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The use of reported speech in the interactions of individuals with traumatic brain injury

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THE USE OF REPORTED SPEECH IN THE INTERACTIONS OF INDIVIDUALS WITH TRAUMATIC BRAIN INJURY

by

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A thesis submitted in partial fulfillment of the requirements for the Master of Arts degree in Speech Pathology and Audiology in the Graduate College of The University of Iowa

May 2014

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This is to certify that the Master’s thesis of

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CHAPTER 1
REVIEW OF THE LITERATURE

Traumatic brain injury (TBI) is a significant public health concern that has garnered increased attention in recent years due to its considerable impacts on individuals, their families, and society. In the United States, more than 1.7 individuals sustain a TBI annually (Faul, Xu, Wald, & Coronado, 2010). The effects of TBI are often chronic, with an estimated 5.3 million Americans living with a disability related to TBI (Langlois, Rutland-Brown, & Wald, 2006). Impairments linked to TBI have far-reaching impacts – and the problem is expanding. From 2002 to 2006, TBI-related hospitalizations rose by nearly 20% (Faul et al., 2010).

Many individuals affected by TBI present with lasting changes in cognitive ability, personality, behavior, and communication. To lay observers, however, these deficits may not be immediately evident. The tendency for deficits related to TBI to be masked upon an initial visual appraisal contributes to limited public awareness of the pervasiveness of the problem, which has led to TBI being designated a “silent epidemic” (Faul et al., 2010). In addition to immediate cognitive, communicative, and social consequences, individuals with TBI are significantly more likely to develop depression, alcoholism, or to become homeless than non-brain injured individuals (Bremner, Duke, Nelson, Pantelis, & Barnes, 1996; Holsinger et al., 2002; Horner et al., 2005; Hwang, Stephen et al., 2008).

The effects of TBI extend beyond the individual, impacting family dynamics and other social relationships. Initially following the traumatic event, family members experience anxiety, shock, disbelief, and denial (Mathis, 1984), but the burden on
families continues past the acute phase. Family caregivers experience high levels of stress and burden that often do not diminish with time (Douglas & Spellacy, 1996; Kreutzer, Marwitz, & Kepler, 1992). This is in contrast with others in caregiving capacities, who report decreases in stress level over time (Greenberg, Seltzer, & Greenley, 1993). The changes in personality and social interaction brought about by TBI affect the ways family members relate to one another (Degeneffe, 2001). TBI subsequently results in unique and lasting familial consequences that warrant increased attention.

The long-term cognitive, behavioral, and social consequences of TBI contribute to its designation as one of the most disabling injuries (Langlois et al., 2006). In fact, injury-related productivity loss attributed to TBI is fourteen times that associated with spinal cord injury, another disabling injury (Finkelstein, Corso, & Miller, 2006). Even mild TBI can result in cognitive and social problems that affect an individual’s ability to return to work (Englander, Hall, Stimpson, & Chaffin, 1992). This, in combination with the high incidence of TBI, results in high cost to society. As measured by the sum of medical costs and lost productivity, the cost of TBI in the United States is estimated to total $60 billion annually (Finkelstein et al., 2006). Besides direct monetary costs, TBI imposes additional burdens on society that are harder to quantify. A meta-analysis conducted by Shiroma, Ferguson, & Pickelsimer of twenty epidemiologic studies estimates the prevalence of TBI in the overall offender population to be 48-72% (Shiroma, Ferguson, & Pickelsimer, 2010). In contrast, psychiatric disorders are reported in a much smaller 6-19% of incarcerated individuals (Ditton, 1999). The majority of head-injured inmates report that their head injury preceded their first criminal act,
suggesting that head injury increases the likelihood of criminal activity (Sarapata, Herrmann, Johnson, & Aycock, 1998). Studies of death row inmates also indicate a high prevalence of TBI (75% and 100% respectively) (Freedman & Hemenway, 2000; Lewis, Pincus, Feldman, Jackson, & Bard, 1986).

The wide-reaching impacts of TBI on individuals and society make it an important population to characterize in order to develop effective interventions to address its negative impacts on society. Speech-language pathologists play an important role in treatment following TBI, addressing many aspects of the speech, language, social, and cognitive changes following TBI. TBI results in a unique constellation of deficits due to the diffuse nature of damage, resulting in a different profile of impairment in each individual. Despite this individuality, certain distinctions can be made about the characterization of impact following TBI when compared to other communication disorders. TBI has been defined as a “cognitive-communication impairment” rather than a disorder of language (Hartley, 1995). Impairment in TBI is at the level of cognition and social interaction, rather than at the linguistic level. Despite this distinction, most studies of communicative impacts of TBI have focused on the microlinguistic level (e.g. Chapman et al., 1992; Ehrlich, 1988; Glosser & Deser, 1991; Hartley & Jensen, 1991; McDonald, 1993; Mentis & Prutting, 1987). If impairment in TBI is truly above the level of language, studies should turn to focus on social-interactive functions of discourse to better characterize the communicative deficits seen in TBI. Reported speech is an interactional discourse resource deployed in social interaction that may fill this gap and will be investigated in this study.
**Definition of Traumatic Brain Injury**

TBI is defined as sudden physical damage to the brain caused by mechanical force, in contrast to disease, vascular accident, or anoxia (Frankowski, 1986; McDonald, Togher, & Code, 1999; Morton & Wehman, 1995). TBI can be either penetrating or blunt. Penetrating head injuries are caused by penetration of the skull and dura. Penetrating injuries are uncommon, except in instances of war, and are usually fatal (Togher, McDonald, & Code, 1999). Closed head injuries (CHI) are caused by a blunt blow to the skull. CHI results in multi-focal damage to the brain and causes widespread deficits (Togher et al., 1999). All participants in this study will be drawn from a registry of individuals with CHI.

**Demographics of TBI**

The “classic” profile of a brain-injured individual is of a young adult male who engages in risk-taking behavior and is more likely to be from a lower socioeconomic background (Ylvisaker & Feeney, 1998). This depiction is generally accurate – incidence of TBI is higher for males than females, young adults have heightened risk for TBI, and roughly half of hospitalized patients with TBI are intoxicated on admission – but this portrayal does not illustrate the full range of demographics of TBI survivors (Corrigan, Rust, & Lamb-Hart, 1995; Faul et al., 2010).

In actuality, according to the Centers for Disease Control, adults over the age of 75 experience the highest rates of TBI (Faul et al., 2010). In general, young children between the ages of 0 and 4, older adolescents age 15 to 19, and adults older than 65 are most likely to sustain a TBI (Faul et al., 2010). Very young children have the highest
rates of emergency room visits, while the highest rates for hospitalization and death occur in adults over the age of 75 (Faul et al., 2010). In every age group, incidence of TBI is higher for males than for females, with males approximately 1.4 times more likely to sustain a TBI than females (Faul et al., 2010).

TBI is the most common cause of brain damage in young adults (Collins, 1990; Thurman, Alverson, Dunn, Guerrero, & Sniezek, 1999). Recent advances in medical technique have reduced mortality for young victims, who just ten to twenty years ago would not have survived the complications following severe brain injury (Hannay, Howieson, Loring, Fischer, & Lezak, 2004). As a result, increasing numbers of young survivors are living with significant brain damage but otherwise healthy physical condition (Hannay et al., 2004).

**Causes of TBI**

Across all age groups, falls are the leading cause of TBI, with motor vehicle accidents (MVAs) the second most common cause (Faul et al., 2010). More than half of TBIs sustained by young children and adults older than 65 are the result of a fall, whereas MVAs account for more than half of TBIs in adolescents (Masson et al., 2001). Falls result in the highest numbers of emergency department visits and hospitalizations, while MVAs result in the greatest number of TBI-related deaths (Faul et al., 2010).

Though falls and MVAs are the leading causes of TBI, assault accounts for 25-40% of injuries (Hanks et al., 2003; Hannay et al., 2004). Violent causes of TBI are highest among young adults aged 20 to 24, with the most frequent occurrence among
individuals who are male, have less than a high school education, and are unemployed (Faul et al., 2010; Hanks et al., 2003).

**Mechanism of TBI**

TBI refers to acquired (rather than congenital) trauma from an external source (as opposed to internal trauma caused by stroke, tumor, encephalitis, etc.). The pathophysiology of TBI depends on a number of factors related to the circumstances surrounding the injury. Consequences differ for penetrating versus closed head injuries, movement of the skull versus lack of movement during injury, and linear versus rotational inertia of brain tissue in relation to the movement of the skull. Each injury also results in unique effects of secondary events following the initial trauma (Ylvisaker & Feeney, 1998).

Brain damage following TBI typically occurs in two phases: primary injury at the time of impact and secondary injury in response to the initial traumatic event. Primary injuries include contusions, hemorrhages, and diffuse axonal injury. Secondary injuries include damage caused by elevated intracranial pressure, edema, hypoxia, and ischemia.

Primary injuries are those caused by the immediate mechanical disruption of neural pathways (Mcintosh, 1993). In TBI resulting from contact forces, focal contusions can occur at the moment of impact at the site of the blow (coup) and often in an area opposite the blow (contrecoup). Coup and contrecoup contusions often account for more specific and localizable behavioral changes following TBI (Hannay et al., 2004). Localized brain damage can also occur in the absence of contact forces. In cases of rapid deceleration, contusions can occur in areas where the cortex rests on the rough surface of
the base of the skull as well as in deep brain structures such as the basal ganglia and brainstem (Courville, 1942; Hannay et al., 2004). In cases involving a great deal of momentum on impact (such as MVAs), clearly defined focal deficits are harder to distinguish, resulting in the description of these injuries as “multi-focal” (Hannay et al., 2004; J. L. Ponsford, Olver, & Curran, 1995).

The combination of translational forces and the rotational acceleration of the brain within the skull can put strain on nerve fibers, leading to diffuse axonal injury. Diffuse axonal injury (DAI) is the result of shearing, twisting, tearing, and breakage of axons, and is often considered the most common and important pathologic feature of TBI (Smith, Meaney, & Shull, 2003; Ylvisaker & Feeney, 1998). Diffuse damage caused by DAI tends to be more pronounced in anterior versus posterior regions and in deeper brain structures versus surface areas (Hannay et al., 2004). The severity of damage due to DAI is influenced by the velocity, duration, rate of deceleration, and direction of head movement (Hannay et al., 2004). DAI severity is thought to correspond with level of impairment and prognosis following TBI (Adams, Graham, Gennarelli, & Maxwell, 1991).

Secondary injury following TBI develops in the hours and weeks following the initial traumatic event (Cooper, 1985). This delayed damage is thought to result from changes in the brain’s neurochemical systems brought about by primary injuries. Changes in the neurochemistry of the brain may result in brain swelling, changes in brain blood flow, and neurotoxic effects leading to the death of neuronal or glial cells (Hannay et al., 2004).
Swelling or edema following TBI can focal or generalized. Edema can lead to compression of the brain against the confines of the skull. Compression of lower brainstem structures devoted to vital functions as a result of swelling and increased intracranial pressure is the most frequent cause of death following TBI (Adams, Graham, & Gennarelli, 1985). Increased intracranial pressure can also lead to reduced blood flow to the cortex. This reduction in blood flow can result in cell death due to hypoxia or ischemia. In severe TBI, some degree of hypoxic-ischemic injury was found in over eighty percent of cases (Chang et al., 2009; Graham, Adams, & Doyle, 1978). The hippocampus, a structure central to the formation of new declarative memory, is particularly sensitive to hypoxic-ischemic injury (Bigler, 1990).

**Cognitive Consequences of TBI**

*Executive Function*

Despite frequent mention in the neuropsychological literature, the concept of executive function awaits a formal definition (Jurado & Rosselli, 2007). General consensus has designated executive function as an umbrella term encompassing the mental functions which regulate aspects of deliberate behavior (Ylvisaker & Feeney, 1998). Executive functions are involved in the formulation of goals and the planning for achieving them, as well as the carrying out and revision of these plans in response to feedback (Ylvisaker & Feeney, 1998). Despite a lack of clarity in the formal definition of executive functions, there is relative agreement about the importance of these cognitive functions for human behavior and functioning (Jurado & Rosselli, 2007). Intact executive functioning is required for appropriate and socially responsible adult conduct.
These complex cognitive functions allow an individual to shift mindsets quickly and adapt to evolving situations, while at the same time inhibiting inappropriate behaviors (Jurado & Rosselli, 2007).

The importance of executive functions to human functioning cannot be overstated. As long as executive functions are intact, even patients with considerable cognitive losses can continue to be independent and productive (Lezak et al., 2004). In contrast, when executive functions are impaired, all other cognitive systems have the potential to be negatively affected, even if these systems remain individually intact (Sohlberg & Mateer, 1989). Unfortunately, executive impairment may be at the core of disability following TBI (Ylvisaker & DeBonis, 2000). Executive function has been found to be the most severely disrupted cognitive function when premorbid intelligence is controlled for (Johnstone, Hexum, & Ashkanazi, 1995).

Attention

Individuals with TBI frequently complain of difficulty concentrating following their injury (Van Zomeren & Van Den Burg, 1985). These difficulties “concentrating” or “focusing” have been attributed to deficits in attention (Gronwall & Sampson, 1974; Miller, 1970). However, in individuals with TBI, presumed attentional deficits may arise from the combined effects of slowed processing speeds and the inherent limitations of working memory capacity (McDonald et al., 1999). Support for this theory comes from differences in accuracy between timed versus untimed attentional tasks. In untimed tasks, individuals with TBI present with normal sustained attention. Individuals with TBI show normal accuracy on the Stroop Test, but significantly longer response times (J.
Ponsford & Kinsella, 1992; Stuss et al., 1985). Similar results have been documented in untimed divided attention tasks. In these tasks, such as choice reaction time tests, individuals with TBI perform more slowly but with normal accuracy (J. Ponsford & Kinsella, 1992; Stuss et al., 1989). Additionally, TBI participants show disproportionate increases in response time as the complexity of the divided attention task increases (J. Ponsford & Kinsella, 1992; Van Zomeren, 1981).

For tasks that involve performing under time constraints, problems with accuracy emerge. For example, the Paced Auditory Serial Addition Test (Gronwall & Sampson, 1974) requires participants to add pairs of numbers before the presentation of the next stimulus. Participants are therefore required to respond at the pace set by the experimenter. In this divided attention task, individuals with TBI are shown to be significantly less accurate than healthy comparisons (J. Ponsford & Kinsella, 1992). Results of these studies suggest that individuals with TBI sacrifice speed for accuracy when possible, but when the task does not allow for increased processing time head-injured individuals make significantly more errors (J. Ponsford & Kinsella, 1992). Thus, when individuals with TBI are encounter situations in which they are unable lengthen their response time, slowed processing abilities negatively impact working memory and therefore attentional capacity (McDonald et al., 1999).

Memory

TBI frequently results in impairments in declarative memory. Declarative memory supports the acquisition of new knowledge as well as allows its retrieval and use in novel contexts. Declarative memory can be subdivided into semantic and episodic
memory (Tulving, 1972). Semantic memory encompasses vocabulary and general world knowledge that is context independent. In contrast, episodic memory refers to memory for autobiographic events that are bound together by context (i.e. time and place) (Cohen & Banich, 2003).

Declarative memory has been found to be supported by the medial temporal lobes (MTL) and the hippocampal system in particular (Cohen & Banich, 2003; Squire & Zola, 1996; Squire, 1992). Most individuals with severe TBI experience hypoxic episodes following the traumatic incident (Chang et al., 2009). Because the hippocampus is especially sensitive to hypoxic-ischemic injury, individuals with TBI are vulnerable to deficits in declarative memory (Ylvisaker & Feeney, 1998). In fact, declarative memory deficits have been identified as perhaps the most common residual problems for individuals with TBI (Bachman, 1992; Hunkin, Parkin, Bradley, & Burdon-Cooper, 1995).

**Psychosocial Consequences of TBI**

TBI can result in significant change in personality, social behavior, and emotion. It has been suggested that these psychosocial changes contribute more to negative vocational, social, and familial outcomes than do physical or cognitive deficits (Brooks, Campsie, Symington, Beattie, & Mckinlay, 1986; Thomsen, 1984; Ylvisaker & Feeney, 1998). Personality change is prevalent following TBI, occurring in 60-80% of cases (Brooks et al., 1986; Thomsen, 1984). These changes can be broadly categorized as loss of emotional control and loss of motivation (Kinsella, Packer, & Olver, 1991). Family-reported changes linked to loss of emotional control include increases in
quarrelsomeness, aggression, short temper, self-centeredness, and impulsivity (Kinsella et al., 1991). Changes in motivational level include decreased initiative, loss of spontaneity, and disinterest (Kinsella et al., 1991; Thomsen, 1984). Additionally, childishness, socially and sexually inappropriate behavior, and increased talkativeness have been observed in patients with TBI (Brooks et al., 1986; Kinsella et al., 1991; Lezak, 1978; Thomsen, 1984).

Underlying these broad changes in personality after TBI are deficits in social perception and cognition. In normal adults, social cognition supports prediction and interpretation of others’ behavior, the formation of shared social experience, and effective communication (McDonald, 2013). Social cognition includes processes such as emotion perception, empathy, theory of mind, and pragmatic inference (McDonald, 2013). Many individuals with TBI have difficulty recognizing emotions conveyed through facial expression or tone of voice (Hopkins, Dywan, & Segalowitz, 2002; McDonald & Flanagan, 2004; Milders, Fuchs, & Crawford, 2003). The ability to interpret more general social information is also impacted by TBI. Theory of Mind (ToM) is defined as the ability to infer the beliefs, feelings, and intentions of others to understand and predict their behavior (Bibby & McDonald, 2005). ToM has been reported to be impaired in individuals with TBI when asked to make judgments about a speaker’s thoughts or beliefs (Bara, Tirassa, & Zettin, 1997; McDonald & Flanagan, 2004). However, TBI does not result in uniformly impaired social perception.

Many individuals sustaining a TBI experience negative changes in social participation. These changes in social contact have been linked to changes in personality in the individual with TBI (Oddy, 1984). More than half of individuals sustaining a
severe TBI report little to no social contacts a year after their injury (Tate, Lulham, Broe, Strettles, & Pfaff, 1989). It has been suggested that loss of social contacts results in increases in the incidence of depression and anxiety in individuals with TBI (Lezak, 1988). Rates of depression have been shown to be increased in individuals with TBI (Brooks et al., 1986; Holsinger et al., 2002). Though cognitive deficits show improvement over time, negative emotional effects of TBI often increase. Incidence of anxiety, depression, and social withdrawal is often higher in individuals with chronic TBI than in acutely injured patients (Fordyce, Roueche, & Prigatano, 1983).

**Communicative Consequences of TBI**

Historically, communication following TBI has been described as “confused language skills” (Groher, 1977; Halpern, Darley, & Brown, 1973), “empty” (Heilman, Safran, & Geschwind, 1971), and “tangential” (Levin, Grossman, Rose, & Teasdale, 1979). It was also noted that while language abilities at the sentence level typically improve to within normal limits, many individuals with TBI are not able to manage at the conversational level (Groher, 1977; Togher et al., 1999). When tested using traditional aphasia batteries, individuals with TBI show the most prominent deficits in word-finding on naming and word fluency tasks (Levin, Grossman, Sarwar, & Meyers, 1981; Lohman, Ziggas, & Pierce, 1989). These deficits in naming appear to be among the most reported persisting communication difficulties following TBI (Levin, Grossman, & Kelly, 1976; Levin et al., 1981).

While traditional aphasia batteries may identify microlinguistic deficits following TBI, these instruments do not capture the broad range of communicative deficits seen
after TBI (Togher et al., 1999). In 1982, aphasiologist Audrey Holland argued that communication disorders following TBI were qualitatively different from aphasia, and proposed that disordered language in TBI was secondary to cognitive and memory impairments. Holland described the “communicative incompetence” that followed closed head injury and stated that while “aphasic language could be considered to be a disorder of form; head injured language could be considered to be a disorder of use” (Holland, 1982).

The recognition that communication deficits following TBI are different than those seen in aphasia has brought about new terminology. Acknowledging the relationship between cognitive impairments and language processing, Hagan introduced the term “cognitive-language disorder” in 1984 (Hagen, 1984). Hagan argued that cognitive impairments in attention and memory result in the inability to effectively organize incoming and outgoing information, leading to a disruption in language processing (Hagen, 1984).

The term used to describe communicative deficits following TBI has since been updated to “cognitive-communication disorder” to reflect broad deficits in communication rather than language (Hartley, 1995). With this shift in focus came increasing attention to the impact of cognitive-communication deficits on discourse abilities, rather than on isolated language functions (Togher et al., 1999). In connected speech tasks, participants with TBI have been shown to produce a similar amount of content compared to healthy participants, but with reduced communicative efficiency (Ehrlich, 1988). That is, the oral narratives of individuals with TBI were lengthier and slower relative to the amount of content units provided (Coelho, 1999). Additionally,
individuals with TBI have been shown to have deficits in coherence, a measure of the semantic and pragmatic connectedness of a narrative (Glosser & Deser, 1991).

Results from pragmatic rating scales suggest that individuals with TBI experience difficulty when called upon to function as a discourse partner (Coelho, 1995). In dialogue tasks, individuals with TBI show difficulties initiating and sustaining conversational topics, requiring their communication partner to bear more of the communicative burden (Coelho, 1999). Although it has been shown that communication partners can bolster communicative success in other disordered populations, few studies have described the ways in which contributions of the communication partner may impact the communicative abilities of persons with TBI (Togher et al., 1999).

*Reported Speech*

Reported speech is a discourse phenomenon in which a speaker represents speech and thought from another time and place (Hengst, Frame, Neuman-stritzel, & Gannaway, 2005). The common and pervasive nature of reported speech in conversation serves as a rich communicative resource for study by linguistics interested in its semantic and syntactic forms (Sakita, 2002), sociolinguists focused on the interpersonal functions it serves within everyday interactions (Tannen, 1989), and speech-language pathologists interested in its use to support successful communication (Hengst et al., 2005). The use of reported speech involves shifting between the words of the current speaker to those of the speaker being reported, and thus requires the binding together of multiple voices, contexts, and goals (Hengst et al., 2005). Reported speech is complex – one utterance
can simultaneously belong to two people (the reporter and the reported) and exist in two worlds (the present context and the reported context) (Gunthner, 1999).

Reported speech is often employed in narratives, where quoting the speech of others serves to dramatize the story and provide a vivid reenactment of events as they originally unfolded (Besnier, 1992). Recreating the speech of characters in a story is also thought to increase the listener’s involvement or active participation in the conversation (Tannen, 1989).

Beyond direct quotation, reported speech is a strategic discourse practice that extends beyond direct verbatim accounts of another’s words. Oftentimes, speakers construct or reconstruct the speech of another to serve their own purposes (Clark & Gerrig, 1990; Myers, 1999; Tannen, 1989). When reporting the speech of others, the speaker can take creative liberties to serve their own intentions and communicative aims (Gunthner, 1999). In this way, use of reported speech serves a social function. The way in which a speaker chooses to represent the words of another allows them to either align with a preferred social identity or to separate from liability for an utterance (Irvine, 1996). Speakers can subtly manipulate the real or imagined utterances of others by adapting their wording or exaggerating their speaking style. Judith Irvine refers to these instances of reported speech as “double-voiced” – when both the meaning of the reported words and the reporter’s commentary (as indicated by prosodic features) can be understood (Irvine, 1996).

In healthy adults, reported speech is a robust practice. That is, despite the requirement that listeners hold in memory multiple contexts and temporal frames, use of
reported speech is rarely the cause of communication breakdowns. In a study of over 42 hours of focus-group discussion, no participants displayed a misunderstanding of the shifts in time and voice created by the use of reported speech (Myers, 1999). In addition, focus groups are communicative contexts that foster the sharing of potentially controversial opinions. Myers notes that in a sample of focus group discussions, participants often made use of reported speech to state an unpopular opinion. Depending on the response of the group to the opinion expressed as reported speech, the participant could choose to either distance him or herself from the utterance, or claim it as their own opinion. Furthermore, Myers argues that in focus groups, which are most often comprised of participants who are strangers to one another, participants are cautious about directly disagreeing with other members in the group. Instead, they may use strategies such as reported speech as an indirect means of aligning or distancing themselves from the other members of the group (Myers, 1999).

**Reported speech in individuals with aphasia**

Hengst examined reported speech use in individuals with aphasia during everyday conversation with routine communication partners. Findings from this study suggest that despite profound language impairments, individuals with aphasia are able to creatively employ reported speech (Hengst et al., 2005). In fact, Hengst et al. observed that reported speech stood out as a communicative practice that seemed to contribute to the engaging and natural feel of the conversations of individuals with aphasia. Results from this study suggest that reported speech is not dependent on language, but instead functions as an interactional discourse resource at the level of communication.
**Reported speech in individuals with cognitive impairments**

In a study by Duff and colleagues, patients with focal lesions to the hippocampus showed differences in quantity and quality of reported speech use when compared to healthy participants (Duff, Hengst, Tranel, & Cohen, 2007). Patients with amnesia produced approximately half as many reported speech episodes as non-brain injured comparisons. Qualitative differences in reported speech use were also noted. Reported speech episodes with a pre-amnesia reported context were animated and detailed, while reported speech with a post-amnesia context seemed less detailed. It was also observed that certain discourse genres resulted in greater incidence of reported speech. Between-task talk produced the greatest number of reported speech episodes. Within target discourse tasks, conversational and narrative tasks elicited the most reported speech, with very little reported speech observed in picture description or procedural discourse tasks.

All patients with amnesia had focal damage to the hippocampus. Results of this study suggest the critical importance of the hippocampus for successful use of reported speech. The use of reported speech requires an individual to flexibly bind together different contexts (bringing the past and the present together in a single utterance). Duff et al. propose that the hippocampus supports this ability to bind together unique combinations of past and present (Duff et al., 2007).

In a later study, patients with focal damage to the ventromedial prefrontal cortex (vmPFC) showed no significant differences in reported speech use (Duff, Ballard, Bachelder, & Tranel, 2009; Duff, Kurczek, & Miller, in preparation). Despite profound
deficits in social-emotional processing, participants with damage to the vmPFC did not show deficits in reported speech use.

**The Current Study**

Since the early eighties, it has been accepted that the deficits following TBI do not result in a primary language disorder but in a disorder of communication (Hagen, 1984; Holland, 1982). Thus far, however, studies of the effects of TBI have focused largely on microlinguistic measures, such as productivity and cohesion (e.g. Chapman et al., 1992; Ehrlich, 1988; Glosser & Deser, 1991; Hartley & Jensen, 1991; McDonald, 1993; Mentis & Prutting, 1987). The current study does not examine a linguistic measure, but rather a communicative resource and behavior: the use of reported speech. In addition, despite observational and clinical reports that the hallmark communicative deficits seen in TBI emerge in social interaction, much of the data collected on the communicative abilities of individuals with TBI have been collected in monologue tasks such as story retell and picture description (e.g. Chapman et al., 1992; Ehrlich, 1988; Mentis & Prutting, 1991). In contrast, the current study will examine reported speech use within an *interactional* framework, while still sampling a variety of discourse genres (e.g. conversation, narrative, picture description, procedural).

The primary question to be addressed is:

> In the context of social interaction, are there differences in the quantity or quality of reported speech in adults with traumatic brain injury versus healthy non-brain injured comparison participants?

There are several possible outcomes to this study. From a sociolinguistic perspective, use of reported speech is seen as a marker for interactional success; that is, conversations
with more reported speech are thought to be more engaging and foster improved interpersonal connections (Tannen, 1989). Given that TBI often results in impairment in social interaction, it could be predicted that individuals with TBI will produce fewer episodes of reported speech than healthy comparison participants.

Results of this study will further inform our understanding of the discourse phenomenon of reported speech. Though reported speech use is a robust practice in healthy speakers (Myers, 1999), it has been shown to be impaired in those with dense memory impairments (Duff, Hengst, Tranel, & Cohen, 2007). Because of the widespread deficits caused by TBI, results of this study may indicate that other cognitive deficits, besides memory impairment, negatively impact reported speech use.

A second possible outcome is that there is no difference in the frequency of reported speech use across groups. It may be that reported speech is such a robust communicative resource that its use will not be impacted by the sequelae of TBI. The use of reported speech by individuals with TBI might parallel that of individuals with aphasia, where reported speech is a relative communicative strength that contributes to positive communicative interactions.

Additionally, due to the heterogeneity of deficits following TBI, no differences in reported speech may be found between healthy participant and TBI groups if the particular individuals with TBI do not have profound memory deficits. It may be that reported speech is only negatively impacted by memory impairment and not by the social communicative deficits or other cognitive sequelae of TBI. If participants in this particular group of individuals with TBI do not have the cognitive impairments
previously linked to reported speech deficits (e.g. memory), no differences in reported speech frequency may be found (Duff, Hengst, Tranel, & Cohen, 2007).

Finally, given the high variability inherent in TBI, a mixed result is possible. Results of this study may indicate that individuals with TBI with certain neuropsychological profiles show more impairment in reported speech use than others. Since reported speech use has been shown to be impacted by memory impairments (Duff et al., 2007), individuals with TBI with more profound memory impairments may show more impaired reported speech use than individuals with other cognitive deficits.

To address the primary research question, participants interacted with clinicians in the context of a mediated discourse elicitation protocol, designed to sample a variety of discourse genres while preserving the interactional aspects of communication (Hengst & Duff, 2007). The entire protocol was videotaped, transcribed, and coded in order to examine frequency and form of reported speech episodes. Reported speech use by both the participant and the clinician was analyzed. In addition to examining differences in the number of reported speech episodes of individuals with TBI versus healthy comparison participants, qualitative differences was examined by analyzing the distribution of the various types of reported speech (direct, indirect, indexed, projected) as well as the temporal domain expressed within each reported speech episode (past, in-session, future).

Results of this study will aid in clarifying what broader aspects of discourse may be impaired following TBI. Further characterization of the cognitive-communication deficits caused by TBI will improve the field’s ability to target these deficits in speech-
language interventions and may lead to the development of novel and effective treatment paradigms. If reported speech is found to be unimpaired in individuals with TBI, clinicians may capitalize on this relative strength in clients with TBI, encouraging use of reported speech to increase listener engagement and interest, or to align or distance oneself from a particular person or stance, to improve the social interactions of individuals with TBI. Conversely, if reported speech is impaired in individuals with TBI, it might be an important aspect of discourse to target in therapy to address social communication deficits.
CHAPTER 2

METHODS

Participants

Interactional discourse data were collected from 10 individuals with traumatic brain injury and 10 healthy comparison participants. Participants with TBI were drawn from the Iowa Traumatic Brain Injury Registry. Healthy comparison participants were matched to participants with TBI on age, education, sex, and handedness. Healthy comparison participants were drawn from a registry of healthy participants from previous studies and from the Iowa City community.

Participants with Traumatic Brain Injury

The ten participants with TBI (six male, four female) were between the ages of 24 to 70 years old (M = 48.30, SD = 15.73). All ten participants were right handed (+100) as determined by the Edinburgh Handedness Scale (Oldfield, 1971). Participants with TBI had 11 to 20 years of education (M = 15.20, SD = 2.66). All participants with TBI had normal or corrected-to-normal vision and hearing, no history of premorbid neurological or psychiatric disease, and no history of premorbid language or learning disability (per self-report). All participants with TBI spoke English as their primary language and were at least one year post injury. Participants with TBI were medically stable with time post-onsets ranging from 2-14 years (M = 4.60, SD = 3.66). Demographic information for participants with TBI is presented in Table 1.

The etiologies of TBI for participants in this study included two motor vehicle accidents, six falls, one unhelmeted motorcycle accident, and one assault. Initial Glasgow Coma Scales (GCS) scores were available from the medical records of four of the participants. Of these four participants, two sustained severe brain injury (GCS = 6,
8) and two sustained mild brain injury (GCS = 13, 15). Neuroimaging data were available for nine of the ten participants with TBI. Of these nine participants, four had positive findings for frontal lesions or contusions (3622, 3694, 3696, 3704). All participants with TBI experienced post-traumatic amnesia, ranging from 24 hours to 22 months. Specific information about etiology and severity is listed in Table 2.

All participants with TBI completed or were in the process of completing a battery of neuropsychological testing (see Appendix A and Tranel, 2009). This testing covered the areas of intellectual abilities, memory, speech and language ability, perception and attention, visuoconstructional ability, psychomotor and psychosensory functions, executive functioning, personality and affect, and premorbid status. The neuropsychological data were used to guarantee participants could successfully complete the study (i.e., had normal intelligence and were free of aphasia) and to determine if neuropsychological profile or cognitive status predicted reported speech use.

Scores for available neuropsychological assessments are listed in Table 3. All participants with TBI were within normal limits on the Wechsler Adult Intelligence Scale (M=104.8; SD = 14.4). As a group, memory was intact as measured by the Wechsler Memory Scale General Memory Index (M = 108.7), the Auditory Verbal Learning Test Trial 5 (M = 12.30) and Delayed Recall (M = 10.7). The only exception was participant 3656, who was impaired on both memory measures. Participants were free of aphasia and performed within normal limits on measures of language including the Boston Naming Test (M = 57.1) and the Token Test (M = 43.2). Finally, on a measure of executive function, the Wisconsin Card Sorting Test, of the participants who had
completed this measure (N=7), five participants performed within normal limits and two were impaired.

**Healthy Comparison Participants**

Ten healthy comparison participants were matched to the participants with TBI based on age, sex, education, and handedness. The average age of participants with TBI was 48.30 (SD = 15.73) and the average age of comparison participants was 42.50 (SD = 15.46), a difference which was not statistically significant (t(18) = .832, p = .417). The average years of education was 15.20 (SD = 2.66) for participants with TBI and 15.30 (SD = 1.70) for comparison participants. This difference was also insignificant (t(18) = -.100, p = .921).

All comparison participants had normal or corrected-to-normal hearing and vision and spoke English as their primary language. By self-report, none of the comparison participants had a positive history for any neurological, psychiatric, language, or learning disorder. Demographic information for comparison participants is displayed in Table 4.

**Clinicians**

Clinicians implementing the data collection protocols were a licensed speech-language pathologist, four graduate speech-language pathology students and one undergraduate speech-language pathology student (all female). All clinicians were blind to the study hypotheses. Clinicians were trained in the Mediated Discourse Elicitation protocol (described below) via direct instruction. Following this instruction, each clinician was video-recorded implementing this protocol with another student. Video recordings were reviewed by research assistants to determine whether the clinicians were maintaining protocol fidelity. Clinicians were provided with feedback based on this
review and asked to implement the elicitation protocol a second time. All clinicians were deemed to be implementing the elicitation protocol with high fidelity following these training sessions.

Data collection

Data for this study were collected as part of a broader study comparing two discourse elicitation protocols: the Mediated Discourse Elicitation Protocol (referred to as MDEP) (Hengst & Duff, 2007) and the TalkBank Protocol (MacWhinney, 2007). For the purposes of this broader study, changes were made to the original design of the MDEP protocol to more closely match the content and structure of the TalkBank protocol. For the present study, data were drawn only from discourse samples obtained using the modified MDEP protocol. Data obtained using the MDEP protocol was chosen for analysis because the MDEP’s design to preserve interactional aspects of communication was thought more likely to support reported speech use.

The modified MDEP protocol begins with a scripted introduction explaining the purpose of the study. The purpose of the study was explicitly stated during the introduction to lessen the participant’s tendency to speculate about clinician or task motivation (Hengst & Duff, 2007). In addition, task changes were cued by explicitly stating a change was occurring (e.g. “Now we are going to switch gears…”, “we are going to switch gears again…”), to signal to the participant a change in goals and motivation and to alert them to the changing expectations of the clinician. Following the initial introduction, the clinician explained to the participant that she “want[s] to see how you converse with other people, and how they converse with you”. The protocol then
instructed the clinician to engage the participant in an informal conversation lasting approximately ten minutes. In line with the original MDEP protocol, no conversational topics or interview-style questions were established for the clinician. Instead, each clinician drew on her own personal repertoire of appropriate casual conversation topics (Hengst & Duff, 2007). After initiating conversation, clinicians were instructed to follow the participant’s conversational leads.

After approximately ten minutes of conversation, the MDEP protocol transitions to a set of targeted discourse tasks. Consistent with previous studies of discourse, these tasks included storytelling, picture description, and procedural discourse tasks. In contrast with traditional discourse elicitation protocols, where the clinician consistently maintains a clinical stance, in the MDEP the clinician adapted her behavior to participate as an appropriate communication partner (i.e. as an audience during story-telling and a “student” during procedural tasks).

The first targeted discourse task in the MDEP protocol is storytelling. Participants were asked to recount a frightening experience as well as a “family story”. During this task, the clinician provided appropriate backchannel support (e.g. “Wow! That’s incredible.”, “yikes!”, nodding, laughter, etc.), as well as asked for clarification when needed. Picture description tasks consisted of story retell based on a wordless picture book, description of a picture sequence, and description of a Norman Rockwell painting. The final task elicited procedural discourse, asking participants to describe how to make their favorite sandwich, how to shop in an American supermarket, and how to change a tire. During these tasks, the clinician took the perspective of a student by taking
notes, reading the procedure back to the participant, and asking if there were any aspects the participant would like to add or change.

**Data analysis**

*Transcription*

Sessions were transcribed in their entirety including task instructions, the targeted discourse tasks, and any inter-task conversation between the clinician and the participant, following conventions established in Duff et al., 2008 (Duff, Hengst, Tranel, Cohen, 2008). Transcription involved three phases and included two research assistants: an original and a consensus transcriber. In the first phase, the original transcriber transcribed the audio portion of the videotaped interaction. Audio transcription included all spoken utterances and audible sounds (e.g. tongue clicks, sighs) and made record of pause times. In phase two, the original transcriber re-watched the videorecording and transcribed all gestures produced by the participant and the clinician (e.g. head nods, hand gestures). When the original transcriber was satisfied that their transcription was an accurate representation of the verbal and nonverbal communication in the videotaped session, the consensus transcriber was asked to aid in the third phase. In this phase, the consensus transcriber and the original transcriber watched the videotaped interaction simultaneously, monitoring for errors (e.g. missed head nods, missed words) and discussing ambiguous utterances (e.g. due to unintelligibility). Together, the original transcriber and the consensus transcriber generated a final consensus transcription.
**Turn and Word Coding**

Transcripts were coded by research assistants to determine the number of interactional turns and words in a given session. Interactional turns are defined as verbal utterances and communicative nonverbals (e.g. head nods). A change in speaker indicates a turn boundary. When the clinician and participant spoke (or gestured) simultaneously, each speaker’s utterance was counted as an interactional turn.

Transcripts were also coded for “words” and “edited words”. “Words” were broadly defined and included fillers such as “uh” and “um”. Contractions (e.g. “don’t”) were counted as one word, as were proper nouns (e.g. “Des Moines” = one word). “Edited words” were calculated by determining the number of words in each discourse sample when mazes were not included. A maze was defined as any series of words that did not result in meaningful communication (Loban, 1963). Examples of mazes include exact repetition of words (except when repetition was used as emphasis), false starts or revisions (e.g. so I w- I was ), and utterances that were abandoned (e.g. I guess- What were you saying?). Nonlinguistic vocalizations (e.g. fillers such as ‘uh’ or ‘um’) and word parts (e.g. it was tri- tricky) were also excluded in edited word counts.

Coded words and turns were counted and reliability checks were performed on 15-20% of each transcript’s total turns. Sections of each transcript were selected randomly for inter- and intra-reliability measures. Intra-reliability for turns was 97.22% and inter-reliability was 91.38%. For total words, intra-rater reliability was 99.57% and inter-rater reliability was 99.29%. Edited words were coded with 99.31% intra-rater reliability and 98.33% inter-rater reliability.
Reported Speech Coding

Instances of reported speech use by both the participant and the clinician were coded independently by the author and a research assistant. A reported speech episode (RSE) included the speech being reported as well as any framing used by the speaker to indicate it as “reported” (e.g. “He said…”, “She was like…”). The initial phase of reported speech coding was a broad pass in which coders identified all possible instances of reported speech. Additionally, coders categorized each possible RSE by type and temporal domain and noted whether the speaker used prosodic or gestural markers to delineate an RSE. During the second, consensus phrase of coding, coders discussed each potential RSE. An RSE was eliminated from analysis if it was directly read (e.g. the clinician reading from the protocol; the clinician reading notes from the procedural discourse task back to the participant).

Type

Reported speech episodes were categorized independently by the author and a research assistant into one of five reported speech types: direct, indirect, indexed, projected, and undecided. Direct RSEs are defined as speech presented by the speaker as a direct quotation. In direct reported speech, the verb tense and pronoun agreement reflect the reported context (e.g. “I said, ‘Well I’m goin’ there this weekend’”). Indirect RSEs are those in which the speaker presents the reported speech as a paraphrase. In indirect reported speech, the verb tense and pronoun agreement reflect the reporting (or current) context (e.g. “He asked me what I thought I was doing”). Indexed RSEs are defined as speech that is not directly presented, but rather is “indexed” or “pointed to”.
Indexed reported speech often makes use of deictic pronouns or demonstratives to point to something previously said (e.g. “I just told this a while back” and “I heard him say that”). Projected RSEs are reported speech that has never actually been said. That is, projected RSEs include speech that might have been said, or that will or should be said (e.g. “If you’re in the Midwest you can probably ask whosoever standing next to you” and “I suppose I should have said make sure you have some money before you went”). Projected reported speech also includes instances where a speaker gives voice to animals or inanimate objects (e.g. Look at Fido! He’s saying “Give me a treat!”). Reported speech episodes were classified as “Undecided” if they were determined to be a blended form, or if they contained too many errors or were abandoned before a particular type could be adequately indicated (“They always joke about like- oh- and th- but she did finally get married”).

**Temporal Domain**

Reported speech episodes were also categorized into four temporal domains: past, in-session, future, and undecided. Reported speech episodes categorized as “past” included any RSE that reported speech from before the session. In-session RSEs included any reference to speech within the session (e.g. like I mentioned before”, “I already told you this, but”). Reported speech episodes were also classified as “in-session” if they were projected reports during the target task (e.g. when presented with a picture and asked to tell a story, participant says, “and the girl is saying ‘leave me alone’…”). Reported speech episodes were coded as “future” if they reflected speech that was anticipated. Future RSEs were typically projected in type (e.g. when she gets home she’s gonna tell you to do your homework). Finally, RSEs were labeled as “unspecified” if it was unclear
what temporal frame they fell into (because they were abandoned, etc.) or if an RSE referred to habitual thoughts or speech.

**Framing**

Each RSE was examined to determine whether framing devices were used by the participant to indicate use of reported speech. RSEs could be framed by use of a framing verb (e.g. she said), framing gesture, or a change in voicing.

**Additional Codes**

Each RSE was coded for completeness. An RSE was judged as incomplete if it was abandoned by the speaker or was incomplete due to interruption. Each RSE was also evaluated to determine if it was linguistically correct. Linguistically correct RSEs were coded as “accurate” while linguistically incorrect RSEs were coded as “errored”. Finally, RSEs were also coded by whether the speaker was reporting his or her own speech or the speech of someone else.

**Reliability**

Reliability for reported speech coding (type and temporal domain) was calculated based on a sample of approximately 15% of each participant’s total RSEs. Intra-rater reliability for reported speech type was 90.5% and inter-rater reliability was 83.8%. Intra-rater reliability for temporal domain coding was 93.2% and inter-rater reliability was 97.3%.
Statistical Analysis

The first analysis examined the frequency of reported speech use across groups. The dependent variable was the total number of RSEs across the entire session, per group. Frequency of reported speech use was compared using one-tailed t-tests of independent samples. This test was used to test the hypothesis that individuals with TBI will be impaired in reported speech use relative to healthy comparison participants.

A second analysis was conducted to examine the distribution of reported speech across types and temporal domains. These distributions of reported speech attributes are not independent and a normal distribution cannot be assumed. Therefore, nonparametric tests were used to analyze these variables.
Table 1. Demographics of Participants with TBI

<table>
<thead>
<tr>
<th>Participant</th>
<th>Sex</th>
<th>Handedness</th>
<th>Age at testing (Years)</th>
<th>Education (Years)</th>
<th>Chronicity (Years Post Onset)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3622</td>
<td>M</td>
<td>R (+100)</td>
<td>24</td>
<td>16</td>
<td>3</td>
</tr>
<tr>
<td>3625</td>
<td>M</td>
<td>R (+100)</td>
<td>38</td>
<td>11+GED</td>
<td>3</td>
</tr>
<tr>
<td>3632</td>
<td>M</td>
<td>R (+100)</td>
<td>25</td>
<td>16</td>
<td>6</td>
</tr>
<tr>
<td>3641</td>
<td>M</td>
<td>R (+100)</td>
<td>70</td>
<td>20</td>
<td>14</td>
</tr>
<tr>
<td>3656</td>
<td>F</td>
<td>R (+100)</td>
<td>48</td>
<td>18</td>
<td>2</td>
</tr>
<tr>
<td>3691</td>
<td>M</td>
<td>R (+100)</td>
<td>59</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td>3694</td>
<td>F</td>
<td>R (+100)</td>
<td>53</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td>3696</td>
<td>F</td>
<td>R (+100)</td>
<td>60</td>
<td>14</td>
<td>2</td>
</tr>
<tr>
<td>3702</td>
<td>M</td>
<td>R (+100)</td>
<td>63</td>
<td>15</td>
<td>3</td>
</tr>
<tr>
<td>3704</td>
<td>F</td>
<td>R (+100)</td>
<td>43</td>
<td>16</td>
<td>2</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td></td>
<td>48.30</td>
<td>15.20</td>
<td>4.60</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td></td>
<td></td>
<td>15.73</td>
<td>2.66</td>
<td>3.66</td>
</tr>
</tbody>
</table>

Note: M = male; F = female; R = right; GED = General Education Development;
Table 2. TBI Etiology and Severity

<table>
<thead>
<tr>
<th>Participant number</th>
<th>Etiology</th>
<th>GCS</th>
<th>Acute neuroimaging results</th>
<th>RA</th>
<th>PTA</th>
</tr>
</thead>
<tbody>
<tr>
<td>3622</td>
<td>Fall</td>
<td>8</td>
<td>Bifrontal contusion</td>
<td>None</td>
<td>2 days</td>
</tr>
<tr>
<td>3625</td>
<td>MVA</td>
<td>13</td>
<td>Subarachnoid hemorrhage bilaterally, focal hyperdensity in the right temporal lobe</td>
<td>None</td>
<td>7 weeks</td>
</tr>
<tr>
<td>3632</td>
<td>Fall</td>
<td>n/a</td>
<td>Basilar skull fracture and concussive sensorineural hearing loss</td>
<td>n/a</td>
<td>24 hr</td>
</tr>
<tr>
<td>3641</td>
<td>Fall</td>
<td>n/a</td>
<td>CT: small bleed</td>
<td>n/a</td>
<td>24 hr</td>
</tr>
<tr>
<td>3656</td>
<td>Unhelmeted MVA</td>
<td>6</td>
<td>Subarachnoid hemorrhage, intraparenchymal hemorrhages, intraventricular hemorrhage</td>
<td>n/a</td>
<td>3-4 months</td>
</tr>
<tr>
<td>3691</td>
<td>Fall</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>1-2 weeks</td>
</tr>
<tr>
<td>3694</td>
<td>Fall</td>
<td>15</td>
<td>CT: Bifrontal hemorrhagic contusion, no diffuse axonal injury</td>
<td>6 hours</td>
<td>1 week</td>
</tr>
<tr>
<td>3696</td>
<td>Fall</td>
<td>n/a</td>
<td>Subarachnoid hemorrhage involving left precentral sulcus</td>
<td>n/a</td>
<td>4-5 hours</td>
</tr>
<tr>
<td>3702</td>
<td>MVA</td>
<td>n/a</td>
<td>MRI: Normal</td>
<td>1 month</td>
<td>22 months</td>
</tr>
<tr>
<td>3704</td>
<td>Assault</td>
<td>n/a</td>
<td>Traumatic subarachnoid hemorrhage, bifrontal contusions</td>
<td>15 minutes</td>
<td>24 hours</td>
</tr>
</tbody>
</table>

Note: MVA = motor vehicle accident; n/a = not available
Table 3. Performance on Neuropsychological Measures for Participants with TBI

<table>
<thead>
<tr>
<th></th>
<th>Intelligence</th>
<th>Memory</th>
<th>Language</th>
<th>Executive Function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WAIS-III FSIQ</td>
<td>WMS-III GMI</td>
<td>AVLT TR5/DR</td>
<td>BNT</td>
</tr>
<tr>
<td>3622</td>
<td>117</td>
<td>132</td>
<td>15/12</td>
<td>n/a</td>
</tr>
<tr>
<td>3625</td>
<td>89</td>
<td>n/a</td>
<td>14/11</td>
<td>53</td>
</tr>
<tr>
<td>3632</td>
<td>120</td>
<td>111</td>
<td>15/14</td>
<td>53</td>
</tr>
<tr>
<td>3641</td>
<td>113</td>
<td>115</td>
<td>14/11</td>
<td>60</td>
</tr>
<tr>
<td>3656</td>
<td>85</td>
<td>75</td>
<td>3/4</td>
<td>58</td>
</tr>
<tr>
<td>3691</td>
<td>80</td>
<td>103</td>
<td>12/11</td>
<td>58</td>
</tr>
<tr>
<td>3694</td>
<td>112</td>
<td>111</td>
<td>13/12</td>
<td>60</td>
</tr>
<tr>
<td>3696</td>
<td>112</td>
<td>n/a</td>
<td>14/14</td>
<td>59</td>
</tr>
<tr>
<td>3702</td>
<td>107</td>
<td>114</td>
<td>8/3</td>
<td>57</td>
</tr>
<tr>
<td>3704</td>
<td>113</td>
<td>n/a</td>
<td>15/15</td>
<td>56</td>
</tr>
<tr>
<td><strong>M</strong></td>
<td><strong>104.80</strong></td>
<td><strong>108.71</strong></td>
<td><strong>12.30/10.70</strong></td>
<td><strong>57.11</strong></td>
</tr>
<tr>
<td><strong>SD</strong></td>
<td><strong>14.45</strong></td>
<td><strong>17.27</strong></td>
<td><strong>3.89/4.06</strong></td>
<td><strong>2.67</strong></td>
</tr>
</tbody>
</table>

Note: M = Mean; SD = Standard Deviation; WAIS-III FSIQ = Wechsler Adult Intelligence Scale-III Full Scale IQ; WMS-III GMI = Wechsler Memory Scale-III General Memory Index; AVLT TR5/DR = Auditory Verbal Learning Test Trial 5/Delayed Recall; BNT = Boston Naming Test; TT = Token Test; WAB = Western Aphasia Battery; WCST CAT/PE = Wisconsin Card Sorting Test Categories/Perseverative Errors; n/a = not available; **bolded** scores indicate performance two standard deviations below population means
Table 4. Comparison Participant Demographics

<table>
<thead>
<tr>
<th>Participant number</th>
<th>Sex</th>
<th>Handedness</th>
<th>Age at testing (Years)</th>
<th>Education (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3622c</td>
<td>M</td>
<td>R</td>
<td>19</td>
<td>14</td>
</tr>
<tr>
<td>3625c</td>
<td>M</td>
<td>R</td>
<td>32</td>
<td>18</td>
</tr>
<tr>
<td>3632c</td>
<td>M</td>
<td>R</td>
<td>21</td>
<td>15</td>
</tr>
<tr>
<td>3642c</td>
<td>M</td>
<td>R</td>
<td>44</td>
<td>14</td>
</tr>
<tr>
<td>3656c</td>
<td>F</td>
<td>R</td>
<td>43</td>
<td>16</td>
</tr>
<tr>
<td>3691c</td>
<td>M</td>
<td>R</td>
<td>56</td>
<td>15</td>
</tr>
<tr>
<td>3694c</td>
<td>F</td>
<td>R</td>
<td>53</td>
<td>13</td>
</tr>
<tr>
<td>3696c</td>
<td>F</td>
<td>R</td>
<td>56</td>
<td>14</td>
</tr>
<tr>
<td>3702c</td>
<td>M</td>
<td>R</td>
<td>65</td>
<td>16</td>
</tr>
<tr>
<td>3704c</td>
<td>F</td>
<td>R</td>
<td>36</td>
<td>18</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td></td>
<td>42.50</td>
<td>15.30</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td></td>
<td></td>
<td>15.46</td>
<td>1.70</td>
</tr>
</tbody>
</table>

Note: M = male; F = female; R = right
Figure 1. MDEP Materials for Picture Description Tasks
Figure 2. MDEP Materials for Story Retell Task
CHAPTER 3
RESULTS

There were no significant differences between groups in the number of total words produced by both the participant and the clinician in a session (t(18) = .459, p = .651) or in total edited words (t(18) = .393, p = .699). When words produced by the clinician were not taken into account, participants with TBI produced an average of 3,291 words per session (SD: 676) and healthy comparison participants produced an average of 3,372 words per session (SD: 1,215), a difference which was not statistically significant (t(18) = -.184, p = .856).

There were no significant differences in number of turns per session. (t(18) = .791, p = .439). An average of 372 turns were taken in TBI sessions (SD: 92) and an average of 334 turns were taken in comparison sessions (SD: 118).

Frequency of Reported Speech - Participants

Reported speech was observed in all 20 of the sessions analyzed, with a range of 8 to 85 RSEs per participant. Participants with TBI produced an average of 21.4 RSEs (SD: 10.9) with a range of 8 to 44 RSEs. Healthy comparison participants produced an average of 29.0 RSEs (SD: 21.1) and a range of 10 to 85. This difference was not statistically significant, t(18) = -1.012, p = .325. Figure 3 illustrates RSE frequencies between participant groups.

Distribution of Reported Speech Type

The distribution of reported speech type was similar across groups. For participants with TBI, an average of 36.1% of total RSEs were direct (SD = 16.9%),
42.9% were indirect (SD = 15.0%), 9.1% were index (SD = 7.2%), 8.4% were projected (SD = 7.7%), and 4.5% were undecided in type (SD = 4.9%). For healthy comparison participants, an average of 45.3% of total RSEs were direct (SD = 14.6%), 34.1% were indirect (SD = 18.8%), 6.4% were index (SD = 8.0%), 11.3% were projected (SD = 6.1%), and 2.9% were undecided in type (SD = 3.4%). Differences in distributions of reported speech types were analyzed using nonparametric tests. No statistically significant differences were found for distributions of any reported speech type using a related-samples Wilcoxon signed rank test. Distributions of direct RSEs were found to be the same across groups (p = .203), as were distributions of indirect RSEs (p = .260), indexed RSEs (p = .477), projected RSEs (p = .374), and RSEs with undecided type (p = .407). Figures 5 and 6 illustrate the distributions of RSE type in both participant groups.

**Distribution of Reported Speech Temporal Domain**

The distribution of reported speech across temporal domain was also remarkably similar across groups. For participants with TBI, an average of 43.8% of total RSEs were past (SD = 14.8%), 50.7% were in-session past (SD = 14.7%), 3.9% were future (SD = 6.0%), and 1.7% were undecided in temporal domain (SD = 3.6%). For healthy comparison participants, an average of 52.1% of total RSEs were past (SD = 18.0%), 42.1% were in-session past (SD = 18.2%), 3.9% were future (SD = 4.4%), and 2.0% were undecided in temporal domain (SD = 3.3%). Differences in distributions of reported speech temporal domains were analyzed using nonparametric tests. No statistically significant differences were found for distributions of any reported speech temporal domain using a related-samples Wilcoxon signed rank test. Distributions of past RSEs were found to be the same across groups (p = .333), as were distributions of in-session
past RSEs (p = .203), future RSEs (p = .933), and RSEs with undecided temporal domain (p = .893). Figures 7 and 8 illustrate the distributions of RSE temporal domains in both participant groups.

**Self/Other**

Participants with TBI reported their own speech (self-report) in an average of 27.5% of their total RSEs (SD = 12.8%). These participants reported the speech of others (other-report) in an average of 72.5% of their total RSEs (SD = 12.8%). Healthy comparison participants reported their own speech (self-report) in an average of 33.9% of their total RSEs (SD = 11.3%). These participants reported the speech of others (other-report) in an average of 66.1% of their total RSEs (SD = 11.3%). Figure 9 illustrates the proportions of self- and other-reporting by participants with TBI and comparison participants.

**Framing**

Participants with TBI used framing verbs in an average of 84.1% of their total RSEs (SD = 12.3%). Healthy comparison participants used framing verbs in an average of 87.4% of their total RSEs (SD = 8.6%). Participants with TBI used framing gestures during an average of 26.3% of their total RSEs (SD = 18.3%). Healthy comparison participants used framing gestures during an average of 31.7% of their total RSEs (SD = 16.3%). Participants with TBI used a signaling voice in an average of 18.5% of their total RSEs (SD = 17.1%). Healthy comparison participants used a signaling voice in an average of 37.0% of their total RSEs (SD = 17.4%). Figure 10 illustrates the proportions of framing strategies used by participants with TBI and healthy comparison participants.
Figure 3. Average Frequency of RSEs Produced by Participants
Figure 4. Average Frequency of RSEs by Type
Figure 5. Average Proportion of RSE Type
Figure 6. Average Frequency of RSE Temporal Domains
Figure 7. Average Proportion of RSE Temporal Domains
Figure 8. Average Proportion of Self/Other Reporting
Figure 9. Average Percentage of RSEs with Framing Strategies
CHAPTER 4
DISCUSSION

Summary

The current study examined the use of reported speech by individuals with traumatic brain injury compared to reported speech use by healthy comparison participants. The primary question of interest was:

In the context of social interaction, are there differences in the quantity or quality of reported speech in adults with traumatic brain injury versus healthy non-brain injured comparison participants?

Contrary to initial hypotheses, participants with TBI did not significantly differ from healthy comparison participants in the frequency with which they utilized reported speech. Participants with TBI produced all reported speech subtypes in similar proportions to those of healthy comparison participants. Participants with TBI also showed no differences in the proportions of temporal domains (e.g. past, in-session, future) represented in their reported speech episodes. These results were surprising given the social communication impairments considered to be a hallmark deficit in TBI and the interactional nature of reported speech use. Though the communication partners of individuals with TBI report that these individuals are less interesting than healthy communication partners, they are not using less of this interactional discourse resource.

The lack of an impairment in reported speech use in our participants with TBI is particularly striking compared to deficits in reported speech seen individuals with hippocampal amnesia (Duff et al., 2007). Though individuals with amnesia produced similar proportions of reported speech subtypes, they produced half as many RSEs as
healthy comparison participants. These results suggest that the hippocampus is a critical neural substrate for successful reported speech use. Given that hippocampal damage is common following TBI (Bachman, 1992; Hunkin, Parkin, Bradley, & Burdon-Cooper, 1995), we expected impairments in memory following TBI to negatively impact the frequency of reported speech use in our participants with TBI. In fact, since individuals with TBI have more widespread deficits than patients with focal hippocampal damage, we might have expected to observe an even greater impairment in the frequency of reported speech use. Several possible explanations for these surprising results are described below.

**Severity of TBI and Impairment**

Though severity of traumatic brain injury is notoriously difficult to measure, based on Glasgow Coma Scales two of our participants were classified as sustaining a “severe” TBI, two were classified as sustaining a “mild” TBI, and the remaining six did not have available GCS scores. It may be that the participants in this study did not show deficits in reported speech use because as a group their injuries were not severe enough to cause disruptions in this discourse practice. Since reported speech use has been noted to be a very robust practice in healthy adults (Myers, 1999), it may take considerable disruption in cognitive abilities to create impairments in the use of reported speech.

To investigate this possibility, reported speech frequency was compared in two individuals with “severe” TBI (as determined by initial Glasgow Coma Scale scores) and two individuals with “mild” TBI. Participants 3622 and 3656 were considered to have sustained a “severe” TBI. These participants produced 15 and 44 RSEs, respectively.
The two participants with “mild” TBI (3625 and 3694) produced 8 and 23 RSEs, respectively. The participant with the lowest Glasgow Coma Scale score (3656, GCS: 6) produced the most RSEs of any participant with TBI. These single cases appear to contradict the notion that severity of TBI negatively impacts the frequency of reported speech use.

There is some variability in the sample of participants with TBI. However, all participants were in the chronic epoch of recovery (more than 1 year post-onset) and had stable neuropsychological profiles that, as a group, fell broadly within normal limits. In particular, only one participant with TBI (3656) had impairments in memory. This participant’s memory impairment was not severe enough to be classified as “densely amnesic”. The operational definition of amnesia used to identify participants for the Duff et al., 2007 study is a Wechsler Memory Scale-III General Memory Index score that is at least 25 points lower than a participant’s score on the Wechsler Adult Intelligence Scale-III. Within the group of participants with TBI, 3656 had the most impaired memory scores, but used reported speech at the highest frequency (44 RSEs across the session). Therefore, it appears that degree of memory impairment is a better predictor of impairment in reported speech use than a diagnosis of TBI and that a profound deficit in memory is required before disruptions in reported speech are observed. This is in line with previous work in patients with amnesia and focal vmPFC damage (Duff, Hengst, Tranel, & Cohen, 2007; Duff, Ballard, Bachelder, & Tranel, 2009).
Reported Speech and Social Communicative Competence

Results of this study raise questions about the role of reported speech in interpersonal communication. Anecdotal observation and previous studies strongly suggest social communicative deficits in TBI, but participants in this study did not show apparent deficits in reported speech use. Despite the assertion that reported speech fosters emotional connections and interpersonal involvement between communication partners, participants in this study did not show impairments in reported speech use.

Further support for the possibility that reported speech does not adequately reflect social communicative competence is found in a previous study in which individuals with profound deficits in social and emotional processing due to vmPFC damage did not differ from healthy comparison participants in their use of reported speech (Duff, Ballard, Bachelder, & Tranel, 2009). Results of this study and previous studies of reported speech may indicate that reported speech use taxes cognitive processes such as memory more than it functions as an indicator of social communicative aptitude (Duff, Hengst, Tranel, & Cohen, 2007; Duff, Ballard, Bachelder, & Tranel, 2009).

Conversely, it may be that reported speech is an appropriate measure of social communication but the methods utilized in this study for eliciting and coding reported speech do not fully capture the interpersonal and social functions of reported speech. Deficits in reported speech may have emerged if discourse was elicited in a different manner (e.g. in more natural conversational settings outside the laboratory; use of different discourse elicitation tasks; conversation with known communication partners). The discourse elicitation methods utilized in this study did not require participants to reveal potentially controversial opinions. Thus, the methods utilized in this study may
not have elicited kinds of reported speech that function to align or distance a speaker from a particular opinion. If discourse were elicited in a similar manner to the focus groups examined by Myers, it is possible that these functions of reported speech would have been elicited (Myers, 1999). It may be that individuals with TBI would show deficits in the ability to use reported speech as social alignment or detachment, or to display empathy or solidarity, as do healthy participants in focus group studies (Myers, 1999). Finally, differences in reported speech may be present in this data set but were not captured by the coding procedures used. Individuals with TBI may have deficits in aspects of reported speech use outside of reported speech frequency, type, or temporal domain.

**Number of RSEs per Session**

During coding and analysis of reported speech episodes in this study, it was noted that the total number of RSEs per session was significantly depressed compared to previous studies using this protocol. In a study of reported speech use in patients with focal vmPFC damage, sessions using the original MDEP protocol elicited an average of 72.9 RSEs per session (SD: 42.4). In contrast, an average of 30.5 RSEs per session were elicited in this study (SD: 17.7). It is unclear what is driving the reduced frequency of RSEs in these sessions when compared to previous studies of adults with amnesia (Duff, Hengst, Tranel, & Cohen, 2007) and focal damage to the ventromedial prefrontal cortex (Duff, Ballard, Bachelder, & Tranel, 2009). All three studies included healthy comparison participants. It is surprising that these participants would show such a significant depression of RSEs per session.
Possible explanations for this discrepancy will be explored below. First, participants with TBI are generally younger than patients with focal hippocampal and vmPFC damage. This difference in average group age may be driving the decreased use of reported speech. Second, in this study changes were made to the MDEP protocol to accommodate a larger study comparing the MDEP protocol to the TalkBank protocol. It is possible that these changes negatively impacted the amount of reported speech produced in each session. Finally, individual clinicians can be more or less successful in their implementation of the MDEP protocol as an interactive and collaborative communicative interaction. It is possible that lapses in fidelity of protocol implementation lead to a decrease in reported speech use.

**Age of Participants**

The socioemotional selectivity theory (SST) submits that social interaction serves to accomplish three universal goals: the acquisition of information, the development and maintenance of self-concept, and the regulation of emotion (Carstensen, 1993). SST argues that the motivations for social interaction evolve over the lifespan and that with aging, the relative importance of each of these social goals changes (Carstensen, 1993). This theory suggests that in old age, emotion is the leading motivating factor in social interaction (Carstensen, 1993). As people age, the range of their social partners decreases and their opportunities for social contact diminish. These changes in social environment lead to changes in the significance of certain social goals – decreases in some and increases in others. Despite a decrease in *quantity* of social interaction in the elderly population, older adults report increasing satisfaction with the *quality* of their relationships as they age (Field & Minkler, 1988).
Specifically, SST proposes that the first goal of social interaction - acquisition of information - is more motivating early in life but that its strength as a motivator decreases over time. In young adulthood, transmission of information is a central social goal. For example, the large social functions attended by adolescents present allow many opportunities for acquiring information (particularly social information, e.g. “Who’s dating whom?”, “Who’s ‘cool’ and who’s not”, “How should I act in [this] situation?”). While potential to gain information is relatively high, the potential for meaningful interaction in these social settings is often low. SST hypothesizes that adolescents are motivated to attend large social functions (although they will reap fewer affective gains) because of the diversity of their potential interactions and the increased potential for acquiring information. By middle age, the frequency of attendance at these types of large social functions decreases significantly. For example, the informal gatherings of adults in middle age tend to be smaller and are made up of participants from a restricted range of social partners. SST hypothesizes that as adults age, basic information about social interaction has already been obtained through life experience. For these reasons, SST hypothesizes that acquisition of novel information becomes less motivating over time.

The second universal goal of social interaction is the development and maintenance of self-concept. Proponents of SST suggest that self-concept remains a significant social goal throughout the aging process, but that the focus of this goal shifts. In adolescence, social interactions serve to develop self-concept. Social interaction in adolescence and early adulthood crystalizes the understanding of “self” through contact with other people (e.g. “I am like this person”, “I am not like that person”). In later adulthood, the focus transfers to the maintenance of self-concept. Because self-concept
is better established by late adulthood, the drive to seek interactions with a diverse social network might lessen. In fact, SST proposes that a well-established sense of self might drive older adults to be increasingly *selective* in their social partners (e.g. socializing only with those with similar outlooks and opinions), in an effort not to “upset” their understanding of their identity.

The third universal social goal suggested by SST is regulation of emotion. Social interaction is thought to a medium for emotional regulation. For example, adults may seek social contact during challenging life circumstances and may rely on their communication partners to initiate positive emotions. In SST, Carstensen argues that the emotional fulfillment provided by social contact becomes a more prominent goal as individuals age and that older adults may be more motivated to actively pursue positive emotional experiences (Carstensen, 1993). SST suggests that increased attention to positive emotional interactions is driven by the life stage of older adults. That is, as older adults near end-of-life, they are more motivated to avoid challenging interactions in favor of more positive interactions, and are more likely to invest energy in proactively *constructing* positivity in their interactions.

If older and younger adults differ in their social interactional goals, these differences in motivation might also impact the ways in which they communicate. It is possible that younger adults would favor styles of communication that facilitate transmission of information, while older adults would be more likely to use styles of communication that establish and maintain positive emotional bonds or serve to maintain a particular identity or sense of self.
Participants in this study are significantly younger than participants in previous studies of reported speech. It may be that older adults use reported speech more than younger adults. If this is the case, aspects of socioemotional selectivity theory might be hypothesized to apply to social communication in addition to social interaction more broadly. If younger adults use reported speech with less frequency than older adults, it may be that younger adults are more interested in fast transmission of information. In contrast, older adults may use reported speech more frequently because they are prioritizing goals of emotional regulation over information acquisition goals. These results would align with a previous study of storytelling across groups of younger and older adults. In this study, older adults showed an emphasis on emotion rather than information (Pasupathi, Henry, & Carstensen, 2002). This study suggested that “the differences between older and younger adults' behavior in this context may be interpreted as reflecting attempts to make the interaction more meaningful and emotional” (Pasupathi, Henry, & Carstensen, 2002). Additionally, older adults have been reported to be more skillful storytellers from an adult listener's perspective than younger adults (Kemper, Kynette, Rash, O'Brien, & Sprott, 1989; Kemper, Rash, Kynette, & Norman, 1990; Pratt & Robins, 1991). Given that reported speech use enhances storytelling by increasing listener engagement, it is possible that older adults’ improved story-telling abilities arise out of superior use of reported speech.

To examine the possibility that reported speech use may be impacted by age, the frequency of reported speech use by the youngest and oldest participants from each group was examined. The youngest participants, 3622 (age 24) and 3622c (age 19), produced 15 and 23 RSEs, respectively. The oldest participants, 3641 (age 70) and 3702c (age 65)
produced 25 and 16 RSEs, respectively. These single cases appear to contradict the hypothesis that the age of participants impacted the frequency of reported speech use.

**Changes to MDEP protocol**

As previously stated, changes were made in the original MDEP protocol (Hengst & Duff, 2007) to accommodate a broader studying comparing discourse elicitation protocols. The MDEP was modified to better align with the structure of the TalkBank protocol (MacWhinney, 2007). These changes included the removal of one narrative (“Tell me where you were and how you learned about [prominent world event]”) and one picture description task (picture of the World Trade Center). The changes also included changing the “Cookie Theft” picture description task to a picture sequence description and the addition of a story retell task (the story of Snow White). It is possible that these changes in the original protocol resulted in the decreased frequency of reported speech across sessions.

The removal of a narrative in particular might result in decreased reported speech use, as narratives in particular foster reported speech use (Besnier, 1992). However, it is unlikely that the changes in the protocol resulted in such a large decrease in reported speech use, as the highest proportions of reported speech use in previous studies were found in inter-task talk, rather than the targeted discourse tasks (including narratives). Therefore, perhaps the decreased frequency of reported speech use could be attributed to an overall decrease in inter-task talk. This might be explained by improper implementation of the MDEP protocol, as described below.
Role of the Clinician

In contrast with more traditional discourse elicitation protocols in which the clinician is expected to participate very little, the Mediated Discourse Elicitation Protocol relies on a skillful clinician who is able to transition between various communicative roles. The MDEP protocol is interactive and intended to be a more natural and situated means of eliciting samples of discourse. As such, the MDEP protocol can be challenging to implement for clinicians used to a more traditional, evaluative discourse elicitation approach. They may be more inclined to sit back and evaluate the participant’s communicative competence without the “scaffolding” of an interactive communication partner. In fact, during the development of the original MDEP protocol, an experienced clinician involved in its development initially had difficulty transitioning between a “clinician” role and one of a responsive communication partner (Hengst & Duff, 2007).

Results of this study may have been impacted by how closely the clinicians were able to follow the MDEP protocol. The MDEP protocol was designed to maximize opportunities for natural, collaborative, and interactional discourse. However, even seasoned clinicians can have difficulty transitioning to a more interactive style (Hengst & Duff, 2007). If fidelity of MDEP protocol implementation was not maintained across sessions, this may have impacted reported speech use and masked possible group differences.

Limitations of the Study

This study was limited by several factors including heterogeneity in the group of participants with TBI, lack of fidelity of implementation of the MDEP protocol, and a
relatively small sample size. These limitations negatively impact generalization of these findings to a larger population. Because TBI results in diffuse damage and presents as a unique constellation of cognitive and communicative deficits, it is difficult to recruit relatively homogenous participant pools (e.g. with similar anatomical damage and similar cognitive deficit profiles). Due to the heterogeneity of the group and small sample size, it is difficult to pinpoint whether reported speech is entirely unaffected by TBI or if reported speech use would be impaired in a more homogenous, severely impaired group. Finally, neuropsychological measurements were not available for all participants in this study, making it difficult to draw conclusions about specific deficits’ impact on reported speech use.

**Future Research**

Future studies should include replication of these results with larger groups of participants with TBI with more similar profiles of cognitive deficits. In addition, future replications of this study could include qualitative ratings of the interactional quality of each session, as rated by observers blind to study hypotheses. These ratings might be used to determine whether frequency of reported speech use predicts any particular aspect of social communication. Due to the decreased use of reported speech across sessions (including healthy comparison sessions) in this study as compared to previous studies of reported speech, the role of age in reported speech use should be investigated. It would be interesting to investigate whether younger participants use less reported speech or differing distributions of reported speech types as compared to older participants. Future studies should also examine the effects on reported speech use of manipulating discourse tasks within discourse elicitation protocols. Finally, future studies should investigate the
use of signaling voices in individuals with TBI and healthy adults. In this study, it was noted that though both participants with TBI and healthy comparison participants used signaling voices in similar proportions, participants with TBI were more flat in affect and used less variability in their voice than did healthy comparison participants. Future studies should attempt to quantify this qualitative observation.
APPENDIX A

TRAUMATIC BRAIN INJURY REGISTRY

NEUROPSYCHOLOGICAL BATTERY

1. Intellectual and achievement abilities
   a. Wechsler Adult Intelligence Scale-IV (Wechsler, 2008)
   b. Wide Range Achievement Test-4: Reading, Spelling and Arithmetic Subtests (Wilkinson, 1993)

2. Memory
   a. Benton Laboratory Orientation Questionnaire (Benton Laboratory, 1976)
   b. Wechsler Memory Scale-III (Wechsler, 1997)
   c. Auditory-Verbal Learning Test: standard administration, 24-hour delayed recall and recognition trials (Rey, 1964)
   d. Benton Visual Retention Test (Administration A) (Sivan, 1991)
   e. Complex Figure Test - delayed recall (standard) and 24-hour delayed recall (Knight & Kaplan, 2004)
   f. Brief Visual Memory Test-Revised (Benedict, 1997)
   g. Recognition Memory Test (Warrington, 1984)
   h. Rotor Pursuit (Corkin, 1968)
   i. Mirror Tracing Test (Milner, 1962)
   j. Bead Memory Subtest from the Stanford-Binet IV Intelligence Scales (Thorndike et al., 1986)
   k. Iowa Autobiographical Memory Questionnaire (Tranel & Jones, 2005)
   l. Iowa Famous Faces Test (Tranel, 2006)
   m. Boston Remote Memory Battery (Albert et al., 1979): Multiple Choice Questionnaire; and Recall Questionnaire

3. Speech and Language
   a. Multilingual Aphasia Examination (Benton & Hamsher, 1978)
   b. Boston Diagnostic Aphasia Examination, Third Edition (Goodglass et al., 2000)
   c. Boston Naming Test (Goodglass et al., 2000)
   d. Assessment of Writing (Benton Laboratory)
   e. Iowa-Chapman Reading Test (Manzel & Tranel, 1999)
   f. Clinical Speech Ratings (Benton Laboratory, BDAE)
   g. Clinical Elicitation of Singing (Benton Laboratory)
   h. Assessment of Gestural & Buccofacial Praxis (Benton Laboratory)
   i. Category Fluency Test (Benton Laboratory)

4. Perception and Attention
   a. Facial Recognition Test (Benton et al., 1983)
b. Judgment of Line Orientation Test (Benton et al., 1983)
c. Hooper Visual Organization Test (Hooper, 1983)
d. Agnosia Screening Evaluation (Benton Laboratory)
e. Screening evaluation for visual, auditory, and tactile neglect (Benton Laboratory)
f. Useful Field of View Test (Ball & Owsley, 1993)

5. Visuoconstruction
   a. Complex Figure Test-Copy (Knight & Kaplan, 2004)
   b. Drawing of a clock, a house, and a bicycle (Lezak et al., 2004)
   c. Three Dimensional Block Construction (Benton et al., 1983)
   d. Psychomotor and psychosensory functions
   e. Purdue Grooved Pegboard Test (Lafayette Instruments)
   f. Right-Left Discrimination (Benton et al., 1983)
   g. Finger Localization/Recognition (Benton et al., 1983)
   h. Dichotic Listening
      (adapted from Kimura, 1967; Damasio & Damasio, 1979)
   i. Line Cancellation Test (Benton et al., 1993)
   j. Smell Identification Test (Sensonics, Inc.)

6. Executive functions
   a. Trail-making Test (Reitan & Wolfson, 1985)
   b. Wisconsin Card Sorting Test (Heaton et al., 1993)
   c. Stroop Color and Word Test (Golden, 1978)
   e. Category Test (Halstead, 1947; DeFilippis, McCampbell, & Rogers, 1979)
   f. Tower of London Test (Shallice, 1982)
   g. Tower of Hanoi Test (Glosser & Goodglass, 1990)
   h. Proverbs Test (Gorham, 1956)

7. Personality and affect:
   a. Behavior Check List - Current Function (Patient, Relative, and Examiner Versions) (Benton Laboratory)
   b. Beck Depression Inventory (Beck et al., 1961)
   c. Beck Anxiety Inventory (Beck, 1993)
   d. Minnesota Multiphasic Personality Inventory-2 (MMPI-2) (Hathaway & McKinley, 1951, 1989)
   e. Iowa Scales of Personality Change (Barrash et al., 2000)

8. Premorbid status
   a. Geschwind-Oldfield Handedness Questionnaire (Oldfield, 1971)
   b. Patient Biography Form-Patient Version (Benton Laboratory)
   c. Patient Biography Form-Relative Version (Benton Laboratory)
   d. National Adult Reading Test (NART; Nelson & Willison, 1991)
APPENDIX B
MEDIATED DISCOURSE ELICITATION PROTOCOL

Introduction:

“This is a research project on Language, Memory, and Emotion. We are interested in how people with and without brain damage use language everyday to get along in the world. Specifically, we are interested in looking at the way people can use language to interact with others, to express their ideas, and to think and remember. So, in the time we have together, I am going to ask you to do some things for me in these areas.”

Activities:

1. Using Language to Interact with Others
   a. Conversation – “I want to see how you converse with other people, and how they converse with you. So, here I am just interested in your conversational abilities. We can talk about any topics we want and I’d like, as much as possible, for this to be similar to the kinds of conversations you have in your daily life.”

2. Using Language to Express Ideas – “Now we are going to switch gears and I am going to have you do some different things for me so I can see you use language. I am going to have you do 3 different things.”

   A. Story Telling – “For the first one I am going to have you tell me some stories. Do you consider yourself a good storyteller? Are you the family storyteller?” (Clinician provides backchannel support – be a good audience: f/u with “Have you told/talked about that story a lot?” Follow 30-second rule – clarification question cues.)
      a. Tell me about a frightening experience
      b. Family Story (can be one you’ve told a lot, or a story that is a favorite in your family)

   B. Picture Description – “We are going to switch gears again. I am going to have you look at a picture book and some pictures.” (Clinician as teacher – make sure they talk about everything. Follow 30-second rule – visual direction – scanning cues).
      a. Snow White story (allow to look at book for a few minutes, then put book away)
      b. Picture sequence- Look at this carefully and tell me everything you see happening in these pictures.
      c. Norman Rockwell

   C. Procedural – “For the last one, I want you to tell me how to do things. I am going to write down everything you tell me and when you are done, I’ll read it
back to you. After I read it back to you, you can let me know if you think of anything else to add.” (Clinician as student – note taker).

a. Tell me how you make your favorite sandwich. (Clinician writes down procedures).

“Now I am going to read this back to you.

Do you want to add or change anything?”

b. Pretend I’m from Timbuku and I don’t know how to shop in a supermarket. Tell me everything I need to shop in an American supermarket.

“Now I am going to read this back to you.

Do you want to add or change anything?”

c. Tell me how to change a tire on a car or a truck?

“Now I am going to read this back to you.

Do you want to add or change anything?”
**APPENDIX C**

**TRANSCRIPTION CONVENTIONS**

- **BOLD**
  - Loud or marked voice for emphasis

- **(what)**
  - Questionable transcription (sounds, including vocalizations, are in grey)

- **XXXXXX**
  - Unintelligible sequence, each X roughly one syllable length

- **…3…**
  - Number of seconds of silence

- **…**
  - Notes a pause in speech of less than one second

- **^^h**
  - Audible inhalations and exhalations (or sighs)

- **[cough]**
  - Description of nonspeech sounds

- **We- well-**
  - Word cut off short or abandoned

- **O:::kay**
  - Indicates prolonged sound or syllable

- **Hey dad,**
  - Voice spoken with decreased intensity

- **Whistle**
  - Words cross speakers with closely matched intonational pattern

- **Okay**

- **/gin/**
  - Phonetic transcription using International Phonetic Alphabet

- **HEY**
  - Shout or loud voice relative to surrounding speech

- **s l o w**
  - Stretched out or slower rate relative to surrounding speech

- **hurryup**
  - Rapid rate relative to surrounding speech

- **Okay.**
  - Period (.) indicates end of turn intonation

- **A dog,**
  - Comma (,) indicates questioning intonation pattern

- **S K I**
  - Speaker is saying the names of letters, as if spelling out loud
<table>
<thead>
<tr>
<th>*flapping arms</th>
<th>Activity note in black, correlates temporally to * in line of speech produced by that person. Used here primarily to record iconic gestures</th>
</tr>
</thead>
<tbody>
<tr>
<td>m hm</td>
<td>Nasal agreement</td>
</tr>
<tr>
<td>uh huh</td>
<td>Oral agreement</td>
</tr>
<tr>
<td>m m</td>
<td>Nasal disagreement</td>
</tr>
<tr>
<td>uh uh</td>
<td>Oral disagreement</td>
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REFERENCES


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