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Discourse Communication in Individuals with and without Traumatic Brain Injury

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Abstract

Traumatic brain injury (TBI) is a global health epidemic that has detrimental consequences for individuals who sustain the brain injury, their families, and society. As a result of TBI, many individuals experience significant cognitive-communicative impairments, including difficulties with structuring and eliciting discourse. The purpose of this study was to gain a better understanding of these language difficulties and their possible clinical implications by comparing discourse communication samples from adults with TBI to those from adults without TBI. Audio recordings of 18 adults, consisting of narratives on different genres of discourse communication (e.g., conversational, procedural, personal narrative, and fictional narrative), were used for the purposes of this project. The discourse samples of 4 individuals with TBI were compared with the discourse samples of 14 individuals without TBI on the basis of several discourse communication measures including: (1) story length, (2) frequency of discourse errors, (3) elements, (4) story organization, (5) information content, and (6) information relevance. Overall, the differences observed between the TBI and non-TBI individuals on the discourse communication tasks reflect the typical communication impairments experienced by those living with TBI. Compared to the discourse samples of participants without TBI, the individuals with TBI produced more linguistic dysfluencies and discourse errors which indicated impairments related to pragmatic skill, information transfer and relevance, linking the events in a story, and effectively structuring discourse communication. The participants without TBI showed strengths in the quality and completeness of their spoken narratives. Ultimately, the differences observed among participants from each group provide important insight into what types of speech-language therapy might be appropriate and effective for these individuals.

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Chapter 1

Traumatic brain injury (TBI) is a major cause of death and disability in the United States, contributing to approximately 30% of all injury deaths (Faul et al., 2010). According to the Centers for Disease Control and Prevention (CDC), each day 138 people in the United States die from injuries that include TBI (Faul et al., 2010). The estimated 5.3 million Americans living with TBI-related disability typically face a number of challenges in their efforts to return to a full and productive life post-injury (Langlois et al., 2006). In addition, the CDC estimated that the total cost of acute care and rehabilitation for individuals with TBI in the United States to be around $10 billion per year, not including the indirect costs to families and society (e.g., lost earnings, work time, and productivity for family members, caregivers, and employers, or the costs associated with providing social services) (CDC, 2010). Over the course of an individual's lifetime, it can cost between $600,000 and $1,875,000 to care for a survivor of severe TBI (CDC, 2010). Nevertheless, TBI is commonly referred to as the *silent epidemic* because the complications that result from TBI, such as changes affecting thinking, sensation, language, or emotions, may not be readily apparent to the observer (Faul et al., 2010).

TBI is "the result of a bump, blow, or jolt to the head or a penetrating head injury causing trauma to the brain and consequently disrupting normal brain function" (Faul et al., 2010, p. 140). However, not all blows or jolts to the head will result in a TBI. "The severity of a TBI may range from "mild," i.e., a brief change in mental status or consciousness to "severe," i.e., an extended period of unconsciousness or amnesia after the injury" (CDC, 2010, para. 3). According to Rice et al. (2003), a common cause of TBI is the impact "of a mechanical insult, through means of an external force, to the brain that causes brain tissue damage, cerebral

inflammation, and neurodegeneration in the central nervous system" (p. 407). The resulting trauma of a TBI frequently affects the brain's frontal, parietal, and temporal lobes (Hellawell et al., 1999), resulting in a reduction in attention, memory, sequencing, and planning (Cicerone & Kalmar, 1995). Accordingly, TBI affects executive functions and cognitive processes, which foster communication, resulting in a number of cognitive-communication deficits (Vy Tu et al., 2010).

The greatest communication challenge following TBI involves the individual's ability to engage in discourse level tasks (Alexander et al., 1989). Deficits involving longer units of language (known as the discourse level) are known to remain long after the injury (Ehrlich, 1988). These discourse tasks demand highly integrated within the individual's cognitive, linguistic, and social skills (Alexander et al., 1989) and involve long units of language that convey a message (Galski et al., 1998). Coelho (2007) has suggested that discourse proficiency, in terms of comprehension and production, involves a complex integration of linguistic and cognitive organizational processes. Furthermore, communication impairments following TBI are often difficult to delineate objectively (Coelho, 2007). However, the communication deficits resulting from TBI are often apparent during complex communication, which include the various forms of discourse, such as procedural, narrative, and conversational discourse, as opposed to disruptions at the word or sentence levels (Cannizzaro & Coelho, 2012).

Some of the comorbid characteristic features of discourse communication following TBI include: increased dysfluency, reduced length of output, extended silent pauses, rapid topic shifts, and poor cohesion, along with limited efficiency, content accuracy, and semantic connectivity (Hartley & Jensen, 1991). Moreover, discourse following TBI has been characterized as off-target, disorganized, tangential, and constantly distracted from the point by

trivial associations with environmental stimuli (Alexander et al., 1989). Additionally, individuals with TBI often display a number of behavioral deficits including apathy and socially inappropriate activities along with a lack of self-monitoring in conversation (Alexander et al., 1989).

As a result of the numerous cognitive-communication difficulties, conversations with individuals with TBI have been rated as less interesting, less appropriate, less rewarding, and more effortful than conversations involving individuals without brain injury (Bond & Godfrey, 1997). Disruptions at the discourse level have also been linked with a number of negative social outcomes (Sim et al., 2013). These disruptions may continue for several years after the initial onset of a TBI and appear to have a negative impact on quality of life (Coelho, 2007). Overall, this loss of social communicative competence poses a major obstacle for the individual's reintegration into the community (Dahlberg et al., 2007), and these difficulties have been linked to social isolation, increased reliance on family for social support, and significant problems returning to work, school, and premorbid avocations (Coelho et al., 2002).

Coelho (2007) has suggested that discourse analysis is sensitive to the subtle communication deficits that are commonly demonstrated by individuals with TBI and are an integral aspect of the assessment process with this population**.** Furthermore, it has been suggested that discourse is an important point of intersection between language and cognition, requiring an intervention centered on cognition (Cannizzaro & Coelho, 2012). The analyses from samples of discourse language provide integral information regarding linguistic, cognitive, and social functioning, which can be very useful in designing customized interventions and treatment plans for individuals with TBI **(**Coelho, 2007). Ultimately, discourse studies involving the TBI

population have varied relative to the type of discourse task. This study focused on procedural, narrative (fictional and personal), and conversational discourse analysis measures.

Significance

Examining the discourse tasks of individuals with TBI compared to non-TBI individuals provides important insight into which aspects of communication and language these individuals have difficulty with as a result of their injury, along with which aspects of communication and language these individuals excel in. Further research may help identify which areas of communication could be improved upon through means of speech-language therapy and other interventions. Disrupted discourse in this population has frequently been regarded as a serious handicap and a major obstacle to community reintegration (Galski et al., 1998). Unsurprisingly, this significant difficulty with discourse language is related to decreased quality of life, and can also result in a reduction in employment and academic opportunities (Togher, 2013).

Understanding the challenges regarding certain difficulties with discourse and communication experienced by individuals with TBI could also lead to better clinical interventions. For instance, the utilization of communication partners who use story organizers, or support conversation through means of collaboration/elaboration may benefit individuals with disrupted discourse (Togher, 2013). Furthermore, adding to the body of literature regarding the difficulties with different discourse genres that individuals with TBI experience has important clinical implications that could eventually lead to improved effectiveness of speech-language therapy for the individuals affected by TBI. Due to the high incidence and prevalence of TBI, large monetary costs, and its detrimental impact on aspects of quality of life, it is imperative that TBI be properly assessed, diagnosed, managed, and prevented (ASHA, 2005). Speech-language pathologists play an integral role in the assessment, intervention, counseling, and advocacy for

individuals with TBI. Overall, maximizing the outcome of intervention and speech-language therapy will help individuals with TBI to communicate and participate more effectively in daily conversation, form and maintain peer relationships, improve overall quality of life, and lead to a more independent lifestyle.

Purpose Statement

The purpose of this study was to examine and compare the oral discourse communication of adults with and without TBI through having participants engage in a variety of discourse communication tasks. The genres of discourse communication this study examined included narrative (fictional and personal), procedural, and conversational.

Research Questions

1. Does the discourse language of individuals with TBI differ from the discourse language of individuals without TBI?
2. If so, in what ways does the communicative discourse of individuals with TBI differ from the discourse language of individuals without TBI?
3. How does the discourse language of individuals with TBI and individuals without TBI compare to existing literature on the discourse skills of both populations?

Key Terms

Conversational Discourse: "involves a dialogue between two people in an interactive exchange" (Galski et al., 1998, p. 770).

Discourse: refers to a continuous string of language, which conveys a message (Cherney, 1998), which can be either written (e.g., newspaper articles, books) or verbal (e.g., class lecture) (Champman et al., 2005).

Narrative Discourse: "a monologue in which a person describes real or imagined events to a relatively passive listener" (Galski et al., 1998, p. 770).

a) Fictional: "a monologue in which a person describes imagined events to a relatively passive listener" (McCabe, Bliss, & Lynn, 2008, p. 136); "A fictional narrative is either a composition or a recall of a previously heard or read story" (McCabe, Bliss, & Lynn, 2008, p. 194).

b) Personal: "Personal narratives consist of past tense, first and/or third person, and usually temporal sequencing (depending on the cultural background of a speaker)" (McCabe & Bliss, 2006, p. 130); "Personal narrative is a recount of a real past experience" (McCabe, Bliss, & Lynn, 2008, p. 194).

Procedural Discourse: "Procedural discourse is a monologue discourse task concerned with explaining to a listener how a particular activity is carried out" (Snow, Douglas, & Ponsford, 1997, p. 947).

Traumatic Brain Injury (TBI): "any extracranial mechanical force to the brain that results in any period of loss of consciousness, any loss of memory for events immediately before or after the injury, or any alteration in mental status at the same time as the injury" (Kim et al., 2007, p. 106).

Chapter 2: Literature Review

This section describes the literature relevant to the discourse communication of individuals with TBI and without TBI. The literature was primarily reviewed using several online databases spanning diverse subject areas. The PubMed, PsychInfo, and Web of Science Databases were each searched for resources on the discourse deficits of individuals with traumatic brain injury. Key words such as *traumatic brain injury* and *discourse deficits* were used in conjunction with search terms that included *communication disorders, quality of life, social integration, cognition, procedural, communicative, narrative, fictional,* and *personal discourse*, etc. Within the PubMed database, the *relevant citations* search feature was used for articles that were determined to be relevant to this project. Within the Web of Science database, the *cited reference search*, which provides a list of sources that an article was formerly referenced in, was used for especially relevant articles. Additionally, a 2010 publication from the Centers for Disease Control and Prevention (CDC) and the National Center for Injury Prevention and Control provided relevant statistics regarding the estimated average annual number of traumatic brain injury-related emergency department visits, hospitalizations, and deaths in the United States and relevant information regarding the health outcomes of traumatic brain injury.

The following review of the literature is organized into 7 main sections: (1) Traumatic Brain Injury (TBI), (2) Discourse, (3) Narrative Discourse, (4) Procedural Discourse, (5) Conversational Discourse, (6) Discourse Transcription, (7) Discourse Analysis, and (8) Cognitive Function. Each section is further divided into subsections. At the end of each section, the relevance of the literature to the study design and research questions addressed within this thesis project will be discussed.

Traumatic Brain Injury (TBI)

Background. Traumatic brain injury (TBI) is a leading cause of both morbidity and mortality, accounting for approximately 2.4 million emergency room visits annually in the United States and more than 500,000 hospital admissions (Kim et al., 2007). A reported 5.8 million survivors of TBI in the United States have acquired a chronic disability as a result of their injuries (Kim et al., 2007) including long-term cognitive and psychological impairments (Faul et al., 2010). Nearly one third (30.5%) of all injury deaths included a diagnosis of TBI (Faul et al., 2010). A TBI can be defined as "any extracranial mechanical force to the brain that results in any period of loss of consciousness, any loss of memory for events immediately before or after the injury, or any alteration in mental status at the same time as the injury" (Kim et al., 2007, p. 106). TBI is typically caused by a bump, blow, jolt, or penetrating wound to the head that disrupts normal functioning of the brain (Faul et al., 2010).

Furthermore, the resulting trauma of a TBI commonly affects cognitive processes and executive functions which support communication, resulting in a variety of cognitive-communication deficits (Togher, 2011). TBI can also produce widespread and significant disabilities in the lives of those affected (Jorgensen & Togher, 2009). Along with a variety of physical difficulties, many disabling factors of TBI involve a wide range of cognitive, emotional, psychosocial, and communicative difficulties (Jorgensen & Togher, 2009). Nonetheless, TBI has been referred to as a *silent epidemic* (Vaishnavi et al., 2009) since major post-TBI disabilities and neuropsychiatric issues are often not immediately apparent (Reeves & Panguluri, 2011).

Discourse

Background. According to van Dijk & Kintsch (1983), discourse is defined as the related, extended, and meaningful representation of communication across a variety of language

units. Discourse can also be conceptualized as a series of linguistic units that communicate a message (Coelho et al., 1994). Discourse, however, does not encompass a specific set of rules that defines it as grammaticality, which is the case with sentences (Coelho, 1999; Ulatowska et al., 1981). Furthermore, discourse is recognized as language "in its naturally occurring form" and is largely influenced by linguistics, along with various cognitive and social factors (Galski et al., 1998, p. 186). Even though discourse is typically described as a series of related sentences, it may be of any length (e.g., single word, phrase, sentence, or a combination of these forms), with the length determined by its communicative function (Coelho, 1999). Normal discourse production has been indicated to involve both macro- and microprocesses, organized in a hierarchical fashion (Levelt, 1989; van Dijk & Kintsch, 1983).

According to Coelho (1999), message development precedes linguistic information. As the message is being developed, cognitive and emotional information along with communicative intentions are coded into both macro- and micro-propositions. For instance, in describing a cartoon story, a speaker will need to first recognize the general theme of the cartoon before the description of the story can be planned and formulated (Coelho, 1999). The end result will be a pragmatically and semantically coherent text in which the individual actions and events depicted in the stimulus images are ordered in a logical fashion with minimal comments on the irrelevant details of the story (Coelho, 1999).

Discourse and TBI. The production and/or comprehension of a narrative requires a complex interaction of linguistic, cognitive, and social abilities (i.e., language use) that is recognized to be sensitive to communicative deficits, which are frequently demonstrated by individuals with TBI (Coelho, 1999). The communication impairments in individuals with TBI are often subtle and easily underestimated or overlooked if the language assessment is only based

on insensitive screening tests, language batteries designed for aphasia, or conversational samples (Lê, Mozeiko & Coelho, 2001). In the early stages of recovery, individuals with TBI often perform within the normal range on traditional clause level language assessments (Jorgensen & Togher, 2009). However, individuals with TBI often experience significant difficulty with communication across a number of discourse production genres (Jorgensen & Togher, 2009). Additionally, studies examining the discourse abilities of adults with TBI have shown that while adults with TBI may display *normal* or *near normal* language on traditional aphasia tests, they exhibit differing levels of impairment in terms of the coherence, cohesion, and informational context of their extended verbal production (Coelho, Liles, & Duffy, 1994; Hartley & Jensen, 1991). Ehrlich (1998) has suggested that the analysis of communication skills of individuals with TBI should always encompass assessment at the discourse level; especially since these individuals' deficits in traditional language skills are more subtle than what is often displayed in aphasia and/or other adult communication disorders.

Galski et al. (1998) have outlined the different types of discourse that have been studied in the TBI population: (1) conversational discourse, which involves a dialogue between two people in an interactive exchange; (2) narrative discourse (e.g., descriptive or story), which consists of a monologue where a person describes real or imagined events to a relatively passive listener; (3) procedural discourse in which a listener is directed to perform an act in a series of chronological or conceptually related steps; and (4) conversational discourse, which involves a dialogue between two people in an interactive exchange. Furthermore, these genres of discourse language can be analyzed for grammatical complexity (sentence level), cohesion (how meaning is tied across sentences), coherence (how an individual conveys the overall theme of a narrative),

story grammar (expression of the logical relationships between characters and events within a story), and completeness (inclusion of critical components of a story) (Coelho, 2007).

Overall, each of the genres of discourse differs in terms of the cognitive and linguistic influences that are placed on a speaker (McCabe, 2006). For instance, one major influence on discourse is the cognitive demand that is required to produce a genre. Berman et al. (1994) have found that children perform better with tasks that reduce cognitive load. Conversational discourse has a relatively small cognitive demand, since an adult conversational partner can assist the child by asking clarifying questions or leading the child in the discourse (McCabe, 2006). In contrast, personal narratives are cognitively challenging since they require planning and organization of the utterances around a theme. Another significant influence on discourse is the length of the genre. For instance, a conversation is a genre of discourse in which a short, single utterance could be considered socially appropriate. “The other genres involve collections of utterances; single utterances are not sufficient for these genres” (McCabe, 2006, p. 127).

The findings from various studies on the discourse communication of the TBI population have generally revealed pragmatic inappropriateness relative to difficulty in initiating and/or sustaining conversation with decreased response adequacy (Coelho, Lies, & Duffy, 1994; Snow, Douglas, & Ponsford, 1997). Investigations with the TBI population have also indicated reduced informational content (Chapman et al., 1992; Ehrlich, 1998; Mentis & Prutting, 1991) along with the decreased utilization of cohesion devices (Hartley & Jenson, 1991). Furthermore, previous studies have also indicated disrupted coherence (Glosser & Deser, 1992; McDonald, 1993) with increased lexical production errors (Glosser & Deser, 1992; Hartley & Jensen, 1991). The conversations of individuals with TBI have been rated as less interesting, less appropriate, and more effortful, compared to conversations with non-TBI controls (Bond & Godfrey, 1997).

Additionally, discourse production of individuals with TBI has also been described as *disorganized*, *tangential*, *confused*, *inefficient*, and *self-focused* (Coelho et al., 1994; Ehrlich, 1998; Liles et al., 1989).

Narrative Discourse

Narrative discourse typically occurs in either the first or third person and has been described as "a language representation of a happening, real or imagined" (Ulatowska et al., 1981, p. 19). This genre of discourse is composed of matching a verbal sequence of clauses to a sequence of events that have actually taken place. Narrative skills tax the linguistic, cognitive and communicative abilities of speakers (McCabe & Peterson, 1991). Hence, narrative discourse assessments provide a rich context for examining language development and determining an individual's communicative strengths and weaknesses. These assessments of narrative discourse typically examine personal or fictional narratives. Furthermore, the clauses of a narrative are usually ordered in temporal sequence (Ulatowska et al., 1981). According to Ulatowska et al. (1981), a fully formed narrative consists of an episode with the following structure: (1) Abstract* (What is it about?); (2) Setting involving the time and location, background, and identification of participants (Who, When, What, Where?); (3) Complicating action involving events (Then what happened?); (4) Evaluation (So what?); (5) Result or resolution (What finally happened?); (6) Coda* (What is the moral?) (*Abstract and coda are optional).

Narrative discourse has been examined in a number of studies of communication in children, adolescents, and adults with TBI compared to non-TBI controls (Chapman et al., 1992; Coelho et al. 1991; Hartley & Jensen, 1992; Liles et al., 1989). However, the results of these studies have shown that the analysis of narratives at the word or sentence level typically has not differentiated individuals with TBI from non-TBI individuals (Leer & Turkstra, 1999). As a

result of these findings, the attention has been shifted toward the analysis of structures and relations beyond the level of the sentence (Coelho, 1995), which include the overall organization of narrative discourse along with the logical progression of ideas within it (Chapman et al., 1992; Hartley & Jensen, 1992; Mentis & Prutting, 1987). Moreover, individuals with TBI often fail to address the essential content elements of the story in narrative discourse, such as the main events and characters, which have been found to take place even when the organization demands are reduced, such as providing the person telling the story with the sequence of events in picture stimuli (Tucker & Hanlon, 1998). In the formation of narratives, the omission of critical information and relevant details are commonly reported in studies examining the communication skills of individuals with TBI (Biddle, McCabe, & Bliss, 1996; Hay & Moran, 2005; Tucker & Hanlon, 1998). With regard to these findings, measures of narrative content have potential to offer another critical dimension for the understanding of discourse deficits following TBI (Lê, et al., 2011). According to Lê et al. (2011), "the inclusion of content measures with organizational measures may render a more global picture of an individual's narrative discourse performance" (Lê et al., 2011, p. 749). For this study, we examined both TBI and non-TBI individuals' performance on both personal and fictional narrative discourse communication tasks.

Fictional narratives. According to Tucker & Hanlon (1998), narrative discourse production requires the integration of linguistic information within an overall theme, or macrostructure. In narrative production tasks, such as those based on picture descriptions, the act of drawing inferences, or detecting implied meaning from the stimuli involves the ability to select and integrate the cues underlying the theme of macrostructure (Glosser, 1993; Myers & Brookshire, 1996; Ulatowska & Chapman, 1994). The results of various studies using fictional narratives have suggested a significant loss of central information following severe TBI,

resulting in *impoverished* narratives (Glosser, 1993; Myers & Brookshire, 1996; Ulatowska & Chapman, 1994). Narrative discourse tasks have also shown the complex and subtle disruptions in communication, which are displayed by many recovered individuals who have sustained severe TBI (Coelho, 1995).

A wide variety of stimuli and elicitation techniques have been employed in studies investigating narrative discourse. These stimuli have ranged from line drawings, such as the "Cookie Theft" image from the Boston Diagnostic Aphasia Examination (BDAE) (Goodglass & Kaplan, 1972) to multi-frame cartoon drawings (Hartley & Jensen, 1991), to filmstrips (Liles et al., 1989) to Norman Rockwell paintings (Liles et al., 1989; Coelho et al., 1991, 1995), to re-telling a pre-recorded story (Hartley & Jensen, 1991), and video narration (Dollaghan et al., 1990).

In Coelho et al.'s (1991) investigation, which examined the story grammar of two speakers using a Norman Rockwell painting as the stimulus, it was reported that one of their speakers, despite being able to use cohesive devices appropriate, was not able to produce complete episodes. These results provide support for the notion that discourse should be evaluated at a number of levels, which allow for a range of cognitive and linguistic factors to be considered (Coelho et al., 1991). Similar findings were reported by Liles et al. (1989) in an investigation examining the discourse production of individuals with and without TBI using the Norman Rockwell painting as a stimulus. The results of this study indicate that the brain injured participants made more errors at the level of sentence formation, regardless of the task, with the most evident disruptions in the linguistic and cognitive organization of the text. These results also suggest the usefulness of this elicitation procedure for characterizing the discourse issues of individuals with head injury (Liles et al., 1989).

In a more recent study conducted by Cannizzaro & Coelho (2002), the narrative discourse production of a cohort of 55 participants with TBI was examined using a story telling task in which participants were also presented with an image of a Norman Rockwell painting. Each subject was instructed to: "Tell me a story about what is happening in this picture" while the image remained in view throughout the duration of the narrative. The results of this study indicate that individuals with TBI introduced more extraneous propositional content in their narratives, which suggested difficulties in the organization of information at the between-sentence level (Coelho, 2002). In light of these findings, a color print of a Norman Rockwell painting was presented to each participant on a computer screen as the discourse elicitation procedural for the fictional narrative discourse task in the present study.

Personal narratives. Personal narratives perform a significant function in the majority of all societies. Through utilization of personal narratives, individuals are able to make sense of their experiences and portray themselves to others (Biddle et al., 1996). Biddle et al. (1996) underscored the importance of using personal narratives to measure narrative discourse, which is a discourse genre that reflects the ability of an individual to describe a past experience. This study utilized spontaneous personal narratives along with a dependency analysis to examine the discourse abilities of individuals with TBI. Ultimately, Biddle et al. (1996) concluded that dependency analysis was found to reliably differentiate the discourse of the individuals with TBI from the non-TBI participants, and the TBI individuals were found to be significantly more dysfluent than their matched controls. Furthermore, the TBI individuals' performance on the personal narrative tasks was also indicated to produce a significant burden on the listener, since it was more difficult to understand their narratives.

McCabe & Bliss (2006) also examined personal narratives of individuals with TBI, and non-TBI participants. A personal narrative reflects a natural form of discourse that comprises many adult interactions and is critical for assessing functional communication in individuals who have sustained brain injury. Furthermore, personal narratives represent a more functional type of discourse that involves retelling a story or describing pictures from a sequence of illustrations. According to McCabe & Bliss (2006), a personal narrative is elicited when a clinician relates a personal experience, such as witnessing or having a car accident or buying a house. To elicit a personal narrative, the clinician will ask the conversational partner whether they experienced a similar situation, and if the answer is positive, the adult will be asked to describe the event. However, a neutral prompt can also be utilized to expand the discourse, such as "And then what happened?" or "Anything more?" For the purposes of the present study, participants engaged in two separate personal narrative tasks; one of which involved the participant telling the examiner about a time they or someone they know was seriously injured, and the other task required the participant to tell the examiner about a recent vacation they went on or what they did over their last summer vacation.

Procedural Discourse

According to Snow et al. (1997), procedural discourse is a monologue discourse task that is concerned with explaining to a listener how a particular activity is carried out. The main purpose of procedural discourse is *to inform* or *instruct* (Snow et al., 1997) and it consists of steps or procedures which are stated in specifiable order, and which are either conceptually or chronologically linked (Ulatowska et al., 1981). The results of a study conducted by Ulatowska et al. (1981) have indicated that the procedural genre places greater demands on the speaker's ability to be precise and explicit in conveying information. Procedural discourse is also

comprised of information units, which are referred to as *steps* (Snow et al., 1997). According to Snow et al. (1997) the steps for procedural discourse tasks can be organized hierarchically into essential, optional, (may be either auxiliary or substeps), and target steps. The essential steps contain the information, which must be understood by the listener in order to know what actions are required to complete the given task (Ulatowska et al., 1981). On the other hand, optional steps can provide clarification and/or extra detail about information that is contained in the essential steps. Ultimately, the target step indicates the completion of the procedure (Snow et al., 1997).

For the present study, participants engaged in two separate discourse tasks: the "ATM Machine" task and the "Trip to New York" task. Operating an automatic teller machine (ATM) is one of the most common tasks involving community-living skills that an individual might engage in. Individuals with TBI have different levels of cognitive function that can affect their ability to perform basic tasks, such as their ability to operate an ATM (Fong et al., 2010). According to Fong et al. (2010), these difficulties may be a result of cognitive deficits such as memory difficulty, poor problem-solving, or slow motor and information processing speed. Previous studies have employed tasks involving participants to list the steps involved in withdrawing money from a bank account (Snow et al., 1997). The results of Snow et al.'s (1997) investigation indicate that the TBI individuals differed from the control participants on measures relating to content and productivity. Additionally, the TBI group was also found to differ significantly from the control group with respect to the production of pragmatic errors, which were predominantly concerned with information transfer. Given the sensitivity of this task to differentiate individuals with and without TBI and the universal familiarity of this basic function, the "ATM Machine" task was used for the purposes of the present study.

The “Trip to New York” task is a complex, elicited discourse task that was developed for a larger assessment study. This discourse task has demonstrated sensitivity in adults with and without TBI (Kiran et al., 2008). For instance, Fleming & Harris (2008) employed the “Trip to New York” task to test individuals with mild cognitive impairment (MCI), in which the participant was instructed to provide a spoken description of their plans for an imagined trip. The results of Fleming & Harris’s (2008) investigation indicated that the MCI and control groups differed significantly in the total numbers of words produced. The MCI group not only produced fewer words than the controls, but also produced discourse samples, containing fewer core thematic elements. According to Gloser & Deser (1992), thematic coherence is recognized as an important index of language decline. Moreover, the control group produced discourse that, compared to the MCI group, displayed superior planning, organization, abstract reasoning, and cognitive flexibility, which are each higher-order cognitive processes that are implicated in early cognitive decline (Fleming & Harris, 2008).

Furthermore, the “Trip to New York” is presumed superior to frequently used picture description or retell tasks (Fleming & Harris, 2008). According to Fleming & Harris (2008), the “Trip to New York” “is more strictly generative, requiring participants to supply nearly all of the conceptual and semantic content” (p. 733). Additionally, “the task potentially requires elements of both narrative and procedural discourse, without the externally imposed constraints of either genre” (Fleming & Harris, 2008, p. 733). Moreover, the “Trip to New York” task requires the participant to use planning, organization, and cognitive flexibility, each of which are abilities know to be comprised as a result of brain damage (Lezak, 1995). Thus, this task is considered to be a cognitively challenging, complex discourse task. Since increased discourse complexity may

be expected to detect subtle changes in language ability (Ulatowska et al., 1986), this task was utilized for the purposes of the current study.

Conversational Discourse

Conversational discourse involves a dialogue between two individuals in an interactive exchange (Galski et al., 1998). The analysis of conversational discourse has been of particular interest to researchers because of its importance in the process of socialization (Coelho et al., 2002). Overall, the development and maintenance of social relationships has been recognized to be particularly challenging for individuals with TBI. As a consequence of this difficulty, many individuals with TBI face social isolation, an increased reliance on family for social support, and significant problems with returning to work, school, and premorbid avocations (Coelho et al., 2002). A study conducted by Galski et al. (1998) found that competence in discourse predicted social integration and quality-of-life in subjects 47-105 weeks post-TBI. These interactional problems may be the results of social skills deficits, which are felt to be a reflection of subtle impairments in pragmatic language use during conversation (Bond & Godfrey, 1997). Moreover, Galski et al. (1998) noted that while conversational discourse is closest to real life, it appeared to be less challenging than narrative and procedural discourse for the participants with TBI. Conversations may be less demanding than other types of discourse "because of the different cognitive and linguistic demands for conceptualization, abstraction, ordering, and sequencing" (Coelho, 2007, p. 128). Therefore, conversational discourse is said to be more related to social integration and quality of life.

According to Coelho (2007), the elicitation of conversational discourse samples typically involves participants engaging in conversational interaction with an examiner or other partner. In this interaction, the participant may be provided with a list of topics to discuss to "ensure that all

dyads begin at a common point and facilitates comparisons of performance across dyads or of multiple conversations within the same dyad" (Coelho, 2007, p. 127). Given the importance of conversational discourse in socialization and daily life, a conversational discourse task was included for the purposes of this study. Participants engaged in a two minute conversation with the examiner in which they were presented with each of the following prompts: *Tell me about your family, Can you tell me about the sort of work/study you do?, What sort of things do you normally do on the weekends?, Do you have any particular favorite TV programs?* (Snow et al., 1997).

Discourse Transcription

The T-unit is a commonly used tool for the transcription of discourse language samples. The T-unit, which stands for minimal terminable unit, was introduced by Hunt (1965) to measure the development of sentences in the writing of grade school children. A T-unit consists of an independent clause and any dependent clauses associated with it (Hunt, 1970). Hunt (1970) described the T-unit as "the shortest units into which a piece of discourse can be cut without leaving any sentence fragments as residue" (p. 189). Overall, the T-unit measure is used to "segment passages of continuous language into the shortest unity that is grammatically allowed to be punctuated as a sentence" (Cherney et al., 1998, p. 9). According to Hunt (1970), consistent usage of the T-unit structure will virtually eliminate problems in determining the beginning and end of an utterance. Additionally, this measure of analysis will allow for some general indices of syntactic complexity (Cherney et al., 1998). A T-unit is similar to a sentence but is identified more reliably (Hughes et al., 1997). It can be problematic to segment narratives into sentences "because of the tendency of some speakers to link sentences of a narrative with conjunctions such as *and, or,* and *then*, making it difficult to identify sentence boundaries" (Coelho et al.,

2010). According to Coelho et al. (2010), through use of T-units, which are defined objectively, the problem of continuous conjoining of clauses is solved.

Furthermore, the concept of the T-unit is structured around the clause as the main structural element. In Hunt's (1965, 1970) analyses, an independent or main clause must contain (a) a subject nominal, (b) a finite verb or verb phrase, and (c) depending on the verb, certain objects of complements. Additionally, modifiers can be added, the verb phrase may be expanded through adding auxiliary verb forms, and subordinate clauses may be embedded in or appended to this independent clause.

For this study, each communication task was transcribed verbatim as the initial coding step. Afterward, each transcription was coded manually into T-units (i.e., an independent clause plus any subordinate clauses associated with it) (Hunt, 1970) (see Appendix A). Hunt's (1970) Guidelines for T-Unit Analysis (see Appendix A) were used for the transcription of each discourse sample. Finally, each transcription was distributed, segmented, and analyzed in regard to measures of information content, informational relevance, organization, and pragmatic skills.

Discourse Analysis

Procedural discourse analysis. Snow et al. (1997) conducted a study to examine procedural discourse following severe TBI with an emphasis on the need to study discourse with premorbid sociolinguistic behavior. The results of this investigation indicate the TBI group differed significantly from the control group in terms of the amount of content provided (defined as the percentage of predetermined total number of essential steps present in their discourse samples), along with the percentage syllables *on-target* discourse (i.e., discourse concerned with conveying *essential* and *optional* information) (Snow et al., 1997). Additionally, the TBI group was also found to differ from the control group in terms of pragmatic abilities. Specifically, the

TBI group showed errors that reflected poor topic maintenance, along with difficulties with information transfer (i.e., information redundancy and insufficient information bits) (Snow et al., 1997).

Galiski et al. (1998) used a similar procedure to analyze procedural discourse samples. A sample of procedural discourse was obtained by asking participants with TBI and without TBI (control) to provide step-by-step instructions for purchasing groceries in a supermarket as if talking to someone from another country that has never been to an American supermarket (Galski et al., 1998). Compared to the control group, the participants with TBI manifested fewer pragmatic references in the procedural discourse task. The findings from this investigation indicate that for the participants with TBI, poorer quality of life was related to failure to repair errors in procedural discourse. Additionally, the features brought out in the discourse tasks suggest that the individuals with TBI tended to be significantly slower in initiation of the discourse than the normal controls as well as wordier. The researchers suggest that the individuals with TBI were slower in completing the task, compared to the normal control individuals, due to the excessive inclusion of irrelevancies (*empty speech*) (Galski et al., 1998).

Researchers have utilized a variety of other discourse tasks to measure procedural discourse, which include requests for descriptions of some aspect of the person's treatment program or work (Mentis & Prutting, 1987), explaining a novel procedure to a naïve listener (McDonald, 1993), or withdrawing money from a bank account (Snow et al., 1995). When producing procedural discourse, individuals with TBI have indicated to display difficulty in observing *Gricean Maxims* (McDonald, 1993), and have shown an overall reduction in communicative efficiency, together with reduced use of reference (Snow et al., 1997).

McDonald (1993) used a procedural discourse task to compare two TBI speakers with demographically matched controls. The particular strengths of this study were that the listener was naïve about the information that was conveyed by the speaker and the speaker could not draw on previous knowledge, since the speaker did not have any past experience with the given task (McDonald, 1993). Therefore, the speaker could not rely on an assumption of shared world knowledge, as was the case with previous tasks that have been used to measure procedural discourse in individuals with TBI (e.g., making a sandwich, writing a letter). Overall, McDonald (1993) found that, while the differences between the measure of cohesive harmony between the TBI and non-TBI individuals were non-significant, the TBI individuals made inappropriate use of exophoric reference. This occurred when their utterances contained ambiguous information, or information they had erroneously assumed the listener was privy to (McDonald, 1993; Snow, et al., 1997).

Furthermore, McDonald (1993) also adapted Grice's (1975) conversational maxims to develop a set of five seven-point rating scales to examine repetitiveness, detail, clarity, organization, and effectiveness. The discourse of the TBI individuals was indicated to be inadequate in meeting the informational needs of the listener (McDonald, 1993). The results of this study suggest that the discourse errors occurred predominantly in Grice's quantity and manner categories, resulting in explanations, which were determined to be confusing and disorganized by the listener (McDonald, 1993).

In a recent study, Snow et al. (2007) utilized the operational definitions of *essential* and *optional* steps that were gathered through asking 20 speech-language pathologists to complete a written version of the task, and to classify their steps as *essential* or *optional*. For the purposes of this study, a step was considered to be *essential* if it was classified to be so by 80% of the

clinicians. The remaining steps were considered to be *optional*. Snow et al. (2007) utilized a fundamental and descriptive approach to analyze their data because of the concerns surrounding the theoretical validity of a hierarchical distinction between the *essential* and *optional* steps. This analysis entailed each syllable in the transcripts to be classified into one of four different categories so that a broad distinction could be determined between the discourse that was considered to be *on-target* (i.e., relevant to the task of how to withdraw money from a bank account), from the discourse that was classified as *off-target* (i.e., not contributing to information transfer about the task) (Snow et al., 2007). These four categories are: (1) Syllables which conveyed so-called *essential* information; (2) Syllables which conveyed so-called *optional* information; (3) Syllables in mazes; (4) Syllables which conveyed *low content* output (i.e., conveying repeated or irrelevant output) (Snow et al., 2007).

For the present study, Snow et al.'s (1997) operational definitions of *essential* and *optional* steps were applied to the ATM procedural discourse task in which the participant was instructed to describe the steps involved in withdrawing money from an ATM. These steps were used as a content measure to analyze each of the participants' procedural discourse samples. Using Snow et al.'s (1997) operational definitions, we tallied the total number of essential steps (0-8) along with the percentage proportion of the essential steps out of the clinician's totals (x/8 = %) for measure 1 of the analysis for the procedural discourse tasks. Appendix B lists each of the *optional* and *essential* steps that were derived for withdrawing money from an ATM and further delineates the scoring procedure.

Additionally, a second measure was used to analyze the procedural discourse task, which factored the percentage of T-units *on-target*, using a modified version of the scoring method outlined by Snow et al. (1997). For measure 2 of this discourse task, we calculated the

percentage of the *on-target* steps by combining the *essential* and *optional* steps, and then divided the total number of *on-target* steps by the total number of T-units. Please refer to Appendix C for the complete scoring chart for this measure. The third measure that was used to analyze this task consisted of a modified version of Damico's (1985) Clinical Discourse Analysis (CDA), the CDA-M, which is a measure of an individual's pragmatic abilities (Snow et al., 1997). "This measure has emerged out of the conversation component of this study, and reflects all CDA (Damico, 1985) discourse errors outside those occurring in the following three parameters: *non-specific vocabulary*, *linguistic nonfluency*, and *revision behavior*" (Snow et al., 2007, p. 956). Additionally, the behaviors that are included in the CDA-M include, for instance, informational redundancy, insufficient information bits, failure to structure discourse, and poor topic maintenance. Please see Appendix C for the complete scoring chart for this measure.

A separate measure was used to analyze the second procedural narrative task in which the participant was instructed to describe the steps included in planning a trip to New York City. For the "Trip to New York" task, the core elements, which are a thematic coding measure, were scored using Fleming & Harris's (2008) Core Elements score sheet. According to Fleming & Harris (2008), this measure allows for a multidimensional scoring system to be employed for analysis of the complex discourse task on a variety of domains. Using the core element score, Fleming & Harris indicated a decrease in the higher-order cognitive skills of participants with mild cognitive impairment (MCI). These researchers explained, "the scoring of core elements explored the fullness and depth of the spoken discourse samples" (Fleming & Harris, 2008, p. 736). According to Fleming & Harris (2008), the core element scores mirror both intact travel schema and persevered planning, problem-solving, and organizational abilities. As a result of these findings, Fleming & Harris's (2008) guidelines for scoring core elements were used in this

study to reflect the completeness and quality of the discourse sample involving planning a trip to NYC. Please see Appendix D for the complete scoring chart for this measure.

Fictional narrative analysis. Story grammar is often used for the analysis of fictional narratives. According to Cannizzaro & Coelho (2012), "story grammar knowledge refers to the supposed regularities in the internal structure of stories that guide an individual's comprehension and production of the logical relationships (i.e., causal and temporal) between people and events" (p. 1065). Procedures for analyzing story grammar have been described in previous reports (Coelho, 2002; Merritt & Liles, 1987). In essence, almost every story will follow a basic story grammar structure. "Story grammar measures a storyteller's ability to organize content, to structure a narrative and to provide logical relationships between people and events" (Merritt & Liles, 1987; Mozeiko et al., 2011, p. 829).

Labov & Waletsky (1967) identified five main elements of story grammar: 1) orientation, which provides information about the time, place, characters, and their activity or the situation that will follow; 2) complicating action clauses, which are narrative clauses that explain the series of events within a story; 3) result or resolution, which brings the story's main events to an end; 4) evaluation or the character's actions and events within a story; and 5) coda, which indicate the end of the story and serve as a link between the narrative and the present moment in which the story is being told. However, according to Cannizzaro & Coelho's (2002) evidence-based practice investigation, it was determined that training of story grammar elements in fictional narratives did not lead to an increase in functional communication.

Moreover, the Narrative Scoring Scheme (NSS) (Heilmann et al., 2010) is a sensitive measure of children's overall narrative language skills and has also been used for the analysis of fictional narratives. The NSS produces both a holistic score and numerous dimensional scores,

which include measures of macrostructure and coherence (Rollins, 2015). The NSS utilizes a 0- to 5-point scale for each of the following seven dimensions: "(1) Introduction, (2) Conflict Resolution (i.e. existence of conflicts and how they are resolved), (3) Conclusion, (4) Character Development, (5) Mental States (i.e. the amount and type of vocabulary that are used to describe the characters' thoughts and feelings), (6) Referencing (i.e. consistent and appropriate use of antecedents and clarifiers), and (7) Cohesion (i.e. appropriate sequencing, details, and transitions throughout the narrative)" (Rollins, 2015, p. 24). A score of 5 indicates proficiency; 3, emerging/inconsistent; and 1, immature or minimal (Rollins, 2015). Using this measure, Rollins (2015) found that on average, individuals with Autism Spectrum Disorders (ASD) had poorer quality narratives, as depicted by their NSS Total Score.

According to Heilmann et al. (2010), the NSS "incorporates multiple aspects of the narrative process into a single scoring rubric and provides an overall impression of the child's narrative ability" (2010, p. 156). This metric encompasses both the basic features of the story grammar approaches along with the higher-level narrative skills that have been determined to continue to develop through the school-age years (Heilmann et al., 2010). Ultimately, the NSS was developed to improve on the simple story grammar measures through requiring examiners to make inter-utterance and text-level judgments. These judgments have been indicated to be more effective than discrete coding schemes in identifying children with language impairment (McFadden & Gillam, 1996).

In light of the NSS's ability to go beyond basic story grammar measures and allow the clinician to make inter-utterance and text-level judgments, Heilmann et al.'s (2010) NSS measure was utilized for analysis of the fictional narrative task in the present study. Please refer to Appendix E for the complete NSS Scoring Rubric and description.

Personal narrative analysis. High-point analysis is a method that is frequently used for analysis of personal narrative discourse tasks. High-point analysis is often chosen because it examines the structure of the narrative as a whole (Peterson & McCabe, 1983). Labov & Waletzky (1967) theorized that a coherent narrative is organized around a *high point* or a key moment in a story. Overall, high point analysis examines narrative functions of specific utterances and episodes in terms of the structure outlined by Labov & Waletzky (1967), which consists of an abstract, orientation, complicating action, evaluation resolution, and a coda.

Furthermore, McCabe et al. (1991) have analyzed personal event narratives of young children using high point analysis to illustrate the developmental sequence of the narrative macrostructure. It was determined that story grammar, which is a frequently used method of analysis for narratives, did not previously distinguish the narratives of children with high-functioning Autism Disorders (ASD), from typically developing children, while high point analysis did (McCabe et al., 1991). In a recent study, McCabe et al. (2012) used high point analysis to examine the personal narratives of young adults with ASD. Using high point analysis to analyze the organization of the narratives, it was found that the group with ASD produced narratives that were significantly poorer in terms of high point macrostructure (McCabe et al., 2012).

Another measure that has been used for analysis of narratives is the Massachusetts Comprehensive Assessment System (MCAS). According to McCabe et al. (2008), the MCAS is a new approach that was developed for their project since children's oral narratives "now commonly serve as the linguistic resource they need to tap to pass the high-stakes test in states such as Massachusetts" (p. 198). Overall, the rubrics that were developed to score composition were applied to the children's oral productions in McCabe et al.'s (2008) study. Using this

measure, the investigators found that children with language impairment display differential ability to produce personal versus fictional narratives and more personal narratives were judged as true narratives by the clinicians than fictional stories.

For this study, high-point analysis was utilized for analysis of the two personal narrative discourse tasks: the Recent Vacation and Injury/Illness tasks. High-point analysis was chosen because it examines the structure of the narrative as a whole (Peterson & McCabe, 1983). The present study used Peterson & McCabe's (2008) high point analysis measure (see Appendix F) for analysis of the personal narrative discourse samples for this study. We also used McCabe et al.'s (2008) Massachusetts Comprehensive Assessment System (MCAS) to further analyze the personal narratives (see Appendix G) for organization, topic/idea development, story details, use of language, and awareness of audience or task. At the end of analysis, we combined the scores for high point analysis and MCAS for an overall total score. Additionally, we calculated the average of the high point analysis, MCAS total score, and the overall total score for both the Recent Vacation and Injury/Illness tasks.

Conversational discourse analysis. A variety of different analyses have been applied to the conversational samples from individuals with TBI (Coelho et al., 2002). Analyses such as pragmatic rating scales and checklists have been utilized (Snow et al., 1997), along with formal, highly structured analyses such as generic structure analysis and exchange structure analysis, which are based on Halliday's (1994) Systemic Functional Linguistics (Togher et al., 1999). Coelho et al. (1993) used analysis procedures, which have examined topic initiation and response appropriateness (Coelho et. al., 1993) and topic management (Coelho et al., 1993; Mentis & Prutting, 1991). These analyses have indicated that individuals with TBI experience difficulties with topic management, turn taking, and expressing information in a logical fashion (Coelho et

al., 2002). Furthermore, conversations involving individuals with TBI have been rated as less interesting, less appropriate, and more effortful than conversations with non-TBI controls (Bond & Godfrey, 1997).

A measure that has been commonly used to analyze conversational discourse samples is the proportion of T-units within the episode structure. As defined by Hunt (1970), "A T-unit is one main (independent) clause plus any subordinate clauses or non-clausal structures attached to or embedded in the main clause. A main clause must have a subject and verb and may have optional objects or complements" (p. 24). T-units have been utilized largely in the research on discourse language. Coelho (2002) has defined the T-unit as the units of language that contribute to episodic structure (i.e., T-units in episode structure/total number of T-units in story narrative). According to Coelho (2002), this measure is considered to be an indication of the participants' ability to use story grammar as an organizational plan for language. For instance, the participants will occasionally insert comments during a story-retelling task that may have been related to the story, though they did not contribute to the actual story (Coelho, 2002). Even though these stories may be longer in terms of the total number of T-units, the proportion of the T-units that actually contributed to the episodic structure was found to be very minimal. Overall, this can lead to stories that are composed of irrelevant, distracting content and a lack of conciseness.

Another tool that has been frequently used for analyses of conversational discourse tasks is the Clinical Discourse Analysis (CDA). The CDA was developed as a descriptive approach and was designed for analyzing spontaneous language samples (Damico, 2015). Additionally, the CDA was modeled after Grice's Cooperative Principle (1975). Through use of Grice's theoretical framework, 17 different problem behaviors can be categorized within it. According to Damico (2015), "the focus of the assessment is on the functionality of discourse regardless of the

underlying cause" (p. 184). The CDA analyzes the functionality of language discourse in a holistic manner and focuses on language in conversational interaction. It has been utilized with over 600 individuals, ranging in age from 6 years, 3 months to 74 years, 4 months (Damico, 2015).

For this study, we analyzed the participant conversational discourse samples using Damico's (1985) Clinical Discourse Analysis (CDA) to determine linguistic non-fluency, inappropriate intonational contours, message inaccuracy, inappropriate responses, revision behavior, etc. Please refer to Appendix H for the complete CDA scoring chart and the description of the CDA categories/qualities. Additionally, we transcribed the language samples into T-units using Hunt's (1965, 1970) Guidelines for T-unit Analysis (see Appendix A) and then compared the total number of T-units between participants. Please see Appendix A for examples of T-unit analyses.

Cognitive Function

The Montreal cognitive assessment (MoCA). The MoCA is a cognitive screening test (Nasreddine et al., 2005). This assessment is administered in approximately 10 minutes and is scored on a maximum of 30 points. Several cognitive domains are assessed with the MoCA. One of the tasks is a short-term memory recall task which involves two learning trials of five nouns and delayed recall after approximately 5 minutes. No points are awarded for trials one and two and a maximum of 5-points can be attributed in the delayed recall task. Furthermore, a clock drawing task (1 point for the contour, hands, and numbers, for a maximum of 3 points) and a three-dimensional cube copy (1 point) are used to examine visuospatial abilities. Executive functions are assessed through the trail-making B task (1 point), a phonemic fluency task (1 point is given if the participant generates 11 words or more in 60 seconds) and a two-item verbal

abstraction task (2 points). Attention, concentration, and working memory were each evaluated using a sustained attention task (target detection using tapping, 1 point if there is 0-1 error, an error being a tap on a wrong letter or a failure to tap on letter A), a serial subtraction task (maximum of 3 points). One point is awarded for one correct subtraction, 2 points for two-to-three correct subtractions, and 3 points for four or five correct subtractions. A digits forward and backward task (1 point each) is also included in this assessment to examine attention, concentration, and working memory. Moreover, language is assessed using a three-item confrontation naming task with low-familiarity animals (lion, camel, rhinoceros; 3 points maximum), repetition of two syntactically complex sentences (1 point is awarded for each sentence correctly repeated for a maximum of 2 points), and the aforementioned fluency task. The last task in the MoCA assessment is an orientation to time and place evaluation (6 points maximum; the participant must tell the exact day, date, month, and the exact place and city). No points are given if the subject makes an error of 1 day for this task. A cut-off of 26 is associated with cognitive impairments on the MoCA assessment (Nasreddine et al., 2005).

The MoCA was originally developed to assess patients with mild cognitive impairment and was subsequently applied more widely for vascular cognitive impairment after ischemic stroke (de Guise et al., 2013; Folstein et al., 1975; Nasreddine et al., 2005; Norman, 2010; Rabadi et al., 2008). This assessment examines the various cognitive functions which are frequently impaired in the TBI population including executive functions and psychomotor speed (de Guise et al., 2013). According to de Guise et al. (2013), “the acute cognitive deficits following a TBI generally consist of confusion and disorientation, short- and long-term memory problems, attention deficits, executive deficits and slowness” (p. 1429). Hence, the MoCA has been indicated as an appropriate tool to assess the cognitive impairments of individuals with

TBI, given that it is brief and has been shown to be reliable in detecting cognitive impairment (Folstein et al., 1975; de Guise et al., 2013). Furthermore, the MoCA also utilizes numerous and more demanding tasks to assess higher-level language abilities, memory, and complex visuospatial processing and, therefore, "has fewer pronounced ceiling effects compared with the traditional Mini-Mental State Examination (MMSE)" (de Guise et al., 2013, p. 1430). Previous studies have indicated that TBI patients had a high prevalence of MoCA-defined cognitive impairment (Folstein et al., 1975; de Guise et al., 2006). The MoCA has also been shown to be more sensitive to subtle cognitive deficits and early cognitive in a variety of populations as compared to the MMSE (de Guise et al., 2013).

Given the reliability and validity of this assessment with evaluating the TBI population, the MoCA (Nasreddine et al., 2005) was used for the current study. For this study, the MoCA was utilized as a preliminary measure to indicate general cognitive function of both the TBI and non-TBI participants. Please see Appendix G for the complete MoCA score sheet.

Summary of the Literature Review

TBI is a major public health issue that impacts the lives of almost 2 billion Americans each year (Faul et al., 2010). Though TBI can lead to a variety of neurological, behavioral, and personality changes, one of the most significant detriments of this injury is the communicative impairment that can occur as a result of TBI. Impaired discourse is recognized as the hallmark of post-TBI cognitive-communication disorder and, due to the central role discourse plays in everyday communication, impaired discourse abilities significantly contribute to the participation restrictions that underlie the social isolation frequently experienced among individuals living with TBI. A variety of genres of discourse communication (i.e., procedural, personal, fictional,

conversational, narrative) have been used for evaluating the language and determining the communication impairments of individuals with TBI.

Previous studies have indicated that individuals with TBI tend to produce pragmatic inappropriateness relative to difficulty in initiating and/or sustaining conversation with decreased response adequacy (Coelho, Lies, & Duffy, 1994; Snow, Douglas, & Ponsford, 1997). Investigations with the TBI population have also indicated reduced informational content (Chapman et al., 1992; Ehrlich, 1998; Mentis & Prutting, 1991) along with the decreased utilization of cohesion devices (Hartley & Jenson, 1991). Additionally, the conversations of individuals with TBI have been rated as less interesting, less appropriate, and more effortful, compared to conversations with non-TBI controls (Bond & Godfrey, 1997). Collectively, these communicative impairments can lead to impaired social competence and social isolation for individuals with TBI. As a result of the high prevalence and incidence of TBI, in addition to its detrimental effects, lack of a cure, and overall burden on society, it is imperative that effective treatments be developed and validated.

Studies focusing on the discourse communication abilities of individuals with TBI are lacking. Furthermore, little research has been done to compare the performance of individuals with TBI to individuals without TBI on discourse language tasks. Examining the discourse productions of adults with TBI and adults without TBI will contribute to a growing understanding of the cognitive, social, and language similarities and differences observed among these individuals. This area of research has important clinical implications that could help identify the specific speech-language therapy needs of individuals living with TBI. Increased individualization of speech-language therapy could lead to improved effectiveness in treatment,

helping individuals with TBI to improve their overall communication skills and in turn, increase their independence and participation in society and reduce their social isolation.

Chapter 3: Methods

Research Design

This non-experimental study utilizes a cross-sectional design. Data was collected at one point in time in single, one-on-one testing sessions with an examiner.

Recruitment of Sample from Population

For this study, 15 adults with traumatic brain injury (TBI) were compared with a group of 4 adults without TBI for a total of 19 participants. The participants were comprised of both males and females, ranging in age from 18 to 64 years old. All participants were adults (> 18 years of age), status-post onset of a single traumatic brain injury (TBI group), who communicate primarily by verbal means, and are currently receiving out-patient based speech and language pathology treatment services (see Appendix J). All TBI participants in this study had a history of a single TBI and subsequent cognitive-communication deficits, as determined by his or her treating out-patient speech-language pathologist. Excluded were those with severe aphasia, those who communicate by nonverbal means, and individuals with a significant history of psychiatric disorder, substance abuse, or language/learning disability.

For the typical control group, all participants were also adults (> 18 years of age), who communicate primarily by verbal means. Control participants in this study had no history of traumatic brain injury or loss of consciousness lasting longer than 5 minutes. Excluded were those with severe aphasia, those who communicate by nonverbal means, and those persons with a significant history of psychiatric disorder, substance abuse, or language/learning disability.

Participants for the TBI group were recruited (see Appendix K) through local brain injury support groups (i.e., Chittenden County Traumatic Brain Injury Group) and from local clinicians working with these populations. Access to these local support groups is open to the public and

recruitment was done via the internet through the University of Vermont (UVM) list serve. Subjects were instructed to contact Dr. Cannizzaro, the principal investigator, via email or phone call after receiving the recruitment flyer and contact information to volunteer to participate in the study. Dr. Cannizzaro performed all of the screening for exclusion criteria for this study. Additionally, Dr. Cannizzaro recruited participants through providers by asking them to email the recruitment flyer (see Appendix K) to potential participants. The provider did not ask the patient for permission to release their name and phone number to Dr. Cannizzaro; potential participants were instructed to contact him directly if interested. Dr. Cannizzaro responded to volunteers via email and/or phone contact and participants arranged their appointments via phone and/or email. Furthermore, Dr. Cannizzaro recruited non-TBI participants on-campus and from the local community with flyers (see Appendix K) and through word of mouth.

Data Collection

The participants were given the informed consent form, HIPAA authorization cover form, and HIPAA authorization form by the PI or key personnel. Once the forms were signed, the PI kept the original forms in a locked research lab in Pomeroy Hall (Pomeroy 413) and a signed copy was given to the participant. After providing informed consent, the participants went through protocol for fNIRS and language collection using the Montreal Cognitive Assessment (MoCA) (Nasreddine et al., 2005) (see Appendix I). All data collection took place in a research lab (Pomeroy 413) located in the E.M. Luse Center for Speech, Language and Hearing. All data collection took place during an individual session with the examiner (Dr. Michael Cannizzaro or other verified study personnel).

Once the MoCA was completed, the participant was instructed to engage in a series of communication tasks, which included procedural discourse, conversational discourse, and

narrative discourse (fictional and personal) tasks. All communication tasks took place in a quiet treatment room (Pomeroy 413). In this setting, one-on-one interaction with the designated examiner (PI or key personnel) and the participant took place seated comfortably at a table in the treatment room. Instructions were presented to the participant with a PowerPoint, which the examiner read aloud to the participant. The PowerPoint was presented on a computer screen, directly in front of the participant so the participant was also able to read the directions on the screen. After the instructions were completed, the examiner asked the participant if he or she had any questions and if he or she was ready to begin.

Each of the communication tasks was presented to the participant on a computer screen using PowerPoint. Additionally, the directions for each of the communications tasks were previously recorded using audio overlay. The participant was asked to start performing the given task once the PowerPoint slide on the computer screen changed. For some of the tasks, the participant may have finished before the slide changed. If this was the case, the participant was asked to sit calmly until the next slide appeared. For some of the tasks, the participant may have run out of time before he or she was finished. If this was the case, the participant was asked to stop performing on the current task and move on to the next slide. Before and after many of the tasks, the participant was shown a cross in the middle of the screen (+), which signified a twenty second rest period. The participant was asked to look passively at the cross until the slide changed. There was no task during these slides. The first slide of the PowerPoint was a cross. The participant was asked: *"Do you have any questions?", "Are you ready to begin?"*

Data for this study remained in a locked research lab (Pomeroy 413) at the University of Vermont. Data was collected from single, one-on-one sessions with the participants (kept in locked filing cabinets within the locked laboratory), entered into a password protected data file,

and stored on a password protected laboratory computer. Only the principal investigator, Dr. Cannizzaro (faculty advisor), and undergraduate and graduate students listed as key personnel in the Cannizzaro Research Lab were permitted to access the data (raw & analyzed). Dr. Cannizzaro and key personnel were responsible to account for the data and ensure that it was being maintained in the locked research lab in 413 Pomeroy Hall. All data will be kept for a period of up to two years following the close of data collection for this study and will be destroyed, following E.M. Luse Center guidelines (i.e. secureshred).

Ethical Considerations

This study had very few ethical considerations and minimal potential risks, such as a breach of confidentiality and possible discomfort in talking about injuries for participants with TBI. The only potential cost for participants was their time, and there was also potential for fatigue. If participants with TBI were not comfortable talking about their own injuries, they were informed that they could cease participation in the study at that time or could talk about an injury to someone else. Overall, there are no known risks involved in using cognitive and linguistic assessment.

Individuals with TBI are potentially vulnerable due to cognitive impairments subsequent to the brain injury. However, this population was included exclusively for this study to further the knowledge base and potentially improve the assessment and treatment practices in speech-language pathology rehabilitative services for this individuals living with TBI. TBI participants for this study were all currently enrolled in out-patient treatment which reduces the overall risks in that they are independent to semi-independent community dwelling citizens. The informed consent procedures also reduced undue risks to this population. Additionally, the experimental procedures applied in this protocol were similar to more informal means of assessment and

treatment used with this population during out-patient speech-language pathology rehabilitation, indicating the relevance of these procedures to typical everyday practice of a speech-language pathologist. Lastly, all participants were provided with a parking pass for the Pomeroy Hall parking lot.

Procedure

Procedural discourse. For this study, the participant was instructed to engage in two different procedural narrative tasks. For the first procedural narrative, the participant was instructed to list all of the steps involved in withdrawing money from an automatic teller machine (ATM). In accord with Fleming & Harris (2008), specific instructions (which were presented to the participant using audio overlay and were displayed on the PowerPoint slide on the computer screen directly in front of the participant) were: *"Tell me all the steps involved in withdrawing money from an automatic teller machine (ATM), as if I had never done it before. There are no right or wrong answers. You will have 60 seconds to complete this task, but it is not required that you fill the entire time"* (Snow, Douglas, & Ponsford, 1997) (see Appendix B). After the audio overlay for this slide was completed, the slide changed automatically to a slide with the following instructions, which remained on the screen in front of the participant for the duration of the task: *"Please begin this task now. Describe the steps involved in withdrawing money from an ATM."* Once the sixty seconds for this task were completed, the slide automatically changed to a slide with a "+" (twenty second rest period).

After the rest period, the second personal narrative task was presented to the participant on the PowerPoint slide. For this task, participants were instructed to describe in detail every activity associated with preparing for a trip to New York City (NYC). In accord with Fleming & Harris (2008), specific instructions were: *"Imagine that you are going on a vacation a week from*

now. You are traveling to New York City for a two-week stay. Think about all you will have to do to get ready to go, such as how you will get there, what you will bring, and what you will do. When the slide changes, describe in detail all the activities associated with the trip. There are no right or wrong answers. You will have 60 seconds to complete this task, but it is not required that you fill the entire time" (see Appendix D). After the audio overlay for this slide was completed, the slide changed automatically to a slide with the following instructions which remained on the screen in front of the participant for the duration of the task: *"Please begin this task now. Describe in detail all the activities associated with a trip to New York City."* Once the sixty seconds for this task were completed, the slide automatically changed to a slide with a "+" (twenty second rest period).

Conversational discourse. To measure conversational discourse, the participant was instructed to engage in a short conversation with the examiner. The participant was presented with the following instructions on the PowerPoint slide: *"Now you're going to have a short conversation with the examiner. You will begin when the slide changes. The examiner will begin the conversation. This should take about 2 minutes for each conversation"* (Snow, Douglas, & Ponsford, 1997). For the first part of this task, the participant completed a warm-up activity and the examiner used the following prompt to begin the task: *"Tell me about your family".* After the warm-up task was completed, the examiner began the conversation with the following prompt to begin the discourse task: *"Can you tell me about the sort of work/study you do?"* The second prompt for this task was: *"What sort of things do you normally do on the weekends?"* The third prompt the examiner used to engage in conversation with the participant was: *"Do you have any particular favorite TV programs?"* Please refer to Appendix H for the complete conversational discourse procedure. Discourse data from each of the four prompts were combined for analysis.

Narrative Discourse

Personal narratives. Participants were asked to tell two different personal narratives related to their previous, personal experiences. Three secondary prompts were used to encourage elaboration for both personal narrative tasks, which included: *"Uh huh", "Tell me more",* and *"Then what happened?"* For the first personal narrative task, the participant was instructed to tell a story about a time they were injured or a time someone close to them was injured. In accord with McCabe et al. (2008), specific instructions were: *"I am going to describe an experience that happened to me. Then when the slide changes, I want you to share an experience of yours that comes to mind. There are no right or wrong answers. You will have 60 seconds to complete this task, but it is not required that you fill the entire time. Last year my uncle was severely injured in a car accident. So far it has been a long and difficult recovery. Can you tell me about a time when you or someone close to you was seriously injured?"* After the audio overlay for this slide was completed, the slide changed automatically to a slide with the following instructions, which remained on the screen in front of the participant for the duration of the task: *"Please begin this task now: Describe a time you or someone close to you was injured."* Once the sixty seconds for this task were completed, the slide automatically changed to a slide with a "+" (twenty second rest period).

After the rest period, the second personal narrative task was presented to the participant on the PowerPoint slide in which the participant was instructed to tell a story about their last summer vacation or what he or she did over summer vacation. In accord with McCabe et al. (2008), specific instructions for this task were: *"I am going to describe another experience. When the slide changes, I want you to share an experience that comes to mind. There are no right or wrong answers. You will have 60 seconds to complete this task, but it is not required that*

you fill the entire time. On my last vacation, my family and I went to Florida. What did you do during your last vacation or over summer vacation?" After the audio overlay for this slide was completed, the slide changed automatically to a slide with the following instructions, which remained on the screen in front of the participant for the duration of the task: *"Please begin this task now: Describe your summer vacation or last memorable vacation."* Once the sixty seconds for this task were completed, the slide automatically changed to a slide with a "+" (twenty second rest period).

Fictional narratives. For the fictional narrative task, participants were shown a picture on the computer screen and were asked to tell a story, in their own words, about the pictured materials. For this task, the participant was shown a Norman Rockwell print as a stimulus and was instructed to tell an original story about the pictured scene displayed before them. The picture depicts a small boy and a police officer at the local dinner, as a counterman observes the boy with the police officer. Participants were instructed on the PowerPoint slide with the following prompt: *"Next you will tell me a story about the picture below. The scene in this picture represents a moment in time. Something happened to cause the pictured event and something is going to happen afterwards. When the slide changes, please tell me the whole story from what happened before the pictured event through what will happen after this scene. You will have 60 seconds to complete this task, but it is not required that you fill the entire time"* (Fleming & Harris, 2008) (see Appendix D). After these instructions were presented, the participant then began to tell their story while the picture remained in view of the participant throughout the task. Once the sixty seconds for this task were completed, the slide automatically changed to a slide with a "+" (twenty second rest period).

Transcription and Coding

Each of the discourse samples was transcribed manually, verbatim as the initial coding step. Transcribers could listen to an utterance up to three times to ensure that conditions for determining intelligibility were uniform across all narrative samples. Only complete and fully intelligible utterances were included in the analyses. The transcriptions were then distributed manually into T-units for further analysis of the discourse tasks (see Appendix A). As defined by Hunt (1970), T-units are "the shortest units into which a piece of discourse can be cut without leaving any sentence fragments as residue" (Bardovi-Harli, 1992, p. 390). Furthermore, each independent clause was counted as a T-unit. According to *Owl at Purdue* (2010), "An independent clause is a group of words that contains a subject and verb and expresses a complete thought", while a dependent clause "is a group of words that contains a subject and verb but does not express a complete thought. A dependent clause cannot be a sentence. Often a dependent clause is marked by a dependent marker word (e.g., after, although, as, as if, because, before, even if, even thought, if, in order to, since, though, unless, until, whatever, when, whenever, whether, and while)" (para. 2). For example, the sentence, "There was a woman next door, and she was a singer" counts as two T-units, since it contains two (or more) T-units when the independent clauses (with subjects and finite verbs) are conjoined. The sentence "There was a woman next door who was a singer" would count as one T-unit, since the sentence contains one or more clauses that are embedded in an independent clause.

All transcription and coding of the discourse samples took place on a password protected computer at the University of Vermont. In addition, all procedures were audio recorded in accordance with the teaching policies of the E.M. Luse Center clinical facilities. Audio recordings were stored as digital audio files on a password protected computer within the locked

laboratory. All digital audio files contain only subject numbers and will be kept for a period of up to two years following the close of data collection for this study. All data was collected from the transcribed audio recordings and remain locked in the Dr. Michael Cannizzaro Research Lab in Pomeroy Hall at all times, was entered into a password protected data file, and then stored on a password protected laboratory computer. Only the PI and key personnel who have completed the UVM Protection of Human Subjects in Research Training have access to this information and are involved in the transcription and coding of the discourse samples. Each sample was distributed, segmented, and analyzed in regard to measures of information content, informational relevance, organization, and pragmatic skills.

Data Analysis

The discourse samples of the participants with TBI were compared to the discourse samples of the individuals without TBI. Additionally, descriptive statistics and data on the typical individuals were obtained to explain typical behavior on the discourse tasks for the general population. The discourse samples were compared based on several factors including: information content, cohesion, coherence, information relevance, organization, and pragmatic skill. The totals and scores for each variable were recorded in Microsoft Excel.

Statistical analysis included both descriptive and inferential statistics, and all analyses were run using SPSS software, Version 23. Independent t-tests were used to compare the TBI group to the non-TBI group in regard to MoCA scores, age range (years), total number of T-units, performance on the procedural discourse tasks, and performance on the conversational discourse tasks. Additionally, a chi-square test of independence was performed to examine the relation between TBI and education level. To determine if the groups differed in terms of the three measures for the personal narrative discourse tasks and in regard to the variables for the

fictional narrative discourse tasks, Mann-Whitney U tests were conducted. Significance levels were set to $p<.05$ prior to data analyses. If significant between-group differences were observed for a particular variable, the group means for that variable were compared to determine how the adults with TBI differed from the adults without TBI on that discourse task.

Procedural discourse analysis. For the first procedural narrative in which the participant was instructed to list the steps involved in withdrawing money from an ATM, three different measures were utilized to score the narratives. For the first measure, the examiner scored how many essential and optional steps the participant included in their narrative, using the operation definitions outlined by Snow et al. (1997) for the designated *essential* and *optional* steps. The second measure consisted of scoring the percentage of syllable *on target*, as outlined by Snow et al. (1997). For the third measure, a modified version of *Clinical Discourse Analysis (CDA-M)* developed by Snow et al. (1997) was used for further analysis of the procedural discourse narratives. Please refer to Appendix C for the complete scoring charts for each of the three measures.

For the second procedural narrative task in which the participant is instructed to describe the steps involved in planning a vacation to New York City, the core elements from the participant's narrative were scored by the examiner to determine the quality and completeness of the discourse sample (Fleming & Harris, 2008). A multidimensional scoring system was employed to analyze the "Trip to New York" task on multiple domains. The discourse task was analyzed in terms of 13 thematic core concepts, which were rated 0 if the concept was absent, 1 if mentioned briefly, and 2 if mentioned in detail (Total points = 26). Each of the core elements were derived from a previously reported normative study that utilized the complex discourse

production task (Fleming & Harris, 2008; Kiran et al., 2005; Kiran et al., 2006). Please refer to Appendix D for the complete scoring chart and list of core elements for this discourse task.

Conversational discourse analysis. The conversational discourse tasks were analyzed using the *Clinical Discourse Analysis (CDA)* (Snow, Douglas, & Ponsford, 1997). This tool is based on the theoretical work of Grice (1975), who proposed a "co-operative principle of conversation", which are known as the Gricean Maxims. This is comprised of four maxims which, according to Grice (1975), speakers adhere to in order to promote successful conversation. These maxims include: (1) *Quantity*: make your contribution as informative as is required, do not make your contribution more informative than is required; (2) *Quality*: do not say what you believe to be false, do not say that for which you lack adequate evidence; (3) *Relation*: be relevant; (4) *Manner*: avoid obscurity of expression, avoid ambiguity, be brief (avoid unnecessary prolixity), be orderly (Grice, 1975). In order to comply with each of these maxims, conversational partners will use certain devices and processes to "ensure that linguistic, pragmatic, and 'social rules' are not violated" (Snow, Douglas, & Ponsford, 1997, p. 415). These include cohesion, coherence, reference, and a variety of subtle conversations surrounding topic shift, turn-taking, speech (e.g., inappropriate speech style, inappropriate intonational contours) and non-verbal behaviors (e.g., situational inappropriateness, inefficient attention to and use of gaze).

Furthermore, the CDA consists of 19 parameters which are organized into four categories: *quantity*, *quality*, *relation*, and *manner*, as per Grice's maxims. Damico's detailed definitions, descriptions, and examples of each of the parameters within the CDA were used to facilitate analysis. The scoring of the CDA requires a record to be developed of the frequency of discourse errors occurring in each parameter. Afterward, four measures are then derived: (a) total

utterances, (b) total discourse errors, (c) total utterances containing errors, and (d) percentage utterances containing errors (Snow et al., 1997). Along with these parameters, the conversational discourse samples were distributed into T-units. Please refer to Appendix H for the complete CDA scoring chart.

Personal narrative discourse analysis. For this study, high point analysis, which "focuses on the overall structure of a narrative" (McCabe et al., 2008, p. 198), was used to score each personal narrative as one of seven different narrative patterns. As outlined by McCabe et al. (2008), each narrative is scored on a scale of 0-7 points, with a score of 0 = "nonnarrative", 1 = "one-event", 2 = "two-events", 3 = "miscellaneous", 4 = "leap-frogging", 5 = "chronological", 6 = "ending-at-the-high point", 7 = "classic". Please refer to Appendix G for the complete high point analysis scoring sheet and descriptions for each narrative pattern.

Additionally, the Massachusetts Comprehensive Assessment System (MCAS) (McCabe et al., 2008) writing score guide for fourth-grade compositions was applied to each of the oral discourses produced by participants in the study (see Appendix G). Scores on the MCAS range from 0-6, with a score of 0 indicating no evidence of any appropriate topic/idea development, organization, details, or awareness of audience or task, a score of 1 indicating little topic/idea development, organization, and/or details: little or no awareness of audience and/or task, a score of 2 indicating limited or weak topic/idea development, organization, and/or details; limited awareness of audience and/or task, a score of 3 indicating rudimentary topic/idea development and/or organization; basic supporting details; simplistic language, a score of 4 indicating moderate topic/idea development and organization; adequate, relevant details; some variety in language, a score of 5 indicating full topic/idea development; logical organization; strong details; appropriate use of language; and a score of 6 indicating rich topic/idea development; careful and

or/subtle organization; effective/rich use or language (highest score = 6). The MCAS was utilized for the analysis of personal narrative discourse tasks for the current study since oral language skill is the resource for writing, and through analysis, we can determine the extent to which participants with TBI have oral skill. At the end of the assessment, the scores from both the high point analysis and MCAS were added together for a total count.

Fictional narrative discourse analysis. The Narrative Scoring Scheme (NSS) was used for the analysis of the fictional narrative discourse tasks. The NSS is an assessment tool that provides an index of the individual's ability to produce a coherent narrative (Andriacchi et al., 2003). Overall, this scoring procedure "combines many of the abstract categories of Story Grammar, adding features of cohesion, connecting events, rationale for characters' behavior and referencing" (Andriacchi et al., 2003, p. 18). Scores on the NSS range from 0-5 and are assigned to each of the seven characteristics which include: (1) Introduction, (2) Character Development, (3) Mental States, (4) Referencing, (5) Conflict Resolution, (6) Cohesion, (7) Conclusion. Categories that could not be scored receive a score of zero or NA (non-applicable). Scores of zero are given if the participant did something that precluded the examiner from scoring a section of the NSS, such as skipping a part of the story or refusing to complete the task (Andriacchi et al., 2003). A score of NA is given for mechanical, examiner, or operator errors (i.e., interference from background noise, issues with recording (cut-offs, interruptions), examiner quitting before child does, examiner not following protocol, examiner asking overly specific or leading questions rather than open-ended questions or prompts).

For all other sections of the NSS, a score of 1 reflects minimal presence/immature performance, a score of 3 reflects emerging skills, and a score of 5 reflects proficient performance. Transcribers also have the opportunity to assign a score of 2 and 4 if performance

was judged to be "between the major anchors" Andriacchi et al., 2003, p. 158). After scores are awarded for each of the seven categories, they are added up for a total score (highest score = 35). Please refer to Appendix E for the complete NSS Scoring Rubric. The NSS was used to analyze the fictional narrative discourse tasks because of its ability to bring together the benefits of concrete scoring criteria combined with judgment of text-level constructs (Andriacchi et al., 2003). Additionally, the NSS "incorporates higher level narrative components, including cohesive markers and measures of literature language, to measure a wider range of skills than traditional story grammar analyses" (Andriacchi et al., 2003, p. 200), which makes this assessment a valuable tool to analyze the discourse of individuals with and without TBI.

Reliability

The principal investigator transcribed verbatim 75% of the 19 audio recordings of participant discourse tasks. After manual transcription was completed, the principal investigator distributed the utterances from each transcription into T-units. These audio recordings were chosen at random and consisted of discourse samples from nine participants without TBI and four participants with TBI. Key personnel, a graduate research assistant, transcribed verbatim 25% of the 19 audio recording of participant discourse tasks. After the manual transcription was completed, the graduate research assistant distributed the utterances from each transcription into T-units. These audio recordings were also chosen at random and consisted of discourse samples from five participants without TBI. A third person, an undergraduate research assistant, re-listened to 60% of the participant audio recordings and checked/corrected the corresponding transcriptions for word and T-unit errors. For word errors, only .236% error was detected and only .250% error was detected for T-units.

The principal investigator and the graduate research assistant each scored 100% of the 19 audio recordings of participant discourse samples to assess inter-rater reliability. An additional 10% of the participant discourse samples were re-analyzed by the principal investigator and the graduate research assistant approximately 2 weeks after the initial analyses were completed to assess intra-examiner reliability. Reliability measures were based on point-to-point scoring. Inter-rater reliability as 94.7% and intra-examiner reliability was 100%.

Chapter 4: Results

Traumatic brain injury (TBI) is a global health epidemic that has detrimental consequences for individuals who sustain the brain injury, their families, and society. As a result of TBI, many individuals experience significant cognitive-communicative impairments, including difficulties with structuring and eliciting discourse. The purpose of this study was to gain a better understanding of these language difficulties and their possible clinical implications by comparing discourse language samples from adults with TBI to those from adults without TBI.

Description of Sample

The final sample consisted of 4 participants with TBI, 1 male and 3 females, ranging in age from 21.0 to 64.0 years. The control group without TBI consisted of 15 participants (1 participant with missing data), 2 males and 13 females, ranging in age from 18.0 to 52.0 years. Moreover, Montreal Cognitive Assessment (MoCA) (Nasreddine et al., 2005) raw scores were used to indicate general cognitive function with scores 24.0-30.0 (M = 28.0) for the TBI group and 26.0-30.0 (M = 28.32) for the non-TBI participants. The chronological age ranges and MoCA score ranges for the TBI and non-TBI group are presented in Table 1.

Table 1

Characteristics of Participant Groups

Participant Group	*n*	Age Range (years)*	*p*	*t*	MoCA Scores	*p*	*t*
TBI	4	21.0-64.0, M = 48.5	.005	$t(17)$ = -3.189	24-30, M = 28.0	6.88	$t(17)$ = .408
Non-TBI	15	18.0-53.0, M= 25.0			26-30, M = 28.4		

*p<.05 in independent t-test

Table 1 shows that the mean MoCA scores for the TBI group and the non-TBI group were almost identical. Independent t-tests indicated that there were no significant between-group differences between the TBI group and the non-TBI group regarding mean MoCA scores, $t(17)$ =

.408, $p > .05$. Furthermore, the TBI group had a higher mean for age range as compared to the non-TBI group. Independent t-tests revealed a significant difference (marked with asterisks in Table 1) between the TBI group and the non-TBI group for age range, $t(17) = 3.19$, $p < .05$.

A chi-square test of independence was performed to examine the relation between TBI and education level. The relation between these variable was not statistically significant, χ^2 (2, N = 19) = 4.807, $p > .05$. The results of the chi-square test of independence are displayed in Table 2.

Table 2

Results of Chi-square Test and Descriptive Statistics for Education Level

	Education Level		
Participant Group	College 1-3 years	College 4 years	Graduate School
TBI	2 (10.5%)	0 (0.0%)	2 (10.5%)
Non-TBI	11 (57.9%)	3 (15.8%)	1 (5.3%)

Note. $\chi^2 = 4.807$, df = 2, $p = .090$. Numbers in parentheses indicate column percentages. $p > .05$

Questions Guiding Research

Three research questions guided the statistical analyses for this study: (1) Does the discourse of adults with TBI differ from the discourse of adults without TBI? (2) If so, in what ways does the discourse of adults with TBI differ from the discourse of adults without TBI? And (3) How does the discourse language of individuals with TBI and individuals without TBI compare to existing literature on the discourse skills of both populations?

Procedural Discourse: Comparing Means of Discourse Tasks

Group mean values for the dependent variables related to procedural discourse language production were calculated for the participants in the TBI group and the participants in the non-TBI group. In Table 3, the group means for each of the five dependent variables are displayed.

Table 3

Group Means for Procedural Discourse Language Measures

Variable	**TBI Mean (*SD*)**	**Non-TBI Mean (*SD*)**	***p***	***t***
Percentage of Essential Steps*	42.95 (13.22)	68.75 (15.31)	.008	$t(16) = -3.05$
Percentage of T-units *on-target*	68.06 (11.18)	76.16 (24.73)	.540	$t(16) = -.63$
CDA-M Total	1.30 (.96)	.50 (.52)	.050	$t(16) = 2.12$
Core Elements Total Score	6.00 (2.00)	6.64 (1.82)	.550	$t(16) = -.61$
Total T-units	68.25 (5.12)	64.36 (11.9)	.540	$t(16) = .63$

*$p<.05$ in independent t-test

Table 3 shows that the non-TBI group had higher mean scores for information content (percentage of essential steps) and information relevance (percentage of T-units *on-target*) on the procedural discourse tasks as compared to the TBI group. The TBI group also had a higher mean frequency of discourse errors in their procedural discourse samples as compared to the non-TBI group as signified by the CDA-M total scores. Additionally, the TBI group had lower mean scores for the Core Elements Total Score as compared to the non-TBI group. Lastly, the TBI group had higher mean scores for the total T-units as compared to the non-TBI group.

Independent t-tests revealed a significant difference (marked with asterisks in Table 3) between the TBI group and the non-TBI group for the percentage of essential steps measure. The TBI group obtained significantly lower scores ($M = 42.99$) than did the non-TBI group ($M = 68.75$), $t(16) = -3.05$, $p < .05$. The comparison of group means for the CDA-M total scores approached significance ($t(16) = 2.12$, $p < .05$), with the TBI group having a higher mean

frequency of discourse errors (M = 1.30) as compared to the non-TBI group (M = .50). As displayed in Table 3, significant differences were not found between the TBI group and the non-TBI group for the other three dependent variables for the procedural discourse tasks.

Conversational Discourse: Comparing Means of Discourse Tasks

Group mean values for the dependent variables related to conversational discourse language production were calculated for the participants in the TBI group and the participants in the non-TBI group. In Table 4, the group means for each of the two dependent variables are displayed.

Table 4

Group Means for Conversational Discourse Language Measures

Variable	**TBI Mean *(SD)***	**Non-TBI Mean *(SD)***	***p***	***t***
Total T-units	68.36 (5.12)	64.36 (11.90)	.540	$t(16) = .627$
CDA Total Score (% of utterances with errors)*	26.98 (13.71)	12.21 (7.04)	.009	$t(16) = .2.996$

*p<.05 in independent samples t-test

Table 4 shows that in the TBI and non-TBI group comparison, the TBI group had higher mean scores for percentage of utterances with errors in their conversational discourse than the non-TBI group. The TBI group also had higher mean values for total number of T-units as compared to the non-TBI group.

Independent t-tests did not reveal significant between-group differences for total T-units, $t(16) = .627$, $p>.05$. As summarized in Table 4, the TBI group had a higher mean for total T-units and CDA total score compared to the non-TBI groups' mean for total T-units and CDA total score. Independent t-tests did, however, reveal significant differences between the TBI group and the non-TBI group for CDA total scores. The TBI group obtained significantly higher scores on this measure (M = 26.98) than did the non-TBI group (M = 12.21), $t(16) = 2.996$, $p <.05$.

Personal Narrative Discourse: Examining Group Difference Between TBI and Non-TBI

Group differences regarding participant performance on the personal narrative discourse tasks were examined. A Mann-Whitney U test was conducted to evaluate the hypothesis that the TBI group would score lower, on the average, than the non-TBI group on the personal narrative discourse tasks. The results of the test were not statistically significant (see Table 5). However, an examination of the rank averages for each of the personal narrative discourse measures demonstrates that the participants in the TBI group had a higher average rank across all personal narrative discourse measures, as compared to the non-TBI group. Table 5 displays the results of the Mann-Whitney U test.

Table 5

Mann-Whitney U Test Results

		High Point Analysis Total Score (Injury/Illness Task)	High Point Analysis Total Score (Vacation Task)	MCAS Total Score (Injury/Illness Task)	MCAS Total Score (Vacation Task)	Overall Total Score (Injury/Illness Task)	Overall Total Score (Vacation Task)
Mean Rank	Non-TBI	8.93	9.32	8.89	8.93	8.79	9.00
	TBI	11.50	10.13	11.63	11.50	12.00	11.25
Mann-Whitney U		20.00	25.50	19.50	20.00	18.00	21.00
Wilcoxon W		125.00	130.50	124.50	125.00	123.00	126.00
Z		-1.171	-.339	-.972	-.974	-1.120	-8.20
Exact Sig.		.442	.798	.382	.442	.327	.505

Fictional Narrative Discourse: Examining Group Differences Between TBI and Non-TBI

Group differences regarding participant performance on the fictional narrative discourse tasks were also examined. A Mann-Whitney U test was conducted to evaluate the hypothesis that the TBI group would score lower, on average, than the non-TBI group on the fictional narrative discourse tasks. The results of the test were not statistically significant, Z = -.965, P = .382. However, an examination of the rank averages of the TBI group and the non-TBI group of their Narrative Scoring Scheme (NSS) scores demonstrated that the individuals in the TBI group had a higher average rank of 7.25, as compared to the non-TBI group which had an average rank of 10.14. Table 6 displays the results from the Mann-Whitney U test.

Table 6

Results from the Mann-Whitney U Test

		NSS Total Score
Mean Rank	Non-TBI	10.14
	TBI	7.25
Mann-Whitney U		19.00
Wilcoxon W		29.00
Z		-.965
Exact Sig.		.382

Summary of the Results

The results of this study indicate that the discourse communication of the participants with TBI differed from the discourse communication of the participants without TBI with respect to some, but not all of the discourse communication tasks examined. In regard to performance on the procedural discourse task, participants without TBI received higher mean scores on the percentage of T-units *on-target* measure and the participants with TBI displayed higher mean scores (more errors) on the CDA-M measure. Independent t-tests revealed a significant

difference between the TBI group and the non-TBI group for the percentage of essential steps measure, with the TBI participants receiving lower scores on average than the individuals in the non-TBI group. Moreover, in comparing participant performance on the conversational discourse tasks, the TBI group had higher mean values for the total number of T-units as compared to the non-TBI group. Independent t-tests revealed a significant difference between the TBI group and the non-TBI group for total scores on the CDA measure, with the TBI group receiving higher scores on average than the individuals in the non-TBI group.

In regard to participant performance on the personal discourse task, the results of the Mann-Whitney U did not indicate a significant difference between the rank averages of the groups' scores on the measures of this discourse task; however, an examination of the rank averages of the TBI groups scores on each measure of the personal discourse task demonstrate that the individuals in the TBI group received higher scores (more errors) on each measure, as compared to the individuals in the non-TBI group. Furthermore, in comparing participant performance on the fictional narrative discourse task, the results of the Mann-Whitney U also did not indicate a significant difference between the rank averages of the groups' scores on the measures of this discourse task. Nonetheless, as was the case with the personal narrative scores, an examination of the rank averages of the TBI groups' scores on each measure of the personal discourse task demonstrate that the individuals in the TBI group received higher scores (more errors) on each measure, as compared to the individuals in the non-TBI group. On average, the participants with TBI made more discourse errors (higher scores) on both the personal and fictional narrative discourse task, as compared to the individuals without TBI.

Chapter 5: Discussion

The goal of this project was to look for differences in the discourse communication of adults with and without traumatic brain injury (TBI) by using a series of measures designed to assess cognitive abilities and language skills. For the most part, the observed differences in the discourse communication reflect the communication deficits individuals with TBI typically display. The results were also consistent with existing literature on the discourse communication of adults with TBI (Biddle et al., 1996; Coelho, 2002; Coelho, Lies, & Duffy, 1994; Glosser, 1993; McCabe & Bliss, 2006; Snow et al., 2007; Snow, Douglas, & Ponsford, 1997; Myers & Brookshire, 1996; Ulatowska & Chapman, 1994).

Cognitive Function

The Montreal Cognitive Assessment (MoCA) (Nasreddine et al., 2005) is a cognitive assessment tool that examines the various cognitive functions, which are frequently impaired in the TBI population, including executive functions and psychomotor speed (de Guise et al., 2013). Considering the acute cognitive deficits following a TBI generally consist of confusion and disorientation, short- and long-term memory issues, attention deficits, executive deficits and slowness, the MoCA has been indicated as an appropriate tool to assess the cognitive impairments of individuals with TBI since it includes a variety of tasks which assess higher-level language abilities, memory, and complex visuospatial processing. Additionally, the MoCA's high reliability and short duration of assessment (~10 minutes) make this measure ideal to use with TBI individuals.

No significant differences were observed in MoCA raw scores when comparing the TBI to the non-TBI group in the independent samples t-test, $t(17) = .408$, $p>.05$. In comparing the mean differences between the TBI and the non-TBI group, the TBI group had a slightly higher

mean score on the MoCA (M = 28.4) as compared to the non-TBI group (M = 28.0). Overall, participants performed highly on the MoCA (e.g., above the cut-off score of <26 for mild cognitive impairment), regardless of whether or not they had sustained a TBI. These results indicate that general cognitive function was intact and not likely to have direct impact on the TBI group's performance on the series of discourse communication tasks employed in the present study.

Effect of Number of T-units

The T-unit (i.e., an independent clause plus any subordinate clauses associated with it) (Hunt, 1970) is a commonly used tool for the transcription of discourse language samples. T-units were used for the present study since they alleviate the issue of continuous conjoining of clauses with conjunction such as *and, or,* and *then* (Coelho, 2007). No significant differences were observed in total number of T-units when comparing the TBI to the non-TBI group in the independent samples t-test, $t(16) = .63$, $p>.05$. In comparing the mean differences between the TBI and the non-TBI group, the TBI group had a slightly higher mean score for total number of T-units (M = 68.25) as compared to the non-TBI group (M = 64.36). These results are consistent with the findings from Coelho's (2002) investigation, in which it was determined that even though the participants with TBI produced stories that were longer in terms of the total number of T-units, the proportion of the T-units that actually contributed to the episodic structure was found to be very minimal.

Overall, the results from Coelho's (2002) investigation and the present study indicate that individuals with TBI may be more likely to produce stories that are composed of irrelevant, distracting content and a lack of conciseness, as compared to individuals without TBI. Additionally, the TBI group was found to include more irrelevant T-units (i.e., *off-target* steps:

information or comments that did not contribute to the description of the task) in their procedural discourse narratives as compared to the non-TBI group. Similar results were also found by Coelho (2002) in which the proportion of T-units contained within the episode structure was employed as an indication of participants' ability to use story grammar as an organization plan for language. As was the case with the current study, though the TBI individuals' stories were longer in regard to the total number of T-units produced, the proportion of T-units that contributed to the episodic structure was determined to be rather small.

Procedural Discourse Performance

Essential steps. According to Ulatowska et al. (1981), essential steps contain the information that is necessary to be understood by the listener in order to know what actions are required to complete the task in question. Significant differences were observed between the TBI group and the non-TBI group for the percentage of essential steps measure for the "ATM Machine" procedural discourse task in the independent samples t-test, $t(16) = -3.05$, $p < .05$. The TBI group obtained significantly lower scores ($M = 42.99$) than did the non-TBI group ($M = 68.75$). These results indicate that the TBI group differed significantly from the non-TBI group in terms of the amount of content they provided (defined as the percentage of predetermined total number of essential steps present in their discourse samples) along with the percentage of syllables determined to be *on-target* discourse (i.e., discourse concerned with conveying so-called *essential* and *optional* information).

Furthermore, these results are consistent with the findings from Snow, Douglas, & Ponsford's (1997) study in which the TBI group differed from the control group in terms of the total number of essential steps included in their discourse sample, with the TBI group including fewer essential steps in their procedural discourse as compared to the non-TBI individuals.

Ultimately, these findings support previous claims (Biddle, McCabe, & Bliss, 1996; Hay & Moran, 2005; Tucker & Hanlon, 1998) that TBI individuals tend to omit critical information and relevant details in the formation of their narratives.

Percentage of T-units *on-target*. According to Snow, Douglas, & Ponsford (1997), *on-target* discourse (i.e., discourse concerned with conveying both *essential* and *optional* information) is considered to be relevant to the task in which the participant explains the steps involved in withdrawing money from an ATM machine. No significant differences were observed between the TBI group and the non-TBI group for the percentage of T-units *on-target* for the "ATM Machine" procedural discourse task in the independent samples t-test, $t(16) = -.63$, $p>.05$. However, consistent with previous results, the TBI group produced fewer T-units *on-target* ($M = 68.06$) as compared to the non-TBI group ($M = 76.16$), which suggests that the individuals with TBI may have experienced difficulties with information transfer (i.e., information redundancy and insufficient information bits).

Similar results were reported by Snow, Douglas, & Ponsford's (1997) study in which the TBI participants were found to differ from the control group in terms of their pragmatic abilities and specifically, produced more errors that reflected difficulties with information transfer. Because discourse communication abilities can vary considerably between individuals and due to the small sample size of TBI individuals, it makes sense that there was not a significant difference observed in the percentage of T-units *on target* for the "ATM Machine" procedural discourse task despite the fact that the results indicate that the TBI group was not as proficient as the non-TBI group.

CDA-M total scores. The CDA-M (Snow, Douglas, & Ponsford, 1997) is a modified version of the Clinical Discourse Analysis (CDA) (Damico, 1985), and a frequency count of

errors on 14 of the original 17 parameters within Damico's (1985) CDA. In previous investigations, individuals with TBI have been found to make significantly more conversational errors (e.g., informational redundancy, insufficient information, failure to structure discourse) than non-TBI participants on the parameters measured by the CDA-M (Snow, Douglas, & Ponsford, 1997). Therefore, the CDA-M was included in the current study in an effort to determine whether the conversational errors measured by the CDA-M differentiated the TBI group from the non-TBI group.

The comparison of group means for the CDA-M total scores for the "ATM Machine" procedural discourse task approached significance in the independent samples t-test, $t(16) = 2.12$, $p > .05$. The TBI group, however, did have a higher total score ($M = 1.30$) (i.e., calculation of CDA-M total score = tally of the total number of errors made by each participant) as compared to the non-TBI group ($M = .50$), which suggests that the TBI group displayed poorer pragmatic abilities as compared to the non-TBI group. Previous studies have also indicated that individuals with TBI tend to produce pragmatic inappropriateness relative to difficulty in initiating and/or sustaining conversation with decreased response adequacy (Coelho, Lies, & Duffy, 1994; Snow, Douglas, & Ponsford, 1997).

In the present study, the TBI group was the only participant group to score on the *inability to structure* parameter of the CDA-M ($n = 1$) (see Table 1). The TBI and non-TBI group both scored on the *insufficient information* parameter, with the scores for the TBI group being lower ($n = 4$) than the non-TBI group ($n = 7$). The non-TBI group was also the only participant group to score on the *information redundancy* parameter of the CDA-M ($N = 4$). Although the frequency of these errors might be regarded as low, as was the case in Snow, Douglas, & Ponsford's (1997) investigation, it must be noted that these errors may have a disproportionately

negative impact on the listener. Additionally, the low overall frequency of these errors needs to be considered with respect to the brevity of this discourse task. Because these errors were concerned with staying on topic and providing an appropriate amount of information, they could be expected to have a negative impact on the conversational partner.

Overall, the results from the present study and Snow, Douglas, & Ponsford's (1997) investigation suggest that the performance of the TBI participants clearly indicated that they are able to select and provide information in so-called 'steps'. Though in doing so, they made a number of pragmatic errors, and performed significantly more poorly than the non-TBI group in this respect. These results also provide support for Hartley & Jensen's (1991) finding that deficiencies displayed by TBI individuals when producing procedural discourse tends to reflect "pragmatic difficulties in taking the perspective of the listener and problems in monitoring performance for purposes of clarity" (p. 281).

Table 1

Frequency of Participant Scores on Parameters of the CDA-M

Modified Version of *Clinical Discourse Analysis (CDA-M)*		
***CDA-M* Parameter**	**Participant Group**	
	TBI (*n*)	**Non-TBI (*n*)**
Insufficient Information	4	7
Information Redundancy	0	4
Poor Topic Maintenance	0	0
Inability to Structure	1	0
Inappropriate Response	0	0
Message Inaccuracy	0	0

Core elements total scores. According to Gloser & Deser (1992), thematic coherence is an important index of language decline. In light of this finding, the quality of each "Trip to New York" procedural discourse task was determined by the thematic coding of the discourse sample (i.e., core elements) (Fleming & Harris, 2008) provided during production. As was the case with

Fleming & Harris's (2008) investigation, the scoring of core elements explored the fullness and depth of the participant discourse samples. No significant differences were observed between the TBI group and the non-TBI group for the core elements total score measure of the "Trip to New York" procedural discourse task in the independent samples t-test, $t(16) = -.61$, $p > .05$. The TBI group, however, did obtain a slightly lower score ($M = 6.00$) for the core elements measure as compared to the non-TBI group ($M = 6.64$). Overall, these results indicate that the TBI group produced slightly lower quality narratives in terms of information content for the "Trip to New York" procedural discourse task as compared to the non-TBI group. These results are consistent with Fleming & Harris's (2008) investigation using the "Trip to New York" procedural discourse task with individuals with and without TBI, which found that the non-TBI group scored much higher in terms of the total number of core elements as compared to the TBI group.

Overall, the results of this study indicate that performance on this procedural discourse task distinguished the TBI group from the non-TBI group in terms of the length and quality of the discourse, with the TBI group performing more poorly. Existing studies speculate that this qualitative difference in the discourse samples, as measured by the total number of core element scores, is indicative of a decrease in higher-order cognitive skills, such as competence in planning, problem solving, and organizational abilities (Fleming & Harris, 2008). Nevertheless, the non-TBI individuals demonstrated richer discourse as measured by the total core element scores. According to Fleming & Harris (2008), these scores appear to reflect both intact travel schema and preserved planning, problem-solving, and organizational abilities.

Conversational Discourse Performance

CDA total scores. The Clinical Discourse Analysis (CDA) (Damico, 1985) is a tool based on the theoretical work of Grice (1975), who proposed a "co-operative principle of

conversation", which are known as the Gricean Maxims. The CDA was used in the present study to evaluate participant performance on the conversational discourse task due to this measure's ability to analyze the discourse errors in terms of quantity, quality, relation, and manner.

Significant differences were observed between the TBI group and the non-TBI group for scores on the CDA (percentage of utterances with errors) for the conversational discourse task in the independent samples t-test, $t(16) = 2.996$, $p < .05$. These results indicate that the TBI group experienced difficulty in terms of their pragmatic performance (signified by higher number of errors on the CDA) as compared to the non-TBI group. The bulk of the CDA errors made by the TBI group concerned information transfer and difficulty structuring output (see Table 2). Both the TBI and non-TBI groups' errors were made on the quantity and manner categories of the CDA. Specifically, the TBI group made more errors on the *insufficient information bits* (e.g., the speaker does not provide the amount or type of information needed by the listener) ($n = 8$), *revision behavior* (e.g., the speaker seems to come to dead ends in a maze, as if starting off in a certain direction, then coming back to a starting point and beginning anew after each attempt) ($n = 15$), and *inability to structure discourse* (e.g., discourse of the speaker lacks forethought and organizational planning, i.e. discourse is confusing – illogical/lacks temporal sequencing) ($n = 2$) parameters of this measure as compared to the non-TBI group.

These results are consistent with Snow, Douglas, & Ponsford's (1997) findings regarding conversational discourse performance of adults with and without TBI using the CDA. Snow, Douglas, & Ponsford (1997) obtained similar results to the present study in which the TBI groups' errors in conversational discourse reflected poor topic maintenance, and difficulties with information transfer, which was signified by higher scores on the *information redundancy* (e.g., this involves the continued and inappropriate fixation on a proposition; the speaker will continue

to stress a point or relate a fact even when the listener has acknowledged its reception) and *insufficient information bits* (e.g., the speaker does not provide the amount or type of information needed by the listener) parameters.

Consistent with previous investigations that have utilized the CDA, it is important to note that the two parameters, *linguistic non-fluency* and *revision behavior*, accounted for the vast majority of discourse errors made by *all* participants in *both* groups (Snow, Douglas, & Ponsford 1997; Jordan, 1990). This information is integral for establishing an understanding for not just individuals with TBI, but also for the normal range of discourse behavior for non-injured individuals.

Table 2

Frequency of Participant Scores on the Parameters of the CDA

Category	**Parameter**	**Participant Group**	
		TBI (*n*)	**Non-TBI (*n*)**
Quantity	Insufficient information bits	8	4
	Non-specific vocabulary	0	2
	Informational Redundancy	0	4
	Need for repetition	1	1
Quality	Message inaccuracy	0	0
Relation	Poor topic maintenance	0	0
	Inappropriate responses	0	0
	Inability to ask relevant questions	0	0
	Situational inappropriateness	0	0
	Inappropriate speech style	0	0
Manner	Linguistic non-fluency	14	18
	Revision behavior	15	12
	Delay before responding (>5 s)	0	1
	Inability to structure discourse	2	1
	Difficulty with turn-taking	0	0
	Inefficient attention to and use of gaze	0	0
	Inappropriate intonational contours	0	0

Personal Narrative Discourse Performance

High point analysis scores. High-point analysis (Peterson & McCabe, 1983) is an analysis that focuses on the overall structure of a narrative. High-point analysis was employed in the current study due to this measure's ability to look at the form of a narrative taken as a whole and to determine the quality of participant personal narratives. Additionally, analysis of high-point components can indicate the informativeness of a narrative (Bliss, Lynn, & McCabe, 2008). No significant differences were observed between the TBI group and the non-TBI group for the high point analysis measure for the "Vacation" or "Illness/Injury" personal narrative discourse tasks in the Mann-Whitney U test. Additionally, the results of the Mann-Whitney U test did not indicate significant differences between the mean ranks for the TBI and the non-TBI group on both the "Vacation" and the "Illness/Injury" task.

The current study's non-significant finding needs to be considered with respect to the small sample size of TBI individuals included in this investigation. These results must also be considered with respect to the brevity of both the "Vacation" and "Illness/Injury" tasks. Similar results were also reported by McCabe & Bliss (2005) in which children with specific language impairment, compared to typically developing children, told shorter person narratives that often omitted key information and violated the chronological sequencing of events, as reflected by their lower high-point analysis scores. These results provide evidence for the sensitivity of using high-point analysis for evaluating the personal narrative discourse of individuals with language impairments, which are likely to be experienced by those living with TBI.

Table 3

Frequency of Participant High Point Analysis Scores

High Point Analysis				
Pattern	**Participant Group**			
	TBI (*n*)		**Non-TBI (*n*)**	
	Vacation Task	**Illness/Injury Task**	**Vacation Task**	**Illness/Injury Task**
Nonnarrative	0	0	0	0
One-event	0	0	1	1
Two-events	0	0	0	0
Miscellaneous	0	0	0	0
Leap-frogging	3	0	10	3
Chronological	1	4	3	10
Ending-at-the high point	0	0	0	0
Classic	0	0	0	0

As displayed in Table 3, the total number of "Vacation" task narratives that were classified as *leap-frogging* (e.g., the narrative jumps from one event to another within an integrated experience, leaving out major events that must be inferred by the listener, and confusing the logical sequence of those events) were higher for the non-TBI group (n = 10) as compared to the TBI group (n = 3). However, the total number of "Illness/Injury" task narratives that were classified as *chronological* (e.g., the narrative contains a chronological sequence of events but no real concentration of evaluative comments in a climax) were higher for the non-TBI group (n = 10) as compared to the TBI group (n = 4). Additionally, the total number of "Vacation" task narratives that were classified as *chronological* were higher for the non-TBI group (n = 3) as compared to the TBI group (n = 1). The non-TBI group was the only participant group to produce narratives (both "Vacation" and "Illness/Injury" tasks) that were classified as *one-event* (e.g., the discourse contains only a single past tense event). Overall, these results suggest a general higher level of performance by the non-TBI group on the personal narrative tasks, as indicated by the non-TBI groups' tendency to produce higher quality narratives in

regard to their higher high-point analysis scores and higher frequency of this groups' narrative being categorized as a more complex high-point analysis pattern (*chronological*). Table 4 provides examples of *leap-frogging*, *chronological*, and *one-event* narratives from participants with TBI and from participants without TBI.

Table 4

Examples of High Point Analysis Patterns from Participant Personal Narratives

Pattern	Task	Participant Group	Narrative Example
One-event	"Illness/Injury"	Non-TBI	"Um my sister took a lot of drugs and got in a accident. Sad."
	"Vacation"		"I went to Florida, too! My friend's a pilot. And she flew us around in a plane. And then she brought me home."
Leap-Frogging	"Vacation"	Non-TBI	"Over Spring break, I went to Florida with two of my roommates and a friend from home. We stayed at my roommate's house which-because she lives in Florida. Uh we went to the beach we…went out at night. We saw some people from school there. Um it was really fun. We had really nice weather. We stayed for the whole week."
		TBI	"I went to Albany, New York. My family um settled in Albany, New York in 1620. I did some genealogical research to trace back um my family history. Um my son entering the New York State Museum nearly broke the front entrance door. Um let's see what else we did. We checked out XXX museum. And they had an exhibit with artifacts from the 1600s and 1700s. We also saw that our family owned slaves. Um it was very interesting. Um I enjoyed myself and I'd love to return and see-"
Chronological	"Illness/Injury"	Non-TBI	"Um senior… before the senior year of high school um I broke my femur. Um I was jet skiing on the lake. And I was with my dad it was the first time I was out. And he was gonna show me tricks that uh we could do. And I… turned around to look at what tricks he was performing. And he… um… he… was coming up right beside me and hit me. And um my femur was broken in the middle of the lake."
		TBI	"Um just about three years ago, I fell off of um essentially a cliff. Uh and fell very far into about six inches of water. Uh I broke my neck in five places. Um dislocated my right shoulder, destroyed my left elbow. Uh I broke both of my hips. Um I was i-in a neck brace and a wheelchair for six weeks. And the neck brace for another six weeks after that. Um I have since had five surgeries on my left elbow to uh try to keep it together with metal. And then get it moving again and finally taking out the metal this past December. Um I had a pretty serious brain injury from the accident. And as of now, everything seems to have resolved."

MCAS scores. The Massachusetts Comprehensive Assessment System (MCAS) (McCabe et al., 2008) was utilized for the analysis of personal narrative discourse tasks for the current study. This measure was used since oral language skill is the resource for writing, and through analysis, we can determine the extent to which participants with TBI have oral skill. No significant differences were observed between the TBI group and the non-TBI group for MCAS measure for the "Vacation" and "Illness/Injury" personal narrative discourse task in the Mann-Whitney U test. The results of the Mann-Whitney U test, however, indicate that the TBI groups' mean rank was higher for the MCAS total score for the "Illness/Injury" task (M = 11.63) and the MCAS total score for the "Vacation" task (M = 11.50) as compared to the non-TBI groups' mean rank for MCAS total score for the "Illness/Injury" task (M = 8.89) and the MCAS total score for the "Vacation" task (M = 8.93). These results indicate that the TBI group produced more linguistic dysfluencies (e.g., false starts, internal corrections, and fillers) as compared to the non-TBI group.

Additionally, these results are consistent with previous investigations (Hartley & Jensen; Biddle et al., 1996) which have suggested that individuals with TBI produced narratives which were less fluent than non-TBI individuals, as determined from their tendency to use more fillers and false starts than the control group. Overall, these dysfluencies have several implications. According to Biddle et al. (1996), the individuals with TBI may have been using the fillers in effort to compensate for potential issues with word retrieval or memory. As was the case with the present study, this strategy significantly disrupted the TBI individuals' flow of their oral narratives, making them more difficult to follow. Additionally, the "abundance of false starts used by children and adults with TBI indicated problems with the planning and organization of narrative discourse" (Peterson & McCabe, 1983, p. 463). That is, the participants with TBI may

have experienced significant difficulty in organizing and executing complex discourse on request (Biddle et al., 1996).

Fictional Narrative Discourse Performance

NSS total score. The Narrative Scoring Scheme (NSS) (Andriacchi et al., 2003) is an assessment tool that provides an index of the individual's ability to produce a coherent narrative through comprising the evaluation of seven narrative macrostructure components: introduction, character development, mental states, referencing, conflict/resolution, cohesion, and conclusion. Examination of these narrative elements is integral to determine whether there are essential narrative elements that are frequently omitted or poorly constructed and that would have a negative impact on the comprehension of the narrative being conveyed (Finestack, Palmer, & Abbeduto, 2012). Thus, the participant fictional narrative tasks were assessed using NSS procedures. No significant differences were observed between the TBI group and the non-TBI group for the NSS total score measure for the fictional narrative discourse tasks in the Mann-Whitney U test, $Z = -.965$, $P = .382$. The mean rank for the TBI group, however, was lower ($M = 7.25$) as compared to the non-TBI group ($M = 10.14$). These results indicate that the fictional narratives produced by the TBI group contained less central information and therefore, impoverished narratives, as compared to those produced by the non-TBI group.

Furthermore, these results are consistent with previous studies using fictional narratives, which have suggested a significant loss of central information (i.e., information pertaining to the story) following severe TBI, resulting in *impoverished* narratives (Glosser, 1993; Myers & Brookshire, 1996; Ulatowska & Chapman, 1994). Similar results were reported by Rollins (2014) in which the narrative discourse samples of young adults with Autism Spectrum Disorders (ASD) were evaluated using the NSS. The results of this investigation indicate that

individuals with ASD had poorer quality narratives as determined by scores on the NSS. Like individuals with TBI, people with ASD often experience difficulties with the pragmatics of language. Provided that pragmatic communication skills are central to a wide variety of interactions, ranging from everyday conversation to more formal interactions in educational or work settings (Snow, Douglas, & Ponsford, 1997), these results highlight the importance targeting speech and language therapy services to help individuals with TBI remediate these difficulties. Brooks et al. (1987) has suggested that difficulty in conversation is a significant predictor of failure to return to work following TBI, underscoring the importance of helping these individuals build strong pragmatic/social language skills and allow them to live more independent lives.

Implications for Clinical Practice

Individuals living with TBI and subsequent cognitive-communicative impairments will likely benefit from some form of speech-language pathology. The weaknesses observed between the TBI and non-TBI groups can serve as guidelines when developing treatment plans for individuals affected by TBI. Overall, the findings from the present study suggest significant impairments in regard to including critical information and relevant details in the formation of their narratives, as indicated by lower essential steps scores of the TBI group in the procedural discourse tasks. Additionally, the results of the current study indicate significant impairments in regard of the TBI individuals' pragmatic performance, information transfer, and with structuring output, as suggested by the higher number of errors on the CDA.

In this context, it is important to note the results of Brooks et al.'s (1987) investigation, who suggested that the presence of what they referred to as "conversational" difficulties was highly predicative of failure to return to work after sustaining a TBI. According to Snow,

Ponsford, & Douglas (1997), workers who experience difficulty staying on topic, and/or have a tendency to provide insufficient or excessive information, "are likely to cause frustration and annoyance a best, and serious mis-communications at worst" (p. 962). In light of these findings, individuals living with TBI may benefit from speech-language therapy focused on pragmatic language skills, or using language to go beyond simply transmitting information. Individuals with TBI may need help learning how to recognize and respond appropriately to social cues.

Additionally, the individuals with TBI were found to produce more linguistic dysfluencies as compared to the non-TBI group. These impairments can also have a detrimental impact on listeners and may make it more difficult for others to understand the speech of these individuals. In regard to these findings, individuals with TBI may benefit from speech-language therapy targeted on improving linguistic fluency and focusing on remediating the aspects of speech these individuals struggle with.

Although an individual's diagnosis is a good start point to help guide intervention and services, individual differences must also be considered since no two individuals are the same. Each of the previously discussed impairments are areas that should be assessed carefully by clinicians if cognitive-communication impairments are suspected. However, it is integral to look at the individuals profiles of intact vs. impaired functions of individuals with TBI to evaluate these patients holistically. The most effective forms of therapy involve helping individuals embrace their unique strengths to meet their own challenges.

Limitations

A possible limitation of this study relates to the participant sample, mainly the small number of participants with TBI. Our small sample size, nonetheless, allowed us to determine significant differences between the discourse communication of individuals with and without TBI. However, a larger, more diverse sample would help make the results of the present study more generalizable to individuals with TBI. The present study's sample of non-TBI individuals may also not be generalizable to the population due to the fact that many participants were undergraduate students at the University of Vermont. Additionally, the sample in the current study is limited and potentially biased in regard to level of education since all participants were either current college students or had previously completed college or other higher-education. The participants' high level of education may have had a positive impact on their performance on the discourse tasks, and therefore the results may not be generalizable to individuals who are not as highly educated. Furthermore, all control participants were recruited from the campus community and therefore, the sample of non-TBI individuals may not be generalizable to the general non-injured population.

Another possible limitation of the present study lies in the scoring of the participant discourse tasks. The principal investigator may have had more in-depth background knowledge of the project, as well as knowledge of the research questions and research literature than the graduate research assistant, which could have potentially led to some scoring differences. Although concise operational definitions and structured coding directions were adapted from reputable studies and used as guidelines for scoring, there is still a possibility of individual scoring differences. Despite the potential for differences in scoring, inter-rated reliability was

determined to be 94.7% and intra-examiner reliability was 100%. Therefore, any coding differences observed were minor and did not affect the overall reliability of the present study.

Conclusion & Directions for Future Research

The present study is unique in that it compared the discourse communication of adults with TBI across three different genres (procedural, conversational, narrative: fictional and personal) to that of adults without TBI. This study is also unique in that it is the first to utilize the Narrative Scoring Scheme (NSS) and high-point analyses measures to analyze the discourse samples of individuals with TBI. Since performance on a variety of discourse genres that differ in their cognitive-linguistic demands on the speaker were examined, the present study adds to the body of literature on discourse communication by forming a comprehensive picture of an individual's discourse communication ability.

Ultimately, as hypothesized, performance on discourse communication tasks distinguishes individuals with TBI from those without TBI. The participants with TBI differed from the participants without TBI with respect to some, but not all of the discourse communication measures examined in this study. The participants with TBI tended to perform most poorly on the procedural and conversational discourse tasks, indicating impairments related to pragmatic skill, information transfer and relevance, linking the events in a story, and effectively structuring discourse communication. Additionally, the participants with TBI produced more linguistic dysfluencies as compared to the non-TBI group. The non-TBI participants, on the other hand, showed strengths in the quality and completeness of their spoken narratives.

Overall, the difference observed among participants reflect the communication deficits individuals with TBI typically display and provide important insight into what types of speech-

language therapy might be appropriate and effective for these individuals. Additionally, differences and variation in narratives observed among participants within the same group underscore the importance of viewing each person as an individual with unique strengths and challenges.

Future Research

The findings from the present study contribute to a growing body of research on the discourse communication of individuals with and with TBI; however, further research on both populations is needed. The more researchers investigate the discourse communication of individuals with and without TBI, the more clinicians can do to help individuals living with TBI. A suggestion for future research would be to include a larger sample size of both TBI and non-TBI individuals. Including a larger sample would allow for the opportunity for participants to be matched based on a variety of characteristics, such as chronological age, education level, gender, etc. Furthermore, this study could also be replicated with a more diverse sample that involves comparing the discourse communication of individuals from a variety of cultural and linguistic backgrounds. Additionally, future studies could include participants who vary more in terms of age, education level, and gender to allow for the findings to be more generalizable to the general population.

Moreover, when discourse is sampled on only one occasion, as was the case in the present study, the participant may be less likely to elicit typical performance. It may be beneficial for future investigations to sample discourse communication over a period of several days. In this way, the participant will be able to increase his or her familiarity and comfort with the examiner and protocol of the study, and therefore, produce discourse more in line with their typical abilities. Another suggestion for future research would be to take a closer look at the

general cognitive function of participants with and without TBI. Scores from the MoCA were used solely to indicate the general cognitive function of each participant, though taking a closer look at how participants' MoCA scores, or scores on other tests of cognitive function relate to discourse communication could also be beneficial. The methodology for the current study was a compilation of several established research methods commonly used in reputable studies examining discourse communication, so the framework is set for additional research.

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Dedication

This thesis is dedicated to the loving memory of Scott Michael DellaTorre, who believed in me when I did not believe in myself, who saw all the good in me when I could not, and who made me laugh when I needed to the most. Of course you can "get a shout out" in my thesis.

Appendix A

Guide to T-Unit Analysis

What is a T-Unit?

As defined by Hunt (1970), T-units are "the shortest units into which a piece of discourse can be cut without leaving any sentence fragments as residue" (Bardovi-Harli, 1992, p. 390).

How to count T-Units:

Each independent clause is counted as a T-unit.

Independent Clause: An independent clause is a group of words that contains a subject and verb and expresses a complete thought. An independent clause is a sentence.

Dependent Clause: A dependent clause is a group of words that contains a subject and verb but does not express a complete thought. A dependent clause cannot be a sentence. Often a dependent clause is marked by a dependent marker word (e.g., after, although, as, as if, because, before, even if, even thought, if, in order to, since, though, unless, until, whatever, when, whenever, whether, and while.

Examples: (from *A Second Look at T-Unit Analysis: Reconsidering the Sentence* (Bardovi-Harli, 1992):

1. There was a woman next door [1], and she was a singer [2]. (S + S) = 2 T units
2. There was a woman next door who was a singer [1]. (S) = 1 T unit
3. I like the movie we saw about Moby Dick, the white whale [1] the captain said if you can kill the white whale, Moby Dick, I will give this gold to the one who can do it [2] and it is worth sixteen dollars [3] they tried and tried [4] but while they were trying they killed a whale and used the oil for the lamps [5] they almost caught the white whale [6]. (6 T units/ 1 sentence)

*Taken from

Bardovi-Harli, K. (1992). A second look at T-unit analysis: reconsidering the sentence. *TESOL Quarterly, 26* (2), 390-395.

Berry, C. & Brizee, A. (2010, April 17). *Identifying Independent and Dependent Clauses.* Retrieved from https://owl.english.purdue.edu/owl/resource/598/01/

Hunt's (1965, 1970) Guidelines for T-Unit Analysis

Definition: A T-Unit is one main (independent) Clause plus any subordinate clauses or non-clausal structures attached to or embedded in the main clause. A main clause must have a subject and verb and may have optional objects or compliments

1. Read the transcript carefully several times so that you are certain you understand the meaning and intent of what is being said
2. Look particularly for specific conjunctions that will act as signals to a specific type of clause being used

Simple sentences have one main clause only. *Complex sentences* have one main clause and one of more subordinate clauses, which are introduced by various states or implied subordinate conjunctions, such as *that, whatever, whoever, wherever, who, what, why, when, where, whether, which, after, although, as, as if, as long as, because, before, if, in order that, provided, since, so, so that, though, until, unless, while.*
Compound sentences consist of two or more main clauses and thus are two or more T-units. They are conjoined by coordinating or correlative conjunctions or by conjunctive adverbs, such as *and, but, or, nor, yet, besides, so, either… or, neither…nor, both… and, not only… but also, also, however, then, therefore, accordingly, nevertheless, consequently.*

3. Identify main clauses first; then examine surrounding language to determine which other clausal units are attached to (subordinate to) the main clause. Disregard false starts or revisions, since the final form of the utterance is all that matters. If necessary, edit out extraneous words and revisions before defining T-units. Even if you are dealing with a written discourse sample punctuated by the client, ignore the punctuation and follow the rules defined here.
4. Pencil in rough breaks between T-units, using a slash mark. Read over the transcript again to make certain your segmentation is correct.
5. Underline subordinate clauses within T-units (This can be done later if so desired.)
6. Number T-units.
7. If using a word processor, make a break at the end of each T-unit so that the next T-unit begins on a separate line.

*Taken from
Coelho, C. A., Cherney, L. R., & Shadden, B. B. (1998). *Analyzing discourse in communicatively impaired adults.* Gaithersburg, MD: Aspen Publishers.

Appendix B

PROCEDURAL NARRATIVE:

Prompt:
"Tell me all the steps involved in withdrawing money from an automatic teller machine (ATM), as if I had never done it before."

Essential Steps:

1. Locate/go to ATM machine
2. Insert card in machine
3. Enter PIN (personal identification number)
4. Select account
5. Enter amount to withdraw
6. Remove receipt
7. Remove money
8. Remove card

Optional Steps:

1. Decide which bank
2. Check that you have your card in your wallet
3. Join the queue at the ATM
4. Make sure the machine is on/working
5. Decide how much to withdraw
6. Open purse/wallet
7. Remove card from purse/wallet
8. Check directions re: orientation of card for insertion
9. Adjust viewing shield
10. Read instructions on screen
11. Recall PIN
12. Press enter/OK after each instruction
13. Selection function
14. Request account balance
15. Check that sufficient funds are available
16. Press OK or change after the selected amount is displayed on the screen
17. Select denominations
18. Ensure that the amount desired can be dispensed by the machine
19. Wait while the instruction is being processed
20. Indicated whether or not you want a receipt
21. Check that the amount provided is correct
22. Place money in wallet
23. Place card in wallet
24. Terminate the transaction
25. Leave

*Taken from
Snow, P., Douglas, J., & Ponsford, J. (1997). Procedural discourse following traumatic brain injury. *Aphasiology*, *11*(10), 947-967.

Appendix C

Procedural Discourse Task "ATM Machine" Score Sheet

Scoring:

Measure 1:

Total # of Essential Steps (0-8)	**Percentage proportion of essential steps out of clinician's totals**
x	x/8 = %

Measure 2: Percentage of t-units *on-target*

Essential		**Optional**		***On-Target***		**Total**
#	%	#	%	#	%	Total t-units:

Measure 3: Modified Version of *Clinical Discourse Analysis (CDA-M)*

***CDA-M* Parameter**	**Tally**	**Total**
Insufficient information		
Informational Redundancy		
Poor Topic Maintenance		
Inability to Structure		
Inappropriate Response		
Message Inaccuracy		

Notes:

*Taken from
Snow, P., Douglas, J., & Ponsford, J. (1997). Procedural discourse following traumatic brain injury. *Aphasiology*, *11*(10), 947-967.

Appendix D

PROCEDURAL NARRATIVE

Prompt:

(1) "Imagine that you are going on a vacation a week from now. You are traveling to New York City for a two-week stay. Think about all you will have to do to get ready to go, such as how you will get there, what you will bring, and what you will do. I want you to tell me all of your plans until I ask you to stop after about five minutes."

(2) "Imagine that you will be moving into a new apartment or house. Think about all you will have to do to get ready to move, from leaving your old residence to occupying your new one."

Scoring:

Core Elements

Core Elements	Examples	Score (0-2)*
Temporal	(Decide what day/time need to go)	
Transportation/ticket	(Flight tickets, rental car, travel agents)	
Work/School/Family	(Call my boss, arrange for substitute teacher)	
Money/Cost	(Figure out how much it will cost, to the bank, credit card)	
Clothing/Packing	(Check weather, pack warm clothing, shoes, personal care)	
Lodging	(Arrange hotel, stay with friends)	
Medication/Health	(Took prescription medication)	
Securing/House	(Lock the doors, take care of cats)	
Activities	(Empire state building, statue of liberty, Broadway shows)	
Food	(Restaurants, China town, New York style food)	
People	(Meet with friends, family or old acquaintances)	
Identification	(Driver's license, credit card, passport)	
Local Cost/money	(Withdraw cash for local expenses, credit cards)	

*scoring: 0 if concept is absent, 1 if mentioned briefly, 2 if mentioned in detail (Total 26)

Total Score: _____

*Taken from

Fleming, V. B., & Harris, J. L. (2008). Complex discourse production in mild cognitive impairment: Detecting subtle changes. *Aphasiology*, *22*(7-8), 729-740.

Appendix E

FICTIONAL NARRATIVE:

Prompt:
Next you will tell me a story about the picture below. The scene in this picture represents a moment in time. Something happened to cause the pictured event and something is going to happen afterwards. When the slide changes, please tell me the whole story from what happened before the pictured event through what will happen after this scene. You will have 60 seconds to complete this task, but it is not required that you fill the entire time.

Scoring:

NSS Scoring Rubric

Characteristic	Proficient (5)	Emerging (3)	Minimal/Immature (1)	Score
Introduction	1) Setting: - States general place and provides some detail about the setting (e.g., reference to the time of the setting, daytime, bedtime, season). - Setting elements are stated at appropriate place in story. 2) Characters: - Main characters are introduced with some description or detail provided.	1) Setting: - States general setting but provides no detail. - Description or elements of setting are given intermittently through story. - May provide description of specific element of setting (e.g., the frog is in the jar). 2) Characters: - Characters of story are mentioned with no detail or description.	- Launches into story with no attempt to provide the setting.	
Character Development	-Main character(s) and all supporting character(s) are mentioned. - Throughout story it is clear child can discriminate between main and supporting characters (e.g., more description of, emphasis upon main character(s)). - Child narrates in first person using character voice (e.g., "You get out of my tree", said the owl.).	- Both main and active supporting characters are mentioned. - Main characters are not clearly distinguished from supporting characters.	- Inconsistent mention of involved or active characters. - Character(s) necessary for advancing the plot are not present.	
Mental States	- Mental states of main and supporting characters are expressed when necessary for plot development and advancement. - A variety of mental state words are used.	- Some use of evident mental state words to develop character(s).	- No use of mental state words to develop character(s).	

Referencing	- Provides necessary antecedents to pronouns. - References are clear throughout story.	- Inconsistent use of referents/antecedents.	- Excessive use of pronouns. - No verbal clarifiers used. - Child is unaware listener is confused.	
Conflict Resolution	- Clearly states all conflicts and resolutions critical to advancing the plot of the story.	- Under developed description of conflicts and resolutions critical to advancing the plot of the story. OR - Not all conflicts and resolutions critical to advancing the plot are present	- Random resolution(s) stated with no mention of cause or conflict. OR - Conflict mentioned without resolution. OR - Many conflicts and resolutions critical to advancing the plot are not present.	
Cohesion	- Events follow a logical order. - Critical events are included while less emphasis is placed on minor events. - Smooth transitions are provided between events.	- Events follow a logical order. - Excessive detail or emphasis provided on minor events leading the listener astray. OR - Transitions to next event unclear. OR - Minimal detail given for critical events. OR - Equal emphasis on all events.	- No use of smooth transitions.	
Conclusion	- Story is clearly wrapped up using general concluding statements such as "and they were together again happy as could be".	- Specific event is concluded, but no general statement made as to the conclusion of the whole story.	- Stops narrating and listener may need to ask if that is the end.	

Scoring: Each characteristic receives a scaled score 0-5. Proficient characteristics=5, Emerging=3, Minimal/ Immature=1. Scores in between (e.g., 2, 4) are undefined, use judgment. Scores of 0, NA are defined below. A composite is scored by adding the total of the characteristic scores. Highest score=35.
A score of 0 is given for Child Errors (i.e., telling the wrong story, conversing with examiner, not completing/refusing task, using wrong language creating inability of scorer to comprehend story in target language, abandoned utterances, unintelligibility, poor performance, components of rubric are in imitation-only).
A score of NA (non-applicable) is given for Mechanical/Examiner/Operator Errors (i.e., interference from background noise, issues with recording (cut-offs, interruptions), examiner quitting before child does, examiner not following protocol, examiner asking overly specific or leading questions rather than open-ended questions or prompts).

Notes:

* Taken from
Heilmann, J., Miller, J. F., Nockerts, A., & Dunaway, C. (2010). Properties of the narrative scoring scheme using narrative retells in young school-age children. *American Journal of Speech - Language Pathology (Online), 19*(2), 154-166.

Appendix F

PERSONAL NARRATIVE:

Prompts:

1. "The other day I lost my keys. I couldn't drive my car or get into my house. Then I found them on the ground! Have you ever lost anything? Have you ever been locked out?"
2. "On my last vacation, my family and I went to Florida. What did you do over summer vacation?"
3. "Last weekend I hurt my ankle at soccer. I had to go to the doctor and get an X-ray. Luckily it was not broken. Can you tell me about a time you've been injured?"

Secondary Prompts:
"Uh huh," "Tell me more," "Then what happened?"

Scoring:

High Point Analysis

Points	Pattern	Description
0	Nonnarrative	The discourse contains no past tense events; usually consists of present tense events and other picture description.
1	One-event	The discourse contains only a single past tense event.
2	Two-events	The narrative extensively reiterates and evaluates a couple of events, but there is no buildup to a climax.
3	Miscellaneous	The narrative contains more than two past tense events but without a logical or causal sequence to these events in the real world.
4	Leap-frogging	The narrative jumps from one event to another within an integrated experience, leaving out major events that must be inferred by the listener. And confusing the logical sequence of those events.
5	Chronological	The narrative contains a chronological sequence of events but no real concentration of evaluative comments in a climax.
6	Ending-at-the high point	The narrative builds up to a high point and then ends; there is no resolution of the climactic events.
7	Classic	The narrative orients the listener to who, what, when, and where something occurred, builds actions up to a high point, evaluatively dwells on it (by telling listeners the "important part" or how the narrator felt about the events), and then resolves it.

*Taken from
McCabe, A., Bliss, L., Barra, G., & Bennett, M. (2008). Comparison of personal versus fictional narratives of children with language impairment. *American Journal of Speech-Language Pathology*, *17*(2), 194-206.

Appendix G

Massachusetts Comprehensive Assessment System (MCAS)

Points	Description
0	No evidence of any appropriate topic/idea development, organization, details, or awareness of audience or task
1	Little topic/idea development, organization, and/or details: little or no awareness of audience and/or task
2	Limited or weak topic/idea development, organization, and/or details; limited awareness of audience and/or task
3	Rudimentary topic/idea development and/or organization; basic supporting details; simplistic language
4	Moderate topic/idea development and organization; adequate, relevant details; some variety in language
5	Full topic/idea development; logical organization; strong details; appropriate use of language
6	Rich topic/idea development; careful and or/subtle organization; effective/rich use of language

	High Point Analysis	**MCAS**	**Total**
Pattern/Points			

Total # of required prompts (primary and secondary): _____

Notes:

*Taken from

McCabe, A., Bliss, L., Barra, G., & Bennett, M. (2008). Comparison of personal versus fictional narratives of children with language impairment. *American Journal of Speech-Language Pathology*, *17*(2), 194-206.

McCabe, A., Hillier, A., & Shapiro, C. (2013). Brief report: structure of personal narratives of adults with autism spectrum disorder. *Journal of autism and developmental disorders*, *43*(3), 733-738.

Appendix H

CONVERSATIONAL NARRATIVE

Warm Up:
"Tell me about your family."
Prompt:
(1) "Can you tell me about the sort of work/study you do?"
Clarification was sought re: time with current employer, previous types of work, preferred aspects of the job, future plans.
(2) "What sort of things do you normally do on the weekends?"
Clarification was sought re: sport, special interests, time spent with family.
(3) "Do you have any particular favorite TV programs?"
Clarification was sought re: reasons for preferences, together with questions re: recent films/movies seen, and preferences re: videos/cinema.

Scoring:

Clinical Discourse Analysis (CDA)

Parameter	Category/Quality*	Utterance #/# of Utterances
Quantity	Insufficient information bits	
	Non-specific vocabulary**	
	Informational Redundancy	
	Need for Repetition	
Quality	Message inaccuracy	
Relation	Poor topic maintenance	
	Inappropriate responses	
	Inability to ask relevant questions	
	Situational inappropriateness	
	Inappropriate speech style	
Manner	Linguistic non-fluency**	
	Revision behavior**	
	Delay before responding (>5 s)	
	Inability to structure discourse	
	Difficulty with turn-taking	
	Inefficient attention to and use of gaze	
	Inappropriate intonational contours	
Summary	Total utterances	
	Total discourse errors	
	Total utterances with errors	
	Percentage of utterances with errors	

*See Appendix for description of Category/Quality
** Not used for comparison between groups

Description of *CDA* Categories/Qualities

***CDA*: Category/Quality**	**Description**
Insufficient information bits	The speaker does not provide the amount or type of information needed by the listener
Non-specific vocabulary	The speaker uses deictic terms such as "this," "that," "then," "there," pronominals, proper nouns, and possessives when no antecedent or referent is available in the verbal or nonverbal context. The listener has no way of knowing what is being referenced. Individuals displaying difficulty also tend to overuse generic terms such as "thing" and "stuff" when more specific information is required.
Informational Redundancy	This involves the continued and inappropriate fixation on a proposition. The speaker will continue to stress a point or relate a fact even when the listener has acknowledged its reception.
Need for Repetition	Repetition is required prior to any indication of comprehension in spite of the fact that the material is not apparently difficult.
Message inaccuracy	An attempted communication involves the relating of not quite accurate information (e.g., indirect speech acts, bantering, ritualized insults).
Poor topic maintenance	The speaker makes rapid and inappropriate changes in the topic without providing transitional cues to the listener.
Inappropriate responses	The individual makes turns that indicate radically unpredictable interpretations of meaning. It is as though the individual were operating on an independent discourse agenda.
Inability to ask relevant questions	The individual does not seek clarification of information that is unclear.
Situational inappropriateness	The behavior tends to account for a generalized lack of relevance. The speaker's utterance is not only irrelevant to the discourse or the question asked, but it also occurs in an inappropriate social or interactional situation.
Inappropriate speech style	The speaker does not change the structural, lexical, or prosodic form of his utterance according to the needs of the listeners.
Linguistic non-fluency	The speaker's production is disrupted by repetitions, unusual pauses, and hesitation phenomena.
Revision behavior	The speaker seems to come to dead ends in a maze, as if starting off in a certain direction, then coming back to a starting point and beginning anew after each attempt. There are many false starts and self-interruptions.
Delay before responding (>5 s)	Communication exchanges initiated by others are followed by pauses of inordinate length at turn-switching points.
Inability to structure discourse	Discourse of the speaker lacks forethought and organizational planning (i.e., discourse is confusing – illogical/lacks temporal sequencing).
Difficulty with turn-taking	The participant in a conversational interaction does not attend to the cues necessary for the appropriate exchange of conversational turns. Two outcomes: 1) The individual does not allow others to add information. 2) The individual does not read switching cues appropriately and does not hold up his part of the interaction.
Inefficient attention to and use of gaze	The individual's use of eye contact is inconsistent or absent.
Inappropriate intonational contours	The speaker's ability to embellish meaning through use of suprasegmental features (e.g., pitch levels, vocal intensity, inflectional contours, etc.) is poor.

*Taken from

Damico, J. S., 1985, Clinical discourse analysis: A functional approach to language assessment. In C. S. Simon (ed.) *Communication skills and classroom success* (London: Taylor & Francis), pp. 165-203.

Snow, P., Douglas, J., Ponsford, J. (1997). Conversational assessment following traumatic brain injury: a comparison across two control groups, *Brain Injury*, *11*(6), 409-429.

Appendix I

Montreal Cognitive Assessment (MoCA)

Administration and Scoring Instructions

The Montreal Cognitive Assessment (MoCA) was designed as a rapid screening instrument for mild cognitive dysfunction. It assesses different cognitive domains: attention and concentration, executive functions, memory, language, visuoconstructional skills, conceptual thinking, calculations, and orientation. Time to administer the MoCA is approximately 10 minutes. The total possible score is 30 points; a score of 26 or above is considered normal.

1. Alternating Trail Making:

Administration: The examiner instructs the subject: *"Please draw a line, going from a number to a letter in ascending order. Begin here* [point to (1)] *and draw a line from 1 then to A then to 2 and so on. End here* [point to (E)]."

Scoring: Allocate one point if the subject successfully draws the following patter: 1-A-2-B-3-C-4-D-5-E, without drawing any lines that cross. Any error that is not immediately self-corrected earns a score of 0.

2. Visuocontructional Skills (Cube):

Administration: The examiner gives the following instructions, pointing to the cube: *"Copy this drawing as accurately as you can, in the space below".*

Scoring: One point is allocated for a correctly executed drawing.

- Drawing must be three-dimensional
- All lines are drawn
- No line is added
- Lines are relatively parallel and their length is similar (rectangular prisms are accepted)

A point is not assigned if any of the above-criteria are not met.

3. Visuoconstructional Skills (Clock):

Administration: Indicate the right third of the space and give the following instructions: *"Draw a clock. Put in all the numbers and set the time to 10 after 11".*

Scoring: One point is allocated for each of the following three criteria:

- Contour (1 pt.): the clock face must be a circle with only minor distortion
- acceptable (e.g., slight imperfection on closing the circle);
- Numbers (1 pt.): all clock numbers must be present with no additional numbers; numbers must be in the correct order and placed in the approximate quadrants on the clock face; Roman numerals are acceptable; numbers can be placed outside the circle contour;
- Hands (1 pt.): there must be two hands jointly indicating the correct time; the hour

- hand must be clearly shorter than the minute hand; hands must be centered within the clock face with their junction close to the clock center.
- A point is not assigned for a given element if any of the above-criteria are not met.

4. Naming:

Administration: Beginning on the left, point to each figure and say: *"Tell me the name of this animal".*

Scoring: One point each is given for the following responses: (1) camel or dromedary, (2) lion, (3) rhinoceros or rhino.

5. Memory:

Administration: The examiner reads a list of 5 words at a rate of one per second, giving the following instructions: *"This is a memory test. I am going to read a list of words that you will have to remember now and later on. Listen carefully. When I am through, tell me as many words as you can remember. It doesn't matter in what order you say them".* Mark a check in the allocated space for each word the subject produces on this first trial. When the subject indicates that (s)he has finished (has recalled all words), or can recall no more words, read the list a second time with the following instructions*: "I am going to read the same list for a second time. Try to remember and tell me as many words as you can, including words you said the first time."* Put a check in the allocated space for each word the subject recalls after the second trial. At the end of the second trial, inform the subject that (s)he will be asked to recall these words again by saying, *"I will ask you to recall those words again at the end of the test."*

Scoring: No points are given for Trials One and Two.

6. Attention:

Forward Digit Span: Administration: Give the following instruction: *"I am going to say some numbers and when I am through, repeat them to me exactly as I said them".* Read the five number sequence at a rate of one digit per second.

Backward Digit Span: Administration: Give the following instruction: *"Now I am going to say some more numbers, but when I am through you must repeat them to me in the backwards order."* Read the three number sequence at a rate of one digit per second.

Scoring: Allocate one point for each sequence correctly repeated, (N.B.: the correct response for the backwards trial is 2-4-7).

Vigilance: Administration: The examiner reads the list of letters at a rate of one per second, after giving the following instruction*: "I am going to read a sequence of letters. Every time I say the letter A, tap your hand once. If I say a different letter, do not tap your hand".*

Scoring: Give one point if there is zero to one errors (an error is a tap on a wrong letter or a failure to tap on letter A).

Serial 7s: Administration: The examiner gives the following instruction: *"Now, I will ask you to count by subtracting seven from 100, and then, keep subtracting seven from your answer until I tell you to stop."* Give this instruction twice if necessary.

Scoring: This item is scored out of 3 points. Give no (0) points for no correct subtractions, 1 point for one correction subtraction, 2 points for two-to-three correct subtractions, and 3 points if the participant successfully makes four or five correct subtractions. Count each correct subtraction of 7 beginning at 100. Each subtraction is evaluated independently; that is, if the participant responds with an incorrect number but continues to correctly subtract 7 from it, give a point for each correct subtraction. For example, a participant may respond "92 – 85 – 78 – 71 – 64" where the "92" is incorrect, but all subsequent numbers are subtracted correctly. This is one error and the item would be given a score of 3.

7. Sentence repetition:

Administration: The examiner gives the following instructions: *"I am going to read you a sentence. Repeat it after me, exactly as I say it [pause]:* ***I only know that John is the one to help today."*** Following the response, say: *"Now I am going to read you another sentence. Repeat it after me, exactly as I say it [pause]:* ***The cat always hid under the couch when dogs were in the room."***

Scoring: Allocate 1 point for each sentence correctly repeated. Repetition must be exact. Be alert for errors that are omissions (e.g., omitting "only", "always") and substitutions/additions (e.g., "John is the one who helped today;" substituting "hides" for "hid", altering plurals, etc.).

8. Verbal Fluency:

Administration: The examiner gives the following instruction: *"Tell me as many words as you can think of that begin with a certain letter of the alphabet that I will tell you in a moment. You can say any kind of word you want, except for proper nouns (like Bob or Boston), numbers, or words that begin with the same sound but have a different suffix, for example, love, lover, loving. I will tell you to stop after one minute. Are you ready? [Pause] Now, tell me as many words as you can think of that begin with the letter F. [time for 60 sec]. Stop."*

Scoring: Allocate one point if the subject generates 11 words or more in 60 sec. Record the subject's response in the bottom or side margins.

9. Abstraction:

Administration: The examiner asks the subject to explain what each pair of words has in common, starting with the example: *"Tell me how an orange and a banana are alike"*. If the subject answers in a concrete manner, then say only one additional time: *"Tell me another way in which those items are alike"*. If the subject does not give the appropriate response *(fruit),* say, *"Yes, and they are also both fruit."* Do not give any additional instructions or clarification.

After the practice trial, say: *"Now, tell me how a train and a bicycle are alike"*. Following the response, administer the second trial, saying: *"Now tell me how a ruler and a watch are alike"*.

Do not give any additional instructions or prompts.

Scoring: Only the last two item pairs are scored. Give 1 point to each item pair correctly answered.
The following responses are acceptable:
Train-bicycle = means of transportation, means of travelling, you take trips in both;
Ruler-watch = measuring instruments, used to measure.
The following responses are **not** acceptable: Train-bicycle = they have wheels; Ruler-watch = they have numbers.

10. Delayed recall:

Administration: The examiner gives the following instruction: *"I read some words to you earlier, which I asked you to remember. Tell me as many of those words as you can remember".* Make a check mark for each of the words correctly recalled spontaneously without any cues, in the allocated space.

Scoring: **Allocate 1 point for each word recalled freely without any cues**.

11. Orientation:

Administration: The examiner gives the following instructions: *"Tell me the date today".* If the subject does not give a complete answer, then prompt accordingly by saying: *"Tell me the [year, month, exact date, and day of the week]."* Then say: *"Now, tell me the name of this place, and which city it is in."*

Scoring: Give one point for each item correctly answered. The subject must tell the exact date and the exact place (name of hospital, clinic, office). No points are allocated if subject makes an error of one day for the day and date.

TOTAL SCORE: Sum all subscores listed on the right-hand side. Add one point for an individual who has 12 years or fewer of formal education, for a possible maximum of 30 points. A final total score of 26 and above is considered normal.

*Taken from
Nasreddine, Z. S., Phillips, N. A., Bedirian, V., Charbonneau, S., Whitehead, V., Collin, I., Cummings, J. L., Chertkow, H. (2005). The Montreal Cognitive Assessment, MoCA: a brief screening tool for mild cognitive impairment. *Journal of the American Geriatrics Society.* 53(4), 695-699.

Appendix I

Inclusion Criteria

Participants will be asked to provide verbal responses to a variety of questions and narrative elicitation prompts. The Interview questions are designed to elicit some basic background information and help to determine eligibility. These questions will be asked over the phone, or through e-mail as potential participants make the initial contact with the PI. The basic assessment procedures are outlined below.

Interview questions to determine that subjects meet the study criteria:

- Are you between the ages of 18 and 45?
- Have you ever had a traumatic brain injury (including concussion) when you lost consciousness for more than 5 minutes?
- Do you have a history of substance abuse, psychiatric illness, language or learning disability, cerebral vascular accident or neurological disease?
- Do you have any visual impairment (not corrected with glasses or contact lenses)?
- Do you have any diagnosed hearing loss?
- What is the highest level of education you have completed?

Appendix J

Recruitment Flyer

Wanted: Study Participants!

For a Research Project Investigating Communication Skills Following Brain Injury

The University of Vermont Department of Communication Sciences and Disorders is currently recruiting subjects for a study of communication abilities following ***traumatic brain injury***. Subjects will be ***paid $20 for approximately one hour of participation***. Study participants will answer questions and verbally respond to pictured and verbal stimuli to elicit communication samples. Light sensors will be placed on the forehead during the study to monitor brain activation related to communication.

Participants in this study will have a history of a single traumatic brain injury and subsequent cognitive-communication deficit as indicated by your former or current speech-language pathologist. Excluded will be those with moderate-severe aphasia, those who communicate by nonverbal means, and those persons with a significant history of other neurologic disorders, psychiatric disorders, chronic substance abuse, or developmental learning disabilities.

Please feel free to contact me to participate or with any questions regarding this study.

Sincerely,

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Help us Better Understand the Communication Patterns Associated with Traumatic Brain Injury (TBI)

Who: Persons who have suffered a ***traumatic brain injury*** and attend or previously attended treat with a Speech-language pathologist to improve communication skills.

What: Be part of a ***1 hour research study and get paid $20***. You will be asked to tell stories in response to pictures and questions while wearing a light sensor headband.

Where: University of Vermont, Department of Communication Sciences & Disorders

Call or e-mail to find out more or schedule an appointment:

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