Differential Performance across Discourse Types in MCI and Dementia

THESIS

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By

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Abstract

The purpose of this study was two-fold: to explore the 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.

Discourse was analyzed for the occurrence of discourse-enhancing and discourse-impairing characteristics. Discourse-enhancing characteristics included 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.

The results of this study revealed significant differences between discourse tasks for all of the discourse-enhancing characteristics and for one discourse-impairing feature, the occurrence of pronouns. Post-hoc analyses revealed expected significant differences between measures for mean length of utterance, verbal facility, and pronouns, indicating decreased verbal facility and increased pronoun usage for measures that were cognitively
more taxing. Conversely, unexpected significant differences between measures were revealed for discourse richness, including the occurrence of modifiers and vocabulary diversity, indicated increased discourse richness for the more cognitively demanding tasks. Correlational analyses revealed several significant relationships between discourse characteristics and cognitive status. However, differences were not consistent enough across measures to be able to reliably predict cognitive performance.

This study resulted in several significant findings that speak to the sensitivity of discourse to shed light on cognitive factors such as episodic memory, working memory, semantic memory, attention, and higher level cognitive functions. However, significant differences between discourse types for discourse characteristics were not consistent enough to be generalizable. Limitations and suggestions for future research are discussed.
Acknowledgments

I would like to acknowledge Dr. Michelle Bourgeois for her patience, guidance, and persistent enthusiasm throughout this research project. Your passion for research is contagious. Thank you for inspiring me to partake in the research endeavor and for helping me to make that inspiration a reality. I would also like to acknowledge Dr. Davida Fromm with Carnegie Mellon University for her assistance with the transcription and data analysis processes. Thank you for your kindness and collaboration, and for making CHAT and CLAN accessible through your incredible wealth of knowledge. Finally, I would like to acknowledge the Department of Speech and Hearing Science for graciously providing clinic space for data collection.
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Fields of Study

Major Field: Speech and Hearing Science; Speech-Language Pathology
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Introduction

The stakes for development of sensitive assessment tools for age-related cognitive decline have never been higher. The burden of dementia on families, communities, and the American medical system is expected to increase over the course of the next two decades as the elderly population in the United States grows from 35 million to more than 70 million (Plassman et al., 2007). Prevalence statistics from data collected in 2002 to 2003 estimate that 13.9% of people age 71 and older have some form of dementia, with prevalence increasing with advancing age (Plassman et al., 2007). The literature base contains no reliable evidence to support the notion that dementia can be prevented. However, with quality intervention, patients’ independence can be maintained for a longer period of time, delaying institutionalization. Over the course of the past several decades, modest gains have been made in pharmacological intervention for cognitive decline (Albert et al., 2011). However, symptom severity and functional impact can also, and perhaps more significantly, be addressed non-pharmacologically through behavioral cognitive intervention (Vickrey et al., 2006). It is vital that such intervention methods in dementia be applied as early in the disease as possible, as this is when behavioral interventions have been shown to be the most effective (Werheid, Ziegler, Klapper, & Kuehl, 2010). It is well established that dissolution of discourse-level language processing is a sentinel marker of mild cognitive impairment (MCI) and early Alzheimer’s disease (AD) (Kempler & Goral, 2008). Therefore, analysis of discourse
has the potential to provide powerful information for assessment and directing early intervention (Fleming & Harris, 2009).

Discourse analysis provides a rich corpus for the study of language and communicative effectiveness in MCI and dementia. Discourse is a complex, naturally occurring form of communication involving the activation and interaction of multiple interconnected cognitive and linguistic subsystems (Fergadiotis, Wright, & Capilouto, 2011). Discourse is produced according to the unique communication requirements in numerous domains of social life (Fergadiotis et al., 2011). Goffman (1981) refers to discourse as “language in use”, inexorably linking it to social purpose. Indeed, assessing discourse is assessing holistic communicative effectiveness (Giles, Patterson, & Hodges, 1996). Said differently, discourse analysis is functional in that it sheds light on how patients communicate in real-world contexts. This is in contrast to traditional screenings and assessments which, instead, test isolated linguistic abilities, and hence, when administered in isolation, may fail to tap the complex interactive processes that are required for real-world communication (Giles et al., 1996).

For the past three decades, researchers have analyzed numerous micro- and macro-linguistic characteristics of discourse. Research results irrefutably indicate that this type of language is sensitive to cognitive changes due to neurological insult and aging (Fleming & Harris, 2009; Giles et al., 1996; Kempler & Goral, 2008). Disturbances within the complex interaction of linguistic, communicative, and other cognitive processes that make up discourse are evident even in borderline dysfunction (Giles et al., 1996). For example, according to Oulhaj, Wilcock, Smith, and deJager
(2009) the most important cognitive predictors of AD are deficits in memory retention and abstract reasoning, which can be present in a person’s discourse more than ten years prior to diagnosis. Similarly, Harris, Kiran, Marquardt, and Fleming (2008) 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).

Numerous memory types and cognitive processes have been implicated with changes in discourse in dementia. The memory types and processes most pertinent to this study include episodic memory, semantic memory, working memory, executive function, and cognitive flexibility (Tulving, 1983; Dijkstra, Bourgeois, Petrie, & Allen-Burge, 2002). Breakdowns in discourse in dementia can be linked in part to semantic memory, which is a person’s overlearned general knowledge and vocabulary (Dijkstra, Bourgeois, Allen, & Burgio, 2004). Johnson, Storandt, and Balota (2003) describe discourse produced by individuals with AD as being “semantically impoverished” despite being grammatically appropriate. Deficits in semantic memory manifest as word-finding problems with substitution of pronouns or conceptually-related words (for example, “dog” for “horse”). This results in pauses, sentence comprehension deficits, and lack of cohesion in discourse (Kempler & Goral, 2008). Giles et al. (1996) administered a picture description task to three groups of adults with dementia (minimal, mild, and moderate severities). Results revealed a highly significant main effect for the rate of
production of information units, with a marked decrease in information units with increasing dementia severity. An equally notable finding in relation to semantic memory was the strong positive correlation between the amount of information relayed and participants’ performance on a battery of semantic tests. The authors suggested that these two deficits—discourse efficiency and lexico-semantic processing—may be linked. This inference supports Hodges and Patterson’s (1995) findings, which indicate that semantic abilities begin to breakdown early in the AD disease process.

Similar indicators of impairment in semantic memory (namely, length and richness of descriptions) were found by Fleming and Harris (2008), who utilized a complex discourse task “Trip to New York” to assess linguistic and core thematic elements as generated by two separate groups: a cognitively healthy group and a group diagnosed with MCI. Quantitative (length and complexity of discourse) and qualitative (thematic coding of core elements: money/cost, lodging, activities, etc.) variables were analyzed. Results revealed significantly fewer words for the MCI group, implicating semantic memory. In addition, the MCI group produced significantly fewer thematic core elements. The authors attributed this finding more to deficits in executive function as revealed by decreased competence in planning, problem-solving, and organizational abilities, than to semantic memory. Reduced cognitive flexibility and executive function are hallmarks of dementia. These cognitive abilities are among the first to deteriorate in dementia (Fleming & Harris, 2008; Harris et al., 2008; Kempler & Goral, 2008). Hence, evidence of cognitive decline is present in the discourse of individuals with MCI, whose functional capacities remain largely unimpacted.
Harris et al. (2008) extended the former study, again with the “Trip to New York” discourse task. Three experimental groups included young healthy adults, older healthy adults, and adults with a diagnosis of MCI. Core linguistic and core thematic variables were analyzed. Significant results, again, were found for qualitative thematic core variables. Young and older normal groups provided more thematic information than did the MCI group. The MCI group provided the least thematic information, which points to deficits in problem solving, communicative skills, and planning. Although the qualitative differences between groups in executive functioning were the most notable findings of this study, some core linguistic variables were also reliable predictors of differences between MCI and normal groups. The MCI group produced significantly higher proportions of pronouns, modifiers, and mazed words than did the normal groups. These linguistic characteristics, which implicate cognitive flexibility and working memory, were better markers of communicative differences than the linguistic characteristics that drew predominantly from semantic memory (e.g., definite and indefinite nouns, and verbs).

The connection between working memory capacity and dementia severity has been well documented (Chapman, Anand, Sparks, & Cullum, 2006; Dijkstra et al., 2002; Dijkstra et al., 2004; Harris et al, 2008; Johnson et al., 2003; Kempler & Goral, 2008). Discourse performance is sensitive to decreases in working memory, particularly with complex tasks, which demand greater cognitive resources (Dijkstra et al., 2002). Working memory makes it possible for an individual to attend to and synthesize competing information. Increased demands on working memory have been shown to
have a more deleterious impact on the discourse of patients with AD than on healthy controls (Haut et al., 1998). The taxation of working memory is evident through a number of extralinguistic discourse characteristics such as inferencing ability, abstraction, gist-level processing, cohesion, and coherence (Schmitter-Edgecombe & Creamer, 2010; Chapman et al., 2006; Dijkstra et al., 2002; McNamara & Kintsch, 1996; Harris et al., 2008). When working memory is not adequate to meet the cognitive demands of a task, the aforementioned characteristics will break down.

Chapman et al. (2006) found decreased working memory among other deficits as evidenced by impaired gist-level processing. They administered a story recall task to three groups of participants: a healthy younger group, a healthy older group, and a group with mild AD. Whereas detail-level processing is the rehashing of explicitly stated information, gist processing requires generalized understanding of a text in addition to inferencing and cognitive flexibility (Schmitter-Edgcombe & Creamer, 2010). In order to produce gist, a person must be able to connect explicitly stated information with world knowledge. Most notably, Chapman et al. (2006) found no age effect but did find a significant difference between healthy groups (young and old) and the AD group for transformed gist, which was defined within the study as the ability of the participants to convey in a single sentence the generalized meaning of the story that was presented to them. In addition, the AD group produced significantly fewer thematic units when compared to the cognitively healthy groups. The fact that there was no age-related decline in transformed gist or thematic units suggests that one’s ability to synthesize information across sentences and generalize meaning through condensation,
generalization, and knowledge-based inferencing need not decrease in healthy aging. However, as these abilities decline in early AD due to decreased short term memory and working memory, and difficulty with abstraction, discourse analysis, specifically of transformed gist abilities, can effectively differentiate the healthy aging individual from the one who has early dementia (Chapman et al., 2006).

Global coherence is similar to transformed gist in that it represents thematically higher order structures in discourse (McNamara & Kintsch, 1996). Global coherence is connected to working memory capacity as it requires continued activation of topic information in a conversation (Dijkgraaf et al., 2004). Dijkstra et al. (2002) investigated global coherence in the discourse breakdowns of nursing home residents with early-, middle-, and late-stage dementia. A short conversational sample was analyzed for the occurrence of discourse-building and discourse-imparing features. They defined discourse builders as conversational elements that promote productive communication (e.g., the number of unique words, the number of information units, coherence, cohesion, and topic maintenance). Conversely, discourse impairments were defined as obstructers of effective conversation and included repetitions, empty phrases, non-specific words, disruptive topic shifts, aborted phrases, and incorrect verb tense. Results indicated profound differences between the discourse of early- and late-stage residents. However, notable differences were also found between early- and middle-stage residents, including the number of unique words in the conversational samples, elaborations on topic, and global coherence. Compared to late-stage residents, early-stage residents were better able to keep information activated throughout the conversation and integrate this information
with new information. However, early-stage residents were not without impairments in discourse. They displayed greater deficits with global coherence, which places a high demand on cognitive resources, than with discourse characteristics that were activated on an utterance-by-utterance level such as cohesion and local coherence. Global and thematic coherence, as described by the aforementioned studies, are particularly powerful in providing insight into abnormal language changes with aging and the onset of cognitive changes (Glosser & Deser, 1992).

The current literature base provides a relatively comprehensive picture of the types of changes that occur in discourse at each stage of dementia and how they relate to memory and cognitive-linguistic deficits. Also detailed in the literature are the specific linguistic features that are the most sensitive to cognitive changes versus the ones that remain intact throughout the course of the illness. However, what remains relatively untouched in the MCI and dementia literature base is whether people with MCI or dementia produce discourse differently based on the type of discourse (e.g., descriptive, narrative, procedural, persuasive, expository, and conversational). One could presume that discourse performance will differ across discourse type, as each discourse type imposes distinct cognitive and linguistic demands on the speaker. Furthermore, each discourse type requires use of distinct linguistic characteristics based on the social purpose of the discourse as well as varying degrees of cognitive effort (Fleming & Harris, 2008).

Four discourse types were included in this study: procedural, descriptive, narrative, and conversational. Six separate discourse tasks were utilized to impose
varying cognitive, linguistic, and social constraints on the participants. Procedural discourse is produced using overlearned sequences and common vocabulary, and hence, can be expected to remain intact in people with dementia until the later stages of illness. Similarly, advice-giving in conversational discourse tends to draw from overlearned scripts and activates deep-seated roles that are stored remote memory, which remains intact longer in dementia (Dijkstra, Bourgeois, Youmans, & Hancock, 2006). Advice-giving provides constraints and a structural schema to the speaker with dementia which may serve to increase focus and organization in discourse (Dijkstra et al., 2006). This is in contrast to more traditionally-defined conversational discourse, which provides no constraints to the speaker and draws predominantly from episodic memory. Episodic memory has been shown to be impaired in MCI and early dementia (Albert et al., 2011; Oulhaj et al., 2009). Descriptive discourse also provides varying levels of challenge to the speaker with dementia based on the constraints presented by the object or situation being described. Descriptive discourse relies heavily on semantic memory. Discourse of people with dementia has been described as being “grammatically appropriate … (but) semantically impoverished” (Johnson et al., 2003). This is the result of breakdowns in semantic memory, which impact word-finding and vocabulary retrieval. In comparison to other types of descriptive discourse, picture description focuses attention, lessens interference, and reduces the memory load (Giles et al., 1996). Multiple-paneled pictures provide greater visual support to the speaker than do single-paneled pictures, which require greater working memory and thought organization. Complex story retell, specifically of a classic fairy tale as conducted in this study, requires even greater
cognitive flexibility, as it involves incorporating previously learned details stored in remote and episodic memory with delayed recall of new details. In addition, complex vocabulary retrieval is required. This type of descriptive discourse requires integration of episodic memory, semantic memory, and working memory as well as higher cognitive functions such as thought organization and planning.

An analysis schema utilized by Dijkstra et al. (2004) was adapted for use in the current study. Discourse-building features are defined by Dijkstra et al. (2004) as “features contributing to the continuation of discourse” such as richness in unique words, information units, and elaborations, all of which reveal strong vocabulary and intact semantic memory. In addition, discourse characterized by discourse-building features was described as being concise and demonstrating global and local coherence, and cohesion. Conversely, discourse-impairing features are defined by Dijkstra et al. (2004) as those that “hinder the continuation of discourse” such as repetitions, empty phrases, indefinite terms, aborted phrases, incorrect pronouns, and disruptive topic shifts. In this study, discourse-enhancing features that were analyzed include mean length of utterance, verbal facility (number of words uttered per second), vocabulary diversity, type token ratio, and occurrence of modifiers. Discourse-impairing features that were analyzed include the occurrence of utterances with repetitions, revisions, and inappropriate terminations (trailing off, self-interruptions, interruptions by other speakers, and aborted utterances); and the occurrence of pronouns.

The purpose of the current study was two-fold: to determine the effect of discourse type on the quality and efficiency of expressive communication in people with
MCI and early dementia; and to determine which, if any, of the measures or variables predict cognitive performance. We hypothesized that the personal narrative, conversational narratives, and Cinderella story retell would contain greater discourse-impairing features than the picture descriptions and procedural discourse. This is because the former types draw on episodic memory and require greater cognitive flexibility and working memory capacity to maintain global coherence and transformed gist processing. Conversely, we hypothesized that the cognitively less taxing discourse types, the picture descriptions and procedural discourse, would contain greater discourse-enhancing characteristics versus the personal and conversational narratives and the complex story retell. This is because the former types draw less heavily on episodic memory and higher cognitive functions and place constraints on vocabulary retrieval (e.g., by providing pictures or a structured conversational task). Finally, we hypothesized that discourse-impairing features present in the more cognitively taxing discourse types (e.g., the personal narrative, the advice question, and story retell) would be the strongest predictors of cognitive performance.
Method

Experimental Design

We employed a within-subjects design in order to examine the effects of six different discourse conditions on discourse efficiency and richness as measured by discourse-enhancing and discourse-impairing linguistic characteristics.

Participants

The study included a total of eight participants (five men, three women; age range: 59-79; mean age = 71.63, SD = 7.31) who were recruited from a weekly memory strategy-building and support group at the OSU Speech-Language-Hearing Clinic (OSU-SLHC). One participant opted to withdraw from the study prior to completion of the testing session. Therefore, the final sample included seven participants. Informed consent was obtained from all participants and/or participants’ caregivers as approved by and according to the guidelines of the Institutional Review Board of the Ohio State University (see Appendix A).

The following identifying information was collected via a caregiver-completed questionnaire: date of birth, gender, race, years of education, employment status, primary language spoken at home, dementia etiology, dementia duration, how and by whom dementia was diagnosed, depression status, history/presence of other neurological and
medical conditions, and current medications. Pertinent participant demographic data are summarized in Table 1.

Table 1
Participant Demographics

<table>
<thead>
<tr>
<th>Participant</th>
<th>Age</th>
<th>Sex</th>
<th>Ethnicity</th>
<th>Education</th>
<th>Diagnosis</th>
<th>MoCA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>77</td>
<td>F</td>
<td>Caucasian</td>
<td>Ph.D.</td>
<td>MCI</td>
<td>24</td>
</tr>
<tr>
<td>2</td>
<td>69</td>
<td>F</td>
<td>Caucasian</td>
<td>Master's</td>
<td>AD</td>
<td>29</td>
</tr>
<tr>
<td>3</td>
<td>59</td>
<td>F</td>
<td>African American</td>
<td>Bachelor's</td>
<td>AD</td>
<td>17</td>
</tr>
<tr>
<td>4</td>
<td>79</td>
<td>M</td>
<td>Caucasian</td>
<td>Clinical Doctorate</td>
<td>Mixed Dementia; vascular contributions</td>
<td>23</td>
</tr>
<tr>
<td>5</td>
<td>71</td>
<td>M</td>
<td>Caucasian</td>
<td>some college</td>
<td>AD</td>
<td>n/a</td>
</tr>
<tr>
<td>6</td>
<td>64</td>
<td>M</td>
<td>Caucasian</td>
<td>Bachelor's</td>
<td>Dementia; unspecified etiology</td>
<td>24</td>
</tr>
<tr>
<td>7</td>
<td>79</td>
<td>M</td>
<td>Caucasian</td>
<td>Master's</td>
<td>MCI; pointing to AD</td>
<td>20</td>
</tr>
<tr>
<td>8</td>
<td>75</td>
<td>M</td>
<td>Caucasian</td>
<td>Master's</td>
<td>Frontotemporal Dementia</td>
<td>23</td>
</tr>
</tbody>
</table>

*a*Highest level of schooling completed. *b*Total possible score = 30. *c*Suggested cutoff score for normal controls = ≥26. Suggested cutoff score for MCI and AD = <26. *d*Participant withdrew from study prior to completing MoCA.

We confirmed that each participant had a medical diagnosis of MCI or dementia through review of participants’ neuropsychological reports, when available. Otherwise, confirmation was provided by participants’ caregivers based on subjective complaints of declines in memory and objective impairment on clinical memory tests. In addition, participants were administered the Montreal Cognitive Assessment (MoCA: Nasreddine et al., 2005; maximum score = 30) as a means to objectively describe the memory and cognitive status of each participant. It should be noted that inclusion in this study was
not determined by or dependent upon MoCA scores. Based on normative data, suggested
cutoff scores are: ≥26 for normal controls (average score: 27.4, range: 25.2-29.6, SD =
2.2) and <26 for MCI and AD (MCI average score: 22.1, range: 19.0-25.2, SD = 3.1; AD
average score: 16.2, range: 21.0-11.4, SD = 4.8) (Nasreddine et al., 2005). Six out of
seven participants in this study were accurately identified by the MoCA as having a
medical diagnosis of MCI or dementia (mean = 22.86, SD = 3.72). See Table 1 for
participants’ MoCA scores.

Measures

Participants were administered a battery of cognitive and language measures as
part of a larger study involving a pilot protocol of language and cognitive assessments
purporting to identify early language markers of dementia. The MoCA, a cognitive status
screening test that is highly sensitive to MCI and AD, was used to examine orientation,
immediate and delayed recall, language, visuospatial abilities, attention, working
memory, language, and executive function. The Common Objects Memory Test
(COMT: Kempler et al., 2009) was used to assess immediate and delayed recall of object
lists following learning trials. A Quick Test of Cognitive Speed (AQT: Wiig et al., 2002)
assessed perceptual (reaction and response time) and cognitive speed as influenced by
attention, working memory and set-shifting. The AphasiaBank Repetition Test
(www.talkbank.org; 2011) was used to assess word-level and sentence-level repetition
skills. The Boston Naming Test (short form) (BNT: Mack et al., 1992) assessed single-
word confrontation naming. The Verb Naming Test from the Northwestern Assessment
of Verbs and Sentences - Revised (Thompson, in press) assessed production of verbs that
differed with respect to their argument structure. The Famous People Test (Holland, in press) was used to assess participants’ world knowledge and remote memory of famous people representing a variety of domains in life (for example, politicians, sports figures, movie stars, etc.).

Five discourse genres were assessed including a personal narrative, a conversational narrative, single and multi-panel picture descriptions, story-telling, and procedural discourse. Participants were given as much time as they needed for their responses. The personal narratives were elicited via two tasks: first, participants were asked to describe an illness, injury, or hospitalization they had recently experienced; secondly, participants were asked to provide advice to the investigator, who followed the script, “I’m thinking about getting married. What advice do you have for me?” The picture descriptions were elicited from black and white drawings. The first picture stimulus was a four-paneled picture of a child playing with a soccer ball and breaking a window. The second picture stimulus was a single-paneled picture of a cat stuck in a tree (Nicholas & Brookshire, 1995). Participants were directed to look at each picture and create a story with a beginning, a middle, and an end. For the story telling task, participants were shown a paperback picture book of Cinderella with the words covered up. They were instructed to look through the book to aid them in remembering the progression of story events and details. Participants were not given a time limit for looking at the pictures. The book was taken away and they were asked to tell as much of the story as they could. Finally, for the procedural discourse task, participants were asked to describe how they would make a peanut butter and jelly sandwich. The
experimental portion of this study included only the MoCA and the six discourse production tasks.

**Procedure-Logistics**

All participants were tested individually in a therapy room in the OSU-SLHC. The entire test procedure took approximately 120 minutes. All sessions were videotaped for reliability and inclusion in a multimedia database. In addition, all discourse tasks were audio recorded and later transcribed verbatim for discourse analysis purposes.

**Transcription and coding.** Discourse samples were transcribed and coded using the CHAT format and were analyzed with CLAN programs (MacWhinney, 2000). CHAT is a transcription format that has been in use and constant development for the past 30 years. CHAT is particularly well suited for the study of the unique language of dementia because it includes conventions for capturing various aspects of communication behavior that are relevant to dementia such as repetitions, revisions, pauses, fillers, gestures, unintelligible productions, and interruptions (MacWhinney, 2000). Codes utilized in the transcription process in this study are listed in Table 2.
Table 2  
**CHAT codes**

<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>&amp;</td>
<td>Fillers and incomplete words/phonological fragments</td>
</tr>
<tr>
<td>&amp;=</td>
<td>Describes simple paralinguistic events such as gestures, laughter, and sighs</td>
</tr>
<tr>
<td>+…</td>
<td>Trailing off</td>
</tr>
<tr>
<td>+/. or +/?</td>
<td>Interruptions by another speaker</td>
</tr>
<tr>
<td>+/।</td>
<td>Self-interruptions</td>
</tr>
<tr>
<td>+&quot;/। and +&quot;</td>
<td>Precedes quoted material</td>
</tr>
<tr>
<td>[/]</td>
<td>Repetitions</td>
</tr>
<tr>
<td>[//]</td>
<td>Revisions</td>
</tr>
<tr>
<td><a href="http://www">www</a>. and %exp</td>
<td>Marks untranscribed material and provides explanation</td>
</tr>
</tbody>
</table>

Utterances were segmented based on guidelines established by Berndt et al. (2000). These guidelines recommend utilizing the following hierarchical indices to guide segmentation: syntax, intonation, pause, and semantics. After transcription, transcripts were checked for errors and coding accuracy by utilizing the CHECK command in CLAN. All errors were corrected prior to analysis. An example of an error-free transcript is included in Appendix B.

**Analysis.** After the transcripts cleared two layers of checks, linguistic variables were analyzed with CLAN programs. There are a total of 29 CLAN programs. These programs encompass a wide variety of functions including frequency counts, key-word and line profiles, mean length of utterance (MLU), mean length of turn (MLT), type-token ratios (TTR), maximum word length counts, maximum utterance length histograms, vocabulary diversity (VocD), parts of speech, time duration, utterance
terminations, and numerous others. The programs and specific commands utilized in this study are included in Appendix C.

For this study, only participant utterances were analyzed. Therefore, the KWAL program was run first in order to extract *PAR tiers from each transcript. In addition, utterances coded for exclusion were removed. Next, the MOR line was inserted into each transcript to allow for analysis of the morphosyntactic characteristics of the language. The current study sought to determine differences across tasks; therefore, the GEM program was utilized to extract the five discourse tasks from each complete participant transcript. New files for each participant and each task were created for a total of 35 transcripts. To facilitate proportional analysis, mean length of turn, the total number of words, and total number of utterances were calculated for each transcript with the MLT program. Next, MLU, the ratio of morphemes to utterances, was calculated. The VocD program was used to calculate vocabulary diversity and TTR (the ratio of types of words to total words). The percentage of each part of speech was included in a spreadsheet with the MORTABLE program. Next, the FREQ program was utilized to determine the number of each type of pronoun and the number of incomplete utterances. The KWAL program was run again; first, to extract utterances containing revisions, and then, utterances with repetitions. Proportional analysis of revisions and repetitions was facilitated by utilization of the MLT program again to determine the number of utterances containing these discourse characteristics.
Reliability

A second clinician trained in the conventions of CHAT independently transcribed and coded a portion of the participant transcripts. Agreement reliability based on word- and utterance-level agreement was calculated for five out of seven (71%) complete transcripts. Utterance-level agreement was defined as agreement in the separation of utterances and coding of utterance-level discourse characteristics such as repetitions, revisions, and utterance terminators (e.g., interruptions, self-interruptions, and trailing off). Inter-rater reliability for word-level agreement ranged from 95% to 99% (Mean = 96.55, SD = 1.40); utterance-level agreement ranged from 85% to 96% (Mean = 90.03, SD = 4.60). Table 4 contains reliability measurements for each transcript included in the reliability sample. Differences in transcription and coding were resolved through discussion by both raters. Transcription and coding errors were identified and corrected prior to CLAN analysis.

Table 3

Interrater Reliability of Word- and Utterance-Level Discourse Characteristics

<table>
<thead>
<tr>
<th>Transcript</th>
<th>Total</th>
<th>% Agreement</th>
<th>Total</th>
<th>% Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>809</td>
<td>98.64</td>
<td>87</td>
<td>89.66</td>
</tr>
<tr>
<td>4</td>
<td>1790</td>
<td>94.75</td>
<td>225</td>
<td>94.22</td>
</tr>
<tr>
<td>6</td>
<td>1650</td>
<td>96.79</td>
<td>163</td>
<td>85.28</td>
</tr>
<tr>
<td>7</td>
<td>776</td>
<td>97.29</td>
<td>105</td>
<td>96.19</td>
</tr>
<tr>
<td>8</td>
<td>1463</td>
<td>95.28</td>
<td>171</td>
<td>84.79</td>
</tr>
<tr>
<td>M</td>
<td>1297.60</td>
<td>96.55</td>
<td>150.20</td>
<td>90.03</td>
</tr>
<tr>
<td>SD</td>
<td>425.39</td>
<td>1.40</td>
<td>49.45</td>
<td>4.60</td>
</tr>
</tbody>
</table>

Note. Interrater reliability was not calculated on investigator utterances or participant utterances that were excluded from the analysis.
Results

To answer the question of whether discourse type impacts verbal expression in the speaker with MCI or dementia, participant data for each discourse type were compared across the nine dependent variables: MLU, verbal facility (Words/Second), occurrence of modifiers (%Modifiers), VocD, TTR, and occurrence of pronouns, revisions, repetitions, and incomplete utterances (Incomplete Utts). To control for differences in transcript lengths across tasks and participants, proportion scores were calculated when applicable (number of pronouns divided by the total number of words; number of utterances containing revisions/repetitions/incomplete terminations divided by the total number of utterances). The means and standard deviations of the participant data for each of the six narrative measures were analyzed for differences in discourse-enhancing and discourse-impairing characteristics. A multivariate analysis of variance (MANOVA) was performed to determine whether significant differences existed across discourse types within each dependent variable. Post-hoc analysis revealed specific differences between measures for discourse-enhancing and discourse-impairing characteristics. The Bonferroni method was utilized to control for Type I errors.

Discourse-enhancing characteristics

Table 4 includes data for the five discourse-enhancing variables.
### Table 4

**Mean(SD) of discourse-enhancing characteristics across six narrative tasks**

<table>
<thead>
<tr>
<th>Measure</th>
<th>MLU</th>
<th>Words/Second</th>
<th>%Modifiers</th>
<th>VocD</th>
<th>TTR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Advice question</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
<td>13.88 (3.19)</td>
<td>1.74 (0.45)</td>
<td>28.02 (5.84)</td>
<td>61.38 (14.76)</td>
<td>0.55 (0.13)</td>
</tr>
<tr>
<td><strong>Personal narrative</strong>&lt;sup&gt;b&lt;/sup&gt;</td>
<td>10.10 (1.29)</td>
<td>1.92 (0.74)</td>
<td>31.64 (2.39)</td>
<td>70.80 (6.02)</td>
<td>0.55 (0.11)</td>
</tr>
<tr>
<td><strong>Picture description</strong>&lt;sup&gt;c&lt;/sup&gt; (1 panel)</td>
<td>12.75 (2.31)</td>
<td>1.46 (0.66)</td>
<td>22.42 (3.02)</td>
<td>45.71 (11.83)</td>
<td>0.59 (0.05)</td>
</tr>
<tr>
<td><strong>Picture description</strong>&lt;sup&gt;d&lt;/sup&gt; (4 panels)</td>
<td>15.90 (4.43)</td>
<td>2.22 (1.03)</td>
<td>23.33 (4.87)</td>
<td>46.80 (10.84)</td>
<td>0.64 (0.06)</td>
</tr>
<tr>
<td><strong>Story retell</strong>&lt;sup&gt;e&lt;/sup&gt;</td>
<td>14.07 (3.10)</td>
<td>0.88 (0.45)</td>
<td>26.47 (4.77)</td>
<td>59.48 (7.09)</td>
<td>0.47 (0.10)</td>
</tr>
<tr>
<td><strong>Procedural discourse</strong>&lt;sup&gt;f&lt;/sup&gt;</td>
<td>12.63 (2.59)</td>
<td>2.74 (1.05)</td>
<td>28.80 (3.28)</td>
<td>28.95 (10.50)</td>
<td>0.49 (0.09)</td>
</tr>
<tr>
<td>MANOVA</td>
<td>.046&lt;sup&gt;ε&lt;/sup&gt;</td>
<td>.005***</td>
<td>.005***</td>
<td>.000**</td>
<td>.046&lt;sup&gt;ε&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

The means (SD) for MLU for the advice question, personal narrative, picture description (1 panel), picture description (4 panels), story retell, and procedural discourse were 13.88 (3.19), 10.10 (1.29), 12.75 (2.31), 15.90 (4.43), 14.07 (3.10), and 12.63 (2.59), respectively. MANOVA revealed a significant difference in MLU between measures ($F = 2.529$, df = 1.5, $p = .046$) with the source of the difference, as determined by the Bonferroni method, being between the picture description (4 panels) and personal narrative ($p = .027$).

The means (SD) for verbal facility (words/second) for the advice question, personal narrative, picture description (1 panel), picture description (4 panels), story retell, and procedural discourse were 1.74 (0.45), 1.92 (0.74), 1.46 (0.66), 2.22 (1.03), 2.33 (1.03), and 2.74 (1.05), respectively. MANOVA revealed a significant difference in verbal facility between measures ($F = 2.529$, df = 1.5, $p = .046$) with the source of the difference, as determined by the Bonferroni method, being between the picture description (4 panels) and personal narrative ($p = .027$).
A strong main effect was present for discourse types and verbal facility (F = 4.111, df = 1,5, p = .005), with the source of the difference being between procedural discourse and story retell (p = .003).

The means (SD) for %modifiers for the advice question, personal narrative, picture description (1 panel), picture description (4 panels), story retell, and procedural discourse were 28.02 (5.84), 31.64 (2.39), 22.42 (3.02), 23.33 (4.87), 26.47 (4.77), and 28.80 (3.28), respectively. MANOVA revealed a strong significant difference between measures for the percentage of modifiers present in discourse (F = 4.092, df = 1,5, p = .005). Post-hoc measures attributed the source of the difference to be between the personal narrative and both picture description measures (1 panel, p = .008; 4 panels, p = .023).

The means (SD) for VocD for the advice question, personal narrative, picture description (1 panel), picture description (4 panels), story retell, and procedural discourse were 61.38 (14.76), 70.80 (6.02), 45.71 (11.83), 46.80 (10.84), 59.48 (7.09), and 28.95 (10.50), respectively. MANOVA revealed a main effect for VocD and discourse type (F = 9.847, df = 1,5, p = .000), with post-hoc analysis determining five sources of difference: the advice question and procedural discourse (p = .000); the story retell and procedural discourse (p = .001); and the personal narrative and single-paneled picture description, multiple-paneled picture description, and procedural discourse (p = .008, p = .012, p = .000, respectively).

The means (SD) for TTR for the advice question, personal narrative, picture description (1 panel), picture description (4 panels), story retell, and procedural discourse
were 0.55 (0.13), 0.55 (0.11), 0.59 (0.05), 0.64 (0.06), 0.47 (0.10), and 0.49 (0.09), respectively. MANOVA revealed significant differences across discourse type for TTR (F = 2.560, df = 1,5, p = .046). However, no main effects for TTR and discourse type were displayed by Bonferroni calculations (F = 2.421, df = 1,5, p = .054).

Figure 1 depicts significant results of post-hoc analysis for discourse-enhancing characteristics.
Figure 1. Mean scores across six discourse tasks for discourse-enhancing characteristics. Significant differences between discourse types for discourse-enhancing variables are indicated with connecting lines and $p$ values.
Discourse-imparing characteristics

Table 5 includes data for the five discourse-impairing variables.

Table 5

*Mean(SD) of discourse-impairing characteristics across six narrative tasks*

<table>
<thead>
<tr>
<th>Measure</th>
<th>Discourse-Impairing Characteristics</th>
<th>Pronouns</th>
<th>Revisions</th>
<th>Repetitions</th>
<th>Incomplete Utterances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advice question</td>
<td></td>
<td>0.24 (0.04)</td>
<td>0.18 (0.09)</td>
<td>0.19 (0.08)</td>
<td>0.06 (0.11)</td>
</tr>
<tr>
<td>Personal narrative</td>
<td></td>
<td>0.30 (0.10)</td>
<td>0.12 (0.08)</td>
<td>0.11 (0.04)</td>
<td>0.08 (0.11)</td>
</tr>
<tr>
<td>Picture description (1 panel)</td>
<td></td>
<td>0.13 (0.06)</td>
<td>0.17 (0.14)</td>
<td>0.11 (0.09)</td>
<td>0.04 (0.08)</td>
</tr>
<tr>
<td>Picture description (4 panels)</td>
<td></td>
<td>0.24 (0.09)</td>
<td>0.05 (0.06)</td>
<td>0.05 (0.08)</td>
<td>0.02 (0.06)</td>
</tr>
<tr>
<td>Story retell</td>
<td></td>
<td>0.22 (0.05)</td>
<td>0.19 (0.12)</td>
<td>0.17 (0.14)</td>
<td>0.05 (0.05)</td>
</tr>
<tr>
<td>Procedural discourse</td>
<td></td>
<td>0.21 (0.08)</td>
<td>0.18 (0.09)</td>
<td>0.18 (0.13)</td>
<td>0.02 (0.03)</td>
</tr>
<tr>
<td>MANOVA</td>
<td></td>
<td>.007***</td>
<td>.125</td>
<td>.131</td>
<td>.831</td>
</tr>
</tbody>
</table>

Means (SD) for pronouns for the advice question, personal narrative, picture description (1 panel), picture description (4 panels), story retell, and procedural discourse were 0.24 (0.04), 0.3 (0.1), 0.13 (0.06), 0.24 (0.09), 0.22 (0.05), and 0.21 (0.07), respectively. A strong main effect was determined for discourse type and pronoun prevalence (F = 3.875, df = 1,5, p = .007), with post-hoc analyses revealing specific significant differences between the personal narrative and picture description (1 panel) (p = .002).

Means (SD) for revisions for the advice question, personal narrative, picture description (1 panel), picture description (4 panels), story retell, and procedural discourse...
discourse were 0.18 (0.09), 0.12 (0.08), 0.17 (0.14), 0.05 (0.06), 0.19 (0.12), and 0.19 (0.09), respectively. No significant differences in the prevalence of revisions across discourse types were detected (F = 1.867, df = 1, 5, p = .125).

Means (SD) for repetitions for the advice question, personal narrative, picture description (1 panel), picture description (4 panels), story retell, and procedural discourse were 0.19 (0.08), 0.11 (0.04), 0.11 (0.09), 0.05 (0.08), 0.17 (0.14), and 0.18 (0.13), respectively. No significant differences were revealed by MANOVA (F = 1.834, df = 1, 5, p = .131).

Means (SD) for incomplete utterances for the advice question, personal narrative, picture description (1 panel), picture description (4 panels), story retell, and procedural discourse were 0.06 (0.11), 0.08 (0.11), 0.04 (0.08), 0.02 (0.06), 0.05 (0.05), and 0.02 (0.03), respectively. MANOVA revealed no significant differences (F = .446, df = 1, 5, p = .831). Figure 2 depicts significant results of post-hoc analysis for discourse-impairing characteristics.
Figure 2. Mean scores across six discourse tasks for discourse-impairing characteristics. Significant differences between discourse types for discourse-impairing variables are indicated with connecting lines and p-values.
Correlational analysis

Exploratory Pearson correlational analyses were performed for each of the discourse characteristics and participants’ MoCA scores to determine which, if any, of the discourse characteristics were predictive of each other or of cognitive performance. For the advice question, MoCA scores were significantly correlated with VocD and revisions (r = .874, p = .010 and r = .808, p = .028, respectively); and verbal facility was correlated with pronouns (r = .766, p = .045). For the personal narrative, modifiers and vocabulary diversity were correlated with revisions (r = .790, p = .035 and r = -.850, p = .032, respectively). For the single-paneled picture description, correlations were revealed between the MoCA and verbal facility (r = .779, p = .039); and incomplete utterances and vocabulary diversity (r = .865, p = .012). For the multiple-paneled picture description, the following correlations were detected: MoCA scores with pronouns (r = -.831, p = .026), revisions with VocD (r = .761, p = .047), and MLU with VocD, pronouns, and revisions (r = -.798, p = .032, r = -.813, p = .026 and r = -.795, p = .032, respectively). Significant correlations were also present within the story retell including verbal facility with pronouns (r = -.782, p = .038), incomplete utterances with MLU (r = -.761, p = .047), and VocD with TTR (r = 1.000; p = .001). For procedural discourse, MoCA scores were significantly correlated with repetitions (r = .776, p = .040).
Discussion

The purpose of this study was to determine the effect of discourse type on the quality and efficiency of expressive communication in people with MCI and dementia. Secondly, this study sought to determine the ability of discourse types and characteristics to predict cognitive performance. Discourse was evaluated via analysis of the presence or absence of linguistic variables across six discourse tasks that were selected to impose varying levels of cognitive demand on the participants. Linguistic variables were designated as either discourse-enhancing (e.g., MLU, verbal facility, prevalence of modifiers, vocabulary diversity, and TTR) or discourse-impairing (e.g., prevalence of pronouns, revisions, repetitions, and incomplete utterances).

Based on our review of the literature base, we postulated that the personal narrative would be the most taxing measure for the participants due to its reliance on episodic memory, complex vocabulary retrieval, and working memory for maintenance of global coherence. We presumed that the complex story retell would be the second most taxing discourse task due to demands on working memory and a requirement of cognitive flexibility to be able to incorporate newly learned details into existing cognitive schemas stored in remote memory. We appointed the advice question to the third position in the hierarchy of cognitive demand because although this discourse type draws significantly from episodic memory, that demand is tempered by common vocabulary retrieval and activation of ingrained, overlearned scripts and role knowledge. We
postulated that the picture descriptions (multiple-paneled followed by single-paneled) and procedural discourse, respectively, would impose the least cognitive demand on the participants due to minimal requirements for episodic and working memory and provision of additional discourse support (pictoral cues for the former; overlearned, ingrained sequences for the latter).

We hypothesized that discourse types requiring greater episodic memory, working memory, and complex vocabulary retrieval (personal narrative, story retell, and advice question) would be characterized by decreased discourse-enhancing characteristics and increased discourse-impairing characteristics as compared with discourse types that are less cognitively demanding (picture descriptions and procedural discourse). Conversely, we hypothesized that discourse-enhancing characteristics would be greater and discourse-impairing characteristics fewer in the discourse types that draw less from episodic memory, working memory, and higher cognitive functions (picture descriptions and procedural discourse).

The results of this study revealed significant differences across discourse types for six of the nine linguistic variables, including four of the five discourse-enhancing characteristics and one of the four discourse-impairing characteristics. Results support the notion presented in the literature that different discourse types place different demands on the speaker with MCI or dementia, thereby eliciting different levels of linguistic characteristics from the speaker based on the level of cognitive demand and the social purpose of the discourse type (Giles et al., 1996; Harris et al., 2008; Dijkstra et al., 2004; Fergadiotis et al., 2011; Harris et al., 2008).
Our specific hypotheses were partially supported by the results. Verbal facility, as measured by the discourse-enhancing characteristics of MLU and words per second, was shown to be significantly greater for the picture description and procedural discourse than for the personal narrative and story retell, respectively. Stated differently, the discourse tasks that required greater episodic memory, working memory, and cognitive flexibility were characterized by significantly decreased speech rate and MLU. Kempler & Goral (2008) attributed language impairments in early AD to extralinguistic deficits such as memory and attention, as supported by these results.

We expected discourse richness, as measured in this study by vocabulary diversity and the percent of modifiers, to be greater in procedural discourse and the picture descriptions due to discourse supports inherent in those tasks (e.g., visual cues in the former and overlearned sequences in the latter to support vocabulary retrieval). According to the literature, the constraints presented by those tasks serve to decrease lexical diversity in the healthy speaker; however, the opposite effect may be observed in the disordered speaker due to increased support of semantic memory and the provision of structure to discourse, which may presumably reduce demands on working memory and facilitate cohesion (Giles et al., 1996). It was outside of the scope of the current study to analyze the effect of task structure and constraints on discourse cohesion. However, findings related to discourse richness were contrary to our hypotheses, instead indicating main effects for the discourse types that presented no constraints or structure to which the speaker had to adhere.
More specifically, the personal narrative was found to have a greater percentage of modifiers and greater vocabulary diversity than either of the picture descriptions. In addition, the personal narrative, advice question, and story retell, all of which are more complex tasks for the cognitively-impaired speaker, displayed significantly greater vocabulary diversity than the procedural discourse, which is a less challenging discourse task. On a surface level, these findings contradict the well-documented assertion that the discourse of the person with AD is characterized by limited vocabulary and word finding difficulties (Dijkstra et al., 2002; Dijkstra et al., 2004; Kempler & Goral, 2008). However, the loss of semantic features in MCI and early dementia as compared with later-stage dementia is minimal, with discourse being impacted on a larger level by changes in working memory and attention (Johnson et al., 2003). This could account for the unexpected findings relating to discourse richness. Notably, results in this study indicated significantly reduced verbal facility for the more cognitively demanding tasks (e.g., the personal narrative and story retell). This was despite significantly greater vocabulary diversity.

These findings speak to the impact of social purpose on the discourse types utilized in this study. Discourse is structured based on the unique communication requirements inherent in different conversational situations (Fergadiotis et al., 2011). For the personal narrative, a discourse type that is reminiscent of the ancient art of storytelling, the social expectation is that the speaker will use a lot of descriptive modifiers and a diverse vocabulary to describe situations and connect them to world knowledge. The personal narrative draws largely from episodic memory, and the speaker
who is only mildly cognitively impaired may be able to compromise efficiency in order to comply with socially-expected standards of discourse detail and richness. Correlational analyses of discourse variables only partially supported this conjecture, however. In this study, modifiers were significantly correlated with revised utterances, suggesting a trade-off of detail for efficiency. However, VocD was negatively correlated with revisions, and modifiers were negatively correlated with the occurrence of incomplete utterances, instead associating lexico-semantic richness with greater discourse efficiency. It should be noted that the majority of research on vocabulary diversity has been conducted across participant groups, comparing vocabulary diversity across levels of severity. The current study, instead, sought to compare performance within subjects across measures of varying difficulty. This may reduce the generalizability of the literature base to this study.

Only one discourse-impairing characteristic – the use of pronouns – was found to be significantly different across measures. The personal narrative, which is dependent upon working memory, contained proportionately more pronouns than the single-paneled picture description, a task that requires far less working memory. These findings are in agreement with Kempler and Goral (2008), who found a significant association between pronoun use and working memory. In this study, correlational analyses revealed significant negative associations between pronouns and discourse-enhancing characteristics, speaking to the tendency of pronouns to accompany decreased discourse efficiency and quality. For example, pronouns were significantly negatively correlated
with MoCA scores and MLU on the multiple-paneled picture description. For the story retell, increased pronoun prevalence was associated with decreased verbal facility.

Correlational analyses were performed on MoCA scores and discourse characteristics to determine whether cognitive performance can predict discourse performance. We hypothesized that discourse-impairing features within discourse types that require greater cognitive resources would be most predictive of cognitive performance. Results were inconclusive. However, significant correlations between MoCA scores and discourse characteristics were revealed for four of the six discourse types: the advice question, the single- and multiple-paneled picture descriptions, and procedural discourse. Several correlations were expected, including positive associations between cognitive performance and vocabulary diversity for the advice question, and verbal facility for the single-paneled picture description. In addition, as expected, MoCA scores were negatively correlated with the prevalence of pronouns on the multiple-paneled picture description. However, results also revealed two unexpected findings. For the advice question, MoCA scores were positively correlated with revisions. For the procedural discourse, MoCA scores and repetitions were positively correlated. Both of these unexpected findings suggest that higher cognitive performance is associated with decreased verbal efficiency and effectiveness, which is not supported in the literature base. Although correlational analysis yielded some notable significant findings, overall results displayed limited consistency, and hence, are not predictive of cognitive performance.
This study resulted in several significant findings that speak to the sensitivity of discourse to shed light on cognitive factors such as episodic memory, working memory, semantic memory, attention, and higher level cognitive functions. However, this study did not result in consistent significant differences across variables and discourse types as determined by either multivariate or correlational analyses. This could be due in part to the current study’s sole focus on core linguistic variables, which have been shown to be less sensitive to discourse differences in MCI and early dementia than thematic and content information (Harris et al., 2008). The exclusion of content analysis in this study prevented the analysis of intriguing variables such as transformed gist (Chapman et al., 2006; Schmitter-Edgecombe & Creamer, 2010) local and global coherence (Dijkstra et al., 2004), thematic coherence (Harris et al., 2008), information content (Giles et al., 1996), and causal, referential, and temporal cohesion (Dijkstra et al., 2004). All of these extralinguistic discourse characteristics have been shown to reveal differences between the cognitively healthy adult and the person with MCI or early dementia. Utilization of these variables in the context of the current study, through analysis of content in addition to core linguistic variables, may have resulted in greater consistency in the significant differences across tasks.

The diversity among subjects in this study in terms of age, diagnosis, and level of impairment may have also impacted the consistency of significant results across discourse types and variables. For example, participant MoCA scores ranged from 17 (Participant 3) to 29 (Participant 2), representing mild-moderate AD on the lower limit to normal cognition on the upper limit (Song et al., 2008). Inferential statistics were not
conducted to determine significant differences between these two outlying participants. However, trends indicate consistent differential performance between these two participants across measures and variables. For discourse-enhancing characteristics, participant 2 displayed greater MLU on all tasks except for one, the personal narrative. Sizeable differences were also present in verbal facility for all measures, with the largest difference occurring with procedural discourse (4.00 words/second for participant 2; 0.74 words/second for participant 3). Differences were less consistent for measures of discourse richness (%modifiers and VocD), with participant 3 displaying richer discourse on the personal narrative, both picture descriptions, and the procedural discourse. This could be partially attributed to differences in the participants’ discourse styles, with participant 3 utilizing a naturally more effusive conversational style despite also displaying greater cognitive impairment.

For discourse-impairing characteristics, the discourse of participant 3 contained a greater proportion of pronouns than participant 2 on the personal narrative, both picture descriptions, story retell, and procedural discourse. Surprisingly, revisions were more prevalent in the discourse of participant 2 for a number of measures including the advice question, the story retell, and procedural discourse. Notable trends were not displayed for repetitions or incomplete utterances.

Inter-participant differences, as described by nonparametric analysis of performance across variables, suggest the possible sensitivity of the variables utilized in this study, particularly the discourse-enhancing characteristics, to reveal differences between the discourse of normal individuals and individuals with mild-moderate
dementia. However, the range in participant cognitive abilities, ages, and diagnoses may have impacted the consistency of MANOVA and correlational analyses, and furthermore, may have limited the external validity of this study. Additional research is warranted with a larger, more uniform sample, to determine whether consistent differences in core linguistic features exist between discourse types for participants with MCI or early dementia.

**Limitations**

The main limitation of this study was the number of participants. The final sample included seven participants who represented a wide range of ages (59-79 years) and varying dementia etiologies, severities, and cognitive deficits. A larger study including more participants and greater consistency among the level of cognitive impairment and specific deficits would need to be conducted in order for findings to be generalizable. Another limitation of this study was the sole inclusion of core linguistic variables. The inclusion of additional variables such as gist processing, coherence, cohesion, and information units may have resulted in more consistent differences across measures due to their greater sensitivity to cognitive changes in MCI and early dementia. Finally, this study would have benefitted from inclusion of a more complex discourse task requiring greater use of executive function such as the “Trip to New York” task described by Harris et al. (2008).

**Conclusions**

At the heart of discourse is one’s ability to abstract an overall message from an abundance of details and relay that message to a conversational partner. It is this ability
that determines communicative competence (Chapman et al., 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 the everyday interactions that involve the sharing of experiences, and the comprehension and integration of information into one’s schema pertaining to current events, daily happenings, and previous conversations. An inability to connect with others conversationally not only impedes one’s ability to contribute to social conversations, but by extension, seriously impedes one’s quality of life (McDonald & Togher, 2006). For these reasons among many, continued knowledge acquisition on discourse performance is vital to support development of functional screening tools and therapeutic techniques. The informed health professional, armed with knowledge about the functional abilities of a patient to engage in discourse, can create intervention plans to reduce disability and enhance rehabilitation (Harris et al., 2008). Indeed, interventions based on information gained from discourse analysis have worked. Conversational partners can be trained to facilitate conversational coherence in people with dementia through accommodations such as repeating questions, repeating information, using visual cues such as a memory book, or verbal cues (Dijkstra et al., 2004). The occurrence of discourse deficits in nursing home residents declined when they conversed with nursing aides who had received training on communication strategies (Dijkstra et al., 2002).

Indeed, communication in dementia is a cooperative exercise in which the cognitively normal speaker has a direct effect on the quality of the dialogue. However, effective discourse can only be facilitated by the normal speaker with knowledge
regarding the impaired speaker’s specific conversational strengths and weaknesses (McDonald & Togher, 2006). For these reasons, among many, discourse analysis remains a rich field for increased knowledge on the dissolution of language in dementia, and a potential goldmine for functional screening tools and therapeutic techniques to improve the lives of people living with dementia.
References


Appendix A: Informed Consent
The Ohio State University Consent to Participate in Research

Study Title: DementiaBank: Language usage in Dementia
Researcher: Michelle S. Bourgeois, PhD
Sponsor: None

This is a consent form for research participation. It contains important information about this study and what to expect if you decide to participate.

Your participation is voluntary.

Please consider the information carefully. Feel free to ask questions before making your decision whether or not to participate. If you decide to participate, you will be asked to sign this form and will receive a copy of the form.

Purpose:
The purpose of this research is to understand how language and cognition changes over time for persons with memory loss.

Procedures/Tasks:
Twenty-five participants (male and female; 50-80 years) with memory loss due to dementia will be identified at the OSU Speech & Hearing clinic or by family members. Consent for participation in the study will be solicited from the participant, a family member or legal representative. After consent is obtained, the investigators will meet with the individual to administer a battery of language and cognitive tests in an interview format. The protocol should take no longer than 75 minutes to administer. At any time if the participant expresses fatigue or disinterest in the procedures, the session will be discontinued. Each participant will be interviewed for no more than four separate occasions, 1 or 2 assessment and 1 or 2 follow-up conversational sessions. All sessions will be video-taped for analysis.

Duration:
You may leave the study at any time. If you decide to stop participating in the study, there will be no penalty to you, and you will not lose any benefits to which you are otherwise entitled. Your decision will not affect your future relationship with The Ohio State University.

Risks and Benefits:
The purpose of this study is to understand how language and cognition change due to memory loss. You will be asked to describe events in your life, pictures, and to answer questions which could be sensitive or embarrassing. Therefore, some participants could
consider the questions posed in the protocol as an invasion of their privacy. If a participant expresses, either verbally or nonverbally, that they are confused, suspicious, reluctant, or unwilling to engage in conversation with the researcher, the session will be terminated immediately. It is the experience of the PI that these expressions of discomfort are rare and easily resolved by terminating the session. The researcher will notify the staff or family member immediately after terminating a session, in order that the appropriate support measures are implemented to resolve any negative ramifications of the session.

The direct benefit to participants is that they will receive individualized attention, including opportunities to converse with the investigator, and that may be pleasurable for them. The benefit to others includes providing health care professionals with insight into the nature of decline of language and cognitive function in dementia.

Confidentiality:

Efforts will be made to keep your study-related information confidential. However, there may be circumstances where this information must be released. For example, personal information regarding your participation in this study may be disclosed if required by state law. Also, your records may be reviewed by the following groups (as applicable to the research):

- Office for Human Research Protections or other federal, state, or international regulatory agencies;
- The Ohio State University Institutional Review Board or Office of Responsible Research Practices;
- The sponsor, if any, or agency (including the Food and Drug Administration for FDA-regulated research) supporting the study.

Incentives:

You will not be paid for your participation in this study.

Participant Rights:

You may refuse to participate in this study without penalty or loss of benefits to which you are otherwise entitled. If you are a student or employee at Ohio State, your decision will not affect your grades or employment status.

If you choose to participate in the study, you may discontinue participation at any time without penalty or loss of benefits. By signing this form, you do not give up any personal legal rights you may have as a participant in this study.

An Institutional Review Board responsible for human subjects research at The Ohio State University reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and University policies designed to protect the rights and welfare of participants in research.

Contacts and Questions:

For questions, concerns, or complaints about the study you may contact:
Michelle S. Bourgeois, Ph.D., CCC-SLP, (614) 292-1742.

For questions about your rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.

If you are harmed as a result of participating in this study or for questions about a study-related harm, you may contact: Michelle Bourgeois, PhD., (614) 292-1742.
Signing the consent form

I have read (or someone has read to me) this form and I am aware that I am being asked to participate in a research study. I have had the opportunity to ask questions and have had them answered to my satisfaction. I voluntarily agree to participate in this study.

I am not giving up any legal rights by signing this form. I will be given a copy of this form.

Printed name of subject

Signature of subject

Date and time

Printed name of person authorized to consent for subject (when applicable)

Signature of person authorized to consent for subject (when applicable)

Date and time

Investigator/Research Staff

I have explained the research to the participant or his/her representative before requesting the signature(s) above. There are no blanks in this document. A copy of this form has been given to the participant or his/her representative.

Printed name of person obtaining consent

Signature of person obtaining consent

Date and time
*INV: okay, let's do somethin(g) a little bit different.

*INV: tell me how you would make a peanut butter and jelly sandwich.

*PAR: &uh depending on what child you're [/] (.) &=laughs you're making this, <you would put peanut butter> [//] (.) it seemed that (.) you would put peanut butter on one side of the bread and jelly on the other side of the bread.

*PAR: and [/] (.) and (.) if that didn't happen, the child &=laughs (.) said +"/

*PAR: +" that's not the way (.) you make a peanut butter sandwich.

*INV: okay.

*PAR: so that's (.) how you make a peanut butter jamwich [: sandwich] [* n:k] .

*INV: okay.

*INV: is there anything else you would do?

*PAR: I would (..) cut it .

*INV: okay.

*PAR: cut it in half or maybe fourths.

*INV: mhm.

*PAR: I don't know <of any other> [//] (.) of anything else that you would (.) do about making a peanut butter sandwich [+ exc] .

*INV: okay.
Appendix C: CLAN programs and codes displayed in the order utilized in this study

**CLAN Programs (listed below in the order utilized in this study)**

<table>
<thead>
<tr>
<th>Program</th>
<th>Code</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHECK</td>
<td>esc-L</td>
<td>Checks transcript conventions for CLAN compatibility</td>
</tr>
<tr>
<td>CHECK</td>
<td>mor +xl</td>
<td>Checks for CLAN recognition of words</td>
</tr>
<tr>
<td>KWAL</td>
<td>kwal -s&quot;[+ exc]&quot; +d1 +t@ID +t*PAR +t%mor +t@ +f *.cha</td>
<td>Removes *INV tiers and utterances coded for exclusion from transcripts; created new files (extension: .kwal)</td>
</tr>
<tr>
<td>MOR</td>
<td>mor*.cex</td>
<td>Inserts MOR line into transcripts for morphological/syntactical details; created new file (extension: .kwal.mor)</td>
</tr>
<tr>
<td>GEM</td>
<td>gem +stask_name +n +d1 +t*PAR +t%mor +f *.cex</td>
<td>Extracts each task from complete participant transcripts; created new files for each task (extension: .kwal.mor.gem)</td>
</tr>
<tr>
<td>MLT</td>
<td>mlt +d0 @</td>
<td>Calculates mean length of turn, including total number of words and total number of utterances; inserted data into spreadsheet</td>
</tr>
<tr>
<td>MLU</td>
<td>mlu +t*PAR +d *.cex</td>
<td>Calculates mean length utterance; inserted data into spreadsheet</td>
</tr>
<tr>
<td>VOCD</td>
<td>vocd +r6 +d2 +t*PAR *.cex</td>
<td>Calculates vocabulary diversity and type-token ratio; inserted data into spreadsheet</td>
</tr>
<tr>
<td>MORTABLE</td>
<td>mortable +t*PAR +u *.cex</td>
<td>Calculates percentages of each part of speech to total words; inserted data into spreadsheet</td>
</tr>
<tr>
<td>FREQ</td>
<td>freq +t*PAR +d6 +o +s@&quot;r.-,.- pro%,o-%&quot; @ +d2</td>
<td>Tabulates number of pronouns; inserted data into spreadsheet</td>
</tr>
<tr>
<td>FREQ</td>
<td>freq +s+... +s+/. +s+// +t*PAR @ +d2</td>
<td>Tabulates number of incomplete utterances; inserted into spreadsheet</td>
</tr>
<tr>
<td>KWAL</td>
<td>kwal +s&quot;[/]&quot; <em>.cex +t</em>PAR +d +fret</td>
<td>Extracts utterances containing revisions and inserted into .ret files for further analysis</td>
</tr>
<tr>
<td>KWAL</td>
<td>kwal +s&quot;[1]&quot; <em>.cex +t</em>PAR +d +fret</td>
<td>Extracts utterances containing repetitions and inserted into .ret files for further analysis</td>
</tr>
<tr>
<td>MLT</td>
<td>mlt +t*PAR *.ret.cex +d</td>
<td>Tabulates number of utterances in .ret files for proportional analysis</td>
</tr>
</tbody>
</table>