in the MCI and elderely Individuals without MCI were correlated. Spearman correlation test was used to obtain a correlation between discourse production and executive function. No correlation (ρ=0.690, z=0.000) was found between discourse production and executive function in individuals with and without MCI.

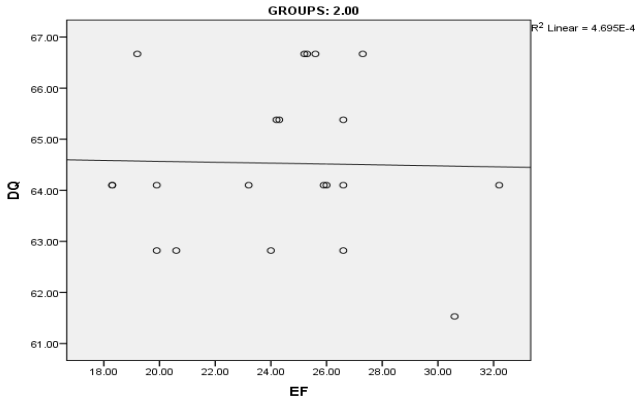

Figure 4.1 Scatterplot of Discourse Quotient and Executive Functions of a study group (MCI).

To summarize, the results of complex discourse production and executive memory of Mild cognitive impairment and elderely Individuals without MCI with reference to the statistical analysis is as follows. Mann Whitney U test was applied to compare the performances of all the participants and results revealed poorer propositional and non-propositional aspects and poorer discourse quotient for individuals with mild cognitive impairment when compared to the performance of the same among neurotypical individuals. There was a significant difference noted between the individuals with MCI and elderely Individuals without MCI for the executive functions too. The Wilcoxon Sign Rank test was administered and no significant difference ($p < 0.05$) was noted between propositional and non-propositional aspects of narrative discourse genres in Mild Cognitive Impaired individuals' group and the group with elderely Individuals

without MCI. Friedman test was administered to check the significant difference for verbal fluency and design fluency within MCI and neurotypical group. A significant difference ($p < 0.05$) was noted between phoneme fluency, category fluency and category switching of verbal fluency in a group with Mild Cognitive Impairment (MCI) and elderely Individuals without MCI .Similarly, the significant difference was noted between filled dots, unfilled dots and alternative conditions of design fluency too in a group with MCI and NTI.

CHAPTER V

DISCUSSION

The primary aim of the study was to study the design fluency performance and macro-linguistic aspects of narrative discourse in individuals with Mild cognitive impairment and geriatric population. An attempt is also made to estimate the association between the discourse production and executive functions among individuals with MCI and without MCI. The individuals with MCI and age-matched elderely Individuals without MCI were assessed for a) complex discourse production by using DAS, and b) executive functioning by using verbal fluency and design fluency tasks. The Statistical analysis of discourse revealed poorer results on both propositional and non-propositional aspects of narrative discourse genres compared to neurotypical individuals discourse. With reference to the executive functions, the MCI group revealed poorer performance when compared to elderely Individuals without MCI.

5.1 Narrative complex discourse production of MCI and neuro-typical.

The present study revealed that there were significant differences in the performance of individuals with and without MCI. Also showed an overall decline in the propositional and non-propositional aspects of the narration complex discourse production. This phenomenon is viewed in normal aging as cognitive aging. Change in various cognitive processes or change in a single mechanism that may underlie performance across a wide range of tasks and skills. This could be attributed to the **decline in the processing capacity** required for performing tasks at different levels and an **inability to process information rapidly** (Salthouse, 1996).

5.1.1 Complex discourse production in Normal aging

In older adults executive function, attentional difficulties and working memory will affect the organization of information at the text level of discourse (Collette et al., 2007). The further reason quoted by the author is a reduction in the efficiency of working memory during discourse comprehension or production at the level of storage and manipulation of information or syntactic processing. In the same way, **attention and executive function impairment may prevent older adults from inhibiting the selection of inappropriate information** (Mozeiko et al., 2011).

With reference to aging, changes related to macrolinguistic aspects of discourse is also reported by Marini et al., (2005). Discourse production is confined to numerous cognitive functions like long term memory and working memory, executive function, and attention. In this study, the author has focused on age-related differences in all these high-level skills which actually provides a clear and complex picture. And this ability can reflect when we construct any text like their own written diaries or personal narratives which include more embedded episodes than those produced by younger adults (Kemper, 1990; Pratt & Robins, 1991). Augmented **verbosity was observed in the discourse which is due to decreased levels of cohesiveness both at local and global coherence level**.

Aging weakens global coherence where the global coherence refers to the ability to semantically relate remote utterances in the framework of a given discourse or written text. Consequently, errors of global coherence might include the production of tangential utterances, utterances conceptually incongruent with the story, or simply fillers. Indeed, when older adults are involved in the spontaneous conversation, they produce more off-topic speech than younger adults (Arbuckle & Gold, 1993; Trunk & Abrams, 2009). They may initially provide relevant

pieces of information but then introduce additional information that can be loosely related or even entirely unrelated to the main topic of the conversation and/or discourse. For all these reasons, the speech output of older people is often perceived as vague and incoherent.

The normal aging adults in this study demonstrated richer discourse as measured by core element scores. Core element scores seem to reflect both intact travel schema and preserved planning, problem-solving, and organizational abilities. These higher-order cognitive skills may be the first to deteriorate and the least likely to be captured by a less complex linguistic task such as naming.

Therefore the influence of cognitive processes on discourse coherence is also studied by Wright et al. (2014), where they had considered both younger adults between the ages of 20–39 and older adults between the ages of 70–87. Measures of cognition included the Wechsler Memory Scale-III (WMS-III; Wechsler, 1997), Comprehensive Trail Making Test (CTMT; Reynolds, 2002); and STROOP Color and Word Test (STROOP; Golden, 2002). Coherence measures included a 4-point rating scale on several discourse stimuli like picture descriptions, storytelling, recounts, and procedures. Wright et al. (2013) have also found a **positive relationship for the maintenance of global coherence and attention and episodic memory.** The researchers concluded that attention and episodic memory are important for maintaining global coherence as individuals' age. Burke and MacKay (1997) hypothesized that episodic memory's ability to form new memories and make new connections declines with age. Therefore, declines in **episodic memory result in declines in coherence maintenance**.

In general normal older individuals' language production is more elaborate syntactically yet less fluent in their utterances. This individual variability may account language in the aging.

In addition, life span changes in both cortical and subcortical mechanisms for speech and language would appear to play a part in the changes in language use associated with aging. However, their discourse is often preserved because the communication skills are generally preserved and however it is not true for everyone who is having any associated pathology or condition.

5.1.2 Complex discourse production in relation to cognitive processes in MCI

Complex discourse production is also studied in individuals with mild cognitive impairment by Valarie (2008) and the aim was to detect subtle changes in communicative ability between the neurotypical and MCI group in terms of length and quality. The sparseness between these groups shows an inability to retrieve words in the MCI group and also poor organizational skills, planning, and problem-solving in the MCI group. This **decrease in higher-order cognitive abilities also reflected in the discourse abilities of individuals with MCI**.

Planning, organization, and cognitive flexibility are important components of executive function (Crawford, 1998; Godefroy, 2003). The MCI group's inability to provide a priori core elements needed for a rich, detailed sample seemed to highlight decreased planning, organization, and cognitive flexibility skills, decrements of which are the hallmarks of dementia.

In contrast, Calarie B. et al., (2009) showed no changes in discourse performance within 6 months from the onset of mild cognitive impairment, a follow-up study. They have observed no significant difference in the performance of discourse over 6 months periods and inferred confrontation naming and memory being remained stable over a minimum 6 months of periods. Finally, they concluded no changes occurring in cognitive linguistic abilities as measured by complex production task in terms of complexity, quality, and length of the discourse. The

authors recommended monitoring of discourse task over 6 months of periods to observe changes in the different domains. According to Rusted, Gaskell, Watts, & Sheppard (2000) the alternative explanation for poor discourse in MCI could be, perhaps reduced core element scores for the MCI group are reflective of **impaired memory and reduced ability to retrieve information from their general knowledge stores.**

The early detection of cognitive-linguistic changes in Mild cognitive impairment is by the examination of relationships between measures of EF and spoken discourse production according to Valarie (2014). Interestingly, no differences were found between the groups in length of generated discourse. Although Fleming and Harris (2008) found differences in terms of length, other studies have found that individuals with MCI use similar numbers of words and phrases as normal controls but express fewer ideas (Cuetos et al., 2007; Forbes-McKay & Venneri, 2005). Similar to Fleming and Harris, no distinctions were found in syntactic complexity, which supports the notion that syntactic complexity in persons with MCI appears relatively spared. Similar findings are observed in the present study and it is recommended to use both the discourse production task in association with cognitive processes (executive function task) as an assessment tool in identification and treatment of individuals with mild cognitive impairment.

5.2. The executive function of MCI and elderely Individuals without MCI.

In the current study, the executive functions were analyzed through tasks of verbal fluency and Design fluency. The verbal fluency ability was assessed through Letter fluency, Category fluency and Category switching fluency tasks. Similarly, design fluency was examined through Basic design fluency, Filter design fluency and Switch design fluency. The scores of

verbal fluency and design fluency of individuals with MCI was poorer than neurotypical participants. For the same scores, significant differences were observed between individuals with MCI and neurotypical adults. The executive function task used was the **Delis–Kaplan Executive Function System (D-KEFS)** category switching measures, according to Nuttan-Upham and colleagues (2008) **this task most strongly discriminated individuals with MCI from cognitively intact elderly**. Similar findings are also obtained in the present study.

The cognitive flexibility tasks that required the participants to switch (e.g., alternating between semantic categories or alternating between filled and unfilled dots during design tasks) were more difficult for those with MCI (Valarie, 2014). Perhaps aspects of the **complex discourse task require intact switching ability, with which the MCI group demonstrated difficulty in switching tasks**. This may account for the increased maze production in the MCI group. Similarly, in the present study, the scores for MCI were poorer when compared to elderely Individuals without MCI.

It is reported with the explanation that the attentional/executive dysfunction act as an important aspect of MCI with reference to MRI technique (Reinvang, et al., 2012). Where they explained the inability of performing two tasks simultaneously was due to a **deficit in divided attention, rather than the result of a more general processing speed deficit.** And by MRI morphometry and diffusion tensor imaging they explained few landmarks which are important for executive function in MCI. The landmarks are the three fronto subcortical circuits (originating in the prefrontal cortex), that is, the dorsolateral prefrontal cortex (inhibition), and the anterior cingulated cortex (response conflict). And impairment in the above-mentioned regions can affect the executive function and these are the areas commonly found to be affected in MCI.

In general, the performance on **design fluency task depends on the bilateral activation of both right and left frontal cortex**. Because many visuospatial tasks recruit both right and left hemisphere mechanisms in order to analyze both global and local information respectively. Hence the difference exists between the individual with and without MCI.

5.3. Comparison of within-group differences in discourse production and executive functions.

In the current study, two categories under the narrative discourse task like the propositional and nonpropositional aspects of discourse were assessed. No significant difference was found between the propositional and non-propositional aspects of complex narrative discourse production within the MCI group and neuro-typical group.

Narrative discourse deficits were studied by eliciting narrative discourse on the use of visual stimuli in patients with mild cognitive impairment and Alzheimer disease groups (Claudia, et al., 2015). MCI group performed better than the AD group for most of the parameters. MCI showed better global coherence of the story with the macro-propositions as compared with the AD group. The contributing factors could be the low use of episodic memory during the task and proper functioning of working memory (Troiani et al., 2008; Cannizzaro and Coelho, 2013). MCI is a transitional stage between normal aging and AD so macrolinguistic plan for the narrative discourse in the MCI could be an intrusion of information, particularly narration would be irrelevant to the story's context which suggests a problem with the semantic-pragmatic component of language. Therefore the macrolinguistic aspects of discourse are equivalent to the non-propositional aspects of narrative discourse and the microlinguistic aspects of discourse is with reference to syntax or the propositional aspects. Observational report of raw score suggested

the difference between the propositional and non-propositional aspects of narrative discourse. The contributing reason could be the **difference in cognitive processing ability utilized for propositional and non-propositional aspects of narrative discourse.**

With reference to executive function and in the fluency task a switching variable was introduced and the participants had to alternate between two sets or categories. In one condition of the verbal fluency task, participants were required to alternate between naming fruits and furniture. In the design fluency task, participants were required to form designs by alternating between empty and filled dots in an array. The participants from the control and experimental group exhibited difficulty in performing on these switching conditions. Participants with mild cognitive impairment did perform lower than the control group.

One possible explanation for the comparable cost of task switching in patients and controls was the chronic nature of the patients' lesions according to Juliana (2001). It would be of interest to test patients with more uniformly acute lesions. The advantage of this chronic patient group was that their behaviors were well stabilized, and were assured that any deficits were attributable to the observed lesions. The advanced age of both patients and control participants also may have obscured some differences between groups, as overall performance may have been diminished.

Other possible explanation could be frontal lobe dysfunction which leads to executive function dysfunction, which shows difficulties in attention, verbal, motor and graphomotor initiatives and conceptual thinking (De Mendonca, et al. 2004).

The additional contributing reason could be the neuropathological changes associated with MCI for example, specific lesions where cortical thickness (CTH) in rostral middle frontal, medial orbitofrontal, caudal anterior cingulated, posterior cingulated, retrosplenial and entorhinal

cortices. The author Grambite R, et al. (2011) report these neuropathological signs to be higher for MCI than the control group. These lesions were significantly associated with inhibition/switching performance, while caudal middle frontal CTH was significantly associated with attention and divided attention. And this attention, divided attention, inhibition or switching performance are essential for switching tasks in verbal and design fluency. From the above finding, we can conclude that **thinning in the caudal middle frontal region are both associated with dysfunction in MCI**.

5.4. Association between the performance of complex narrative discourse production and executive function task in individuals with and without MCI.

In the present study, there was no correlation found to prove the association between the performance of complex narrative discourse production and executive functions in the individuals with and without MCI. It is hypothesized that the difficulties exhibited by participants with MCI could be contributed to **decreased planning, organization skill, and cognitive flexibility** (Fleming & Harris, 2008).

Results of the present study indicated that cognitive flexibility appeared to be important in the complex discourse task while planning ability was not highly associated with discourse measures (Valarie, 2014). As there was no difference between the groups and no association between discourse task and the executive function task. However, the switching aspect of cognitive flexibility appears striking on the observation of raw score where MCI performed poorer on switching tasks. The cognitive flexibility tasks that required the participants to switch (e.g., alternating between semantic categories or alternating between filled and unfilled dots during design tasks) were more difficult for those with MCI. Perhaps aspects of the **complex discourse task require intact switching ability, with which the MCI group demonstrated**

difficulty. This may account for the poor scores on discourse production in that group. Scoring procedures would have to be further developed to capture aspects of switching in the complex discourse task and the executive function task.

The other additional factors could be the influence of **education, profession, knowledge of the topic, Bilingual/multilingualism, language stimulation, and psychological factors**. The educational attainment completed in early adulthood or socioeconomic environment throughout the course of life can influence cognitive functioning in midlife, and even in later life, with a lower risk of cognitive impairment in old age and of developing dementia (Zhang, 2008). Asgari (2017) also studied the influence of education in MCI and found that a significant difference in the years of education between participants with MCI (14 in number) and those who are cognitively intact (27 in number). It is possible that the level of education may significantly influence verbal abilities (example use of verbs, articles, and adjectives, etc) regardless of cognitive decline.

In the present study, participants were taken from old age home and from different location of the Mysore. Many participants were well educated and mostly retired government servants and few of them were handling business work. Occupational attainment, provide a reserve represented by a set of skills that would protect individuals from the cognitive decline associated with normal aging or Alzheimer's disease. However, the processes leading to the formation of this reserve remain unclear. The supporting study could be by Stephane et al (2013), where they studied the relationship between cognitive performance and occupational activity in older adults. All the activities were positively related to cognitive functioning in elderly people. Prevention of cognitive aging and Alzheimer's disease, and regarding the potential impact that some retirement programs might have on cognitive functioning in some

individuals. Fluency and memory scores diminished with age and increased with educational level and all types of occupational activity (professional and nonprofessional) clearly having a positive effect on cognitive functioning.

The topic selected for narrative discourse was a "Journey to a place", where the majority of participants assumed a "Plan for a trip" and was a suitable task for all adults because all adults were familiar with the trip. However, it is probable that nearly all adults have some travel schema from which to construct an acceptable task-response. All participants in the present study readily responded to the complex discourse task, indicating that task requirement familiarity was not a confounding variable for the participants in this assessment. Only participants from old age home found little difficulty in terms of emotional disturbance as they are living without a family.

Apart from the topic, the bilingual advantage in executive functions is thought to stem from the fact that managing two languages requires executive resources in the form of selection of the relevant language and inhibition of the language not in use at that moment of verbal fluency (Green, 1998; Rodriguez-Fornells et al., 2006; Abutalebi and Green, 2007; Moreno et al., 2008; Bialystok et al., 2009; Ye and Zhou, 2009). Since bilinguals have a lifelong experience in controlling their two languages, they should have received more practice than monolinguals in processes that engage executive functions. This idea is supported by previous studies suggesting that earlier second language (L2) acquisition, higher levels of language proficiency in both languages, and more balanced use of both languages may have positive effects on executive performance in bilinguals (e.g., Bialystok et al., 2006a; Carlson & Meltzoff, 2008).

Finally, the present study had participants selected from old age home. Psychosocial factors could also have contributed to the results. During the interview and general conversation,

few participants life stories were noted where it shows they were emotionally disturbed due to separation from family, no family support, being a burden to the family, no contact with the family members. These factors could have directed affected the scores of narrative discourse and executive functions. To support this variable a study by Katarina (2016), report that few psychological conditions in the elderly population are the formation of depressions which is shared with the physical limitations, natural diseases, and cognitive changes. But these physical changes contribute to the development of negative social phenomena like loneliness, isolation, and loss of contact, etc.

CHAPTER VI

SUMMARY AND CONCLUSION

The present study aimed to study macrolinguistic aspects of narration discourse and executive functions using verbal and design fluency task in individuals with and without MCI. The objectives of the study were as follows:

1) To examine the design fluency performance in elderly individuals with and without mild cognitive impairment (MCI).
2) To examine the macro-linguistic aspects of narrative discourse in elderly individuals with and without mild cognitive impairment.
3) To study the association between discourse production and executive functions among elderly individuals with and without mild cognitive impairment.

Thirty-one participants were included in the study, Group A consisting of 10 individuals with MCI and Group B consisting of 21 elderly individuals with our MCI who were age-matched with the Group A individuals. These MCI were between the age ranges of 61-90 years. All the participants were native Kannada speakers and aware of the English language. All of them had undergone a screening test using MOCA and the participant with the MOCA scores between 19-25 was only selected for the study with the diagnosis of MCI. These participants were checked for adequate dexterity control which would be necessary for performing the task (Design fluency). It was made sure that all the individuals had hearing and visual acuity within the normal limits.

The results of descriptive statistics delineate the mean, median and for sub-parameters of discourse under propositional and non-propositional aspects of narration as well as design and verbal fluency for a total of 31 adults with MCI and 10 elderly individuals without MCI. The task was the verbal fluency task and design fluency task (DFT) for the assessment of executive functions. The material used was the Design Fluency Tests of Delis – Kaplan Executive Functions Scale (D-KEFS- Delis et al., 2001) for design fluency assessment, design Fluency Response Sheet, Pen (so examinee cannot erase) and Stopwatch. The complex narrative discourse production task was on the topic "Journey to a place".

With reference to descriptive statistics, the scores of narrative discourse productions in terms of propositional and non-propositional aspects and discourse quotients the individuals with MCI scored lower mean value and similarly, there was lower mean for executive function assessment scores for individuals with MCI when compared to elderly individuals without MCI. Statistically, there were significant differences between the MCI group and without MCI group for discourse measures and executive function scores on the administration of the Mann-Whitney U test. The Wilcoxon Sign Rank test was administered and no significant difference ($p< 0.05$) was noted between propositional and non-propositional aspects of narrative discourse genres in Mild Cognitive Impaired individuals' group and the group without MCI. Friedman test was administered to check the significant difference for verbal fluency and design fluency within MCI and neurotypical group. A significant difference ($p< 0.05$) was noted between phoneme fluency, category fluency and category switching of verbal fluency in a group with Mild Cognitive Impairment and elderely Individuals without MCI. Similarly the significant difference was noted between filled dots, unfilled dots and alternative conditions of design fluency too in a group with MCI and without MCI.

Discourse production confined on numerous cognitive functions like long term memory and working memory, executive function, and attention. episodic memory's ability to form new memories and make new connections in aging. And with respect to MCI inability to provide core elements needed for a rich, detailed sample seemed to highlight decreased planning, organization, and cognitive flexibility skills, decrements of which are hallmarks of dementia (Cummings, 2000). The MCI groups are reflective of impaired memory and reduced ability to retrieve information from their general knowledge stores. In DFT, attention, divided attention, inhibition or switching performance are essential for switching tasks in verbal and design fluency which decline with aging.

The use of a complex spoken discourse production task confirms the need for a cognitively demanding task (narration task) to identify the subtle changes in the communication of individuals with MCI. The subtle changes are better identified through the length and thematic analysis of a spoken discourse task that sufficiently taxes the cognitive system. The results of the present study seem to support the use of a complex generative, discourse production task, such as ''Journey to a place'', in differentiating elderly individual with typical aging from those with MCI.

The broad research in DFT sub served as a potential and useful clinical tool to assess the executive function (Jones-Gotman & Milner's, 1977). DFT is a sensitive test to measure functions which are associated with right frontal lobe lesions, which often confound neuropsychological tests (Ruff, Light, & Evans, 1987; Stuss & Benson, 1984). In the present study verbal fluency was assessed along with design fluency. Tests of verbal fluency are among the most widely used measures of executive function and provide a good index of frontal lobe

function. A large number of studies have investigated the effects of aging on the ability to switch attention. Shifting attention between either different task sets or stimulus-response mappings is a key element of executive functioning (Miyake et al, 2000). Where multiple task demands load on working memory heavily, or the timing of switches cannot be predicted, older adults perform particularly poorly. Reliable findings of age differences in global switch costs indicate that older people may have difficulty in maintaining multiple action sets in mind. This has implications for everyday functioning in complex settings where attention focus and action-sets must often be changed online.

The clinical implication of the present study necessitates examining the components of Executive Functions (EF) to address the issues of specificity and sensitivity (Keil & Kaszniak, 2002). Complex discourse production differentiates individuals with healthy control cognitive aging from Mild Cognitive Impairment, which is subserved with the executive functions. Thus inferring that the complex discourse production task coupled with executive function tasks can be an efficient tool in early detection of MCI. Since there is also a study on 46 cognitively normal adults by Cannizzaro and Coelho (2013) and they investigated the EF and narrative discourse production abilities. As a result, they found an association between the linguistic/nonlinguistic measures of EF, narrative structure, and age. Therefore complex discourse production task looks appropriate for cognitive-linguistic skills assessment of an individual with MCI because this task appears to require higher-order abilities such as problem-solving, planning and cognitive flexibility.

Thus inferring that the complex discourse production task coupled with executive function tasks (verbal and design fluency) can be an efficient tool in early detection of MCI. The

complex discourse production task seems appropriate for the assessment of cognitive-linguistic skills of an individual with MCI because the task appears to require higher-order abilities such as planning, problem-solving, and cognitive flexibility.

Implication:

Understanding the individuals with MCI using traditional cognitive-linguistic assessments is not adequate, there is a need to use the qualitative measures of discourse under propositional and non-propositional level to examine the cognitive–linguistic aspects of expressive language as the output unfolds during a natural form of communication at the discourse level. Cognitive processes are assessed using executive functional task. The clinical findings of the present study found an association between the complex narrative discourse production with good executive functional scores. Thus, the present study is an attempt to validate previous studies with similar findings. The future research can focus on assessing on a larger scale across different types of Dementia and investigate the complex discourse and subsequent deficits in executive function tasks.

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APPENDIX A

General Information Sheet

Name:_____ Date:_____

Age/Sex:_____ Date of birth:_____

Mother tongue:_____ Languages Known:_____

Bilingual: Yes/No Medium of instruction:_____

Highest educational qualification: Graduation/Post Graduation

Handedness: Writing_____ Thowing_____ Drawing_____ Brushing_____

Occupation: _____

Present illness:_____

_____

_____

Investigations: Date:

CT scan:_____

MRI:_____

EEG:_____

Others (vision or auditory etc):_____

Associated illness (depression, psychiatric disorders, aphasia, dysarthria etc:_____

Any others:_____

Diagnosis:_____

Remarks:_____

APPENDIX B

All India Institute of Speech and Hearing, Naimisham Campus, Manasagangothri, Mysore – 570006.

CONSENT FORM

Dissertation on

Design fluency and Macro-linguistic aspects of narratives in elderly individual with and without MCI.

Information to the participants

I, Ms. Shital M Sc (SLP) student of AIISH doing dissertation work titled- **"Design fluency and Macro-linguistic aspects of narratives in elderly individual with and without MCI."** under the guidance of Dr. Hema N., Assistant Professor, Dept. of Speech – Language Sciences, AIISH, Mysore – 6. The aim of the study is to investigate and compare the discourse abilities and the executive function of individuals with and without MCI and to study the correlation between discourse and executive functions. I need to collect data from 20 individuals in the age range of 60 and above. Information will be collected through an interview and video recording for the duration of 30 minutes each. I assure you that this data will be kept confidential. There is no influence or pressure of any kind by us or the investigating institute to your participation and the research procedure is different from routine medical or therapeutic care activities. There is no risk involved to the participants but your cooperation in the study will go a long way in helping us in understanding discourse in individuals with Dementia and it will, thus assist in assessment and treatment of these individuals.

Informed Consent

I have been informed about the aims, objectives and the procedure of the study. I understand that I have a right to refuse participation as participant or withdraw my consent at any time.

I, _____, the undersigned, give my consent to be participant of this investigation/study/program.

Signature of participant/guardian Signature of investigator

(Name and Address) Date

_____

_____

APPENDIX- C

Discourse Analysis Scale for narration task
(Hema & Shyamala, 2008)

Points to be considered while using Discourse Analysis Scale:
The parameters of propositional and non-propositional aspect of narration can be quantified with few general instructions to the evaluator as follows:

1. Initially read the keys provided in the sub headings which explain the exact meaning of the parameters to be scored as good, fair and poor with respect to the particular context of narration.
2. Scoring procedure involves the use of rating scale. Three points perceptual rating scale is used to evaluate each parameters.
3. Each appropriate behavior *(normal)* is given a *higher score* and the inappropriate behavior *(abnormal)* is scored *low*.

<u>Propositional aspects of communication.</u>

This includes the notion of relevancy, clarity of reference and coherence of information. It deals with how discourse is organized with respect to overall plan, theme or topic and how individual utterances are conceptually linked to main theme/topic.

1) Discourse Structure

Good- The discourse is organized with respect to overall plan, theme or topic and how events occurring earlier in time being described before events occurring later, and causative events preceding their consequences. The narrative discourse is never confusing in terms of logically and chronologically.

Fair- The discourse is partially confusing even if it's partially organized with respect to overall plan, theme or topic and how events occurring earlier in time being described before events occurring later, and causative events preceding their consequences, logically and chronologically making the narratives confusing.

Poor- The discourse is completely confusing since it is unorganized with respect to overall plan, theme or topic and how events occurring earlier in time being described before events occurring later, and causative events preceding their consequences. Thus the narrative is completely confusing in terms of logically and chronologically.

a) Discourse forethought----------→( )
[Score: 0-Poor, 1-Fair, 2-Good]

b) Organizational planning ----------→( )
[Score: 0-Poor, 1-Fair, 2-Good]

2) Communication intent

This parameter can be evaluated using frequency count, so check for the presence or absence. If present, make a note whether an individual use this parameter only in required circumstances or in all the circumstances.

Good- Individuals using this parameter in all required circumstances.

Fair- Individuals using this parameter inconsistently in the required circumstances.

Poor- This parameter is absent in the entire context of narration.

a) Initiation of narration----------→( )
[Score: 0-Poor, 1-Fair, 2-Good]

b) Asks for assistance during narration----------→( )
[Score: 0-Poor, 1-Fair, 2-Good]

c) Imagines events correctly----------→( )
[Score: 0-Poor, 1-Fair, 2-Good]

3) Coherence

a). Global coherence----------→( )

Good- Presence of good relationship between the meaning and context of verbalization with respect to the general topic of narration.

Fair- Presence of partial relationship between the meaning and context of verbalization with respect to the general topic of narration.

Poor- Relationship between the meaning and context of verbalization with respect to the general topic of narration is completely absent.

[Score: 0-Poor, 1-Fair, 2-Good]

b). Local coherence----------→( )

Good- Presence of good relationship between the meaning and context of verbalization with that of the immediately preceding utterance produced by the participant.

Fair- Presence of partial relationship between the meaning and context of verbalization with that of the immediately preceding utterance produced by the participant.

Poor- Relationship between the meaning and context of verbalization with that of the immediately preceding utterance produced by the participant is completely absent.

[Score: 0-Poor, 1-Fair, 2-Good]

4) Topic management

a). Introducing topic----------→( )

Good- Correctly introducing the topic.

Fair- Partial but correct introduction to topic.

Poor- Irrelevantly introducing topic or no response.

[Score: 0-Poor, 1-Fair, 2-Good]

b) Topic shift----------→( )

Good- Staying within the given topic.

Fair- Gradual shift from the given topic.

Poor- Rapid shift from the given topic.
[Score: 0-Poor, 1-Fair, 2-Good]

c) Topic changes----------→( )

Good- Coherent topic change where the topic is within the context of verbalization in terms of when and where the narrating event occurred.
Fair- Partially inappropriate topic change but still the topic is within the main context of verbalization in terms of when and where the narrating event occurred.
Poor- Non coherent topic change where the topic is decontextualized.
[Score: 0-Poor, 1-Fair, 2-Good]

d) Perseveration in the topics----------→( )

Good- Perseveration not present.
Fair- Perseveration partially present.
Poor- Perseveration continuously present.
[Score: 0-Poor, 1-Fair, 2-Good]

e) Minimal elaboration----------→( )

In presence of prompts from the investigator, the participants attempting to give yes/no responses along with very few sentential level discourse to elaborate the topic.
Good- Minimal elaboration appropriately present in all required circumstances
Fair- Minimal elaboration partially present in all required circumstances.
Poor- Minimal elaboration absent in required circumstances or minimal elaboration only present throughout the context of narration.
[Score: 0-Poor, 1-Fair, 2-Good]

f) Elaboration of topics----------→( )

Good- Adequate elaboration of topic.
Fair- Partial elaboration of topic.
Poor- Extra elaboration of topic.
[Score: 0-Poor, 1-Fair, 2-Good]

5) Information adequacy

Good- Completely adequate narration at word level/ single sentence level/ multiple sentence level without any prompts from the investigator.
Fair- Partially adequate narration at word level/ single sentence level/ multiple sentence level in the presence of few prompts from the investigator.
Poor- No narration at word level/ single sentence level/ multiple sentence level despite several prompts from the investigator.

a). Word level/ Single sentence level/ Multiple sentence level-----→( )

Underline the level at which the participant is positioned.
[Score: 0-Poor, 1-Fair, 2-Good]

6) Information content

Good- Completely correct description of people, locations, objects, activities and attributes that played a role in the events being narrated about. Good narratives pointing a detailed linguistic picture of the events they are describing.

Fair- Partially correct description of people, locations, objects, activities and attributes that played a role in the events being narrated about; Good narratives pointing more than half a linguistic picture of the events they are describing.

Poor- Incorrect description of people, locations, objects, activities and attributes that played a role in the events being narrated about. Good narratives pointing less than half a linguistic picture of the events they are describing.

a). Meaningful and adequate information----------→( )

[Score: 0-Poor, 1-Fair, 2-Good]

7) Message Accuracy ----------→( )

Good- An attempted narration involving correct narration without any confabulation or any inaccurate information within the same context of narration.

Fair- An attempted narration involving correct narration and few accurate information without any confabulation within the same context of narration.

Poor- An attempted narration involving incorrect narration with confabulation within the same context of narration with all inaccurate information.

[Score: 0-Poor, 1-Fair, 2-Good]

8) Temporal and causal relation (TCR)----------→( )

Good- Presence of all the temporal terms like then, and then, first, next, before, and after; causal terms like because, when, if, while, and until.

Fair- Presence of few temporal terms like then, and then, first, next, before, and after; causal terms like because, when, if, while, and until.

Poor- Absence of all the temporal terms like then, and then, first, next, before, and after; causal terms like because, when, if, while, and until.

[Score: 0-Poor, 1-Fair, 2-Good]

9) Vocabulary specificity----------→( )

Good- Using specific vocabulary when specific information is required.

Fair- Partially using specific vocabulary when specific information is required.

Poor- Overuse of generic terms such as "thing" and "stuff" when more specific information is required.

[Score: 0-Poor, 1-Fair, 2-Good]

10) Linguistic fluency ----------→( )

Good- Fluent discourse without any repetition, unusual pauses or hesitations.

Fair- Partially fluent discourse with very few repetitions, unusual pauses or hesitations.

Poor- Presence of repetition, unusual pauses, hesitations

[Score: 0-Poor, 1-Fair, 2-Good]

11) Speech Style ----------→( )

Good- Appropriate use of any dialectal structural forms, code switching and style-shifting.

Fair- Inappropriate use of dialectal structural forms, code switching, style-shifting is partially present.
Poor- Presence of totally inappropriate dialectal structural forms, code switching, style-shifting.
[Score: 0-Poor, 1-Fair, 2-Good]

12) Intonation ----------→( )
Good- Absence of any inappropriate or abnormal rising, falling, flat intonation with respect to a particular context of narration.
Fair- Inappropriate or abnormal rising, falling, flat intonation with respect to a particular context of narration is partially present.
Poor- Presence of inappropriate or abnormal rising, falling, flat intonation with respect to a particular context of narration.
[Score: 0-Poor, 1-Fair, 2-Good]

<u>Non propositional or Interactional aspects of communication</u>

This is one of the important categories of social communication behavior. These behaviors reflect the reciprocal nature of conversation and the joint co-operation required of the participant. *(Note: In narration it is only from participants' point of view)*
The following subcategories are considered:

1) Revision behaviors ----------→( )
Good- Absence of false starts and self interruptions in the entire context of narration.
Fair- Presence of false starts and self interruptions in some contexts of narration.
Poor- Continuous presence of false starts and self-interruptions in the entire context of narration.
[Score: 0-Poor, 1-Fair, 2-Good]

2) Repair strategy
This parameter can be evaluated using frequency count, so check for the presence or absence. If present, make a note whether an individual use this parameter only in required circumstances or in all the circumstances.
Good- Individuals using this parameter in all required circumstances.
Fair- Individuals using this parameter inconsistently in the required circumstances.
Poor- Individuals not using this parameter at all in the entire context of narration.

a) Use of self correction ----------→( )
Participants find a word or sentence after giving a small pause and continue the topic of narration.
[Score: 0-Poor, 1-Fair, 2-Good]

b) Use of repair through repetition/revision----------→( )
Repeating themselves and correcting the discourse without the investigators help.
[Score: 0-Poor, 1-Fair, 2-Good]

c) Use of other initiated correction----------→( )

Participants not able to find the right word, so the investigator fills it with the correct word to continue the topic of narration.

[Score: 0-Poor, 1-Fair, 2-Good]

d) Use of request for clarification ----------→( )

Requesting the investigator to modify the discourse and use the corrected version of discourse to continue the topic of narration.

[Score: 0-Poor, 1-Fair, 2-Good]

Finally, one can find discourse quotient, using the total score on propositional and non propositional aspects of communication which should be divided by total scores of all the features of propositional and non propositional aspects of communication. This must be multiplied with hundred to get the score in percentage. *Example*: The participant's score is 32. **Discourse Quotient** = 32/44+10= 32/54 x 100= 59.25

APPENDIX D

Scores of complex narrative discourse assessment of individuals with and without MCI

Participants with MCI	DNaPT	DNaPT (in percentage)	DNaNPT	DNaNPT (in percentage)	DNaDQ (in percentage)
1.	20	47.61	3	30	29.48
2.	25	59.52	5	50	38.46
3.	25	59.52	7	70	41.02
4.	9	21.42	2	20	14.10
5.	26	61.90	5	50	39.74
6.	15	35.71	4	40	24.35
7.	5	11.90	1	10	7.69
8.	6	14.28	3	30	11.53
9.	30	71.42	8	80	48.71
10.	11	26.19	2	20	16.66
Participants without MCI	**DNaPT**	**DNaPT (in percentage)**	**DNaNPT**	**DNaNPT (in percentage)**	**DNaDQ (in percentage)**
1.	40	95.23	10	100	64.1
2.	40	95.23	10	100	64.1
3.	42	100	10	100	66.67
4.	40	95.23	9	90	62.82
5.	38	90.47	10	100	61.53
6.	41	97.61	9	90	64.1
7.	41	97.61	10	100	65.38
8.	40	95.23	10	100	64.1
9.	42	100	10	100	66.67
10.	41	97.61	10	100	65.38
11.	41	97.61	10	100	65.38
12.	42	100	10	100	66.67
13.	42	100	10	100	66.67
14.	40	95.23	10	100	64.1
15.	39	92.85	10	100	62.82
16.	40	95.23	10	100	64.1
17.	40	95.23	10	100	64.1
18.	40	95.23	9	90	62.82
19.	39	92.85	10	100	62.82
20.	40	95.23	10	100	64.1
21.	42	100	10	100	66.67

APPENDIX E

Scores of exectuvie function assessment of individuals with and without MCI

Participants with MCI	Executive Functions					
	Verbal Fluency-Phoneme	Verbal Fluency-Category	Verbal Fluency-Category Switching	Design Fluency-Filled Dots	Design Fluency-Unfilled Dots	Design Fluency-Switching
1.	8	14	2	6	6	5
2.	7	9	2	7	5	2
3.	10	13	3	6	4	3
4.	9	12	2	4	5	3
5.	10	11	4	6	4	2
6.	8	10	3	5	3	0
7.	7	9	3	4	3	1
8.	5	9	2	5	4	2
9.	5	11	4	4	4	1
10.	8	12	2	4	5	1
Participants without MCI	Executive Functions					
	Verbal Fluency-Phoneme	Verbal Fluency-Category	Verbal Fluency-Category Switching	Design Fluency-Filled Dots	Design Fluency-Unfilled Dots	Design Fluency-Switching
1.	15	15	5	15	13	7
2.	12	20	8	15	13	10
3.	15	15	7	18	15	7
4.	14	14	5	18	12	9
5.	22	24	7	16	15	8
6.	14	18	7	18	14	9
7.	16	15	7	15	13	7
8.	12	21	6	16	15	8
9.	18	17	7	17	16	7
10.	15	17	5	14	16	6
11.	18	18	6	13	17	8
12.	16	18	7	13	15	7
13.	17	18	5	16	12	8
14.	10	12	5	13	9	6
15.	18	22	6	14	12	8
16.	21	25	7	20	14	10
17.	11	10	6	11	10	7
18.	10	14	5	13	12	6
19.	12	15	4	13	13	5
20.	11	17	4	10	12	6
21.	11	13	5	12	10	7