2019

Macrolinguistic Analysis of Discourse Production in People with Aphasia, Individuals with Mild Cognitive Impairment, and Survivors of Traumatic Brain Injury

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MACROLINGUISTIC ANALYSIS OF DISCOURSE PRODUCTION IN PEOPLE WITH APHASIA, INDIVIDUALS WITH MILD COGNITIVE IMPAIRMENT, AND SURVIVORS OF TRAUMATIC BRAIN INJURY

by

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B.S. University of Central Florida, 2019

A thesis submitted in partial fulfillment of the requirements
for the degree of Master of Science
in the School of Communication Sciences and Disorders
in the College of Health Professions and Sciences
at the University of Central Florida
Orlando, Florida

Fall Term

2019

Major Professor: Anthony Kong

ABSTRACT

This study examined the macrolinguistic features of three genres (single picture description, sequential picture description, and story retell) of discourse samples collected from participants with acquired communication disorders (including two speakers with aphasia, two with mild cognitive impairment, and two with traumatic brain injury) and unimpaired controls (n=6). Comparisons were made to investigate group and genre differences. Standardized assessment scores of cognitive and linguistic evaluations were collected and correlated to features of macrolinguistic discourse analysis.

Participants with acquired communication disorders performed best on the story retell discourse task compared to single picture description and sequential picture description. Significant measures for story retell task include lexical efficiency, time efficiency, and Main Concept score. No significant difference was found on performance between single-picture description task and sequential picture description for participants with acquired communication disorders. The Main Concept Analysis presented with the strongest correlation to macrolinguistic features of analysis. These preliminary findings suggest that main concept score is a predominant indicator of the overall informativeness and macrostructure of a speaker's discourse.

To my husband Michael whose unending love, support, and encouragement inspired me to complete this thesis. To my mother for showing me how to care deeply for others. To my father for encouraging me to be the best version of myself. To my father- and mother-in-law for their constant guidance and wisdom. And to my sister for reminding me not to take myself too seriously.

ACKNOWLEDGMENTS

I am grateful to my thesis committee Chair Dr. Anthony Kong for your willingness to give me a chance to learn about research when I was only an undergraduate student. Thank you for your consistent guidance, instruction, and fostering an appreciation of research that will remain with me for the entirety of my career. I am thankful for Dr. Lauren Bislick and Dr. Jack Ryalls for your knowledge and support throughout the completion of my thesis. I would also like to thank Dr. Amy Engelhoven of the UCF Aphasia House, Peggy Bargmann of Brain Fitness Club and Dr. Diane Robinson of the Central Florida Brain Injury Support Group for your efforts in participant recruitment.

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LIST OF ACRONYMS/ABBREVIATIONS

AQ	Aphasia Quotient
CADL-3	Communication Activities of Daily Living-Three
CIU	Correct Informational Unit
MCA	Main Concept Analysis
MCI	Mild Cognitive Impairment
NABW	Not Aphasic By WAB
OCS	Oxford Cognitive Screen
PWA	Person with Aphasia
QPA	Quantitative Production Analysis
TBI	Traumatic Brain Injury
WAB-R	Western Aphasia Battery-Revised

CHAPTER ONE: INTRODUCTION

Discourse is defined as a collection of complex and individualized communication acts that are transmitted and received in a social setting. Discourse can also be thought of as the most elaborate level of expressive language. Spoken language is multi-faceted and is constructed through different domains of language; form, content, and use (Bloom & Lahey, 1978). The form of language consists of syntax and grammar, the content of language deals with the meaning of words, and the use of language is concerned with speakers following social rules, and using language in conversation. These components come together as discourse in the form of conversational communication, relay procedural instructions, and story-telling (McCarthy & Carter, 1994). Discourse sampling and subsequent analysis is a crucial component of the assessment and intervention process for adults with neurologic disorders (Ehlhardt et al., 2008; Kennedy et al., 2008; Kilov, Togher, & Grant, 2009; Ylvisakar, Turkstra, & Coelho, 2005). Therefore conducting discourse analysis can define strengths and weaknesses that may not become evident through other forms of assessment such as standardized assessment. For example, an individual with a severe language impairment predictably could present with poor performance in verbal abilities on a standardized assessment but may present with intact pragmatic abilities in conversation that support their ability to communicate with others in the environment. This individual's pragmatic strengths are revealed through discourse analysis that would typically be unassessed in older adults and brain injured patients (Ceolho et al., 2005; Dijkstra, Bourgeois, Allen, & Buegio, 2004).

Over the past several decades, researchers have compiled different ways to analyze discourse production. Some studies analyze similar macrolinguistic features of discourse while

other studies prioritize other features. Researchers have a myriad of choices when selecting a desired discourse elicitation method. Selecting an appropriate discourse elicitation method can influence quality and quantity of the discourse produced (Coelho, 2002; Linnik, Bastiaanse, & Höhle, 2015; Olness, 2006, 2007; Olness, Ulatowska, Wertz, Thompson, & Auther-Steffan, 2002; Van Leer & Turkstra, 1999). With this in mind, the literature provides "a lack of unified theoretical base" in studying discourse analysis in individuals with acquired communication disorders (Linnik et al., 2015, p. 766). This leads to differing approaches in existing methodologies and varying definitions of key terminology, which bring about inconsistent findings in studies. For example, there are several methods of describing global coherence, the level of discourse that is concerned with how each unit of discourse relates to the overall topic (Wright, Capilouto, & Koutsoftas, 2013). Researchers have differing methods of analyzing features of discourse analysis, including global coherence, and it can become challenging to compare results of studies. Varying definitions of terminologies negatively impact the "quality, interpretability, and comparability of the outcomes" of future studies in discourse analysis (Linnik et al., 2015). These inconsistencies across the literature make it cumbersome to accurately diagnose and create individualized treatment plans of care for people with acquired communication disorders.

Assessment for adults with acquired communication impairments greatly benefit from discourse sampling and analysis. Results of discourse analysis can yield information about how an individual forms, structures, and uses his or her own language (Hallowell, 2017). Macrolinguistic abilities are concerned with the creation of conceptual links among sentences and conceptualizing the gist of the procedure or story (Marini, Andreeta, Del Tin, & Carlomagno, 2011; Pistino et al., 2019). The microlinguistic features of discourse analysis focus

on components of language that are 'within-sentence' language, such as phonology and word-selection (de Lira, Ortiz, Campanha, Bertoluci, & Minett, 2011). Discourse analysis and knowledge of typical performance on discourse tasks for disordered groups can play a pivotal role in differential diagnosis of communication-based disorders. Hallowell (2017) presents the case using discourse analysis in the differential diagnosis between normal aging, mild cognitive impairment (MCI) and dementia. If an individual fails to mention a few details of a story retelling task, it can be attributed to the effects of normal aging (Drummond et al., 2015), but somebody that gets distracted by the task of retelling the story and leaves out main ideas of the story is more closely associated with MCI (Toledo et al., 2017) or dementia (Dijkstra et al., 2004). Even though there are challenges to conducting discourse analysis (training and mentorship, equipment and software, and time as summarized by Hallowell, 2017), there is a significant value that is brought to the table in the process of differential diagnosis of acquired communication impairments.

Results of discourse analysis highlight areas of deficit that can be targeted as part of a holistic communication plan of care. Although speech-language pathologists tend to focus on smaller units of language, such as words and sentences, targeting discourse provides a well-rounded approach to therapy. Focusing on the functionality of an individual's language when developing a treatment plan of care is necessary in improving the overall communicative success for people with acquired communication disorders. Discourse analysis provides speech-language pathologists with a holistic picture of how their clients communicate. With this in mind, it is imperative to incorporate baseline measures and ongoing assessment throughout treatment as it relates to discourse (Hallowell, 2017).

CHAPTER TWO: LITERATURE REVIEW

Discourse

Discourse is imperative for expressing one's thoughts, wants, and needs, making human connection and telling personal stories (Armstrong, 2000). Engaging in long conversations, communicating one's ideas, and formulating oral presentations are all forms of discourse. Discourse has been defined in various ways across several studies that involve discourse analysis. This may be attributable to the idea that discourse is more complex than just the sum of its parts. Rather, discourse can be thought of as "the mechanism underlying the organization of speech into a coherent flow" (Linnik et al., 2015, p. 767).

There are two different theoretical perspectives that also contribute to the varying definitions of discourse. The formalist or structuralist perspective characterizes discourse as the highest level of language and is concerned with analysis of individual sentences as well as smaller units of language, such as phrases and words (Armstrong, 2000; Harris, 1963, 1988; Grimes, 1975). A formalist/structuralist theory separates the linguistic nature from the content of the discourse sample and tends to focus on analysis of the linguistic components of the discourse sample (Armstrong, 2000). Alternatively, a functional theoretical perspective views discourse as language in use (Armstrong, 2000; Goffman, 1981; Halliday, 1985a, 1985b).Under the functional theoretical framework, the linguistic components and meaning of discourse are combined and the social implications of discourse are prioritized over analysis of the smaller units of language. For the purpose of this study, a formalist/structuralist theoretical perspective will be adopted as analysis of the discourse samples will involve the quantification of several linguistic aspects, including words and utterances.

Discourse Analysis in Clinically-Disordered Groups

Clients with neurologic-based disorders that speech-language pathologists typically treat may include people with aphasia (PWA), traumatic brain injury (TBI), and mild cognitive impairment related to dementia. Earlier studies found that narratives of PWA are shorter and contain simplified grammar; however, the necessary elements of story structure and chronological order of events are present (Linnik et al., 2015). Current studies show that people with anomic aphasia tend to show microlinguistic disturbances together with relevant impairments of cohesion and global coherence. Other impacts on global coherence are microstructural linguistic deficits. For example, poor "construction of cohesive ties" can create a "vague and potentially ambiguous" discourse (Christiansen, 1995; Huber, 1990).

Discourse samples of PWA may present with neologisms and unintelligible utterances. Oral productions of fluent PWA tend to retain grammatical sentence structures but an overall reduced meaning of their utterances. Many researchers find a common consensus on their findings of reduced degree of informativeness of discourse in aphasia. Factors that contribute to the ambiguity of discourse content include "a reduced amount of essential content, information gaps, tangential propositions, and topic shifts" (Linnik et al., 2015; Andreeta, Cantagallo, & Marini, 2012; Capilouto, Wright, & Wagovich, 2006; Stark, 2010). Further reports on narrative analysis reveals reduced abilities of lexical retrieval, increased production of global coherence errors, and reduced amount of lexical informativeness in PWA (Linnik et al., 2015; Andreeta et al., 2012)

Even though many researchers agree on findings of informativeness of discourse in aphasia, there are many various methods that researchers can use to assess the informativeness of

discourse in aphasia. Earlier methods of assessment include content units which consist of a single word, noun phrase, verb phrase, or prepositional phase that is expressed by neurotypical speakers (Yorkston & Beukelman, 1980). Andreetta et al. (2012) identified that thematic or lexical informativeness have been included in recent studies on discourse in aphasia (Capilouto et al.,2006; Foka-Kavalieraki et al., 2008; Stark 2010; Ulatowska & Chapman, 1994; Ulatowska, Freedman-Stern, Doyel, Macaluso-Haynes, & North, 1983); however, the majority of these researchers have not pointed out the dissociation between these two measures of informativeness (Linnik et al., 2015).

Survivors of TBI belong to a heterogenous group with varying severities of cognitive communication disorders. Due to the vast diversity of this group, it can be challenging to assess all aspects of linguistic deficits in discourse production for the entire group. Individuals who have survived a TBI demonstrate significant deficits on the informative dimensions of discourse tasks (Marini et al., 2011). Similarly, PWA experience deficits in informativeness characterized by reduced meaning of utterances, missing information, and poor topic management. The severity of macrolinguistic errors may be influenced by the severity of trauma from the TBI. Discourse of survivors of severe TBI typically contains a poor global organization and reduced informative content. Cognitive deficits in TBI further complicated the disruption of linguistic profile. With this in mind, clinicians can expect the discourse of individuals with cognitive-communication disorders to be characterized by higher-level difficulties in planning and organizing discourse (Marini, Zettin, Bencich, Bosco, & Galetto, 2017).

Individuals with TBI tend to produce an oral discourse with fewer cohesive markers (Liles & Coelho, 1988). Compared to other individuals with neurological impairment such as

PWA, TBI survivors tend to have a lower degree of utterances that contribute to local cohesion and to the overall topic of the narrative task (Glosser & Deser, 1991; McDonald, 1993). Local cohesion can be defined as "the grammatical relationship between parts of a utterance essential for content interpretation" and global coherence is "the order of statements in a logical sequence" (Kong, 2016b, p. 163). However, these results highlight the cognitive nature of the narrative demands of a discourse task and the idea that certain discourse tasks require recall more heavily than others (Marini et al., 2017). Results of some studies suggested reduced cohesion in participants with TBI compared to neurotypical controls (Hartley & Jensen, 1991); however, results of other studies have also found no difference in cohesion performance (Coelho, 2002; Coelho, Le, Mozeiko, Krueger, & Grafman, 2012). Studies suggest poor retention of working memory and the manipulation of information in working memory can negatively impact survivors' ability to "link concepts using appropriate cohesive ties" (Marini et al., 2017 p. 93).

Other working deficits that may be experienced by survivors of TBI include failed topic maintenance and a reduction in available space in working memory or difficulty in reproducing content (Hill, Classen, Whitworth, Boyes, & Ward, 2018). Findings from a recent systematic review conducted by Hill et al., (2018) revealed differences in the organization and accuracy of discourse across a variety of genres (i.e. narrative, procedural, exposition, conversation, description). These differences, such as challenges in managing redundant and tangential information during discourse, can be attributed to participants' brain injury (Hill et al., 2018). Hill et al. (2018) revealed that survivors of acquired brain injuries experienced reduced performance across each cognitive construct assessed. Additionally, Hill et al. (2018) came to the agreement that discourse deficits experienced by survivors of traumatic brain injury are directly related to cognitive impairment (Mar, 2004), specifically executive function, working memory,

and memory. Other cognitive functions, such as attention, intelligence, and processing speed can also impact the quality of discourse production for survivors of traumatic brain injury (Mar, 2004).

The current acceptable diagnostic criteria for individuals with MCI are: "(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, and (d) intact activities of daily living" (Albert et al., 2011; Fleming, 2014). Although there are subtleties to the differences between normal aging and mild cognitive impairment, the literature supports the idea that the communicative difficulties of healthy older adults do not have a strong impact on completing activities of daily living when compared to the communicative difficulties of people with MCI (Drummond et al., 2015). Instead, executive function skills, such as planning, problem solving, and cognitive flexibility, can be impaired in people with MCI (Fleming, 2014). Deficits in these cognitive control mechanisms can influence performance on narrative and picture description discourse tasks (Fleming, 2014), especially when participants are asked to create multiple episodes of an event.

Kim , Kim, & Kim (2019) reported a positive correlation between performances of cognitive domains, such as memory and executive functions, and global coherence measures (in terms of how each utterance pertains to the overall topic) in discourse of healthy adults This suggested that both memory and execution are heavily involved in the maintenance of narrative discourse production. People with MCI tend to exhibit disruptions in the informativeness narrative structure, and global coherence on picture description tasks. This may present in the form of oversimplified sentence production (Kave & Levy, 2003) and an increased amount of

circumlocutions, revisions, and repetitions of ideas (Tomoeda & Bayles, 1993). In addition, individuals with MCI had a tendency to present facts in isolation rather than establishting relationships between the elements (Toledo et al., 2017), with utterances that are shorter as compared to normal controls (Mueller, Koscik, Hermann, Johnson, & Turkstra, 2018).

In a study conducted by Drummond et al. (2015) that evaluated discourse performance of healthy adults, individuals with MCI and people with Alzheimer's disease, the linguistic pattern of the MCI group most closely resembled the healthy adult control group in terms of coherence and cohesion across multiple types of discourse tasks (including sequential picture description tasks and personal narratives). Additionally, the authors argued that participants in the MCI group used more "irrelevant micropropositions and propositions" (p.1) compared to the healthy adult control group. Micropropositions were defined as additional relevant or irrelevant details that were outside of the central idea of the episode. This performance was very similar to the performance of the participants with Alzheimer's disease. The last major finding highlighted in Drummond et al.'s study (2015) addresses the participants' ability to complete an episode during discourse production. Forty-five percent of participants in the MCI group exhibited difficulty in finishing the episode and produced an incomplete narrative. These participants failed to provide a description of a story's outcome and resolution.

In summary, there are impairments that found in the discourse of individuals with acquired communication disorders however, these deficits present themselves differently for each group of speakers. Reduced cohesive markers are commonly found in discourse production of both PWA and survivors of TBI. Although this contributes to overall reduced informativeness, this can be attributed to linguistic disruption for PWA such as reduced lexical retrieval,

neologisms, and increased production of global coherence errors(Linnik, et al., 2015, Andreeta et al., 2012, Capilouto et al., 2006, Stark, 2010). Cognitive impairments such as executive function, working memory, and attention can negatively impact reduced informativeness for survivors of TBI (Mar, 2004). Individuals with MCI and survivors of TBI similarly experience difficulty with linking concepts together during discourse production (Marini et al., 2017;Toledo et al., 2017).

A study conducted by Capilouto, Wright, & Wagovich (2005) identified conflicting results in the literature regarding the informativeness of discourse production amongst healthy adults from the 50-59 year old group and 70-79 year old group. Specifically, older adults' narratives contained "a significantly lower percent correct information units" compared to younger adult participants (Capilouto et al., 2005). In several studies, Marini and colleagues utilized a method of analysis based on cohesion and coherence errors. Their results suggested that the discourse of neurotypical speakers had less local and global coherence errors than PWA (Marini, Carlomagno, Caltagirone, & Nocentini, 2005; Marini et al., 2011, 2017). As one begins to age, it is expected that spoken discourse abilities will deteriorate. For example, older adults tend to have a higher occurrence of disfluencies (i.e. pauses, repetitions, revisions, and interjections) compared to younger adults (Hallowell, 2018; Schiller, Ferreira, & Alario, 2007).

Methods in Elicitation and Analysis of Discourse

As previously indicated, researchers select the genre of discourse they intend to elicit from their participants depending on the cognitive and linguistic skills they are interested in investigating. Based on prior research, it has been determined that there are varying complexities in each of the types of discourse tasks. For example, story retelling requires short term recall, sustained attention, and combination of multiple episodes while sequential picture description

involves the combination of fewer episodes while managing the organization of the theme throughout the episodes (Kim et al., 2019). Additionally, single-picture description needs cognitive flexibility in the form of planning, organization of information, and conscious formation of word groups (Le, Coelho, Mozeiko, Krueger, & Grafman, 2014). The severity of the errors in cohesion and coherence may differ depending on the cognitive underpinnings required for a given discourse task (Marini et al., 2011; Andreeta et al., 2012; Toledo et al., 2017). Picture description, one of the most widely selected elicitation methods, guarantees a one-to-one comparability between discourse samples (Brookshire & Nicholas, 1994; Nicholas & Brookshire, 1993; Olness et al., 2002; Wright, Capilouto, Wagovich, Cranfill, & Davis, 2005) because commonly selected picture description tasks (e.g. cookie thief, cat rescue, picnic) have main concepts lists that have been developed for discourse analysis purposes. It is expected that performance on discourse tasks will vary depending upon the nature of the neurologic disorder and the type of discourse task.

Quantitative Production Analysis (QPA), outlined by Saffran, Berndt, and Schwartz (1989), is a comprehensive and detailed quantitative system that is typically used for analyzing fluent and nonfluent aphasic productions. QPA quantifies the lexical contents and sentence structures of narratives by more than 30 features. (e.g. number of open set words, number of closed set words, TTR, total narrative time, number of utterances, total auxiliary score, number of subject noun phrases). Other indices have been added to the QPA to measure proportions of nouns, verbs, pronouns, etc. (Rochon, Saffran, Berndt, & Schwartz, 2000). Apart from the focus of lexical contents and sentence structures, another approach to quantify discourse is based on the degree of content (or proposition) in the output. For examples, a method of measuring informativeness has been developed by Nicholas and Brookshire (1993), namely correct

information units (CIU). CIU are not content specific but these units are single words which are "accurate, informative, and relevant to the story being told" (Linnik et al., 2015). Main Concepts were originally developed by Nicholas and Brookshire (1993, 1995) and has been adapted by Kong (2009, 2011, 2016b, 2018) to develop the Main Concept Analysis (MCA). The MCA measures the amount of main information within an output by categorizing the presence of each main concept as being accurate and complete. Each main concept identified is subsequently classified as one of the following four categories: Accurate and Complete, Accurate but Incomplete, Inaccurate, or Absent. Content units and correct informational units focus on the microstructural levels of discourse rather than macrostructural levels. Researchers have described the MCA as a hybrid measure that depends on "lexical items produced (i.e., microstructure) but must also contain a verb and its constituent nouns (and potentially associated clauses) to receive full credit" (i.e. macrostructure; Dalton & Richardson, 2019 p. 2; Armstrong, 2000; Davis & Coelho, 2004). Performing a Main Concept Analysis was more sensitive to capture the complete information by awarding partial credit to speakers compared to Lexical Informative Units, Thematic Units, Correct Informational Units, and Content Units.

Further analysis will involve the investigation into other macrolinguistic features of discourse analysis outlined by Andreeta et al. (2012) that take into consideration features of local cohesion, global coherence errors, lexical information units, and thematic informativeness. Some of these features overlap with previously mentioned methods of discourse analysis, specifically lexical information units (defined as content and function words that are phonologically well-formed and are grammatically appropriate; Linnik et al., 2015), and thematic informativeness (defined as a main idea or detail in a story; Andreeta et al., 2012).

Other Forms of Language Assessment and Implications for Treatment

A speech language pathologist's goal is to facilitate communicative success for their clients. In order to create the most individualized and appropriate plan of care, it is imperative to have accurate and comprehensive assessment methods. Although there is no standardized assessment for the cognitive-linguistic abilities of individuals with acquired neurogenic communication disorders, clinicians have utilized discourse analysis as a method to assess these abilities. Discourse is often selected as a method of cognitive-linguistic evaluation due to its "ecological validity, freedom from examiner bias, and functionality" (Cannizzaro & Coelho, 2013; p.544).

Standardized assessments can provide a means of collecting baseline data about language and cognitive domains. The *Western Aphasia Battery-Revised* (WAB-R) (Kertesz,1982) is a popular assessment that can be used to determine an individual's classification of aphasia through evaluation of the Big Four tasks; fluency, naming, auditory comprehension, and repetition. It should be noted that the WAB-R includes a single picture description task with instructions to describe the picture rather than narrate a story based on the elements in the visual scene. Additionally, the analysis of the discourse sample collected from the WAB-R is concerned with fluency, grammatical competence, and paraphasias rather than a thorough macrolinguistic analysis (Kertesz, 1982).

The *Oxford Cognitive Screen* (OCS) (Demeyere et al., 2014) is new instrument that measures five cognitive domains (memory, language, executive function, number processing, and praxis). This screen is inclusive to PWA and people with neglect and was found to be a more accurate scale for detecting post-stroke cognitive deficits when compared to the Mini-Mental

State Exam (Mancuso et al., 2018). The *Communication Activities of Daily Living-Three* (CADL-3) (Holland, Frattali, & Fromm, 2018) evaluates communication skills in adults with acquired communication disorders across several domains including contextual communication, nonverbal communication, humor, and internet basics. The CADL-3 measures functional communication skills rather than discriminating between linguistic or cognitive based impairments. The *Main Concept Analysis* (MCA) is an instrument that is used to elicit and analyze discourse for speakers with acquired communication disorders such as PWA, individuals with dementia, and people with TBI (Kong, 2009, 2011, 2016b, 2018). The MCA quantifies discourse of four sequential picture descriptions based on the speaker's inclusion of main concepts.

Existing Gap of Research Findings, Current Research Questions, and Their Theoretical and Clinical Implications

There are existing studies that compare macrolinguistic features of language between PWA, survivors of TBI, and individuals with MCI, but there are inconsistencies between the studies, in the form of different types of tasks to elicit a response, the specific groups compared in each study, and features of language that have been examined. Many types of discourse elicitation methods have been employed in studies that analyze disordered discourse. These varying genres of discourse require the speaker to use different cognitive and linguistic skills. A single picture description task requires the inclusion of concepts from a single visual scene whereas a sequential picture description invokes the creation of multiple episodes that follow the same theme (Kim et al., 2019; Le et al., 2014). The discourse analysis results of studies that use differing genres of discourse cannot be compared on the same plane due to the difference in cognitive and linguistic skills required for each discourse genre. Researchers also tend to

highlight different methods of discourse analysis in their studies. Some studies prioritized the inclusion of certain analysis features over others. For example, researchers have used measures such as lexical information units, thematic units, content units, correct informational units and main concept units to describe the main ideas included in a story (Andreeta et al., 2012; Linnik et al., 2015). Although these features may be similar, utilization of different terminology to keep track of main ideas can lead to inaccurate comparison between studies. Another example is the contrast in definitions of features of analysis between studies. Marini et al., (2017, p. 96) defines cohesive ties as "anaphoric pronouns, number and gender agreement between nouns and pronouns and cohesive function words" and Armstrong (2000; p. 882) refers to cohesive ties as "pronouns demonstratives, the definitive article, ellipsis, and substitution." Disagreement between working definitions of features of macrolinguistic analysis can also contribute to difficulty in comparing results between studies.

This study, therefore, aims to answer three research questions:

Q1. First, this study will examine the differences of macrolinguistic impairments in discourse production across clinical groups of PWA, TBI, and MCI, as well as between these clinical groups and neurotypical controls. Based on prior research, it is hypothesized that participants with mild cognitive impairment will perform better than participants with fluent aphasia and TBI. It is expected that there will be statistically significant differences between disordered groups and the neurotypical control group.

Q2. Next, this study will compare the differences of macrolinguistic impairments across genres of discourse tasks (i.e., story telling task, single-picture picture description task, and sequential picture description task). Based on prior research, it has been determined that there are varying complexities in each of the types of discourse tasks, including factors such as

visuospatial demands, use of short term memory, cognitive demand required for each task, amount of episodes in each task, and the average amount of time required to complete each task. It is hypothesized that participants will perform better on the story telling task compared to the single-picture description task and the sequential picture description task.

Q3. Finally, this study will explore the relationship between standardized assessment scores and macrolinguistic impairments exhibited by the three clinical groups. Specifically, the correlations between standardized scores on WAB-R, OCS, CADL-3, and MCA and features of macrolinguistic analysis across disordered groups.

It is expected that the findings of this study will provide an alternative and thorough means of macrolinguistic analysis of discourse production in older adults, both neurotypical and impaired. This study involves the elicitation and comparison of multiple genres of discourse across three different groups of disordered speakers and normal control speakers. The inclusion of correlation comparisons between standardized assessment results and features of discourse analysis provides a clinical application for speech-language pathologists that assess and treat adults with communication impairments. Understanding how scores of the included standardized assessments relates to discourse analysis can help guide treatment and management of these acquired communication impairments.

CHAPTER THREE: METHODOLOGY

Participants

A total of six participants with an acquired communication disorder joined this study. Each participant signed a consent form that is linked to the approved IRB in Appendix A. The recruitment protocol included a battery of assessments to determine their eligibility for the study:

1. Two of them were PWA after a single stroke who were recruited from the Communication Disorders Clinic at the University of Central Florida. Both of them fulfilled the criteria of suffering from a (i) single stroke resulting in a left cortical or subcortical lesion(s), (ii) post-onset for at least six months, & (iii) premorbidly right-handed per medical report, discharge notes or self/family reports (Law, Kong, & Lai, 2018). Exclusion criteria included (i) multiple strokes, (ii) severe problems with articulation/oro-motor control/voice production/swallowing, (iii) dementia/brain trauma/brain tumor, & (iv) a history of drug abuse/alcoholism or mental illness (Law et al., 2018).
2. Another two participants with a single closed-head TBI, per discharge notes or self/family reports, were recruited from the Central Florida Brain Injury Support Group. Exclusion criteria included (i) diagnosis of aphasia, (ii) dementia/brain tumor/stroke, (iii) multiple traumatic brain injuries, (iv) an open-head TBI, (v) severe problems with articulation/oro-motor control/voice production/swallowing, & (vi) a history of drug abuse/alcoholism or mental illness (Ylvisake et al., 2005).
3. Two participants with MCI, with a diagnosis with a subtype of MCI from a neuropsychological assessment in their medical records, were also recruited from the

Brain Fitness Club. Exclusion criteria included (i) diagnosis of aphasia, (ii) history of head injury/brain tumor/stroke, (iii) severe problems with articulation/oro-motor control/voice production/swallowing, & (iv) history of drug abuse/alcoholism or mental illness (Fleming, 2014).

Individuals who are unable to provide a written consent and those who are not yet adults were not included. Table 1 displays the demographic information of the six participants.

Table 1Participant Demographic Information

Name	Group	Gender	Age	Education	Handedness	Glasses	Hearing Aid
Participant 1	MCI	Male	83-5	20 years	Left	Yes	Yes
Participant 2	MCI	Female	81-0	19 years	Right	Yes	No
Participant 3	TBI	Male	57-2	10 years	Right	No	No
Participant 4	TBI	Male	27-5	13 years	Right	No	No
Participant 5	CVA	Male	33-9	17 years	Right	Yes	No
Participant 6	CVA	Male	72-7	19 years	Right	No	Yes
Participant 7	Control	Male	85-2	14 years	Right	No	No
Participant 8	Control	Female	81-2	12 years	Right	No	No
Participant 9	Control	Male	36-0	18 years	Right	No	No
Participant 10	Control	Male	60-7	16 years	Right	No	No
Participant 11	Control	Male	24-0	12 years	Right	No	No
Participant 12	Control	Male	74-6	20 years	Right	No	No

Each of the six participants were administered the following standardized assessments:

1. The *Western Aphasia Battery-Revised* (WAB-R) (Kertesz, 1982), a widely used assessment tool that is used to evaluate adults with aphasia from an acquired neurological disorders. The Aphasia Quotient (AQ) score (out of a total of 100) was computed, based on sub-test performance of Spontaneous Content, Spontaneous Fluency, Auditory Comprehension, Fluency and Repetition, and recorded for each participant.
2. The *Communication Activities of Daily Living-3* (CADL-3) (Holland et al., 2018), a battery that evaluates functional communication skills for adults with communication-related

disabilities and how they relate to completing activities of daily living (ADL). The total raw score, computed based on performance of reading, writing, using numbers, social interactions, contextual communication, nonverbal communication, sequential relationships, humor, metaphor, absurdity, and internet basics, and percentile rank were recorded for all participants.

3. The *Oxford Cognitive Screen* (Demeyere et al., 2014), a cognitive screener that provides a quick snapshot of a person's cognitive profile of performance in the domains of picture naming, semantics, orientation, visual field, sentence reading, number writing, symbol cancellation, gestural imitation, verbal recall and recognition, and an executive task that is inclusive to individuals with aphasia and neglect. Each subtest of the OCS was recorded for all participants and a composite score was calculated in order to complete correlation calculations.
4. The *Main Concept Analysis* (MCA) (Kong, 2009), a tool that provides a comprehensive evaluation of the presence, accuracy, completeness, and efficiency of spoken output of individuals with a variety of neurological disorders (including PWA, dementia, and TBI) (Kong, 2011, 2016b, 2018). The Main Concept Score and Accurate and Complete concepts per minute were scored and recorded for each participant.
5. A non-standardized motor speech screen to investigate the presence or absence of dysarthria through repetition of vowels, words, and sentences as well as automatic speech production and diadochokinetic syllables. Participants that require further evaluation for apraxia of speech were administered the *Apraxia of Speech Rating Scale 3.0* to evaluate motor speech planning and programming (Strand, Duffy, Clark, & Josephs, 2014). None of the participants presented with any dysarthria or apraxia of speech.

Table 2 WAB-R Score Results of Disordered Participants

Name	Content (10)	Fluency (10)	Auditory Comprehension (10)	Repetition (10)	Naming & Word Finding (10)	Type of Aphasia	AQ (100)
Par. 1	8	10	9.8	10	7.6	Anomic	90.8
Par. 2	10	10	9.7	9.8	8.1	NABW	95.2
Par. 3	10	10	10	9.6	9.7	NABW	98.6
Par. 4	10	9	10	9.8	10	NABW	96.4
Par.5	8	5	6.5	3.2	5.8	Wernicke's	55
Par. 6	4	1	4.55	1.4	0.5	Wernicke's	22.9

Note: NABW: Not aphasic by WAB

Table 3 CADL Score Results of Disordered Participants

Name	Total Raw Score (100)	Percentile Rank
Participant 1	91	7th
Participant 2	85	2nd
Participant 3	99	75th
Participant 4	99	75th
Participant 5	92	83rd
Participant 6	64	27th

Table 4 OCS Score Results of Disordered Participants

Name	Picture Naming (4)	Semantics (3)	Orientation (4)	Visual Field (4)	Sentence Reading (15)	Number Writing (3)	Symbol Cancellation (50)	Imitation (12)	Verbal Recall/Reasoning (4)	Executive Task (in secs)	Composite
Par. 1	4	3	4	4	15	3	14	12	4	13 sec	71
Par. 2	3	3	2	4	15	2	48	12	4	17 sec	110
Par. 3	4	3	4	4	12	2	47	12	3	5 sec	96
Par. 4	3	3	4	4	13	3	49	12	1	2 sec	94
Par.5	3	3	4	3	10	3	30	12	4	24 sec	96
Par. 6	0	0	2	4	0	0	44	12	3	9 sec	74

Table 5 MCA Score Results of Disordered Participants

Name	AC (26)	AI (26)	IN (26)	AB (26)	Time	MC (78)	AC/min
Par. 1	13	4	2	7	4.94	45	2.63
Par. 2	6	5	0	15	9.1337	28	0.6569
Par. 3	17	5	1	3	2.25	62	7.5556
Par. 4	15	8	0	3	4.1	61	3.6586
Par.5	0	2	8	16	16.6	26	0
Par. 6	0	0	0	26	8.3667	0	0

Note: AC= number of accurate and correct concepts, AI= number of accurate but incomplete concepts, IN= number of inaccurate concepts; AB= number of absent concepts, MC= main concept analysis, AC/min= number of accurate and correct concepts per minute

Data Collection

The procedures for eliciting discourse samples followed as part of the protocol reported in the AphasiaBank (MacWhinney, Fromm, Forbes, & Holland, 2011). A standardized script has been developed to keep prompting consistency across investigators. A second level of prompting has been included to use if a participant does not respond in 10 seconds. This standardized script with the inclusion of the second level of prompting can be found at https://aphasia.talkbank.org/protocol/instructions.pdf. Additionally, a troubleshooting script has been developed for participants who still cannot respond and need additional prompting with simplified questions. This can be located at https://aphasia.talkbank.org/protocol/troubleshooting.pdf.

First, participants were asked to complete a single-picture description task. Participants were provided with a contextually rich picture, Cat Rescue (Nicholas & Brookshire, 1993), and were asked to look at the picture and tell a story with a clear beginning, middle, and end (MacWhinney et al., 2011; Wright & Capuilouto, 2009). Next, participants were asked to complete a sequential picture description task. The participants were presented with Broken

Window, a four-paneled black-and-white line drawing of a child playing with a soccer ball and breaking a window. The participants were asked to look at these pictures and to tell a story with a clear beginning, middle, and end (MacWhinney et al., 2011; Wright & Capiluto, 2009). Finally, participants were asked to complete a story telling task. Participants were provided with a paperback book of *Cinderella* (Grimes, 2005) with the words covered. Participants were asked if they knew the story and each participant reported some degree of familiarity with the story of Cinderella. They were told to look through the book and remember how the story goes. Then the book was taken away and they were asked to tell as much of the story as possible. In order to maximize comparability across participants, the investigator made every effort to remain as silent as possible during the interview. Participants were given as much time as they needed to respond. The protocols were administered in a single session and each session was audio recorded for subsequent orthographic transcriptions.

For each of the six clinical participants, a control participant matched in age (+/- 3 years 5 months), gender, and education (+/- 8 years) selected from the AphasiaBank (MacWhinney et al., 2011). The control transcripts from these participants were then downloaded from the website.

Analyzing Discourse Samples

Transcriptions of language samples were analyzed based upon certain QPA indices on CLAN, a system developed by Brian MacWhinney for The Child Language Data Exchange System (MacWhinney, 2000). The QPA indices that were analyzed on CLAN include (i) total number of words, (ii) number of narrative words, (iii) number of open class words, (iv) number

of closed class words, (v) number of nouns, (vi) number of pronouns, (vii) number of verbs, (viii) TTR, and (ix) number of utterances. Other QPA indices and features from Andreeta et al. (2012) were manually calculated. These indices included (i) total narrative time in minutes, (ii) a lexical efficiency measure and (iii) a time efficiency measure. The lexical efficiency measure was determined by the proportion of narrative words to total number of words uttered while the time efficiency measure was determined by total number of narrative words divided by time. Features from Andreeta et al. (2012) included measures of local cohesion and global coherence.

Local cohesion was evaluated based on percentage of local cohesion errors, including (i) errors of commission, a production of words without a clear referent, (ii) errors of omission, the failure to produce a word attached to a referent, and (iii) total number of local cohesion errors. Additionally, (iv) percentage of irregular topic switching, which occurred whenever an utterance was abruptly stopped but the following utterance did not continue with the flow of thoughts, therefore introducing new pieces of information, was computed. The final measure of local cohesion was (v) the total number of mis-used cohesive ties (i.e. anaphoric pronouns, number and gender agreement between nouns and pronouns, misuse of function words/semantically related content words).

Global coherence was measured using a four-point scale developed by Wright, Capilouto, and Koutsoftas (2013). Each orthographically transcribed language sample was separated into communication units, also known as C-units, which include an independent clause with its modifiers. Each C-unit was scored on a four-point scale, with 4 being a high global coherence score and 1 being a low global coherence score. See Appendix B for scoring criteria for the four-point global coherence rating scale and examples of each rating score.

A set of Main Concepts was determined for each discourse task and each discourse sample was scored on the accuracy and completeness of each main concept found in the language sample. Dalton & Richardson (2018) compiled a list of main concepts for commonly selected discourse elicitation methods (i.e. single-picture description, sequential-picture description, story retelling) that increases reliability across raters. These lists of main concepts has been included in this study and can be found in Appendix C.

Statistical Measures

To address Q1 and Q2, Mann Whitney U tests were conducted to compare the results of macrolinguistic feature analysis, group effect, and genre effect. The macrolinguistic feature analysis will serve as the dependent variable and the independent variables included (i) group, (ii) type of discourse task, and (iii) score on standardized assessment. Post-hoc analyses were then conducted to investigate the statistical significance between groups and genres of the discourse tasks. To address Q3, Spearman's rho correlation coefficients were conducted to examine the scores on the four standardized assessments with the macrolinguistic features of discourse analysis.

For measures of inter-rater reliability, one graduate student clinician was educated on the specific elicitation methods, and trained on CLAN, as well as how to manually score orthographic transcriptions of the language samples. Data from two clinical and two control participants (i.e., 33.3%) were randomly for scoring again by the trained rater in order to determine the degree of inter-rater reliability. For measures of intra-rater reliability, the same set

of the selected transcripts was scored again by the researcher to determine the percentage of agreement.

CHAPTER FOUR: FINDINGS

Statistical measures were conducted with IBM SPSS Statistics 25. Descriptive statistics including the mean, standard deviation, and range were obtained for each discourse task (Tables 6 to 8) and the total of all three discourse tasks (Table 9). These values are calculated according to each disordered group, matched controls, and total disordered group. Please find the tables listed below.

Table 6 Single-Picture Description Task Descriptive Statistics

	CVA (n=2)	Cont-CVA (n=2)	TBI (n=2)	Cont-TBI (n=2)	MCI (n=2)	Cont-MCI (n=2)	Disorder (n=6)
Total # of wd	M:135 SD:84.8528 R:120	M:93.5 SD:9.1924 R:13	M:142 SD:90.5097 R:128	M:63 SD:45.2548 R:64	M:194.5 SD:41.7193 R:59	M:75.5 SD:10.6066 R:15	M:157.1667 SD:65.3649 R:149
# of narr-wd	M:34 SD:33.9411 R:48	M:44 SD:1.4142 R:2	M:64 SD:36.7696 R:52	M:44.5 SD:37.4767 R:53	M:48 SD:19.799 R:28	M:22.5 SD:0.7071 R:1	M:48.6667 SD:27.5584 R:80
# of open class wd	M:59; SD:42.4264 R:60	M:40; SD:4.2426; R:6	M:70.5 SD:37.4767 R:53	M:29 SD:19.799 R:28	M:87 SD:18.3848 R:26	M:30 SD:2.8284 R:4	M:72.167 SD:29.4443 R:71
# of closed class wd	M:76 SD:42.4264 R:60	M:53.5 SD:4.9498 R:7	M:71.5; SD:53.033; R:75	M:34; SD:25.4558 R:36	M:107.5; SD:23.3345 R:33	M:45.5; SD:7.7782; R:11	M:85; SD:36.5951 R:90
# of nouns	M:35 SD:26.8701 R:38	M:20 SD:1.4142 R:2	M:33.5 SD:17.6777 R:25	M:15.5 SD:10.6066 R:15	M:45 SD:7.0711 R:10	M:14 SD:2.8284 R:4	M:37.8333 SD:15.7533 R:38
# of pronouns	M:14 SD:4.2426 R:6	M:6 SD:1.4142 R:2	M:16 SD:11.3137 R:16	M:4.5 SD:3.5355 R:5	M:16 SD:5.6569 R:8	M:5.5 SD:0.7071 R:1	M:15.333 SD:6.0553 R:16
# of verbs	M:20 SD:11.3137 R:16	M:16 SD:1.4142 R:2	M:33.5 SD:20.5061 R:29	M:11.5 SD:7.7782 R:11	M:40.5 SD:0.7071 R:1	M:13.5 SD:0.7071 R:1	M:31.3333 SD:14.0238 R:36
narr time	M:2.2667 SD:2.4044 R:3.4	M:.6 SD:0.2358 R:0.33	M:1.6667 SD:1.314 R:1.87	M:.6 SD:0.4007 R:0.57	M:1.7485 SD:0.3981 R:0.56	M:1.275 SD:0.2711 R:0.38	M:1.894 SD:1.2732 R:3.4
TTR	M:0.496 SD:0.1294 R:0.18	M:0.567 SD:0.0877 R:0.12	M:0.583 SD:0.1916 R:0.27	M:0.605 SD:0.1485 R:0.21	M:0.426; SD:0.07495 R:0.11	M:.535 SD:0.0085 R:0.01	M:.501 SD:0.1294 R:0.35
# of utt	M:11 SD:9.8995 R:14	M:10.5 SD:0.7071 R:1	M:11.5 SD:9.1924 R:13	M:8.5 SD:4.9498 R:7	M:16 SD:0 R:0	M:8.5 SD:0.7071 R:1	M:12.8333 SD:6.5243 R:14
LE measure	M:21.5385 SD:11.6038 R:16.41	M:47.2127 SD:3.1292 R:4.43	M:46.2036 SD:3.5558 R:5.03	M:66.4005 SD:11.7893 R:16.67	M:24.1424 SD:5.001 R:7.07	M:30.0354 SD:3.2774 R:4.63	M:30.6281 SD:13.4675 R:35.38
TE measure	M:33.4008 SD:22.2806 R:31.51	M:78.9658 SD:28.6699 R:40.55	M:43.218 SD:12.1658 R:17.21	M:68.6083 SD:16.6483 R:23.54	M:26.8593 SD:5.2081 7.37	M:18.1156 SD:4.4065 R:6.23	M:34.4927 SD:13.7313 R:34.17
% of loc cohesion	M:76.4 SD:68.7308 R:97.2	M:0 SD:0 R:0	M:8.5 SD:12.0208 R:17	M:0 SD:0 R:0	M:12.5 SD:17.6777 R:25	M:0 SD:0 R:0	M:32.4667 SD:46.8771 R:125
Avr glob coherence score	M:1.6111 SD:0.8642 R:1.22	M:37 SD:0.4243 R:.6	M:3.3834; SD:0.3064 R:.43	M:4 SD:0 R:0	M:3.37 SD:0.7354 R:1.04	M:4 SD:0 R:0	M:2.7882 SD:1.0524 R:2.89
# of C-Units	M:12.5 SD:12.0208 R:17	M:12 SD:1.4142 R:.12	M:17.5 SD:10.6066 R:15	M:10 SD:7.0711 R:10	M:19 SD:1.4142 R:2	M:11 SD:2.8284 R:4	M:16.333 SD:.1294 R:21
MC score	M:5 SD:7.0711 R:10	M:22.5 SD:3.5355 R:5	M:23.5 SD:9.1924 R:13	M:17 SD:7.0711 R:10	M:21 SD:5.6569 R:8	M:21.5 SD:2.1213 R:3	M:16.5 SD:10.6724 R:30
AC/ min	M:0 SD:0 R:0	M:10.3347 SD:1.7036 R:2.41	M:2.2379 SD:2.6209 R:3.71	M:4.9752 SD:2.5704 R:3.64	M:2.498 SD:.6475 R:.92	M:5.0703 SD:.421 R:.6	M:1.5786 SD:1.7223 R:4.09

Table 7 Sequential Picture Description Task Descriptive Statistics

	CVA (n=2)	Cont-CVA (n=2)	TBI (n=2)	Cont-TBI (n=2)	MCI (n=2)	Cont-MCI (n=2)	Disorder (n=6)
Total # of wd	M:75 SD:14.142 R:2	M:56.5 SD:20.5061 R:29	M:89.5 SD:55.8614 R:79	M:40 SD:18.3848 R:26	M:193.5 SD:190.2117 R:269	M:75.5 SD:20.5061 R:29	M:119.3333 SD:105.8445 R:278;
# of narr-wd	M:20.5 SD:16.2635 R:23	M:33 SD:2.8284 R:4	M:51.5 SD:21.9203 R:31	M:27.5 SD:13.435 R:19	M:33 SD:15.5564 R:22	M:28 SD:4.2426 R:6	M:35 SD:19.7990 R:58
# of open class wd	M:40 SD:12.7279 R:18	M:27.5 SD:3.5355 R:5	M:48 SD:26.8701 R:38	M:18.5 SD:7.7782 R:11	M:90 SD:83.4386 R:118	M:28.5 SD:12.0208 R:17	M:59.333 SD:46.3278 R:120
# of closed class wd	M:35 SD:11.3137 R:16	M:29 SD:16.9706 R:24	M:41.5 SD:28.9914 R:41	M:21.5 SD:10.6066 R:15	M:103.5 SD:106.7731 R:151	M:47 SD:8.4853 R:12	M:60 SD:60.1465 R:158
# of nouns	M:24.5 SD:16.2635 R:23	M:12.5 SD:0.7071 R:1	M:24.5 SD:10.6066 R:15	M:9 SD:5.6569 R:8	M:48 SD:41.0122 R:58	M:12.5 SD:4.9498 R:7	M:32.333 SD:23.6446 R:64
# of pronouns	M:8 SD:9.8995 R:14	M:5 SD:4.2426 R:6	M:9 SD:5.6569 R:8	M:3 SD:0 R:0	M:31 SD:39.5980 R:56	M:10.5 SD:3.5355 R:5	M:16 SD:21.7899 R:58
# of verbs	M:13.5 SD:6.364 R:9	M:13 SD:4.2426 R:6	M:17 SD:11.3137 R:16	M:8 SD:2.8284 R:4	M:41 SD:43.8406 R:62	M:13.5 SD:2.1213 R:3	M:23.8333 SD:24.4411 R:63
narr time	M:1.5672 SD:1.2015 R:1.7	M:.4749 SD:0.2006 R:.28	M:1.125 SD:1.0489 R:1.48	M:.5084 SD:0.0589 R:.08	M:1.7 SD:1.5556 R:2.2	M:1.575 SD:.3418 R:.48	M:1.4641 SD:1.0321 R:2.42
TTR	M:0.559 SD:0.1655 R:0.23	M:0.72 SD:0.1273 R:0.18	M:0.514 SD:0.2348 R:0.33	M:0.710 SD:0.1492 R:0.21	M:0.513 SD:0.2334 R:0.33	M:0.585 SD:0.0573 R:0.08	M:0.529 SD:0.1672 R:0.33
# of utt	M:8 SD:1.4142 R:2	M:8.5 SD:0.7071 R:1	M:8.5 SD:6.3640 R:9	M:7 SD:5.6569 R:8	M:18.5 SD:19.0319 R:27	M:9.5 SD:3.5355 R:5	M:11.6667 SD:10.4626 R:28
LE measure	M:27.1338 SD:21.173 R:29.94	M:61.5527 SD:17.3338 R:24.51	M:42.7073 SD:41.4261 R:58.59	M:68.239 SD:2.2236 R:3.14	M:25.3573 SD:16.8895 R:23.89	M:37.714 SD:4.6239 R:6.54	M:31.7328 SD:23.724 R:59.84
TE measure	M:22.0027 SD:13.3574 R:18.89	M:74.8815 SD:25.6366 R:36.26	M:54.8187 SD:55.3006 R:78.21	M:56.0037 SD:32.9179 R:46.55	M:26.1905 SD:14.8156 R:20.95	M:18.5059 SD:6.71 R:9.49	M:34.337 SD:30.7636 R:81.36
% of loc cohesion	M:28.57 SD:40.4041 R:57.14	M:0 SD:0 R:0	M:34 SD:48.0833 R:68	M:0 SD:0 R:0	M:34 SD:48.0835 R:68	M:0 SD:0 R:0	M:32.19 SD:35.4847 R:68
Avr glob coherence score	M:2.1666 SD:1.6499 R:2.33	M:3.625 SD:0.5303 R:0.75	M:2.95 SD:1.4849 R:2.1	M:2.8637 SD:1.607 R:2.27	M:2.7834 SD:1.2493 R:1.77	M:4 SD:0 R:0	M:2.6333 SD:1.1974 R:3
# of C-Units	M:11 SD:2.8284 R:4	M:8.5 SD:0.7071 R:1	M:11 SD:7.0711 R:10	M:8.5 SD:3.5355 R:5	M:19.5 SD:19.0919 R:27	M:10 SD:2.8284 R:4	M:13.8333 SD:10.1866 R:27
MC score	M:3.5 SD:4.9498 R:7	M:10.5 SD:2.1213 R:3	M:15.5 SD:9.1924 R:13	M:12 SD:9.8995 R:14	M:12.5 SD:2.1213 R:3	M:14.5 SD:4.9498 R:7	M:10.5 SD:7.3417 R:22
AC/ min	M:0.2069 SD:0.2926 R:0.41	M:6.2434 SD:0.3433 R:0.49	M:5.5205 SD:3.2615 R:4.61	M:6.2658 SD:6.2899 R:8.9	M:3.5119 SD:4.4616 R:6.31	M:3.0757 SD:2.0144 R:2.85	M:3.0797 SD:3.4474 R:7.83

Table 8 Story Retell Task Descriptive Statistics

	CVA (n=2)	Cont-CVA (n=2)	TBI (n=2)	Cont-TBI (n=2)	MCI (n=2)	Cont-MCI (n=2)	Disorder (n=6)
Total # of wd	M:241 SD:164.0488 R:232	M:305.5 SD:136.4716 R:193	M:171.5 SD:111.0158 R:157	M:106.5 SD:6.364 R:9	M:135.5 SD:61.5183 R:87	M:134.5 SD:84.1457 R:119	M:182.6667 SD:104.4273 R:265
# of narr-wd	M:48 SD:50.9117 R:72	M:147 SD:50.9117 R:72	M:69.5 SD:30.4056 R:43	M:71.5 SD:2.1213 R:3	M:20 SD:21.2132 R:30	M:42.5 SD:36.0625 R:51	M:45.8333 SD:35.8632 R:86
# of open class wd	M:120 SD:73.5391 R:104	M:64.5 SD:68.5894 R:97	M:80 SD:52.3259 R:74	M:43 SD:1.4142 R:2	M:64.5 SD:26.163 R:37	M:48.5 SD:33.234 R:47	M:88.1667 SD:49.2155 R:129
# of closed class wd	M:121 SD:90.5097 R:128	M:167.5 SD:101.1162 R:143	M:91.5 SD:58.6899 R:83	M:63.5 SD:49.498 R:7	M:71 SD:35.3553 R:50	M:86 SD:50.9117 R:72	M:94.5 SD:55.5221 R:139
# of nouns	M:69 SD:43.8406 R:62	M:62.5 SD:12.0208 R:17	M:43.5 SD:33.234 R:47	M:22.5 SD:2.1213 R:3	M:33.5 SD:10.6066 R:15	M:23.5 SD:19.0919 R:27	M:48.6667 SD:29.931 R:80
# of pronouns	M:27.5 SD:20.5061 R:29	M:39.5 SD:23.3345 R:33	M:27 SD:16.9706 R:24	M:11 SD:5.6569 R:8	M:23 SD:9.8995 R:14	M:19 SD:8.4853 R:12	M:25.8333 SD:12.8906 R:29
# of verbs	M:41.5 SD:23.3345 R:33	M:66.5 SD:27.5772 R:39	M:35.5 SD:13.4350 R:19	M:18 SD:5.6569 R:8	M:27 SD:9.8995 R:14	M:23.5 SD:12.0208 R:17	M:34.6667 SD:14.3898 R:38
narr time	M:5.1334; SD:3.1348 R:4.43	M:2.4833; SD:.8014; R:1.13	M:2.9833; SD:2.6398; R:3.73	M:1.2833; SD:.0707; R:.1	M:1.3567 SD:.6694; R:.95	M:1.8167; SD:1.1078; R:1.57	M:3.1578; SD:2.5139; R:6.47
TTR	M:0.444 SD:0.1591 R:0.23	M:.461 SD:0.0552 R:0.08	M:0.458 SD:0.1278 R:0.18	M:0.526 SD:0.0248 R:0.04	M:0.550 SD:0.0658 R:0.09	M:0.239 SD:0.2689 R:0.38	M:0.484 SD:0.1089 R:0.26
# of utt	M:27.5 SD:16.2635 R:23	M:39 SD:0 R:0	M:14.5 SD:12.0208 R:17	M:12.5 SD:0.7071 R:1	M:14 SD:7.0711 R:10	M:15.5 SD:7.7782 R:11	M:18.6667 SD:11.7757 R:33
LE measure	M:16.5647 SD:9.8496 R:13.93	M:49.3162 SD:5.36524 R:7.59	M:44.0065 SD:10.7571 R:15.21	M:67.3159 SD:6.0143 R:8.51	M:12.4939 SD:9.9833 R:14.12	M:28.8593 SD:8.7516 R:12.38	M:24.355 SD:17.2482 R:46.18
TE measure	M:7.7864 SD:5.1509 R:7.28	M:58.956 SD:1.4764 R:2.09	M:30.8734 SD:17.1268 R:24.22	M:55.8461 SD:4.7302 R:6.69	M:12.4037 SD:9.5063 R:13.44	M:21.303 SD:6.8601 R:9.7	M:17.0212 SD:14.1929 R:38.84
% of loc cohesion	M:33.575 SD:3.2881 R:4.65	M:0 SD:0 R:0	M:20 SD:14.1421 R:20	M:0; SD:0 R:0	M:35 SD:35.3553 R:50	M:0 SD:0 R:0	M:29.525 SD:18.628 R:50
Avr glob coherence score	M:1.8462 SD:1.1967 R:1.69	M:3.6795 SD:0.3445 R:0.49	M:3.1283 SD:0.2429 R:0.34	M:4 SD:0 R:0	M:2.485 SD:1.8173 R:2.57	M:3.9286 SD:0.1011 R:0.14	M:2.865 SD:1.1347 R:2.77
# of C-Units	M:31.5 SD:21.9203 R:31	M:39 SD:0 R:0	M:17.5 SD:10.6066 R:15	M:14.5 SD:0.7071 R:1	M:16 SD:8.4853 R:12	M:18.5 SD:14.8492 R:21	M:21.6667 SD:13.8372 R:37
MC score	M:15 SD:21.2132 R:30	M:60 SD:22.6274 R:32	M:19.5 SD:7.7782 R:11	M:35.5 SD:14.8492 R:21	M:6 SD:8.4853 R:12	M:26.5 SD:9.1924 R:13	M:13.5 SD:12.4217 R:30
AC/ min	M:0.3402 SD:0.481 R:0.68	M:5.9544 SD:1.7801 2.52	M:2.3419 SD:3.0203 R:4.27	M:7.3076 SD:3.4544 R:4.89	M:0.5465 SD:0.7728 R:1.09	M:3.8587 SD:0.0176 R:0.02	M:1.0761 SD:1.7204 R:4.48

Table 9 Total Descriptive Statistics

	CVA (n=2)	Cont-CVA (n=2)	TBI (n=2)	Cont-TBI (n=2)	MCI (n=2)	Cont-MCI (n=2)	Disorder (n=6)
Total # of wd	M:451 SD:250.3158 R:354	M:455.5 SD:166.1701 R:235	M:403 SD:257.3869 R:364	M:209.5 SD:57.2756 R:81	M:523.5 SD:86.9741 R:123	M:285.5 SD:74.2462 R:105	M:459.1667 SD:173.8912 R:407
# of narr-wd	M:102.5 SD:101.1163 R:143	M:224 SD:55.1543 R:78	M:185 SD:89.0954 R:126	M:143.5 SD:53.033 R:75	M:101 SD:25.4558 R:36	M:93 SD:32.5269 R:46	M:129.5 SD:74.9046 R:217
# of open class wd	M:219 SD:128.6934 R:182	M:205.5 SD:43.1335 R:61	M:198.5 SD:116.6726 R:165	M:90.5 SD:26.1630 R:37	M:214.5 SD:38.8909 R:55	M:107 SD:24.0416 R:34	M:219.6667 SD:81.8991 R:194
# of closed class wd	M:232 SD:121.6224 R:172	M:250 SD:123.0366 R:174	M:204.5 SD:140.7143 R:199	M:119 SD:31.1127 R:44	M:282 SD:48.0833 R:68	M:178.5 SD:50.2046 R:71	M:239.5 SD:92.8219 R:213
# of nouns	M:128.5 SD:86.9741 R:123	M:95 SD:14.1421 R:20	M:101.5 SD:61.5183 R:87	M:47 SD:18.3848 R:26	M:126.5 SD:23.3345 R:33	M:50 SD:16.9706 R:24	M:118.8333 SD:50.5941 R:132
# of pronouns	M:49.5 SD:14.8492 R:21	M:50.5 SD:26.1630 R:37	M:52 SD:33.9411 R:48	M:18.5 SD:2.1213 R:3	M:70 SD:35.3553 R:50	M:35 SD:5.6569 R:8	M:57.1667 SD:24.9913 R:67
# of verbs	M:75 SD:28.2843 R:40	M:95.5 SD:30.4056 R:43	M:86 SD:45.2548 R:64	M:37.5 SD:4.9498 R:7	M:108.5 SD:33.2340 R:47	M:50.5 SD:10.6066 R:15	M:89.8333 SD:31.9964 R:78
narr time	M:8.9674 SD:6.7406 R:9.53	M:3.5582 SD:1.2377 R:1.75	M:5.775 SD:5.009 R:7.08	M:2.3917 SD:0.271 R:0.38	M:4.8051 SD:0.4881 R:0.69	M:4.6667 SD:1.17853 R:1.67	M:6.5158 SD:4.2363 R:11.5
TTR	M:0.349 SD:0.0983 R:0.14	M:0.413 SD:0.0594 R:0.08	M:0.385 SD:0.1860 R:0.26	M:0.480 SD:0.07 R:0.10	M:0.337 SD:0.03465 R:0.05	M:0.387 SD:0.009 R:0.01	M:0.357 SD:0.0979 R:0.26
# of utt	M:46.5 SD:27.5772 R:39	M:58 SD:1.412 R:2	M:34.5 SD:27.5772 R:39	M:28 SD:1.4142 R:2	M:48.5 SD:12.0208 R:17	M:33.5 SD:4.9498 R:7	M:43.1667 SD:19.4671 R:51
LE measure	M:19.51 SD:11.5966 R:16.4	M:50.315 SD:6.2438 R:8.83	M:48.795 SD:9.058 R:12.81	M:67.56 SD:6.8448 R:9.68	M:19.975 SD:8.1812 R:11.57	M:32.18 SD:3.0264 R:4.28	M:29.4267 SD:16.7873 R:43.89
TE measure	M:10.025 SD:3.7406 R:5.29	M:64.135 SD:6.8094 R:9.63	M:40.625 SD:19.806 R:28.01	M:59.125 SD:15.4786 R:21.89	M:21.4 SD:7.4671 R:10.56	M:19.675 SD:2.011 R:2.83	M:24.0167 SD:16.8460 R:47.25
% of loc cohesion	M:40.5 SD:16.2635 R:23	M:0; SD:0; R:0	M:16.5 SD:13.435 R:19	M:0 SD:0 R:0	M:30.5 SD:36.0625 R:51	M:0 SD:0 R:0	M:29.1667 SD:21.5724 R:51
Avr glob coherence score	M:1.8747 SD:1.2369 R:1.75	M:3.6682 SD:0.433 R:0.61	M:3.3885 SD:0.34627 R:0.49	M:3.6212 SD:0.5357 R:0.76	M:2.8795 SD:1.2674 R:1.79	M:3.9764 SD:.0335 R:.05	M:2.7142 SD:1.0611 R:2.78
# of C-Units	M:55 SD:36.7696 R:52	M:59.5 SD:2.1213 R:3	M:46 SD:28.2843 R:40	M:33 SD:4.2426 R:6	M:54.5 SD:12.0208 R:17	M:39.5 SD:20.5061 R:29	M:51.8333 SD:21.9036 R:55
MC score	M:23.5 SD:33.234 R:47	M:93 SD:28.2843 R:40	M:58.5 SD:10.6066 R:15	M:64.5 SD:2.1213 R:3	M:39.5 SD:16.2635 R:23	M:62.5 SD:2.1213 R:3	M:40.5 SD:23.2788 R:66
AC/ min	M:0.2185 SD:0.3089 R:0.44	M:6.7035 SD:1.0465 R:1.48	M:3.3751 SD:2.1925 R:3.1	M:6.6995 SD:0.1679 R:0.24	M:1.8307 SD:1.2161 R:1.72	M:3.9447 SD:0.6932 R:0.98	M:1.8081 SD:1.8081 R:4.93

To address RQ1, Mann Whiteny U tests were completed to investigate performance on macrolinguistic discourse analysis between disordered participants and normal controls (Table 10). The majority of comparisons did not yield significant findings. Significant results were identified for Lexical Efficiency, percentage of local cohesion errors, average global coherence score, MC score, and AC/min measures on the story retell task and Total discourse category. Other significant results include number of nouns on the single picture description task and Total discourse category.

Table 10 Mann-Whitney U Test Results for Group Effect

Measures	Single Picture Description	Sequential Picture Description	Story Telling	Total
Total # of wd	ns	ns	ns	ns
# of narr-wd	ns	ns	ns	**.065**
# of open class wd	**0.26**	ns	ns	ns
# of closed class wd	ns	ns	ns	ns
# of nouns	**.009**	ns	ns	**.065**
# of pronouns	ns	ns	ns	ns
# of verbs	ns	ns	ns	ns
narr time	ns	ns	ns	ns
TTR	ns	ns	ns	ns
# of utt	ns	ns	ns	ns
LE measure	ns	ns	**.065**	**.065**
TE measure	ns	ns	**.026**	ns
% of loc cohesion	ns	ns	**.002**	**.002**
Avr glob coherence score	ns	ns	**.004**	**.026**
# of C-Units	ns	ns	ns	ns
MC score	ns	ns	**.015**	**.015**
AC/ min	ns	ns	**.009**	**.009**

Note: Total # of wd = Total number of words; # of narr-wd = Number of narrative words; # of open class wd = Number of open class words; # of closed class wd = Number of closed class words; narr time = narrative time; TTR = type token ratio; # of utt = number of utterances; LE measure = lexical efficiency measure; TE measure = time efficiency measure; % of loc cohesion = percent of local cohesion errors; Avr glob coherence score = average global coherence score; MC score = main concept score; AC/min = number of accurate and correct concepts per minute. Sig. level is .050

To address RQ2, Mann Whitney U tests were completed to investigate performance on macrolinguistic discourse analysis between genres for disordered speakers and controlled participants (Table 11). As was with the findings with RQ1, the majority of findings did not result in significant findings. One minimally significant finding was identified in the disordered group comparison between the single picture description task and the story retell task. A larger amount of statistically significant results were found under the control group. The MC score measure was significant across all genre comparisons for control participants. Other significant measures of analysis for control participants are total number of words, number of closed class words, TTR, number of c-units, etc.

Table 11 Mann-Whitney U Test Results for Genre Effect

	Disorder gp (n=6)			Control gp (n=6)		
Measures	Sing. vs. Seq.	Sing. vs. Story	Seq. vs. Story	Sing. vs. Seq.	Sing. vs. Story	Seq. vs. Story
Total # of wd	ns	ns	ns	ns	.026	.004
# of narr-wd	ns	ns	ns	ns	ns	ns
# of open class wd	ns	ns	ns	ns	ns	ns
# of closed class wd	ns	ns	ns	ns	.015	.004
# of nouns	ns	ns	ns	ns	.065	.026
# of pronouns	ns	ns	ns	ns	.004	.015
# of verbs	ns	ns	ns	ns	.065	.015
narr time	ns	ns	ns	ns	.026	.041
TTR	ns	ns	ns	ns	.015	.004
# of utt	ns	ns	ns	ns	.065	.009
LE measure	ns	ns	ns	ns	ns	ns
TE measure	ns	.065	ns	ns	ns	ns
% of loc cohesion	ns	ns	ns	ns	ns	ns
Avr glob coherence score	ns	ns	ns	ns	ns	ns
# of C-Units	ns	ns	ns	ns	.065	.026
MC score	ns	ns	ns	.015	.065	.002
AC/ min	ns	ns	ns	ns	ns	ns

Note: Total # of wd = Total number of words; # of narr-wd = Number of narrative words; # of open class wd = Number of open class words; # of closed class wd = Number of closed class words; narr time = narrative time; TTR = type token ratio; # of utt = number of utterances; LE measure = lexical efficiency measure; TE measure = time efficiency measure; % of loc cohesion = percent of local cohesion errors; Avr glob coherence score = average global coherence score; MC score = main concept score; AC/min = number of accurate and correct concepts per minute. Sig. level is .05

Spearman's rho correlation coefficients were conducted to evaluate the relationship between standardized assessment scores and macrolinguistic analysis of discourse (Table 12). The majority of correlation coefficients were not statistically significant. However, the MCA showed the strongest correlation to macrolinguistic features including AC/minute, MC scores, average global coherence score, time efficiency measure and lexical efficiency measure.

Table 12 Spearman's rho correlation coefficients

	CAT				Bro				Cin				Total			
Measures	WAB-R AQ	OCS	CADL-3	MCA	WAB-R AQ	OCS	CADL-3	MCA	WAB-R AQ	OCS	CADL-3	MCA	WAB-R AQ	OCS	CADL-3	MCA
Total # of wd	ns-	ns-	ns	ns	ns-	ns-	ns	ns-	ns	ns	ns-	ns-	ns	ns	ns	ns
# of narr-wd	ns-	ns-	ns	ns	ns	ns-	ns-	ns-	ns-	ns-	.841*	ns-	ns	ns	ns	ns
# of open class wd	ns-	ns-	ns	ns	ns-	ns	ns-	ns-	ns-	ns-	ns-	ns-	ns	ns	ns	ns
# of closed class wd	ns-	ns-	ns	ns	ns-	ns-	ns-	ns-	ns-	ns-	ns-	ns-	ns	ns	ns	ns
# of nouns	ns-	ns-	ns	ns	ns-	.816*	ns-	ns-	ns-	ns-	ns-	ns-	ns	ns	ns	ns
# of pronouns	ns-	ns-	ns	ns	ns-	ns-	ns-	ns-	ns-	ns-	ns-	ns-	ns	ns	ns	ns
# of verbs	ns-	ns-	ns	ns	ns-	ns-	ns-	ns-	ns-	ns-	ns-	ns-	ns	ns	ns	ns
narr time	ns-	ns-	ns	ns	ns-	ns-	ns-	ns-	ns-	ns-	ns-		ns	ns	.899**	ns
TTR	ns-	ns-	ns	ns	ns-	ns-	ns-	ns-	ns-	ns-	ns-	ns-	ns	ns	ns	ns
# of utt	ns-	ns-	ns	ns	ns-	ns-	ns-	ns-	ns-	ns-	ns-	ns-	ns	ns	ns	ns
LE measure	ns	ns-	.986***	.829*	ns-	ns-	ns-	.882*	ns-	ns-	ns-	ns-	ns	ns	.986***	.829*
TE measure	ns-	ns-	.899**	ns	ns-	ns-	ns-	ns	ns-	ns-	ns	.886*	ns	ns	ns	.943**
% of loc cohesion	ns	ns-	ns	-.899**	ns-	ns-	ns-	ns-	ns-	ns-	ns-	ns-	ns	ns	ns	ns
Avr glob coherence score	ns-	ns-	ns	.829*	ns-	ns-	ns-	ns	ns-	ns-	ns-	ns	ns	ns	ns	ns
# of C-Units	ns-	ns-	ns	ns	ns-	ns-	ns-	ns-	ns-	ns-	ns-	ns-	ns	ns	ns	ns
MC score	ns-	ns-	ns	ns	ns-	ns-	ns-	ns-	ns-	ns-	ns-	ns-	ns	ns	.868*	.841*
AC/ min	ns	ns-	ns	.812*	.812*	ns-	ns-	ns-	ns-	ns-	ns-	ns-	ns	ns	ns	.943*

Note: Total # of wd = Total number of words; # of narr-wd = Number of narrative words; # of open class wd = Number of open class words; # of closed class wd = Number of closed class words; narr time = narrative time; TTR = type token ratio; # of utt = number of utterances; LE measure = lexical efficiency measure; TE measure = time efficiency measure; % of loc cohesion = percent of local cohesion errors; Avr glob coherence score = average global coherence score; MC score = main concept score; AC/min = number of accurate and correct concepts per minute. *=$p<0.05$, **=$p<0.01$, ***=$p<0.001$.

Inter- and intra- reliability measures are reported for each macrolinguistic feature of discourse analysis (Table 13). Every measure of discourse analysis was found to be highly significant for inter- and intra-reliability measures. Inter-and intra- agreement percentage is 100% across all measures.

Table 13 Inter- and Intra- Reliability Measures

Measures	Inter	Inter Agreement %	Intra	Intra Agreement %
Total # of wd	1.00***	100%	1.00***	100%
# of narr-wd	.996**	95.9184%	.998**	95.0276%
# of open class wd	1.00***	100%	1.00***	100%
# of closed class wd	1.00***	100%	1.00***	100%
# of nouns	1.00***	100%	1.00***	100%
# of pronouns	1.00***	100%	1.00***	100%
# of verbs	1.00***	100%	1.00***	100%
TTR	1.00***	100%	1.00***	100%
narr time	1.00***	100%	1.00***	100%
# of utt	1.00***	100%	1.00***	100%
LE measure	.993**	95.9184%	.990**	95.0276%
TE measure	.997**	95.9184%	.995**	95.0276%
% of loc cohesion	.978**	80%	1.00***	100%
Avr glob coherence score	1.00***	100%	1.00***	100%
# of C-Units	1.00***	100%	1.00***	100%
MC score	.889**	94.0299%	.946**	95.4545%
AC/ min	.951**	86.3636%	.921**	88.2353%

Note: Total # of wd = Total number of words; # of narr-wd = Number of narrative words; # of open class wd = Number of open class words; # of closed class wd = Number of closed class words; narr time = narrative time; TTR = type token ratio; # of utt = number of utterances; LE measure = lexical efficiency measure; TE measure = time efficiency measure; % of loc cohesion = percent of local cohesion errors; Avr glob coherence score = average global coherence score; MC score = main concept score; AC/min = number of accurate and correct concepts per minute. *=$p<0.05$, **=$p<0.01$, ***=$p<0.001$

CHAPTER FIVE: DISCUSSION

This study attempted to investigate the macrolinguistic features of discourse in a manner that combines several typical features of analysis that are commonly seen in similar studies. The features included this study contain measures to highlight informativeness, coherence, and cohesion and these features were applied to each of the discourse samples collected from each participant. This approach to discourse analysis is unique in the inclusion of three groups of disordered participants and control participants rather than recruitment of one disordered group and control group (Andreeta et al., 2012; Marini et al., 2017; Toledo et al., 2017). The inclusion of multiple groups of speakers with acquired communication impairments provides a more comprehensive investigation into the macrolinguistic features of discourse. Additionally, this study encompasses a wider range of discourse genres compared to other studies that may include only one or two genres of discourse for analysis (Capilouto et al., 2005; Drummond et al., 2018; Wright et al., 2012). An analysis of three genres of discourse presents a more extensive review of the oral production of speakers with acquired communication disorders. The results of this study extend the conclusions of other studies investigating discourse analysis and add further evidence to their findings.

The results calculated for group effect support the hypothesis for RQ1 that the control participants performed better across all three discourse tasks than participants with acquired communication disorders on measures including lexical efficiency, time efficiency, percent of local cohesion errors, average global coherence score, MC score, and AC/minute. This finding is consistent with the conclusions of studies where control participants made less errors on

measures of local cohesion, global coherence, and informativeness than the disordered participants (Andreet et al., 2012; Kim et al., 2019; Hartley & Jenesn, 1991).

For participants with acquired communication disorders, one minimally significant result was found as the time efficiency measure in the comparison between the single picture description task and the story retell task. Amongst control participants, significant differences were found between single picture description and story retell and sequential picture description and story retell. Significant values for single picture description and story retell are total number of words, number of closed words, number of pronouns, narrative time, and TTR. Minimally significant values were found for number of nouns, number of verbs, number of c-units, and MC score. Significant values for sequential picture description compared to story retell are total number of words, number of closed words, number of nouns, number of pronouns, number of verbs, narrative time, TTR, number of utterances, number of c-units, and MC score. These findings indicate a greater degree of difference for the story retell discourse task compared to single picture and sequential picture description tasks.

Furthermore, these results of significant findings of significant features of analysis including lexical efficiency, percent of local cohesion, average global coherence, MC score, and AC/minute indicate that the story retell task is the best option in selecting a discourse task for macrolinguistic analysis. A story retell task is typically more involved than a picture description task as it involves more characters and more episodes (Kong, 2016a). This genre of discourse is excellent for researchers and clinicians that are seeking to evaluate features of local coherence and global cohesion (Kong, 2016a). Success with the story retell task points to the participants'

utilization of cognitive abilities to manipulate larger amounts of complex information, short term recall, and sustained attention to complete the discourse task (Kim et al., 2019).

The MCA yielded the strongest correlation to features of macrolinguistic analysis compared to the WAB-R, OCS, and CADL-3 for total discourse sample values. Significant measures are lexical efficiency time efficiency, average global coherence score, MC score, and AC/minute. This correlation is understandable knowing the purpose and the execution of the MCA being consistent with the calculation of the MC score and AC/minute of the macrolinguistic feature analysis completed with the discourse samples (Kong, 2009). The MC score is a synopsis of the accuracy and completeness of the discourse sample while AC/minute deals with "the efficiency of main concepts conveyed" (Kong, 2009 p. 452). These two measures are effective in measuring the informativeness of speaker's oral discourse and macrostructure is related to content.

The WAB AQ has a significant correlation to the AC/min measure for the sequential picture description task. This finding suggest a relationship between the severity of an individual's aphasia and the efficiency of production of accurate and complete main concepts. Main Concepts may be more sensitive to changes in discourse than WAB AQ in people with anomic aphasia and not aphasic by WAB (NABW) speakers (Fromm et al., 2017). Additionally, main concepts have a strong correlation with AQ and subtest on the Cantonese Aphasia Battery for Cantonese speakers with aphasia (Kong, 2009; Yiu, 1992).

The CADL-3 raw score has a significant correlation to narrative time, lexical efficiency, and MC score for total discourse sample values. The CADL-3 sets out to evaluate functional communication and the impact it has in completion of certain activities of daily living (Holland

et al., 2018). These results indicate that macrolinguistic features of discourse such as narrative time, lexical efficiency, and MC score play a role in deficits in functional communication. The effectiveness of a communication act depends upon the entirety of the message that is conveyed in an efficient and timely manner. Impairment in discourse has secondary outcomes as negative impacts in the functionality of communication in domains including timeliness of discourse output, lexical efficiency, and informativeness in speakers with aphasia (Richardson, et al., 2018). Although the OCS composite score did not have any significant correlations with features of macrolinguistic analysis of discourse, certain features revealed a higher degree of correlation discourse production, such as number of closed words, number of verbs, number of pronouns, and number of utterances.

Correlations between the OCS composite score and features of macrolinguistic analysis of discourse however the measures with the highest correlation are number of closed words, number of verbs, number of pronouns, and number of utterances. An increased use of pronouns and closed words may be related to reduced cohesion, lack of specificity which in turn can lead to unclear discourse output (Kong, 2016a). This may be correlated to performance on the semantic naming and verbal recall/reasoning subtests of the OCS.

One major limitation of the current study is identified as a very small sample size, which prevents generalization of the findings of this study to the population of adults with communication disorders. The current sample does not accurately depict all types, categories, and severity of diagnoses of the existing groups of disordered speakers. For example, this sample does not include people with non-fluent aphasia, varying severities of aphasia or TBI, survivors of open-head TBI or speakers with MCI compared to speakers with dementia. The findings of

this study are informative, however they may not be inclusive to all people with acquired communication disorders.

In order to conduct statistical analyses, the three disordered groups were combined into one large clinical group. This prevented the systematic comparison of discourse performance among the three disordered groups. Speakers with communication disorders present with different characteristics of discourse production. Specifically, the discourse production of PWA, survivors of TBI, and individuals with MCI differs by several features, including informativeness, local cohesion, and global coherence. The combination of all disordered speakers into one group detracts from the strength of the comparison to control speakers and the separate groups of disorders speakers.

This study and preliminary findings could be improved upon with a larger sample size containing varying types, categories, and severity of diagnoses of the existing groups of disordered speakers that have been matched by age and years of education. A larger sample size would allow for a more accurate comparison between individual groups of people with acquired communication disorders and comparison to control speakers. Future studies should involve the inclusion of other genres of discourse including procedural discourse and personal narratives when conducting macrolinguistic analysis. Inclusion of other genres of discourse allow for the assessment of cognitive and linguistic processes that speakers do not use when completing discourse tasks that are elicited with visual stimuli.

Finally, concerning the clinical implications of the present study's findings, the importance that discourse analysis holds in the assessment of linguistic and cognitive processes in people with cognitive disorders is revealed. Discourse analysis is a powerful means of

assessment that goes beyond evaluation with standardized assessments. Thorough assessment of speakers with acquired communication disorders should inform clinicians to make appropriate treatment decisions when developing a plan of care.

APPENDIX A: UCF IRB APPROVAL OF HUMAN RESEARCH

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Human Research

From: **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To: **Stephanie Eaton and Pak Hin Kong**

Date: **November 07, 2018**

Dear Researcher:

On 11/07/2018 the IRB approved the following modifications / human participant research until 11/06/2019 inclusive:

Type of Review:	Submission Correction for UCF Initial Review Submission Form; Expedited Review Category #6 and #7 Adult Participants (≥21y) able to Consent; n=60
Project Title:	Macrolinguistic analysis of discourse production in people with aphasia, individuals with mild cognitive impairment, and individuals with TBI.
Investigator:	Stephanie Eaton
IRB Number:	SBE-18-14350
Funding Agency:	
Grant Title:	
Research ID:	N/A

The scientific merit of the research was considered during the IRB review. The Continuing Review Application must be submitted 30days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at https://iris.research.ucf.edu .

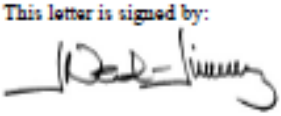
If continuing review approval is not granted before the expiration date of 11/06/2019, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a signed and dated copy of the consent form(s).

All data, including signed consent forms if applicable, must be retained and secured per protocol for a minimum of five years (six if HIPAA applies) past the completion of this research. Any links to the identification of participants should be maintained and secured per protocol. Additional requirements may be imposed by your funding agency, your department, or other entities. Access to data is limited to authorized individuals listed as key study personnel.

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

This letter is signed by:



Signature applied by Jennifer Neal-Jimenez on 11/07/2018 04:33:17 PM EST

Designated Reviewer

APPENDIX B: GLOBAL COHERENCE SCALE AND EXAMPLES

Score	Criteria
4	The utterance is overtly related to the stimulus as defined by the mentioned of actors, actions and/or objects present in the stimulus which are of significant importance to the *main details of the stimulus*. Ex: "The cat belongs to the little girl and the cat has been chased by the dog up the tree and is on a branch in the tree."
3	The utterance is related to the stimulus or designated topic, but with some inclusion of suppositional or tangential information that is relevant to the *main details of the stimulus*; or substantive information is not provided so that the topic must be inferred from the statement. Ex: "Picture shows a tree with a man sitting on one of the branches *coughs* with a sad expression on his face."
2	The utterance is only remotely related to the stimulus or topic, with possible inclusion of inappropriate egocentric information; it may include tangential information or reference some element of the stimulus that is regarded as non-critical. Ex: "I cannot see he's trying to catch the lamp but you miss Johnny."
1	The utterance is entirely unrelated to the stimulus or topic; it may be a comment on the discourse or tangential information is solely used. Ex: "Knew something was wrong there we go."

* (Wright, Capilouto, & Koutsoftas, 2013)

APPENDIX C: MAIN CONCEPT LISTS FOR DISCOURSE TASKS

	Cat Rescue
1	The little girl was riding her bicycle.
2	The cat was in the tree.
3	The dog was barking.
4	The man climbed up the tree.
5	The man tries to rescue the cat.
6	The ladder fell down.
7	The father is stuck in the tree.
8	Someone called the fire department
9	The fire department comes with a ladder.
10	The fire department rescues them.

(Dalton & Richardson, 2018)

	Broken Window
1	The boy was outside.
2	The boy was playing soccer.
3	The ball breaks the window.
4	The man is sitting.
5	The man was startled.
6	The ball broke a lamp.
7	The man picked up the ball.
8	The man looked out of the window.

(Dalton & Richardson, 2018)

	Cinderella
1	Dad remarried a woman.
2	Cinderella lives with stepmother/stepsisters.
3	The stepmother/stepsisters were mean to Cinderella.
4	Cinderella was a servant.
5	Cinderella has to do the housework.
6	The prince needs to get married.
7	There is going to be a ball.
8	They got an invitation.
9	They are excited.
10	Cinderella cannot go.
11	The stepsisters tore Cinderella's dress.
12	Stepmother/stepsisters went.
13	Cinderella was upset.
14	A fairy godmother appeared.
15	The fairy godmother makes (*items)* turn into *(items).*
16	The fairy godmother makes Cinderella into a beautiful princess.
17	Cinderella went to the ball.
18	She had to be home by midnight.
19	The prince and Cinderella danced.
20	The prince falls in love with Cinderella.
21	It is midnight.
22	She ran down the stairs.
23	She lost one of her glass slippers.
24	The prince finds Cinderella's slipper.
25	Everything turns back to its original form.
26	She returned home.
27	The prince searched for Cinderella.
28	The prince comes to Cinderella's house.
29	The stepsisters try on the glass slipper.
30	The slipper didn't fit the stepsisters.
31	He put the slipper on.
32	The slipper fits.
33	Cinderella and the prince are married.
34	Cinderella and the prince lived happily ever after.

(Dalton & Richardson, 2018)

REFERENCES

Albert, M.S., DeKosky, S.T., Dickson, D., Dubois, B., Feldman, H.H., Fox, N.C., … Phelps, C.H. (2011). The diagnosis of mild cognitive impairment due to Alzheimer's disease: Recommendations from the national institute on aging-Alzheimer's association workgroups on diagnostic guidelines for Alzheimer's disease. *Alzheimer's & Dementia: The Journal of the Alzheimer's Association, 7,* 270-279.

Andreetta, S., Cantagallo, A., & Marini, A. (2012). Narrative discourse in anomic aphasia. *Neuropsychologica, 50,* 1787-1793.

Armstrong, E., (2000). Aphasic discourse analysis: The story so far. *Aphasiology, 14*(9), 875-892.

Bloom, L. & Lahey, M. (1978). *Language Development and Language Disorders.* New York: Wiley.

Brookshire, R.H. & Nicholas, L.E. (1994). Speech sample size and test-retest stability of connected speech measures for adults with aphasia. *Journal of Speech, Language, and Hearing Research, 37,* 399-407.

Cannizzaro, M.S. & Coelho, C.A. (2013). Analysis of narrative discourse structure as an ecologically relevant measure of executive function in adults. *Journal of Psycholinguistic Research, 42,* 527-549.

Capilouto, G.J., Wright, H.H., & Wagovich, S.A. (2005). CIU and main event analyses of the structured discourse of older and younger adults. *Journal of Communication Disorders, 38,* 431-444.

Capilouto, G.J., Wright, H.H., & Wagovich, S.A., (2006). Reliability of main event measurement in the discourse of individuals with aphasia. *Aphasiology, 20,* 205-216.

Christiansen, J.A. (1995). Coherence violations and prepositional usage in the narratives of fluent aphasics. *Brain and Language, 51,* 291-317.

Coelho, C.A. (2002). Story narratives of adults with closed head injury and non-brain-injured adults: Influence of socioeconomic status, elicitation, task, and executive functioning. *Journal of Speech, Language, and Hearing Research, 45,* 1232-1248.

Coelho, C.A., Le, K., Mozeiko, J., Krueger, F., and Grafman, J., (2012). Discourse production following injury to the dorsolateral prefrontal cortex. *Neuropsychology, 50,* 3564-3572.

Dalton, S.G.H., & Richardson, J.D. (2018). A large-scale comparison of main concept production between persons with aphasia and persons without brain injury. *American Journal of Speech-Language Pathology, 47,* 1-26.

Davis, G.A., & Coelho, C.A. (2004). Referential cohesion and logical coherence of narration after closed head injury. *Brain and Language, 89*(3), 508-523.

de Lira, J.O., Ortiz, K.Z., Campanha, A.C., Bertolucci, P.H.F., & Minett, T.S.C. (2011). Microlinguistic aspects of the oral narrative in patients with Alzheimer's disease. *International Psychogeriatrics, 23*(3), 404-412.

Demeyere, N., Riddoch, M. J., Slavkova, E. D., Bickerton, W.-L., & Humphreys, G. W. (2014). The Oxford Cognitive Screen (OCS): Validation of a stroke-specific short cognitive screening tool. Manuscript submitted for publication.

Dijkstra, K., Bourgeois, M.S., Allen, R.S., & Burgio, L.D. (2004). Conversational coherence: Discourse analysis of older adults with and without dementia. *Journal of Neurolinguistics, 17*(4), 263-283.

Drummond, C., Coutinho, G., Fonseca, R.P., Assunção, N., Teldeschl, A., Oliveria-Souza, R., Moll, J., Toval-Moll, F., & Mattos, P. (2015). Deficits in narrative discourse elicited by visual stimuli are already present in patients with mild cognitive impairment. *Frontiers in Aging Neuroscience, 7*, 96.

Ehlhard, L.A., Sohlberg, M.M., Kennedy, M., Coelho, C., Yvisaker, M., Turkstra, L.S., & Yorkston, K. (2008). Evidence-based practice guidelines for instructing individuals with neurogenic memory impairments: What have we learned in the past 20 years? *Neuropsychological Rehabilitation, 18*(3), 300-342.

Fleming, V.B., (2014). Early detection of cognitive-linguistic change associated with mild cognitive impairment. *Communication Disorders Quarterly, 35*(3), 146-157.

Foka-Kavalieraki, P.,Kakavouloa, M., Economou, A., Varlokosta, S., Routsis, C., Kasselimis, D., Protopapas, A., (2008). *A comprehensive approach to the analysis of narrative discourse production by Greek speakers with aphasia*. Science of Aphasia IX, Chalkidki, Greece.

Fromm, D., Forbes, M., Holland, A., Dalton, S.G., Richardson, J., & MacWhineny, B. (2017). Discourse characteristics in aphasia beyond the Western Aphasia Battery cutoff. American Journal of Speech-Language Pathology, 26, 762-768.

Glosser, G. & Deser, T. (1991). Patterns of discourse production among neurological patients with fluent language disorders. *Brain and Language, 40*, 67–88.

Goffman, E. (1981). *Forms of Talk*. Oxford: Basil Blackwell.

Grimes, J.E. *The thread of discourse.* The Hague: Mouton. 1975.

Grimes, N. *Walt Disney's Cinderella*. New York: Random House; 2005.

Halliday, M.A.K., (1985a).*An Introduction to Functional Grammar*. London: Edward Arnold.

Halliday, M.A.K. (1985b). Context of situation. In M.A.K. Halliday and R. Hasan (Eds) *Language, Context and Text: Aspects of Language in a Social-Semiotic Perspective.* Geelong, Victoria: Deaskin University Press) p. 1-14).

Hallowell, B. (2017). *Aphasia and other acquired neurogenic language disorders.* San Diego: Plural Publishing Inc.

Harris, Z. (1963). *Structural Linguistics*. Chicago: University of Chicago Press.

Harris, Z. (1988). *Language and Information*. NY: Columbia University Press.

Hartley, L. & Jensen, P., (1991). Narrative and procedural discourse after closed head injury. *Brain Injury, 5,* 267-285.

Hill, E., Classen, M., Whitworth, A., Boyes, M., & Ward, R. (2018). Discourse and cognition in speakers with acquired brain injury (ABI): A systematic review. *International Journal of Language & Communication Disorders, 53*(4), 689-717.

Holland, A.L., Frattali, C.M., & Fromm, D. Communication Activities of Daily Living-Third Edition. Austin, TX: Pro-Ed; 2018.

Huber, W., (1990). Text comprehension and production in aphasia: Analysis in terms of micro- and macroprocessing. In Y. Joanette & H.H. Brownell (Eds.), *Discourse ability and brain damage* (pp. 154-179). New York, NY: Springer.

Kave, G. & Levy, Y. (2003). Morphology in picture descriptions provided by persons with Alzheimer's disease. *Journal of Speech, Language, Hearing Research, 46,* 341-352.

Kennedy, M.R.T., Coelho, C., Turkstra, L., Ylvisaker, M., Moore Sohlberg, M., Yorkston, K., Chiou, H.H., & Kan, P.F. (2008). Intervention for executive functions after traumatic brain injury: A systematic review, meta-analysis and clinical recommendations. *Neuropsychological Rehabilitation, 18*(3), 257-299.

Kertesz A. The Western Aphasia Battery. New York: Grune Stratton; 1982.

Kilov, A., Togher, L., & Grant, S. (2009). Problem solving with friends: Discourse participation and performance of individuals with and without traumatic brain injury. *Aphasiology, 23*(5), 584-605.

Kim, B.S., Kim, Y.B., & Kim, H., (2019). Discourse measures to differentiate between mild cognitive impairment and healthy aging. *Frontiers in Aging Neuroscience, 11*, 221.

Kong, A.P.H. (2009). The use of main concept analysis to measure discourse production in Cantonese-speaking persons with aphasia: A preliminary report. *Journal of Communication Disorders, 42*(6), 442-464.

Kong, A.P.H. (2011). The Main Concept Analysis in Cantonese aphasiac oral discourse: External validation and monitoring chronic aphasia. *Journal of Speech, Language, and Hearing Research, 54*, 148-159.

Kong, A.P.H. (2016a). *Analysis of neurogenic disordered discourse production: From theory to practice.* New York, NY: Routledge.

Kong, A.P.H. (2016b). The Main Concept Analysis: Validation and sensitivity in differentiating discourse produced by unimpaired English speakers from individuals with aphasia and dementia of Alzheimer type. *Logopedics Phoniatrics Vocology, 41*(3), 129-141.

Kong, A.P.H. (2018). Main Concept Analysis for acquired deficits of spoken narratives: Preliminary data on inter-rater agreement and potential application to the Korean-speaking population. *Clinical Archives of Communication Disorders, 3*(1), 14-21.

Law, S.P., Kong, A.P.H., & Lai, C. (2018). An analysis of topics and vocabulary in Chinese oral narratives by normal speakers and speakers with fluent aphasia. *Clinical Linguistics & Phonetics, 32*(1), 88-99.

Le, K., Coelho, C., Mozeiko, J., Krueger, F., & Grafman, J., (2014). Does brain volume loss predict cognitive and narrative discourse performance following traumatic brain injury? *American Journal Speech Language Pathology, 23,* S271-S284.

Liles, B. Z. & Coelho, C. A. (1988). Cohesion analyses. In L. R. Cherney, B. B. Shadden, & C. A. Coelho (Eds.), Analyzing discourse in communicatively impaired adults (pp. 65–84). Gaithersburg, MD: Aspen Publishers.

Linnik, A., Bastiaanse, R., & Höhle, B., (2015). Discourse production in aphasia: A current review of theoretical and methodological challenges. *Aphasiology, 30* (7), 765-800.

MacWhinney, B. (2000). *The CHILDES Project: Tools for analyzing talk* (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

MacWhinney, B., Fromm, D., Forbes, M. & Holland, A. (2011). AphasiaBank: Methods for studying discourse. *Aphasiology 25*(11), 1286-1307.

Mar, R., (2004). The neuropsychology of narrative story comprehension, story production and their interrelation. *Neuropsychologia, 42,* 1414-1434.

Marini, A., Andreetta, S., Del Tin, S., & Carlomagno, S. (2011). A multi-level approach analysis of narrative language in aphasia. *Aphasiology, 25,* 1372-1392.

Marini, A., Carlomagno, S., Caltagirone, C., & Nocentini, U. (2005). The role played by the right hemisphere in the organization of complex textual structures. *Brain and Language, 93,* 46-54.

Marini, A., Zettin, M., Bencich, E., Bosco, F.M., & Galetto, V. (2017). Severity effects on discourse production after TBI. *Journal of Neurolinguistics, 44,* 91-106.

Mancuso, M., Demeyere, N., Abbruzzese, L., Damora, A., Varalta, V., Pirrotta, F., Antonucci, G., Matano, A., Caputo, M., Caaruso, M.G., Pontiggia, G.T., Coccia, M., Ciancarelli, I., & Zoccolotti, P. (2018). Using the Oxford Cogntive Screen to detect cognitive impairment in stroke patients: A comparison with the Mini-Mental State Examination. *Frontiers in Neurology, 9,* 101.

McCarthy, M.J. & Carter, R.A. (1994). *Language as Discourse: Perspectives for Language Teaching,* Harlow: Pearson Education Limited.

McDonald, S. (1993). Pragmatic language skills after closed head injury: Ability to meet the informational needs of the listener. *Brain and Language, 44,* 28–46.

Mueller, K.D., Koscik, R.L., Hermann, B.P., Johnson, S.C., & Turkstra, L.S. (2018). Declines in connected language are associated with very early mild cognitive impairment: Results from the Wisconsin Registry for Alzheimer's Prevention. *Frontier Aging Neuroscience, 9,* 437.

Nicholas, L.E., & Brookshire, R.H. (1993). A system for quantifying the informativeness and efficiency of the connected speech of adults with aphasia. *Journal of Speech Language and Hearing Research, 36,* 338-350.

Nicholas, L. & Brookshire, R.H. (1995). Presence, completeness, and accuracy of main concepts in the connected speech of non-brain-damaged adults with aphasia. *Journal of Speech and Hearing Research, 38,* 145-156.

Olness, G.S. (2006). Genre, verb, and coherence in picture-elicited discourse of adults with aphasia. *Aphasiology, 20,* 175-187.

Olness, G.S. (2007, May 22-26). Narrative structure in aphasia: Impact of task and aphasia severity. In *Clinical aphasiology conference preceedings* (Vol. 37), Scottsdale, AZ. BRK Publishers.

Olness, G.S., Ulatowska, H.K., Wertz, R.T., Thompson, J.L., & Auther-Steffan, L.L. (2002). Discourse elicitation with pictorial stimuli in African Americans and Caucasians with and without aphasia. *Aphasiology, 16,* 623-633.

Pistono, A., Jucla, M., Bézy, C., Lemesle, B., Men, J.L., & Pariente, J. (2019). Discourse macrolinguistic impairment as a marker of linguistic and extralinguistic functions decline in early Alzheimer's disease. *International Journal of Language and Communication Disorders, 54*(3), 390-400.

Richardson, J.D., Dalton, S.G., Fromm, D., Forbes, M., Holland, A., & MacWhinney, B. (2018). The relationship between confrontation naming and story gist production in aphasia. *American Journal of Speech-Language Pathology, 27,* 406-422.

Rochon, E., Saffran, E.M., Berndt, R.S., & Schwartz, M.F. (2000). Quantitative analysis of aphasic sentence production. Further development and new data. *Brain and Language, 72,* 193-218.

Saffran, E.M., Berndt, R.S., & Schwartz, M.F. (1989). The quantitative analysis of agrammatic production: Procedure and data. *Brain and Language, 37,* 440-479.

Schiller, N., Ferreira, V., & Alario, F-X., (2007). Words, pauses, and gestures: New directions in language production research. *Language and Cognitive Processes, 22*(8), 1145-1150.

Stark, J.A. (2010). Content analysis of the fairy tale Cinderella- A longitudinal single case study of narrative production: "From rags to riches". *Aphasiology, 24,* 709-724.

Strand, E., Duffy, J.R., Clark, H., & Josephs, K., (2014). The Apraxia of Speech Rating Scale: A tool for diagnosis and description of apraxia of speech. *Journal of Communication Disorders, 51,* 43-50.

Toledo, C.M., Aluísio, S.M., Dos Santos, L.B., Brucki, S.M.D., Trés, E.S., de Oliveira, M.O., & Mansur, L.L. (2017). Analysis of macrolinguistic aspects of narratives from individuals with Alzheimer's disease, mild cognitive impairment, and no cognitive impairment. *Alzheimer's & Dementia, 10,* 31-40.

Tomoeda, C.K. & Bayles, K.A. (1993). Longitudinal effects on Alzheimer disease on discourse production. *Alzheimer Disease and Associated Disorders, 7,* 223-236.H.K.

Ulatowska, H.K., & Chapman, S.B. (1994). Discourse management in aphasia. In R.L.Bloom, L.K. Obler, S. De Santi, & J. Ehrlich (Eds.), *Discourse analysis and applications: Studies in adult clinical populations* Hillsdale, NJ: Lawrence Erlbaum Associates.

Ulatowska, H.B., Freedman-Stern, R., Doyel, A.W., Macaluso-Haynes, S., & Nprth, A.J. (1983). Production of narrative discourse in aphasia. *Brain and Language, 19,* 317-334.

Van Leer, E., & Turkstra, L. (1999). The effect of elicitation task on discourse coherence and cohesion in adolescents with brain injury. *Journal of Communication Disorders, 32,* 327-349.

Wright H. & Capilouto G.J. (2009). Manipulating task instructions to change narrative discourse performance. *Aphasiology, 23,* 1295–1308.

Wright, H. H., & Capilouto, G.J., & Koutsoftas, A. (2013). Evaluating measures of global coherence ability in stories in adults. *International Journal of Language and Communication Disorders, 48*(3), 249-256.

Wright, H.H., Capilouto, G.J., Wagovich, S.A., Cranfill, T., & Davis, J. (2005). Development and reliability of a quantitative measure of adults' narratives. *Aphasiology, 19,* 263-273.

Yiu, E.M.L., (1992). Linguistic assessment of Chinese-speaking aphasics: Development of a Cantonese aphasia battery. *Journal of Neurolinguistic, 7,* 379-424.

Ylvisaker, M., Turkstra, L.S., & Coehlo, C. (2005). Behavioral and social interventions for children and adults with behaviour disorders after TBI: A systematic review of the evidence. *Brain Injury, 21*(8), 769-805.

Yorkston, K.M., & Beukelman, D.R. (1980). An analysis of connected speech samples of aphasia and normal speakers. *Journal of Speech and Hearing Disorders, 45,* 27-36.