The Effects of Auditory Distraction on Discourse Retell Tasks in Traumatic Brain Injury

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Abstract

The purpose of this study was to examine the effects of auditory distraction on the discourse production abilities of adults with traumatic brain injury. Narrative and persuasive discourse-retelling abilities were compared in ten adults with traumatic brain injury (TBI) and ten healthy, aged-matched control participants. Narrative and persuasive retellings were analysed according to language measures (e.g. number of words, number of T-units, mean length of T-units and sentential complexity); information measures (e.g. number of propositions, number of episodic structure elements, and number of global structure components) and ability to generate a moral or aim. A modified version of Damico's Clinical Discourse Analysis (1992) was included as a further measurement of pragmatic ability for the persuasive genre. The effect of auditory distraction upon passage recall and discourse production abilities was investigated by employing two experimental conditions: (1) no distraction and (2) multitalker babble at 80db. The adults with TBI differed significantly from the non-TBI comparison group for the language domain (sentential complexity), information domain (episodic structure) and generation of a moral or aim. Significant genre differences were documented, for the language domain (number of words and number of T-units), all measures in the information domain, and generation of a moral or aim. No condition effect was found, across group or genre. The results are examined alongside a number of theories including working memory, genre demands and perception of distraction. Clinical implications for assessment and intervention within the TBI population are discussed.

1.0 Introduction

TBI is broadly defined as an "injury to the brain resulting from externally inflicted trauma" pp 23 (New Zealand Guidelines Group Incorporated [NZGG] & Accident Compensation Corporation [ACC], 2006, p 23). It is estimated that incidence of TBI in New Zealand is 660 per 100,000, or 26,200 individuals per year (NZGG & ACC, 2006). While damage to the brain is considered diffuse after a TBI, it is the frequent damage to the frontal and temporal lobe, and the communicative impairments that arise from this, which has been the subject of many investigations (Chapey, 2001; Kennedy & Nawrocki, 2003; Metcalfe, 1994; Squire, 1992).

Discourse production is one area of communication that is typically disrupted following TBI. Discourse refers to an exchange of verbal ideas (Chambers, 2003). Disruptions in discourse in TBI have been identified for both narrative and expository discourse (e.g. Chapman et al., 1997; Hay & Moran, 2005). One type of discourse that has received little attention following TBI is persuasive discourse. Persuasive discourse is an important aspect of communication whereby individuals use convincing language to uphold or change opinions about a topic or idea (Nippold, 1998; DeVito 2003).

A number of factors can influence discourse production including genre and working memory (Chapman et al., 2006; Chapman et al, 1997; Hay & Moran, 2005; Scott & Windsor, 2000). This study investigated another potential influence on discourse production, auditory distraction. Studies are yet to compare the effect of auditory distraction upon discourse production in individuals with TBI and normal healthy controls. This data is necessary for improved understanding of the influence of everyday environmental distraction upon communication in people with TBI.

There are two primary aims for this research;

1. To evaluate discourse production between adults who have sustained a TBI and adults who have not sustained a TBI on two types of discourse: narrative and persuasive;
2. To investigate the impact of an auditory distraction, on discourse production for individuals with TBI and adults who have not sustained a TBI.

1.1 Communication Impairments for people with TBI

Numerous researchers (Beukelman & Yorkston, 1991; Chapey, 2001; Coelho, Youse, Le, & Feinn, 2003) describe a cognitive-communicative impairment with lasting deficits for both adults and children who sustain a TBI. The nature and degree of the impairment is dependant on a number of factors including, severity, age at time of TBI, and site of lesion (Chapey, 2001; Chapman, Levin, Wanek, Weyrauch, & Kufera, 1998; Gomez, Lobato, & Boto, 2000; NZGG & ACC, 2006). No figures are available for the percentage of the TBI population that present with communication impairments. However, the best practice guideline (Traumatic brain injury: Diagnosis, acute management and rehabilitation evidence-based best practise guidelines) recommends that all people who have sustained a TBI should be assessed for impairments in a variety of areas including communication, stating that “the identification of these deficits and any consequential impact on functioning is an important step towards helping the person with TBI, their family/whanau and carer(s)” (NZGG & ACC, 2006, p81).

Communication impairments can be characterised by an array of behaviours including: high-level language impairment; (e.g. impaired cohesion and coherence, impaired discourse, difficulty successfully comprehending abstract concepts and items of increased length) social disorder; (e.g. defying social norms such as: turn-taking, situation appropriateness, poor topic management, tangentially, providing a lack of or too much information, decreased initiation and inhibition) and working memory and attention impairment; (e.g. decreased attention, word finding difficulties (WFD), sequencing and planning difficulties, impaired self-monitoring). Together, these impairments may present as disorganised discourse (Douglas, Bracy, & Snow, 2007; Togher, Hand, & Code, 1997; Tucker & Hanlon, 1998).

1.1.1 Discourse

Discourse production has been investigated as a more sensitive alternative or additional form of language assessment for individuals with TBI (Armstrong, 2002; Biddle et al., 1996; Chapman & Ulatowska, 1994; Chapman et al., 1997; Coelho, 2002; Coelho, Grela, Corso, Gamble, & Feinn, 2005; Coelho, Liles, & Duffy, 1995; Coelho et al., 2003; Hay & Moran, 2005; Snow, Douglas, & Ponsford, 1995; Ulatowska et al., 2003). Such investigations have arisen given that adults with TBI have obtained language scores within normal limits when using traditional assessments for aphasia, such as the Western Aphasia Battery (Biddle, McCabe, & Bliss, 1996; Brookshire, 2003; Kertesz, 1982; McDowell, Whyte, & D'Espositio, 1997; Strauss Hough & Barrow, 2003).

Discourse production is described as an exchange of verbal ideas (Chambers, 2003) typically expressed in an ordered fashion with extended thought or discussion on a given subject, for example, talking about a topic (Macaulay, 2001). Unlike a written sentence, spoken discourse does not have clear signals such as a full stop or capital letter to signal the start and finish of a sentence, instead relying on intonation contours and social etiquette rules (Armstrong, 2002).

Previous studies have (e.g. Biddle et al., 1996; Chapman et al., 1992, Chapman et al., 1997; Ewing-Cobbs, Brookshire, Scott, & Fletcher, 1998; Hay & Moran, 2005) suggested that discourse production provides more insight into functional communicative abilities for the TBI population than standardised assessments alone. Discourse measures are a useful addition when generalising strengths and weaknesses across differing populations and aiding in differential diagnosis. Use of discourse measures also allows researchers to break down communicative competence into linguistic and cognitive factors (Chapman & Ulatowska, 1994). Research by Snow, Douglas and Ponsford (1998) into the TBI population further highlighted the need for discourse assessment and intervention in clinical and community practice. Using a modified version of Damico's Clinical Discourse Analysis (Damico, 1985), a descriptive measure which aims to identify pragmatic errors, Snow et al. (1998) documented a negative relationship between conversational discourse abilities and perceived psychosocial impairment of people with TBI who were almost two years post injury. This indicated that discourse measures are valid in community settings given the long term nature of impaired discourse abilities post TBI and also provided insight into perceived communication limitations that can occur.

Common discourse errors seen in the TBI population include: formulation and paraphrasing problems; errors due to memory limitations; difficulty organising language; the inability to make assumptions based on a group of ideas; and information redundancy or lack of information (Chapman et al., 1997; Hay & Moran, 2005; Snow et al., 1998; Tucker & Hanlon, 1998). Researchers have also suggested that discourse genre may contribute to the successes and difficulties exhibited in discourse production for people with TBI (Coelho et al., 2003; Hay & Moran, 2005; Scott & Windsor, 2000).

Discourse production is separated into several genres: narrative, conversational, expository, procedural and persuasive. Task genre has been shown to influence production (Scott & Windsor, 2000). The differences may be due to the different linguistic and cognitive demands seen between genres (Coelho, Liles & Duffy, 1991; Hartley & Jensen, 1991; Shadden, Burnette, Eikenberry & DiBrezzo, 1991; Ulatowska, Allard, & Chapman, 1990) as previous studies have noted that certain genres are easier or harder for people with impairments (Coelho et al., 2003; Hay & Moran, 2005; Scott & Windsor, 2000). For example, Coelho et al. (2003) found that although deficits were seen in both the narrative and conversational genres for adults with TBI, as a group, they performed better when completing the narrative task than the conversational task. Both Hay & Moran (2005) and Scott & Windsor (2000), found that children with language impairments, including those who sustained a TBI, produced more organised discourse when completing the narrative task compared to the expository task. Typically developing children also performed better in the narrative genre than the expository, providing further evidence for genre differences in discourse (Hay & Moran, 2005; Scott & Windsor, 2000). Genre differences were also seen for language structure (syntax and form) (e.g. Hatch 1992; Scott & Windsor 2000). Two genres of interest to the researcher are narrative and persuasive genres.

1.1.2 Narrative Discourse:

Although narrative discourse may be thought of as a non-interactive genre, it is used in social communicative situations such as, story retelling or describing a chain of events (Gillam, Pena, & Miller, 1999; Snow & Douglas, 2000; Snow, Douglas, & Ponsford, 1999). Elements of a narrative story include a setting: introducing the characters, time and place; some action: a chain of events and defining moment of the story; a resolution: the outcome of the character's actions (Labov, 1972). Storytelling becomes more effective when the speaker successfully includes the above elements (Liles, 1993). Narrative production develops through childhood and adolescence and is characterised by increases in the length, number and cohesiveness of episodes in stories; the ability to embed episodes throughout the story; the inclusion of information about character's feelings and thoughts; and an increased ability to successfully engage the listener whilst telling the story (Nippold, 1998).

Narrative production tasks are particularly useful for evaluating discourse in individuals with TBI. Used in experimental conditions, a narrative task does not require participants to adhere to social norms such as turn-taking. This allows for a level of structure and control to experimental conditions which is not achievable when evaluating conversational discourse (Snow & Douglas, 2000; Snow et al., 1999). Narratives allow investigators to examine how individuals with TBI organise language and communicate complex ideas (Coelho, 2002). Elicitation techniques for narratives have included: story generation tasks (Coelho, 2002; Tucker & Hanlon, 1998), picture retelling (Coelho, 2002; Snow et al., 1999), visual and auditory story retelling (Doyle et al., 2000), and auditory story retelling (Chapman, 1997; Chapman et al., 1998; Hay & Moran, 2005). The limitation of the variety of techniques used to elicit and evaluate narrative discourse is that there are restrictions to the comparisons and generalisation of findings to the TBI population as a whole and give rise to contradictory data (Biddle et al., 1996; Coelho et al., 2003; Togher, 2001).

Previous research for both adults and children with TBI using narrative discourse tasks, describes deficits related to the coherency, cohesion, amount, relevance, structure and accuracy of information (Biddle et al., 1996; Chapman et al., 1992; Coelho, 2002; Hay & Moran, 2005). Hay and Moran (2005) found that, children with TBI showed impairments in both the amount of information they produced and they way the produced it (e.g. sentence length and complexity), when using a story retelling procedure as described by Chapman et al. (1992).

Using a personal narrative task, Biddle et al. (1996) found that while both adults and children with TBI produced equal amounts of discourse as their peers, they produced less efficient and effective discourse when carrying out the communication task. For example, self-monitoring of narratives appeared to be less consistent than peers. At times critical, partial or entire units of information were left out of the narratives making it difficult for listeners to understand the main points or gist of the narrative (Biddle et al., 1996). Biddle et al. (1996) describe increased repetitions, fillers and false starts recorded for the participants with TBI, making them appear less fluent than their peers. The overall dysfluent nature of the narratives can be attributed to impairments in the areas of retrieval, planning, organising and expressing the narrative discourse task (Biddle et al., 1996).

Coelho (2002) used a picture-story retelling task and a picture-story generation task to investigate narrative discourse elicitation techniques in adults with TBI. Overall it can be seen that adults with TBI performed worse on both discourse elicitation tasks than the NBI group. Coelho (2002) predicted that the story generation task would yield lower discourse measure results than the story-retelling task. While results indicated that participants did perform differently using the two tasks, the results were not as simple as predicted and were explained by examining discourse production and story grammar. More words and subordinate clauses were produced using the story-generation task, by participants from both the TBI and NBI groups than in the story-retelling task. An explanation for this finding was that the presentation of the story-retelling task visually via a filmstrip may have encouraged participants to summarise information instead of elaborating or making inferences from the information and thus resulted in lower amounts of words (Coelho, 2002). However, despite less discourse production, overall, the visual story-retelling task was cohesive. Conversely when examining story grammar, the generation of a spontaneous story from a single picture gave rise to fewer cohesive ties and less episodes than participants produced using the story-retelling task. This was explained by suggesting that the visual format of the story-retelling task via a filmstrip provided intrinsic sequencing cues (Coelho, 2002).

1.1.3 Persuasive Discourse:

Persuasive discourse aims to "[strengthen] or [change] attitudes or beliefs" (Devito, 2003, p. 224) and involves "the use of argumentation to convince and other person to perform and act or to accept a point of view desired by the persuader" (Nippold, 1998, p. 189). Persuasive discourse is used in both formal (e.g. debating or political campaigns) and informal (e.g. deciding who gets to choose the TV channel for the night) communicative situations. It is a functional part of everyday communication which uses complex language to communicate a point of view or provides supporting information to communication partners (Hartley, 1995; Nippold, Ward-Lonergan, & Fanning, 2005). The typical structure of a persuasive passage entails stating a position; providing details or evidence which supports the initial position; and ending with a conclusion that reiterates the initial position given (Hutson-Nechkash, 2004).

Nippold (1998) described ongoing development for this pragmatic skill throughout the school-age and adolescent years, with improvements to such areas as; the anticipation of counterarguments; the substitution of “whining” and “begging” tactics for bargaining and continued politeness; providing a larger number of different arguments including advantages for the speaker to comply; and changing the speaker’s persuasive style to cater for differing audience features (Nippold, 1994). However, it appears that full maturation of persuasive discourse skills are not yet complete by seventeen years. Nippold (1998) and Scott and Erwin (1992) state that the persuasive genre may not be mastered before competence is first gained in the expository genre. This makes the persuasive genre a later developing skill.

Nippold et al, (2005) investigated the development of written persuasive skills (syntax, semantics and pragmatics) from childhood to adulthood. Characteristics included; use of complex syntax across age groups being inherently encouraged with the task demands of writing persuasively; and increased maturity giving rise to the participants’ abilities to discuss arguments both for and against the topic; while the younger groups were typically one sided in their argument (Nippold et al., 2005).

However, a further suggestion is that age may not be a reliable measure of persuasive skill development. Instead it has been suggested that motivation towards carrying out the persuasive task and situational factors play a more central role in the complexity of persuasive strategies used regardless of the speakers’ age (Nippold, 1998; Ritter, 1979).

1.1. 4 <u>Persuasive discourse in clinical populations</u>

Ferretti, MacArthur, & Dowdy (2000) compared the written persuasive skills of typically developing children to children with learning disabilities. They found that both groups’ overall abilities were poor, due to an inability to generalise the topic and not solely base arguments on personal experiences. However, children with learning disabilities were even less persuasive than their typically developing peers. They appeared to provide reduced amounts of reasons/information and demonstrated an inconsistent ability to generate alternative positions. Although Nippold et al. (2005), described persuasive discourse as an "empowering" communicative tool, there is a paucity of research regarding persuasive discourse and adults with TBI.

1. 1. 5 Scoring and analysis of discourse tasks

Procedures used to score and analyse the discourse tasks appear to be tailored to three factors in order to maximise outcomes: 1. The language sampling method used (e.g. story generation vs. story retelling), 2. The discourse genre being sampled (e.g. narrative vs. persuasive) and, 3. Typical errors seen in discourse in the TBI population.

Previous research by Chapman (1997) and others (e.g. Chapman et al., 1997; Chapman et al., 1998; Hay & Moran, 2005) used a discourse retell sampling method, which will also be used in the current study. Using this method they analysed the narrative discourse retell samples under three categories: a language measure, an information measure and a story moral measure. The language measure (microstructure) provides analysis regarding the structure of the sample using number of words, T-units, mean length of t-units and sentential complexity to demonstrate the productivity, efficiency and complexity of the samples. These areas have been highlighted in the literature as being impaired in the TBI population (e.g. Chapman et al. 1997; Coelho, 2002; Ewing-Cobbs et al., 1998; Hay & Moran, 2005; Nippold et al. 2005). The information measure (macrostructure, pragmatic measures) analyses the content of the retellings and how they are organised using measures of propositions (information units), episodic structure (what order the passages are retold in) and global story components (the ability of the individual to retell the gist of the passage). Researchers (e.g. Chapman et al. 1997; Coelho, 2002; Hay & Moran, 2005; McDonald & Pearse, 1995) have described deficits across narrative and expository discourse genres using the information measure when comparing the TBI population to age-matched individuals without a TBI.

Although research surrounding the measurement and analysis of spoken persuasive discourse and TBI is limited, Clark and Delia (1976) investigated spoken persuasive skills in childhood and early adolescence. Using an generation-style methodology, the participants were asked to perform a persuasive task based on a scenario given by the interviewer (e.g. it was the participant's birthday and they were asked to persuade their mother to allow them to have a sleep-over party).They described scoring the structure and organisation of the passage (e.g. information domain measures) including; a statement of desire (e.g. stating the argument), the number of difference reasons given for a persuasive generation task (this can be equated to supporting information and is one part of the structure described for persuasive discourse), and counterarguments presented. Using a different sampling method of written samples, persuasive discourse analysis carried out by Nippold et al. (2005) described calculating language domain measurements (T-units and mean length of utterances) and information domain measurements (number of different reasons adapted from Clark & Delia, (1976)). Finally Ferretti et al. (2000), who also used written samples, analysed written persuasive discourse in children with learning disabilities. They developed a scoring rubric for the persuasive essays to analyse the overall persuasiveness. The argument elements analysed were: proposition (argument stated), at least one reason, at least two reasons, at least three elaborations, conclusion, alternative proposition, alternative reason and rebuttal.

It appears that similar types of analyses (e.g. language and information measures) have been employed across language sampling methods and discourse genres. The ability of these measures to highlight discourse errors seen in the TBI population has been documented for the narrative genre; however the paucity of research regarding TBI and the persuasive genre gives rise only to assumptions and hypotheses. Such as, based on the developmental literature regarding the persuasive genre and impairments across other genres (e.g. narrative and expository), individuals with TBI will also present with impaired persuasive discourse.

1.2 Working memory

A number of factors may contribute to impairments in discourse production in the TBI population, for example; task factors such as, genre and task elicitation method (Coelho, 2002; Hay & Moran, 2005); and factors that are specific to individuals with TBI, such as, severity of injury or cognitive functioning abilities (NZGG & ACC, 2006). Individuals with TBI are also reported to frequently present with impairments in working memory (Chapey, 2001; Hartley, 1995; Hinchliffe, Murdoch, & Chenery, 1998; Hinchliffe, Murdoch, Chenery, Baglioni, & Harding-Clark, 1998; McDowell et al., 1997).

Working memory is the area of memory used to temporarily store, process and manipulate information which can then be activated at any given time (Baddeley, 1992; Gillam et al., 1999; Hay & Moran, 2005). The working memory capacity theory depicts competition for storage and processing of language, placing constraints on retrieval processes, inference, slowing information processing and planning (Daneman & Carpenter, 1980; Just & Carpenter, 1992). An added factor such as TBI, places further demands on language processing in working memory, with Chapman et al. (1997) and Hay and Moran (2005), describing an underlying impact on communication deficits. This makes it essential that the role of working memory is accounted for when exploring TBI and language use.

In order to understand the origin of the above statements, it is necessary to explore working memory models. Since 1974, models have been developed and adapted to describe and investigate the benefits of intact working memory, and how inadequate working memory can affect individuals.

1.2.1 Baddeley's Working Memory Model (1974, 1986, 1992).

This is the original working memory model, from which other theories and models have been developed (e.g. (Daneman & Carpenter, 1980; Just & Carpenter, 1992; Tompkins, Bloise, Timko, & Baumgaertner, 1994)).The model introduced a central executive system, which controls the storage, processing and allocation of attention and resources to the slave systems. Baddeley himself stated that not much is known about the central executive system and placed the majority of his focus on the two slave systems; the visuospatial sketchpad; and the phonological loop (Baddeley, 1986). The visuospatial sketchpad stores visual and spatial material in the short-term memory, but is not documented as an essential part of auditory comprehension (Moran & Gillon, 2004). The phonological loop consists of two further systems, the phonological input store; where speech-based information is acoustically or visually encoded, rehearsed and held in the working memory; and the articulatory rehearsal process which is described as equivalent to inner speech (Baddeley, 1992).

1.2.2 Daneman and Carpenter's Theory of Working Memory (1980).

This theory investigated how working memory capacity correlates to individual differences in reading comprehension. Daneman and Carpenter (1980) specifically developed the reading span task, to tax both the storage and processing components of working memory capacity, while also correlating to comprehension measures included in the study. Participants read a set of sentences and then recalled the final word for each sentence. The size of the set continues to increase until a ceiling for recalling the final word is reached, and this is the participant's reading span size. The theory is based on the assumption that the variations found in the reading span task reflect differences in working memory capacity, and therefore, because the task correlates to traditional comprehension measures, working memory capacity is a predictor of the individual differences found in reading comprehension (Daneman & Carpenter, 1980). Differences in working memory capacity may be reflected in the speed, organisation and number of errors in reading comprehension tasks, and participants who have a higher span should be able to hold more final words in their working memory (Daneman & Carpenter, 1980).

Tompkins et al. (1994) adapted Daneman and Carpenter's working memory/reading span task to an auditory task, to assess working memory deficits and the impact on discourse for adults with right hemisphere (RH) syndrome. They found that when the task stimuli were less demanding, the task did not exceed the working memory capacities of the participants with RH syndrome or participants with brain injury. Whereas, when the processing component was enhanced (i.e. the tasks became more difficult) discourse deficits were more pronounced for adults with RH syndrome (Tompkins et al., 1994). This study provides an investigation into working memory capacity when a constraint, such as RH syndrome, is placed on the storage and processing for discourse comprehension.

Just and Carpenter (1992) investigated working memory capacity and language comprehension, describing language comprehension as a good example of a task which requires storage of parts of passages whilst processing takes place. Just and Carpenter's (1992) theory is likened to the area of central executive system described by Baddley (1974, 1986), and their central theme is that of 'activation'. Activation is the common component responsible for engaging storage and processing in working memory, so working memory capacity equals the maximum amount of activation available for storage and/or processing (Just & Carpenter, 1992). A further theme in this theory is resource allocation; how the resources (i.e. working memory capacity) are divided among the storage and processing systems once activation has taken place (Moran & Gillon, 2004). Once the activation amounts are greater than the allocated resources, the storage or processing systems lose recourses to counteract the increased capacity. The losses may be restricted to one system or divided between the two systems, e.g. if storage resources are lost then language comprehension will be lost, and if processing resources are lost then the language processing will be slower (Moran & Gillon, 2004).

It can be seen that the role of working memory has been vastly explored, with significant developments documented that identify a working memory capacity theory, links to language and deficits that can occur when capacity is reached. Individuals with TBI are not only affected by working memory capacity constraints as described above, but also disordered discourse abilities (Douglas, et al 2007; Togher, 1997; Tucker & Hanlon, 1998) which place further constraints on working memory abilities (Chapman et al., 1997; Hay & Moran, 2005).

1.3 The Impact of Distraction on Working Memory and Communication.

Communicating in different environments such as the workplace or a café may also influence working memory capacity and language processing. For example, the individual must attempt to process and share information with communication partners in the midst of auditory; (e.g. people talking in background, industrial noise), visual; (e.g. items throughout the office or café, what other people are wearing), and tactile (e.g. furniture material) distracters (LeCompte, Neely, & Wilson, 1997). One or all of the above distractions may place further constraints on the participation abilities for people with TBI during communicative interactions.

Being able to focus on one task and block out irrelevant distractions is called attentional selectivity (Hughes & Jones, 2003). The brain processes both the primary task and the distraction but just how much impact the distraction has on the primary task has been the subject of multiple investigations (Hughes & Jones, 2003). It is believed that the more taxing the primary task is for the individual, or the bigger the load on working memory, the greater the impact of the environmental distraction (Campbell, 2005; LeCompte et al., 1997).

LeCompte (1994) and others (Beaman, 2005; Beaman & Jones 1997, 1998), also state that when a task places a load on memory this appears to increase the likelihood of negative effects from auditory distraction.

The role of individual differences for sensitivity towards distraction should also be considered. Rosen and Engle (1998) and others (LeCompte et al., 1997; Long & Prat, 2002), suggest that individual differences in working memory abilities will influence task performance; including the amount of information retained when distraction presented simultaneously; ability to suppress irrelevant thoughts, behaviours and distractions; carrying out a strategic and controlled search; and ability to self monitor errors while completing automatic tasks (Rosen & Engle, 1998). Therefore, for people who have sustained a TBI (an example of an individual difference) and show impairments in their working memory abilities, their susceptibility to distractions may be greater than an individual without a TBI.

1.3.1 Types of Distraction:

Campbell (2005) and LeCompte et al. (1997) have suggested that working memory is negatively impacted by the effects of distraction. However, not all distraction may have equal effects. For instance it has been suggested that the type (e.g. visual or auditory), and intensity (e.g. duration and loudness level) of distraction may also play a role. Whyte, Schuster, Polansky, Adams and Coslett (2000) included visual distractions, when assessing the frequency and duration of distractions for people with TBI. Using a person as one form of visual distraction, Whyte et al. (2000) simulated a possibility of a functional distraction found in the work place. While they did not specifically measure the impact that the individual types of distractions had on the participants, they found that it was the primary task that the participants were supposed to be focusing on, which gave rise to differing levels of distraction, and not the type of distraction. This finding suggested that the more structured the primary task is, the lower the amounts distracted behaviour should be (Whyte et al., 2000).

Auditory distractions and their effects have been more widely documented (Banbury, Macken, Tremblay, & Jones, 2001; Beaman, 2005; Jones, 1999; Kewman, Yanus, & Kirsch, 1988; LaPointe, Heald, Stierwalt, Kemker, & Maurice, 2007; LeCompte et al., 1997). Documented auditory distraction effects include; significant decreases to both speed and accuracy of task completion (LaPointe et al., 2007); auditory comprehension deficits (Kewman et al, 1988); disruptions to immediate serial recall (Beaman, 2005; LeCompte et al., 1997); a breakdown in attention selectivity leading to impaired cognitive performance (Banbury et al, 2001; Jones, 1999);

Various types of auditory distraction have also been examined including; white noise (Jones, Miles, & Page, 1990); single and double tones (LeCompte et al., 1997); nonsense syllables (LeCompte et al., 1997); speaking in a foreign language (Ellermeier & Zimmer, 1997); real speech not related to the task (Tun, O'Kane, & Wingfield, 2002); and real speech with semantic connections (Ellermeier & Zimmer, 1997; LeCompte et al., 1997). Studies have found that the type of auditory distraction places constraints on task success. In general, real speech has been found to have increased negative effects compared with pure tones and nonsense speech (Ellermeier and Zimmer 1997; LeCompte et al., 1997).

Equivocal findings emerged when the loudness level of auditory distraction was considered. Studies have reported both negative effects (Ellermeier & Zimmer, 1997; Jones, Beaman & Macken, 1996) and a lack of effect (LaPointe et al. 2007) in the noise range of 40dB(A). In addition, the age of participants has been reported as a significant factor in task performance (Tun et al., 2002).

Auditory distractions have been presented at a variety of differing dB(A) levels by researchers (Beaman, 2005; Belleville, Rouleau, Van der Linden, & Collette, 2003; Buchner, Mehl, Rothermund & Wentura, 2006; Escera, Corral, & Yago, 2002; Gisselgard, Petersson, & Ingvar, 2004; Maas, 1972; Schneider, Daneman, Murphy, & Kwong See, 2000; Occupational

Safety and Health Service [OSH], 2002; Tun et al., 2002). Most researchers however, have endeavoured to provide a functional link to the task and present the sound between 65 – 85 dB(A), which are above average conversation levels (60 dB(A)), are the average levels for office sounds, street noise or radio levels (Maas, 1972; OSH, 2002) and in accordance with health and safety regulations (OSH, 2002), that state that no person should be subjected to noise levels above eight-hour equivalent continuous A weighted sound pressure level of 85 dB(A)).

1.3.2 Distraction in clinical populations:

Effects of distraction have been widely documented in the healthy controls using both clinical and functional tasks (Banbury et al., 2001; Beaman, 2004, 2005; Hughes & Jones, 2003; LaPointe et al., 2007; Rosen & Engle, 1998). However, research examining specific clinical populations is limited. Blanchard et al., (2004), examined the effect of auditory distraction upon dual-task cognitive performance in 22 individuals with Multiple Sclerosis (MS), 15 individuals with Parkinson's disease (PD), and 17 age-matched controls. Task accuracy decreased across all three participant groups with the addition of auditory distraction; however, greater effects were observed in both the MS and PD groups compared to control participants. It is therefore hypothesised that the accumulated effects of auditory distraction tax an already compromised system.

In addition, Stierwalt, LaPointe, Maitland, Toole & Wilson (2006) examined the effect of cognitive and linguistic constraints upon performance of a movement task in a group of individuals with PD. The authors reported that the addition of cognitive and linguistic constraints (i.e. walking and talking) resulted in negative effects upon specific parameters of gait and balance (Stierwalt et al., 2006). The findings of the study suggest increased cognitive and/or linguistic load act as a negative distraction to the primary task of walking.

1.3.3 Distraction and the TBI population:

After interviewing 175 individuals with TBI two years post injury, Ponsford, Olver & Curran (1995) reported that a number of individuals perceived that distractions, which occurred as a result of impaired attention and concentration continued to negatively impact their performance of everyday tasks (Ponsford et al, 1995). To an extent, research has confirmed these opinions. Hein, Schubert, and von Cramon (2005) examined the pattern of input interference in 11 individuals with TBI and 11 with PD. Results of the study revealed that participants with TBI exhibited increased susceptibility to negative effects of a distraction when compared to both individuals with PD and normal controls. These results suggest that the dual-task deficit for processing information is specific to the TBI population (Hein et al., 2005).

Whyte et al. (2000) reported similar findings in their investigation into inattentive behaviours after TBI and the effects of distraction while completing different tasks. The use of this highly functional task revealed that people with TBI appear more susceptible to distractions (both visual and auditory) in a working environment. Although people without TBI are not free from office distractions, the impact of such distractions appear to lessen more quickly than for people with TBI (Whyte et al., 2000). Interestingly the type of tasks for the participants to carry out also appeared to correlate to attention given to the task. Whyte et al. (2000) noted that when the task was unstructured (e.g. making a collage) it gave rise to bigger levels of inattentive behaviours than when a more structured task (e.g. completing a 500-piece puzzle) was given. Whyte et al.'s (2000) study is significant and similar to the present study as it does not use a dual-task paradigm, instead presenting only one task (although not focusing on communication) which must be attended to while adding functional auditory or visual distractions to the background environment to document the effects.

The effects of distraction appear to have generated much interest by researchers. Various types of auditory distractions and loudness levels have been employed with variable results. Effects of distraction have been documented across clinical populations (e.g. Blanchard et al., 2004; Kleiber & Harper, 1999; Stierwalt et al., 2006), and distractions appear to have a longer lasting impact on the TBI population than a non-TBI comparison group (Whyte et al., 2000) Given the limited research available, further investigations into auditory distraction are warranted within the TBI population. As past studies have focused largely on distraction effects on cognitive processing abilities (Blanchard et al., 2004; LaPointe et al. 2007; Stierwalt et al., 2006) further research should explore auditory distraction and the effects on communicative functioning.

1.4 Summary and thesis aims:

While many researchers have investigated the communication impairments of adults with TBI (e.g. Beukelman & Yorkston, 1991; Chapey, 2001; Coelho et al., 2003), it appears that some components have received more attention than others. For a more interactive understanding of these deficits and their impact on activities of daily living, the following issues should be addressed:

1. Although many investigations into discourse production are carried out examining adults with TBI, it can be seen that the discourse genre of persuasion has had relatively little attention (e.g. Ferretti et al., 2000; Nippold, 1994; 1998; Nippold et al., 2005; Ritter, 1979) when compared to investigations into the narrative genre.

2. Auditory distractions in the workplace such as industrial noise or people talking have been documented for both health and safety standards and the effects on productivity

and attention. Recent research has also investigated the positive and negative effects of distractions in specific populations. However, there is a paucity of research regarding the impact of auditory distractions on the TBI population when communicative demands (such as story retelling) are also added.

The general aim of the thesis is to examine the impact of auditory distraction during discourse production for adults with TBI. Specific research questions which have risen from the literature and are of interest in order to gain a more functional understanding of impairments that adults with TBI present with will be addressed here:

1. Will adults with TBI perform consistently worse across discourse production measures than age matched individuals who have not sustained a TBI?

2. Will the type of discourse task presented (narrative versus persuasive) impact on discourse production abilities for both populations?

3. Does auditory distraction result in negative effects to discourse production for individuals with TBI and healthy controls?

4. If an auditory distraction effect exists, is it magnified in the TBI group?

Based on the presented research, it is hypothesised that:

a. Adults with TBI will demonstrate decreased performance on the narrative and persuasive retelling tasks when compared with age matched adults who have not sustained a TBI.

b. Both adults with TBI and age matched adults who have not sustained a TBI will demonstrate decreased performance on the persuasive tasks as compared with the narrative tasks.

c. Both adults with TBI and age matched adults who have not sustained a TBI will demonstrate decreased performance in the auditory distraction condition when compared with the non-auditory distraction condition.

d. Adults with TBI will demonstrate decreased performance in the auditory distraction condition when compared with age matched adults who have not sustained a TBI.

The purpose of the present study examines the language function of discourse production, which has been described as being impaired in adults with TBI. Two different discourse genres are elicited and compared for differences at the macrostructure and microstructure levels, with comparisons made to a control group. Discourse production is also elicited whilst an auditory distraction is present, in order to explore a possible relationship between overall task performance and the auditory distraction.

2.0 Method:

2.1 Participants

A total of 20 participants participated in the study: 10 adults with TBI and 10 age and gender matched individuals who had not sustained a TBI (non-TBI comparison group). The mean age of TBI participants was 45 years (SD 7.8, range 32 - 55 years), and the group consisted of 16 males and 4 females. Participants with TBI were identified from a database of participants compiled by Dr. M. McAuliffe and Dr. C. Moran. Participants were considered appropriate for participation in the study if they held current claims accepted by the Accident Compensation Corporation of New Zealand (ACC), and verified by a neurosurgeon, for impairment resulting from an accidental brain injury. All participants were at least one year post-injury at the commencement of the study. Participants were excluded from the study if: a). English was not the primary language spoken in activities of daily living, b). Any co-existing injuries were present that may have a significant impact on results (e.g. Cardio-vascular accident or prior language disorder). The TBI group differed across age, sex, ethnicity, nature of accident and severity of injury. Severity levels of injuries were not available for all the individuals in the TBI group, due to the lengthy time between time of injury and this investigation; however all reported communication difficulties. Biographical details of TBI participants are presented in table 2.1.

Table 2.1. Biographical details of participants with TBI.

P	Sex	Age	Age at injury	GCS	Severity of injury	CT Scan Results	Nature of accident	Ethnicity
1	F	41	16 and 18	N/A	Moderately severe	R posterior parietal haemorrhage	MVA/ cyclist -	NZ pakeha

							MVA	
2	M	52	19	N/A	Severe	Diffuse brain injury	MVA	NZ pakeha
3	M	41	28	N/A	Severe	L subdural haematoma, infarct L internal capsule	MVA	NZ Maori
4	M	50	36	N/A	Mild	N/A	Collided with metal pole of clothes line	NZ pakeha
5	M	55	44 (initial TBI)	N/A	N/A	N/A	Multiple assaults	NZ pakeha
6	M	36	30		Severe	L subdural haematoma, L occipital lobe contusion	MVA	NZ pakeha
7	M	32	28	N/A	N/A	L temporal medial subdural haematoma	Assault	NZ maori/ pakeha
8	M	46	30 and 35	N/A	N/A	N/A	Assault - MVA	NZ pakeha
9	F	53	23	N/A	N/A	N/A	pedestrian - MVA	NZ pakeha
10	M	39	21	N/A	Severe	N/A	MVA	NZ pakeha

Note: P = Participant; GCS = Glasgow Coma Scale; CT = Computerized Tomography; MVA = Motor Vehicle Accident; N/A = Not Available; L = Left; R = Right; NZ = New Zealand

The individuals with TBI were matched by age (+- 2 years) and gender to participants without TBI. In addition, an attempt was made to match participants on a socioeconomic level based on years of education. This was done to reduce the possible significance of socioeconomic status on areas of discourse production (Coelho, 2002; Snow, Douglas & Ponsford, 1995, 1997; Yorkston, Aeches, Farrier & Uomoto, 1993). The Western Aphasia Battery (WAB) (Kertesz, 1982) was completed prior to undertaking the experimental tasks to exclude the possibility of co-occurring aphasia.

2.2 Procedures

Participants were individually assessed at one of two sites: The University of Canterbury Department of Communication Disorders Research facility in a sound-treated room or in their own home. Administration of assessments, subtests and tasks were counterbalanced to limit order effects. All tasks were administered by the author or a research assistant. All sessions were recorded on a Sony Hi-MD Audio Portable Minidisk Recorder (MZ-NH1) using a Sony Electret Condenser Microphone (ECM-MS907). Participants were given breaks between assessment subtests and tasks if desired. The testing session for control participants lasted between 1½ and 2 hours. Participants with TBI were seen for twenty minutes once a week for five weeks, to allow for fatigue.

2.2.1 <u>Ancillary testing:</u>

Client interview: To gather case history information such as, date of birth, injury details and daily performance details.

Hearing Screening: Pure tone testing screened to 30 dBHL at 500 Hz, 1000 Hz and 2000 Hz. Participants were considered to have competent hearing if the above scores were gained in at least one ear (Hancock, LaPointe, Stierwalt, Bourgeois & Zwaan, 2007). Nineteen participants (TBI group and non-TBI comparison group) presented with competent hearing in both ears, one female participant with TBI presented with competent hearing in one ear only.

Language Measure

Western Aphasia battery (WAB) (Kertesz, 1982).

The WAB was used to assess the overall communicative functioning for the participants using linguistic and non-linguistic tasks. Subtests included verbal tasks to assess: language function, content, fluency, auditory comprehension, repetition, naming, reading, writing, and calculation, and non verbal tasks: drawing, block design and praxis. In addition, the Raven's Coloured Progressive Matrices was completed in order to calculate a Cortical Quotient (CQ). The complete battery (including Raven's Coloured Progressive Matrices test) was administered to control participants in order to verify normal language functioning and to participants with TBI to verify current communicative abilities. Lexical items were changed to suit the New Zealand population (e.g. "rubber" was accepted for "eraser", "does it snow in July?" was changed to "does it snow in January?"). Both the aphasia quotient (AQ) and cortical quotient (CQ) were recorded.

Working Memory Task

The working memory measure of Tompkins et al., (1994) was administered to all participants. This was a shorter adaptation of the Daneman and Carpenter 1980 working memory span. The sentences presented were less complex. Participants needed to recognise whether the sentence presented was true or false and recall the final word in the sentence. In total, 42 sentences were presented at 4 different levels (i.e. three sets of two, three sets of three, three sets of four and three sets of five). Instructions and practise items were carried out prior to starting the task. All task items were administered. A lexical item was modified to suit the New Zealand population ("Florida is next to Ohio" was changed to "Auckland is next to Wellington"). See Appendix A for test instructions and template.

Individual scores for both the Working Memory Task (Tompkins et al, 1994) and WAB (Kertesz, 1982) can be seen in table 2 below.

Table 2. Performance of participants on ancillary testing

	WMT		WAB	
Participant	TBI	Non-TBI comparison group	TBI	Non-TBI comparison group
1	18	38	97.6	98.8
2	21	24	92.55	96.8
3	24	23	94.6	99
4	22	39	94.2	99.6
5	11	42	88.9	99.4
6	33	34	98.7	99.4
7	20	34	95.5	99.1
8	27	33	96.9	98.6
9	30	36	99.8	98.7
10	32	25	95.3	97.8
M	23.80	32.80	95.41	98.80
SD	6.86	6.65	3.16	0.92

Note. WMT = Working Memory Task (Tompkins et al, 1994); results shown are raw scores; WAB = Western Aphasia Battery (Kertesz, 1892); results shown are Cortical Quotients; TBI = Participants with traumatic brain injury; Non-TBI comparison group = age and sex matched peers.

All participants (TBI group and non-TBI comparison group) surpassed the AQ 93.8 from the Western Aphasia Battery (Kertesz, 1982) and therefore presented with language within normal limits, despite reporting communicative difficulties. To compare group performance (TBI vs. non-TBI comparison group) on ancillary tasks paired *t*-tests were carried out and an alpha level of 0.05 was used. Comparisons revealed statistically significant differences between groups for both the working memory task and language measure (WMT and WAB). The mean number of final words remembered in the WMT was 23.80 with an *SD* = 6.86 for the adults with TBI and 32.80 with an *SD* = 6.65 for the non-TBI comparison group. The mean Cortical Quotient in the WAB for the TBI group was 95.41 with an *SD* = 3.16 and a mean of 98.80 with an *SD* = 0.92 for the non-TBI comparison group.

2.2.2 <u>Experimental Task: Discourse Retell Tasks</u>

(a) The participants listened to four discourse passages, two narratives and two persuasive. The passages were collected or adapted from different sources ("Aesop's Fables", n.d.; Hay & Moran, 2005; New Zealand Blood Service, 2007; Pearson Adult Learning Centre, 2004; "Persuasive Blood Donation", n.d.) and modified so as to be of similar lengths. Each passage was presented once only, to correlate to real life communicative interactions. Passages were presented on a Phillips A21003 CD sound machine in a quiet room. After listening to each passage participants were instructed to retell the passage to the author using as much detail as possible. Passages were later transcribed by the author.

(b) Retell of passages was self paced and carried out in two different conditions:

Condition A: Participants retold a narrative and persuasive passage to the clinician in a quiet room with no auditory distractions.

Condition B: Participants retold different narrative and persuasive passages with an auditory distraction element added (multitalker babble presented at 80 dB(A). Stimuli for this condition were generated under standardised acoustic laboratory conditions by Dr Greg O'Beirne. The auditory distraction was added via Phillips A21003 CD sound machine in the environment.

The loudness level of 80 dB(A) was chosen because it is above comfortable loudness levels of 40 db(A) which were found by LaPointe et al. (2007) to have no effect on adults completing a cognitive processing task. 80 dB(A) is also above average conversation levels (60 dB(A)) and falls within the average levels for office sounds, street noise or radio levels (Maas, 1972; OSH, 2002). Multitalker babble was chosen for its ability to represent functional environments.

Narrative discourse: The narrative discourse tasks were presented in a fable story-retell form using a typical structure of a setting, problem and resolution. Narrative passages used are shown in Appendix B. Both fables were 174 words long, contained 7 episodic structure elements and 5 global story components. One fable had 15 T-units, 17 propositions and a sentential complexity of 0.56. The other had 18 T-units, 15 propositions and a sentential complexity of 0.33.

Persuasive Discourse: The persuasive discourse tasks were presented using a structure where an argument was presented, backed up with evidence and a concluding remark. Participants were not explicitly instructed to add their own reasoning to the topic; however, this was scored if included. The two persuasive passages used are depicted in Appendix C. The persuasive passages contained 172 and 179 words with 14 and 7 episodic structure elements and 5 and 4 global story components. One passage had 13 T-units, 15 propositions and a sentential complexity of 0.48. The other passage had 16 T-units, 15 propositions and a sentential complexity of 0.38. Task instructions read aloud to participants are described in Appendix D.

2.3 Scoring

2.3.1 Experimental tasks

Scoring of the story retells was carried out using the following parameters (Chapman, 1997; Hay & Moran, 2005; Snow, Douglas & Ponsford, 1997a):

1. Language domain (Microstructure): All story retells were transcribed by the author into the SALT (V7.0) (Miller & Chapman, 2003) computer program and individually coded to gain the following information about the structure of the passages; number of words (excluding phoneme revisions e.g. p-p-p and fillers e.g. um, er); t-units (see Appendix E for definition and classification criteria); mean length of t-units; sentential complexity (number of dependent clauses divided by total number of clauses).

2. Information domain (Macrostructure): The overall content of the retellings was scored using three components: propositions, episodic structure and global story components (see Appendix F for scoring templates). One proposition (information unit), expresses one idea, responses were only scored if correct e.g. “the goat fell into the well” did not get a point as it was not correct, however “the goat jumped into the well and started drinking” would get a point.

Completeness of episodic structure represents the essential elements needed for both the narrative fables (e.g. setting (characters, time, place), action (sequence of events, turning point in the story), resolution, story closure) and persuasive passages (argument, supporting information/reasons given, and conclusion). Unlike the narrative passages, supporting information did not need to be given in any specific sequence. Participants could score a maximum of seven points for the narratives (one point for each element listed above) and also a maximum seven points for the persuasive passages (one point for stating the argument, a maximum of five points for five or more pieces of correct supporting information and one point for the conclusion).

The global story component is also called “the gist”, and measured the participants’ ability to retell essential bits of information that made the story or passage logical. Global story components were scored on a five point scale for the narrative passages and a five or four point scale for the persuasive passages.

3. Moral/ aim of the passage: Using a three point scale story/passage morals/aims were scored, with three points for correct and complete moral/aim (e.g., one good turn deserves another), two points for a partial response (e.g., there’s always a task that reaps a reward), and one point for no response/ incorrect response (e.g., don’t trust a snake).

4. Modified Clinical Discourse Analysis (CDA-M): A pragmatic analysis developed and updated by Grice (1985; 1992) that focuses on discourse analysis, error analysis (identifying errors that make the language sample appear disordered) and clinical observation. This measure was used to further investigate and describe participant responses for persuasive passages only, given the limited research surrounding the genre of persuasion. Participants scored a point for each problem behaviour. Total number of utterances with problem

behaviours were then divided by the total number of utterances and a percentage of utterances with problem behaviours gained. Errors were identified from a group of behaviours originally based on the theoretical framework of Grice's Cooperative Principle (1975) (see Appendix G for scoring description of the modified version).

2.3.2 Reliability

10% of the transcriptions were analysed by an independent researcher, who was trained by the author to perform reliability checks from transcription to scoring and coding the tasks. Differences in scoring and coding were discussed among the author, independent researcher and Dr. Catherine Moran, and agreement was reached. For the working memory task, there was 100% agreement on number of final words recalled. For the WAB there was 100% agreement for scores gained by participants. The interjudge reliability for transcription of the narrative and persuasive discourse retellings was 90%. The interjudge reliability for language measures was 98% for number of words, 99% for number of T-units, and 98% for sentence complexity. The interjudge reliability for information measures was 96% agreement for number of propositions, 94% for completeness of episode structure, and 85% for global story components. Agreement for story moral and aims was 100%. Agreement using the CDA-M measure was 61%.

2.3.3 Data Analysis

A three way analysis of variance (Group × Discourse Genre × Condition) was performed for the language domain and information domain measures. The measures in the language domain were: total number of words, total T-units, mean length of T-units and sentence complexity. The measures in the information domain were number of propositions, completeness of episodic structure, intactness of global story components, explanation of story moral or aim and percentage of utterances with problem behaviours (CDA-M). Group (TBI vs. non-TBI comparisons) was the between-subjects variable, discourse genre (narrative vs. persuasive) and condition (auditory distraction vs. no auditory distraction) were the within-subjects variables. Where the overall *F* was significant, post hoc pairwise multiple comparisons were made using the Holm-Sidak method. An alpha level of .05 was used for all statistical tests.

3.0 Results

This study compared individuals with TBI and non TBI across two different types of discourse genres (persuasive and narrative) and two different conditions (auditory distraction versus no auditory distraction). The results showed that there were differences across discourse genre for both groups. However, contrary to expectations neither group was significantly affected by condition. The individuals with TBI generally performed more poorly than the non-TBI comparison group, but significance varied depending on the measure. The means, standard deviations and ranges for both groups are presented in Tables 3.1-3.4.

3.1 Language Domain

The TBI group exhibited significantly reduced syntactic complexity when compared to the non-TBI group, $F(1, 64) = 5.770$, $p < .05$, $d = 0.08$. No significant differences were found between groups for all other measures of language domain (total number of word, total number of T-units, mean length of T-units). Significant differences were found for genre for number of words, $F(3, 64) = 5.746$, $p < .005$, $d = 0.20$, and total number of T-units, $F(3, 64) = 15.064$, $p < 0.001$, $d = 0.41$ Both groups produced more words and T-units for the narrative genre than the persuasive genre. No significant differences were found between the two groups for sentence complexity or mean length of T-units across narrative and persuasive genres. No significant differences were found for condition for any of the language measures. There was no interaction effect across group, genre and condition for any of the language measures.

Table 3.1. Measures of language production for persuasive and narrative discourse tasks. (n = 10 per group)

	Persuasive Discourse				Narrative Discourse			
Measure	TBI		Non-TBI		TBI		Non-TBI	
	AD	NAD	AD	NAD	AD	NAD	AD	NAD
Number of words								
M	110.40	137.80	116.60	125.80	157.10	176.80	174.10	198.90
SD	64.65	91.27	62.86	63.38	77.22	75.16	79.19	49.98
Range	47 - 220	23 - 357	48 - 242	41 - 209	87 - 351	76 - 341	29 - 297	143 - 263
Total T-units								
M	9	10.50	8.20	8.80	14.80	14.40	13.60	17.40
SD	4.08	3.78	3.16	3.46	5.43	4.97	4.81	2.84
Range	6 - 16	4 - 15	4 - 14	4 - 17	9 - 26	8 - 24	3 - 20	12 - 21
Mean length of T-unit								
M	10.84	10.71	11.48	12.54	9.90	11.10	10.98	10.73
SD	3.82	4.01	2.64	4.87	2.34	3.50	3.08	2.22
Range	5.8 - 16.71	4.6 - 17.33	7.6 - 15.3	4.1 - 19.5	8.36 - 14.21	6.91 - 16.23	4.83 - 15.22	8.56 - 14.05
Sentence complexity								
M	0.42	0.41	0.47	0.46	0.40	0.44	0.50	0.46
SD	0.11	0.14	0.09	0.13	0.09	0.12	0.10	0.13
Range	0.22 - 0.60	0.25 - 0.68	0.30 - 0.53	0.22 - 0.62	0.29 - 0.55	0.20 - 0.64	0.27 - 0.61	0.18 - 0.61

Note: TBI = Traumatic brain injury group; Non-TBI = Non-TBI comparison group; AD = Auditory distraction group; NAD = no auditory distraction.

3.2 Information Domain

A significant difference was found between the groups for episodic structure, with the non-TBI group producing more complete episodes than the TBI group, $F(1, 64) = 5.636$, p = < .05, d = 0.08. No significant differences were observed between groups for all other information domain measures (propositions and global story components). Significant differences were found for genre for all measures in the information domain. These included: propositions $F(3, 64) = 22.214$, p = < .001, d = 0.51, episodic structure $F(3, 64) = 5.948$, p = < .005, d = 0.21, and global story components $F(3, 64) = 35.495$, p = < .001, d = 0.62. Both groups produced more propositions, included more story components, and had a better global structure for the narrative retellings than the persuasive retellings. No significant differences were found for condition for any of the information domain measures. There was no interaction effect across group, genre and condition for any of the information domain measures.

Table 3.2. Measures of information domain for persuasive and narrative discourse tasks (n = 10 per group)

	Persuasive Discourse				Narrative Discourse			
Measure	TBI		Non-TBI		TBI		Non-TBI	
	AD	NAD	AD	NAD	AD	NAD	AD	NAD
Total propositions								
M	3.05	3.65	4.65	4.90	9.00	8.70	10.65	10.65
SD	1.91	2.06	2.55	3.44	3.55	3.05	4.71	3.24
Range	1 - 6.5	0 - 7.5	1 - 9.5	1 - 12	3.5 - 14.5	6 - 15	1 - 16	3.5 - 14.5
Episodic structure								
M	3.40	3.95	5.00	4.70	5.35	5.50	5.85	6.10
SD	1.54	1.72	1.35	2.11	1.29	1.20	1.43	1.60
Range	2 - 6.5	1 - 6.5	3 - 7	1 - 7	3 - 7	4 - 7	3.5 - 7	2 - 7
Global component								
M	1.70	1.90	1.80	2.30	4.10	4.40	4.50	4.20
SD	1.25	0.88	0.67	1.16	1.10	0.84	0.97	1.03
Range	0 - 4	1 - 3	1 - 3	1 - 4	2 - 5	3 - 5	2 - 5	2 - 5

Note: TBI = Traumatic brain injury group; Non-TBI = Non-TBI comparison group; AD = Auditory distraction group; NAD = no auditory distraction.

3.3 Generation of Story Moral/Aim

A significant difference was revealed between adults with TBI and the non-TBI comparison group, with the non-TBI comparison group finding it easier to generate an aim or moral compared to the TBI group $F(1, 64) = 8.767$, $p < .005$, $d = 0.12$. A significant difference was found for genre $F(3, 64) = 10.069$, $p < .001$, $d = 0.32$ A moderate effect size (Cohen, 1988) was noted for genre with the persuasive aims being easier to generate than the narrative morals. No significant difference was found for condition for generation of story moral/aim across group or genre. An interaction effect was found across group and genre $F(3, 64) = 2.901$, $p < .05$, $d = 0.12$ and a small effect size (Cohen, 1988) calculated.

Table 3.3. Generation of story moral/aims for persuasive and narrative discourse tasks (n = 10 per group)

	Persuasive Discourse				Narrative Discourse			
	TBI		Non-TBI		TBI		Non-TBI	
	AD	NAD	AD	NAD	AD	NAD	AD	NAD
M	2.70	2.60	2.50	2.80	1.40	1.50	2.20	2.50
SD	0.48	0.52	0.71	0.42	0.70	0.85	0.92	0.85
Range	2 - 3	2 - 3	1 - 3	2 - 3	1 - 3	1 - 3	1 - 3	1 - 3

Note: TBI = Traumatic brain injury group; Non-TBI = Non-TBI comparison group; AD = Auditory distraction group; NAD = no auditory distraction.

3.4 Modified Clinical Discourse Analysis (CDA-M)

No significant differences were demonstrated between groups or condition for the CDA-M measure. There was no interaction effect across group and condition for the CDA-M measure.

Table 3.4. CDA-M measures for persuasive discourse tasks. Percentage of utterances with problem behaviours

	TBI		Non-TBI	
	AD	NAD	AD	NAD
M	21.74	17.23	25.90	22.95
SD	13.39	9.82	17.17	14.81
Range	0 - 50	0 - 33.33	11.11 - 71.42	0 - 50

Note: TBI = Traumatic brain injury group; Non-TBI = Non-TBI comparison group; AD = Auditory distraction group; NAD = no auditory distraction.

4.0 Discussion

The following questions were raised by this study: 1. Will adults with TBI perform consistently worse across discourse production measures than age matched individuals who have not sustained a TBI? 2. Will the type of discourse task presented (narrative versus persuasive) impact on discourse production abilities for both populations? 3. Does auditory distraction result in negative effects to discourse production for individuals with TBI and healthy controls? 4. If an auditory distraction effect exists, is it magnified in the TBI group? Significant differences were found for population (TBI versus non-TBI comparison group) and genre (narrative versus persuasive), although not across all measures. No condition effect (auditory distraction versus no auditory distraction) was found. The findings are discussed below along with some possible clinical implications for working with the TBI population.

4.1 Group Differences: TBI Group vs. Non-TBI Group

Whilst group differences were found to be significant, this finding was not consistent across all group measures as predicted. This differs not only from the hypothesis given, that adults with TBI would demonstrate decreased performance on the narrative and persuasive retelling tasks when compared with the non-TBI comparison group, but also from findings of previous research by Hay and Moran (2005). In the language domain a group difference was found for sentential complexity, with the non-TBI comparison group producing more complex language compared to the TBI group. No significant difference was found between groups for the amount of discourse produced (e.g. number of words, number of T-units and mean length of T-units). In other words, while TBI participants were able to produce similar amounts of discourse to the non-TBI comparison group, they did not produce as much complex or meaningful discourse. This could be interpreted as a quantity versus quality discourse production effect. For example, while the TBI group did produce complete T-units, these T-units may have been of a less complex structure, or, the TBI group may have needed to use more words to get their intended point across compared to the non-TBI comparison group. This finding is consistent with descriptions of discourse errors for adults with TBI (e.g. excessive or repeated information given (Biddle et al., 1996; Snow et al., 1997b); reduced communicative efficiency (Biddle et al., 1996; Snow et al., 1995; Hartley and Jensen 1991); reduced informational content (Chapman et al., 1992)).

Group differences were not observed for all components of the information domain. Specifically, the TBI and non-TBI group exhibited similar numbers of propositions and global story components across tasks. Although this was another unexpected finding, it is consistent with that of Biddle et al. (1996), who also observed no difference for mean number of propositions between adults and children with TBI and their non-TBI comparison groups. It appears that the abilities of the TBI group to produce information and key points relevant to the task, were higher than predicted. Conversely, Hay and Moran's (2005) findings do not correspond with the present findings, their TBI participants performed significantly worse across all information domain measures for discourse production.

Significant group differences were found for episodic structure in the information domain, with the non-TBI comparison group producing discourse that was better organised compared to the TBI group. Therefore whilst identifying key points and producing relevant propositions can be seen as areas of strength for the TBI group, difficulties are shown to exist when it comes to producing discourse in a logical order or sequence. This finding is consistent with previous studies (Biddle et al., 1996; Chapman et al., 1992; Chapman et al., 1998; Chapman et al., 1997; Hay & Moran 2005, Snow et al., 1997b; Tucker & Hanlon 1998) that have suggested that deficits can be seen when individuals with TBI attempt to plan, organise and structure discourse production.

It is possible that the discourse production impairment described for the organisation or structure of responses for this TBI group is specific to underlying working memory impairment. Working memory has previously been described as playing an underlying role for communicative impairments seen in the TBI population (Chapman, 1992; Hartley, 1995; Hay & Moran, 2005), and results from Tompkins et al., (1994) Working Memory Task, which was used as part of ancillary testing for this study, support this statement. Using this task a statistically significant difference was found between groups, with the TBI group gaining a lower working memory capacity score than the non-TBI comparison group.

Working memory capacity, gives rise to competition for storage and processing of language, and results in a trade-off that takes place between storing and processing information when the capacity is reached (Just & Carpenter, 1992). When employing the story retelling procedure participants are required to both store and process information (Hay & Moran, 2005), thus interconnecting working memory with discourse production abilities for this investigation. A link between working memory and language production was put forward by Hay and Moran (2005), who suggested that the TBI participants in their study chose processing over storage when retelling the passages. This accounted for higher levels of success seen when producing the global component of the passages. This link also accounts for the deficits seen when specific details were needed to score points for the episodic structure. Hay and Moran's (2005) description of TBI participants choosing to process rather than store information, can explain the significant differences found in this study across groups for the episodic structure and the non-significant group differences found for global components.

Previous research finding correspond to the group differences found for the current investigation. Sentential complexity and episodic structure should be treated as areas of weakness for the TBI population and possible avenues for intervention to focus on.

4.2 Genre effects: Narrative vs. Persuasive

When comparing discourse production differences across genre (narrative versus persuasive) it was hypothesised that both adults with TBI and the non-TBI comparison group would demonstrate decreased performance on the persuasive tasks as compared with the narrative tasks. This prediction was successful across language (number of words and number of T-units) and information domain (total propositions, episodic structure and global story components) measures with the exception of sentence complexity and mean length of T-units. Both groups (TBI group and non-TBI comparison group) demonstrated higher success when producing the narrative passages compared to the persuasive passages.

It appears that the narrative genre yields greater success for discourse production and this success is consistent across clinical populations. Hay and Moran (2005) and Scott and Windsor (2000) also described significant differences across language and information domain areas when comparing narrative and expository genres. Their participants (both those with TBI and non-TBI comparison group) produced longer and better organised discourse in the narrative genre. Narrative discourse performance has also been described as more successful by Coelho et al. (2003) when discourse performance for adults with TBI was compared to their performance using the conversational genre.

One explanation for the greater amounts of success when carrying out narrative discourse tasks over persuasive discourse tasks can be explained by developmental literature. Narrative abilities have been documented from age five (Preece, 1987), with Nippold (1998) describing vast improvements throughout early school years. In comparison, gaining competence using the persuasive genre has been documented by Nippold (1998) and others (Paul, 2007; Scott & Erwin, 1992) as taking place later in adolescence, after individuals have first begun to utilise the expository genre. Because of this, individuals may have less exposure to the persuasive genre than the narrative and expository genres (Paul, 2007; Westby & Clauser, 2005). When discussing the narrative genre Nippold (1998) hypothesised that growth and development stemmed from repeated exposure to narrative discourse, multiple opportunities to produce and receive feedback for narrative discourse. If this hypothesis was deemed plausible, could it not also extend to the development of, and possible success, using the persuasive genre? Meaning that, the lack of exposure and use of the persuasive genre accounts for the genre differences found in the present study.

The T-unit has long been described as a marker of syntactic development (Hunt 1970; Nippold et al., 2005), and is another way that genre differences can be highlighted. The significant finding of increased number of T-units for the narrative genre appears to correlate to the above explanation that narrative ability not only develops before the persuasive genre but perhaps is developed to a higher level than the persuasive genre.

An aspect of developmental literature that was not consistent with the current findings, was syntactic complexity. Hartley (1995) and Nippold et al. (2005) have described persuasive discourse as a genre that uses complex language; however such sentential complexity was not found to be significant for either group. One response to this finding is that of motivation; Ulatowska et al., (2001) used a personal narrative task to elicit discourse. They suggested that the emotional salience of the task may have increased the participants' motivation to communicate, and displayed more natural discourse production abilities. Ulatowska et al.'s (2001) explanation corresponds to that of Nippold (1998) and Ritter (1979) who have suggested that a participant's need or desire to use persuasive discourse may impact on the complexity of discourse produced. Therefore, it may be that the retelling of persuasive passages did not provide enough internal significance or motivation for participants to communicate. One participant commented that the persuasive passage titled Donate Blood "did not interest [him] that much". What resulted in the current study was lower numbers of words, T-units, propositions and episodes produced for the persuasive genre and no difference between genres for syntactic complexity.

Coelho (1991) and others (Hartley & Jensen, 1991; Shadden et al 1991; Ulatowska et al., 1990) have suggested that different genres give rise to different linguistic and cognitive demands. One such demand is genre specific text organisation (Wolfe, 2005). Wolfe's (2005) study examined the influence that semantic associations and text organisation have on narrative and expository text recall abilities and his interpretation of his findings suggest that while semantic associations and text organisation do influence memory recall abilities, genre also plays a significant role influencing both semantic associations and text organisation for discourse recall abilities. In the current study, narrative passages have been described as having the following organisational elements: a setting: introducing the characters, time and place; some action: a chain of events and defining moment of the story; a resolution: the outcome of the character's actions (Labov, 1972). Whereas persuasive passages have just three organisational elements according to Hutson-Nechkash, (2004): stating a position; providing details or evidence which supports the initial position; and ending with a conclusion that reiterates the initial position given. The above descriptions of the genres sampled identify different amounts and elements for episodes that correspond to how discourse is organised. Therefore the influence of genre specific text organisation on discourse recall abilities as proposed by Wolfe (2005), may account for significant differences for structure, global components and amount of information between the narrative and persuasive genres found in the present study.

It appears that in general the narrative genre provides increased structure and results in increased complexity, amounts of language and organisation for discourse production, compared to the persuasive genre. However, more studies are needed to gain a better understanding of how discourse production abilities can be influenced and affected by the genre of persuasion.

4.2.1 Generation of morals and aims

While both populations found it easier to generate aims for the persuasive passages than to generate morals for the narrative passages, the non-TBI comparison group had greater overall success with this task. This finding is consistent with Chapman's (1997) statement that to generate a moral, one must be able to not only store and process the information in the narratives, but also use inference and reasoning skills to produce the implied moral. Research by Moran and Gillon (2005) into the inference abilities of the adolescent TBI population supports this finding. They documented that when increased working memory storage demands, such as retelling a story, are present, successful inference abilities decrease for the TBI population (Moran & Gillon, 2005). When generating an aim for a persuasive passage however, individuals could rely solely on storing and processing the information stated in the passage to deduce an aim. This finding is consistent with that of Hay and Moran (2005) who found that both groups (children with TBI and a non-TBI comparison group) had more success generating aims for the expository passages, where no ability to inference was needed, compared to generating morals for the narrative passages. As suggested by Chapman et al. (1997), the TBI group may also have had difficulty with the abstract nature of the task of generating a moral for the narrative passages. This can be illustrated by the concrete responses given by some TBI participants (e.g. "when you're doing a task like freeing a eagle from a snake and you take the snake off make sure you kill it" and "never fight it with a snake").

The findings for the generation of morals and aims have been shown to be consistent with previous research (e.g. Chapman, 1997; Chapman et al., 1997; Hay & Moran, 2005). This suggests that the abstract nature and use of inference and reasoning to generate a moral for a narrative passage is more difficult than generating an aim for persuasive or expository passages across age (children and adults) and population (TBI vs. non-TBI comparison group).

4.2.2 Modified Clinical Discourse Analysis (CDA-M)

The use of the CDA-M measure for persuasive passages did not yield any significant findings for pragmatic abilities across group or condition. This is not consistent with findings by Snow et al. (1997b) and others (e.g. Snow et al., 1999; Snow et al., 1998; Snow et al., 1997a). These researchers have previously used the measure across multiple genres (e.g. conversational, narrative and procedural) to identify discourse errors of adults with TBI and found statistically significant differences between the TBI population and control groups sampled (Snow et al. (1997a, 1997b; Snow et al., 1999; Snow et al., 1998).

Snow et al.'s (1997b) use of the CDA-M measure was implemented within a different genre (conversational discourse). This enabled the inclusion of the parameter for turn-taking difficulty. A generation task was used, questions were posed to participants to initiate conversation topics (e.g. Can you tell me about the work you do?) and a communication partner took part. The communication partner who made comments, asked questions and played an active role in the conversation. In comparison, the present study used a story retell procedure. Coelho (2002) has suggested that story retell tasks and story generation tasks yield different participant performances across tasks. Coelho (2002) described that the nature of the story retell tasks possibly provided increased structure, encouraging the summarising of familiar information, and aiding the participants to keeping on topic, instead of spontaneously developing information as is needed using a generation task. These factors may account for the limited amount of discourse errors that were found for the TBI group sampled in this study using the CDA-M measure (e.g. topic maintenance errors, delay before responding, inappropriate responses and situational inappropriateness) and lack of significant findings between groups.

The use of story retelling also limited communication partner interactions. Communication partner interactions may be a significant factor which is needed in order to highlight discourse errors in the TBI population using the CDA-M measure. When communication partner interactions are included, the individual with TBI can not simply retell the story using as much detail as possible, as was instructed in the current study. Instead they must attempt to successfully meet the needs of the listener, by processing and responding to their spontaneous requests for information and clarification.

Like Snow et al. (1997b), other researchers (e.g. Coelho et al., 2003) have pursued the use of pragmatic measures when analysing discourse. However Coelho et al., (2003) provides further evidence that genre and task design should be considered when implementing pragmatic measures and can impact on results. Coelho et al., (2003) put forward that while communicative impairments seen in the TBI population may be better highlighted using pragmatic measures, such as the CDA-M used in this study, they suggest that the use of such measures should be carried out within the conversational genre as opposed to the narrative genre. Given that in their study, the narrative task was found to provide more insight into the organisation of discourse rather than the pragmatic nature of the impairments (Coelho, 2003).

A final thought on the CDA-M is regarding the low inter-rater reliability gained for this measure (61%). This may highlight the need for further training on this measure, or indicate that the descriptive nature of these parameters allows for subjective interpretation.

Based on the results from this study and prior research it appears that the CDA-M measure may be better suited to generation tasks, with active communication-partner interactions, such as those found in a conversational genre. This is to ensure that all parameters may be included for analysis. Therefore further application of the CDA-M measure is warranted using different language sampling techniques.

4.3 Auditory Distraction

An important finding of this study is that the condition the tasks were retold in (e.g. auditory distraction versus no auditory distraction) did not have a significant impact on the discourse production abilities across genre (narrative vs. persuasive) or group (TBI population vs. non-TBI comparison group). While this finding was not predicted, it is consistent with a recent poster presented at the 2007 American Speech-Language-Hearing Association Convention by Obermeyer, Stierwalt and LaPointe. Their investigation of adults with TBI and cognitive task performance in the presence of auditory distraction did not consistently produce significant negative task effects when auditory distractions were presented (Obermeyer et al., 2007). Obermeyer et al (2007) put forth two explanations for these results, first, that individuals with TBI do in fact have an equal ability to habituate to distraction to that of individuals without TBI. Secondly that individuals with TBI use compensatory strategies to combat distractions (Obermeyer et al, 2007). While these suggestions are not backed by previous findings (e.g. Whyte, 2000) or self reports of performance in distracting settings by individuals with TBI (Ponsford et al., 1995), they do give rise to a further possibility; that, perhaps individuals with TBI perceive they will be affected by distractions to a greater extent than their actual task performance documents? For example, one participant in the present study expressed that they thought they did worse in the auditory distraction condition than in the quiet condition, when in reality they received similar scores for both conditions.

The multitalker babble was chosen for its ability to represent functional environments where more than one person could be talking at once, such as a coffee shop or mall. LaPointe et al., (2007) documented negative task effects using a similar type of auditory distraction (four-talker babble). Use of the multitalker babble made it quite difficult for the listener to isolate and identify specific words in the sample. However Ellermeier and Zimmer (1997) and

LeCompte et al., (1997) have suggested that greater negative task effects are seen when the auditory distraction is comprised of real speech that is identifiable. And even LaPointe et al., (2007) found a bigger distraction effect when the four-talker babble was combined with word repetition as opposed to results from four-talker babble alone. Taking these findings into account, the lack of condition effect found in the present study could be explained by the specific type of auditory distraction used. Could it be that a type of "cocktail effect" is necessary, whereby participants can readily identify speech when the distraction is played, in order for auditory distractions to significantly impact on discourse production tasks for either population sampled? Further research is needed to test the boundaries of this hypothesis in both the TBI population and the non-TBI population.

Task complexity has been documented by LaPointe et al., (2007) as contributing to susceptibility to auditory distraction when carrying out cognitive tasks. It was noted that the greater the complexity of the task, the greater the degradation of performance when distraction conditions were introduced (LaPointe et al., 2007). Task complexity may explain the lack of a condition effect finding in the present study, perhaps the tasks were easy enough for both populations to be able to cope not only with the demands of the retell but also ignore the auditory distraction.

The specific type of discourse task used in the present study should also be considered regarding complexity and susceptibility to auditory distraction. Coelho (2002) documented decreased discourse performance for adults with TBI, using both story retell and story generation task designs compared to a non-TBI comparison group. Perhaps however, different tasks encourage more or less susceptibility to distractions? For example, Whyte et al, (2000) found that the less structured the task the greater the inattentive behaviours seen when a distraction was added. Coelho (2002) has also described story retelling as a more structured task that encourages familiar information to be summarised and possibly aiding participants in staying on topic. In comparison a story generation task requires participants to produce their own information and is described as less structured (Coelho, 2002). Therefore, in light of Whyte et al.'s (2000) findings, it may be possible that the structure that Coelho (2002) described for the story retelling, aided the participants in the current study. This suggests that the story retelling task contained enough structure to decrease susceptibility to the auditory distraction. It may then be possible that if a story generation task was used instead of the story retell task, that a significant condition effect would be found. Further investigations are needed to address this proposal of task complexity and auditory distraction.

The concept of a "sufficient" loudness level at which to present auditory distractions appears to have resulted in conflicting outcomes. For example Jones et al., (1996) and Ellermeier and Zimmer (1997), state that when background noise was presented at 40dB errors in the primary task increased by up to 30%. Whereas LaPointe et al., (2007) did not find task effects when their distraction was presented at 40dB SL. Other researchers (e.g. Beaman, 2005; Buchner et al., 2006; Elliott & Cowan, 2001; Perham, Banbury & Jones, 2007) have presented auditory distractions at functional noise levels such as 65 to 85 dB(A). Such levels are within health and safety levels for noise and represent noise levels one may encounter in a daily environment e.g. office sounds, street noise or radio levels (Maas, 1972; OSH, 2002). However, consistent negative task effects have also not been documented at these noise levels. This gives rise to a suggestion that the noise levels for the auditory distraction presented in the present study may not have been loud enough. Alternatively the question should also be raised, is it ecologically valid to present the auditory distraction at higher levels? Higher noise levels will not relate to common functional noise levels, a component that is important to the rationale of using auditory distraction, nor may they be safe to repeatedly expose participants to.

It can be seen that while no condition effect was found for the present study, a number of explanations such as participant perceptions, task complexity, and loudness level have be presented to account for this finding. These explanations serve to further highlight the need for additional investigations to take place in the area of auditory distraction.

4.4 Clinical Implications

The findings of this study have implications for both assessment and intervention. This study supports the literature (Armstrong, 2002; Biddle et al., 1996; Chapman & Ulatowska, 1994; Chapman et al., 1997; Coelho, 2002; Coelho et al., 2005; Coelho, Liles & Duffy, 1995; Coelho et al., 2003; Hay & Moran, 2005; Snow et al., 1995; Ulatowska et al., 2003) that discourse assessment is needed when examining expressive language in the TBI population. And like Hay and Moran (2005), expands it by demonstrating the need to examine multiple discourse genres, specifically persuasive discourse, which contributes to functional communication. While multiple discourse elicitation tasks have been documented, the task of retelling also has a functional role in communicative settings. Story retelling may be useful for clinicians that want to assess discourse production abilities without the additional components that come with generating passages. Retelling both narrative and persuasive passages appear to be sensitive to reduced sentential complexity as recorded for the TBI group in the present study. Therefore Hay and Moran (2005) suggest discourse assessments using retelling tasks should endeavour to include complex language structures so as to aid in highlighting such impairments. Although Coelho (2002) has suggested that retelling tasks add structure to discourse samples, the samples gained from the TBI group continued to lack structure and organisation. This serves to highlight the legitimacy of using a retell assessment tool for the adult TBI population.

In this study significant genre differences were found using discourse assessment (e.g. amount of information, global components and structure). This should not be surprising given that different genres are used for differing communicative functions such as retelling a story (narrative) or making an argument (persuasive). Therefore clinicians should beware of generalising impairments found for one genre, across all others. Assessing different genres will aid gaining a more complete understanding of the TBI population's expressive language strengths and weaknesses in discourse production.

Some implications for discourse intervention in the adult TBI population are presented: 1. Intervention is warranted based on findings from this study and others (e.g. Chapman et al, 1997; Hay and Moran, 2005; Snow et al., 1998); 2. Intervention should be genre specific 3. Intervention should focus on three areas: a. quantity of discourse produced (relevant, amount of language); b. quality of discourse produced (i.e. complexity); c. structure and organisation of discourse produced. Although limited intervention studies for the TBI population are documented, Paul (2007), Hay and Moran (2004; 2005), and Moran and Gillon (in press) suggest and have trialled some strategies to enhance the above areas of discourse impairment. Use of visual strategies such as cue cards, charts or rubrics appears to be a consistent intervention tool. Hay and Moran (2004; 2005) suggest using visual charts to reduce working memory load in discourse production. These charts or rubrics such as those found in education books (e.g. "*Help me write: Frames and rubrics for classroom writing success"* by P. Hutson-Nechkash) can be specifically designed to encourage organisation of information and reduce repetitive information. Charts or rubrics should be tailored to genre specific characteristics, (e.g. narrative, with headings such as: setting: characters, time, place; action: chain of events, defining moment of the story; resolution: the outcome of the character's actions (Labov, 1972)), Hay and Moran (2004) used a similar chart as part of an expository discourse production intervention study using adolescents with TBI. Results showed that after training using the chart, the participant was able to provide more information that was also relevant to the task structure and increased efficiency when retelling (as demonstrated by reduced T-units). There was however, an apparent trade off of reduced syntactic complexity, Hay and Moran (2004) went on to extend this finding, by suggesting that this mode of intervention may best be carried out in stages, first targeting relevant information, then moving onto complexity, utterance length and global content structure.

Paul (2007) has suggested a method to enhance discourse impairments specific to genre found in this study, which is also consistent with Nippold's (1998) developmental literature. This method includes exposing individuals to multiple examples of effective discourse production. For example, for the persuasive genre, individuals could watch and later discuss and evaluate samples such as: debates, text, or role plays. Given the ease of implementing such a method, this strategy could be considered as an initial step of exposure before visual strategies are introduced.

The clinical implications for auditory distraction are limited. From this study it appears that neither population was affected by auditory distraction, nor were genre differences found. Therefore, it could be that auditory distractions are not a contributing factor to impaired communicative functioning in the TBI population, however further investigations are needed before susceptibility to auditory distractions can be ruled out for the TBI population.

4.5 Study Limitations

Limitations for this study correspond to the TBI population as a whole and more specifically participants assessed in this study. Due to the length of time between injury and participating in this study, it was difficult to gain complete biographical details for all participants in the TBI group. Furthermore, the variable nature and characteristics that exist for the TBI population (e.g. injury origin, year of injury, severity of injury and type of communication impairments) make it difficult to generalise findings to the greater TBI population, without first applying the assessments to a larger sample size.

4.6 Future Considerations

From this study further questions have arisen that are of future interest to aid in further developing the TBI profile, assessment tools, and the impact of auditory distraction:

1. Is the TBI group as distracted as they claim to be? The question gives rise to the possibility of developing and implementing a rating scale for TBI participants that documents their pre and post perceptions of the impact of auditory distractions as compared to their task performance results. Based on this study it appears that the TBI group were not distracted in their discourse production when an auditory distraction was present, however this is not consistent with previous literature regarding participant perceptions of distraction (Ponsford et al., 1995).

2. Will the use of a different discourse task, namely a generation task, give rise to significant auditory distraction effects for the TBI population? Coelho (2002) describes an increase in task complexity for TBI participants when a generation task is used as opposed to a retell task. Therefore it could be possible that when the task is less structured, an increase in susceptibility to auditory distractions will be found.

3. Although inter-rater reliability was high for the information domain, this was completed by training the independent researcher to use the scoring templates (See Appendix F). Perhaps there is a second step in testing reliability. Whereby, investigating if such high reliability is possible when the independent researcher first develops their own templates for each passage based solely on descriptions of scoring procedures?

5.0 Summary

The introduction of an auditory distraction on discourse retell tasks did not demonstrate a significant decrease in discourse production performance to either group as hypothesised. Further investigation into this area is warranted. This study did however; identify significant deficits within language and information domains for adults with TBI as compared to a non-TBI comparison group. Results support the use of discourse tasks as part of an assessment battery for the TBI population. The findings also suggest use of discourse tasks that varying in genres when assessing the TBI population. This is to enable identification of genre specific impairments. Discourse assessments allow use of communicative strategies that are better matched to requirements of communicating in a functional setting. This allows intervention to be planned and implemented from a functional point of view.

6.0 Appendix

APPENDIX A

Working Memory Measure (Tompkins et al., 1994)

INSTRUCTIONS AND PRACTISE ITEMS

This task looks at working memory capacity that is, how much information you can listen to, understand and then recall when asked to.

You are going to hear some sentences, after you have heard each sentence; I would like you to tell me if the sentence is true or false.
Here are some sentences to practise with:

1. You drink from a cup T
2. You eat the telephone F

That's great. Now can you remember the last word of those 2 sentences? Y/N

This time I will say 2 more sentences and I want you to remember the final word of each sentence, and once you have listened to both sentences I want you to tell me what the 2 final words were. You can list the final words from each set in any order.
Let's try some now:

1. Elephants are <u>small</u>
2. Lemons are <u>sour.</u>

- That's right the final words were 'sour' and 'tiny'/ the final words were 'sour' and 'tiny' – lets try some more.

This time, I would like you to combine the two tasks we have just practised. First I want you to listen to each sentence and after each sentence tell me if it is true or false. Then at the end of the set tell me the final word of each sentence. There will be two sentences in this set; after you have listened to both sentences you can tell me the final words. Ready?

1. Fish live in <u>water</u> T
2. You drink <u>stones</u> F

- Great you told me which sentences were true or false and then the final words.

Now let's try some listening to the tape.

1. Dogs can <u>bark.</u> T
2. You eat <u>trees.</u> F

– Well done, now I will play some more on the tape. At first there will only be 2 sentences in each set, however this will increase slowly to 5 sentences in a set.

TEST ITEMS:

To start, you will hear 2 sentences in each set

Pause: 1 sec between set number, 3 sec between sentences and 5 sec between sets.

Set 1	Set 2	Set 3
You sit on a <u>chair.</u> T	A table is an <u>animal</u>. F	Tigers live in <u>houses.</u> F
Trains can <u>fly.</u> F	Children like <u>games.</u> T	Milk is <u>white.</u> T.

Now you'll hear 3 sentences in each set

Set 4	Set 5	Set 6
Sugar is <u>sweet.</u> T	You ride on a <u>bus.</u> T	Pumpkins are <u>purple.</u> F
Auckland is next to <u>Wellington.</u> F	Cats can <u>talk.</u> F	Mice are smaller than <u>lions.</u> T
Horses run in the <u>Sky.</u> F	Apples grow on <u>trees.</u> T	Roses have <u>thorns.</u> T

Now you'll hear 4 sentences in each set

Set 7	Set 8	Set 9
Twelve equals one <u>dozen.</u> T	Water is <u>dry.</u> F	Chickens eat <u>eggs.</u> F
Bicycles are slower than <u>cars.</u> T	Cows like to eat <u>grass.</u> T	Babies can <u>drive.</u> F
A book can <u>play.</u> F	Ducks have webbed <u>feet.</u> T	A clock tells <u>time.</u> T
Feathers can <u>tickle.</u> T	Little boys wear <u>dresses.</u> F	The sky is <u>green.</u> F

Finally you will hear 5 sentences in each set.

Set 10	Set 11	Set 12
Carrots can <u>dance.</u> F	An orange is a <u>fruit.</u> T	You keep books in <u>ovens.</u> F
Fish swim in <u>water.</u> T	February has six <u>days.</u> F	Rabbits can <u>read.</u> F
You sleep on a <u>bed.</u> T	A shoe has <u>ears.</u> F	A lobster has a <u>shell.</u> T
You eat breakfast at <u>night.</u> F	You wash with <u>soap.</u> T	Chairs can <u>eat.</u> F
People have <u>eyes.</u> T	A car can <u>race.</u> T	Dogs have four <u>legs.</u> T

APPENDIX B

The fox and the goat

One day, a fox was walking along a path when he came to a well. He was not looking where he was going and fell into the deep well. A goat, who was very thirsty, came to the same well and seeing the fox, asked if the water was good. Pretending he was fine, the fox explained that the water was fantastic and encouraged the goat to come down. The goat, thinking only of being thirsty, jumped straight down and started to drink. Just as he drank, the fox explained that they were now both stuck and suggested that they escape together. The goat agreed and so the fox persuaded the goat to let him jump on his back to get to the top of the well. When the fox had done this, he ran away as fast as he could. When the goat yelled at him for breaking his promise, the fox yelled back that the goat should never have gone down without finding a way back up and continued to run away.

The snake and the eagle

A SNAKE had succeeded in surprising an Eagle and had wrapped himself around the Eagle's neck. The Eagle could not reach the Snake, with his beak or his claws. Far into the sky he soared trying to shake off his enemy. But the Snake's hold only tightened, and slowly the Eagle sank back to earth, gasping for breath.

A Farmer saw the unequal fight. In pity for the noble Eagle, he rushed up and soon had loosened the Snake and freed the Eagle.

The Snake was furious. He had no chance to bite the watchful Farmer. Instead, he saw the drink bottle, hanging at the Farmer's belt, and injected his poison into it.

The Farmer now began to walk home. Becoming thirsty on the way, he filled his drink bottle at a river, and was about to drink. Suddenly there was a rush of great wings.

Sweeping down, the Eagle seized the poisoned drink bottle from out his savior's hands. He flew away with to hide the drink bottle where it could never be found.

APPENDIX C

Donate Blood

Would it surprise you if I told you that you could save twelve lives every year? Well this statement is very true. I am going to persuade you to become a blood donor. I am an active blood donor. I try to donate blood every three months because it makes me feel good to know that I am playing an active role in saving peoples lives.

Why do we need blood donors? Well blood is very special; it can not be manufactured or substituted for animal blood and it only has a shelf life of thirty-five days.

Everyday hundreds of New Zealanders need blood transfusions to live; in fact, eighty percent of all New Zealander's will need a blood transfusion sometime in our lives. In reality, you, your family and your friends will need the support of volunteer blood donors, yet less than five percent of all possible donors give blood.

Blood is constantly needed. It is time to spend forty-five minutes to save not one but three lives. Donate blood now!

Fast-Food.

Although many of us find fast food convenient, it is a bad idea to eat it too much or too often. Recently, McDonald's has had a two-dollar deal for a Big Mac and small fries. This is a very big temptation, and even my friend (who doesn't normally eat McDonald's) bought this meal. But what did he actually eat? First, in the hamburger he got five hundred and seventy calories, with almost half of them coming from fat. Ten grams of this fat is saturated, the most dangerous kind, which is harmful to our heart. The Canadian Food Guide recommends that we "choose lower-fat foods more often." Now, remember that my friend also gets a small fries! Unfortunately, there are another two hundred and ten calories in the fries, with ten more grams of fat. Now, imagine he eats this dinner more than once a week! A two-dollar meal contains a lot of fat. So, although it is very convenient (and cheap) to buy fast food, it is quite alarming to see just how much fat we are eating.

APPENDIX D

To introduce the task to the participants, the author read aloud the following information:

> Today you will listen to 4 short passages on a tape. After you have listened to each passage I would like you to tell me what you heard in as much detail as possible, and then tell me a lesson or moral for each passage.
>
> You will retell two of the passages to me in this quiet room, however when you retell the other two passages, you will also be able to hear some noise. Here is a sample of the noise you will hear. Try to ignore the noise as best you can, nothing you hear when you are retelling the passages will be tested, so do your best to ignore the noise.

Before playing each discourse passage, the author read aloud the following information:

> <u>Quiet Condition</u>
>
> I have a story for you to listen to. I will play it on the tape and you will listen to the story only once. When the story is finished, I would like you to tell me the story you just heard, with as much detail as you can remember. After you have finished retelling the story to me I will then ask you to tell me a moral or lesson that could be learnt from the story.
>
> Do you understand? I will push play.
>
> <u>Auditory Distraction Condition</u>
>
> I have a story for you to listen to. I will play it on the tape and you will listen to the story only once. When the story is finished, I would like you to tell me the story you

just heard with as much detail as you can remember. While you are retelling the story I will play some noise in the background. Ignore the noise as best you can and concentrate on telling me the story. After you have finished retelling the story to me I will then ask you to tell me a moral or lesson that could be learnt from the story.
Do you understand? I will push play.

Once the participants had finished listening to the passage the author repeated the instructions:

Now it's your turn to retell the story to me using as much detail as you can remember.

When the participants finished retelling the passage the author asked once "Can you think of anything else that happened in the story" before asking the participants what the moral or aim of the passage was.

APPENDIX E

Scoring of T-units was completed using the descriptions given by Nippold et al., (2005) and discussions with Margaret Maclagan (2007, personal communication).

Definitions and examples of T-units, clauses and commands

T-unit (a.k.a – communication unit):

A T-unit contains "one main [independent] clause plus any subordinate [dependent] clause or non-clausal structure that is attached to or embedded in it" (Hunt, 1970). For example, the utterance "a fox was walking along a path when he came to a well" is one T-unit that contains an independent clause "a fox was walking along a path" and a dependent clause "when he came to a well". However, the utterance "a fox was walking along a path and he came to a well" contains two T-units because it includes two independent clauses joined by the coordinating conjunction "and." A clause is considered to be a new T-unit, each time a coordinating conjunction (e.g., "and," "but," "so") initiates an independent clause.

Independent (Main) clause:
An independent clause makes a complete statement and should typically contain a subject and a main verb (Crews, 1977).

- For example, the following are both independent clauses:
  "A snake surprised an eagle" and "basically the meal was about half fat".

- Commands are coded as independent clauses:

  For example: "Donate blood now!"

- Comment Clauses are also coded as independent clauses:

  For example: "Eighty percent of people need blood, *I think*." Both "eighty percent of people need blood" and "I think" are independent clauses.

Dependent (Subordinate) Clauses:

A dependent clause, although often containing a subject and a main verb, does not make a complete statement and so, cannot stand alone. Use of dependent clauses are an indicator of syntactic complexity.

- Crews (1977), Quirk and Greenbaum (1973) describe three main types of dependent clauses: relative, adverbial, and nominal. Further examples of dependent clauses are also listed below.

  1. Relative clause: (i.e. adjective clause) modifies the noun that precedes it by acting like an adjective: for example, "the fox *that was walking along the path* fell into the well".

  2. Adverbial clause: modifies a verb by acting like an adverb. It often describes a use and begins with a subordinate conjunction: for example, *"unless we work together now,* we'll be stuck down here forever".

3. **Nominal clause:** this clause can serve as either the subject of a sentence (e.g. *"What the fox said about teamwork* was a big lie") or the object (e.g. "The fox did not know *what he should do)*. Many nominal clauses also begin with wh-words: for example, "A goat, *who was very thirsty*, came to the same well".

4. Subject deletion in coordinated clauses:

For example: "and then the farmer went off home, and stopped to fill up the drink bottle, and was about to drink.*"* This illustrates one independent clause ("*and then the farmer went off home*") and two dependent clauses that do not contain subjects ("*and stopped to fill up the drink bottle*" "*and was about to drink*"). Therefore the listener must refer back to the initial independent clause containing the subject to maintain comprehension.

5. Direct speech: Responses containing direct speech are also coded as dependent clauses, for example: "And the fox said *the water is delicious*!*"* as opposed to "and the fox said *that the water was delicious*" which contains a nominal clause.

APPENDIX F

INFORMATION DOMAIN: FAST FOOD			
Episodic Structure			Propositions
		points	
Argument		1	1. Although fast food is thought of as convenient it is a bad idea to eat it too much or too often.
Supporting information	One piece Two pieces Three pieces Four pieces Five or more	1 2 3 4 5	2. McDonalds had a two-dollar deal for a Big Mac and small fries. 3. This is a big temptation. 4. Even someone who doesn't normally eat McDonalds bought it. 5. The hamburger has five hundred and seventy calories. 6. Half of those calories are fat. 7. Ten grams of this fat is saturated. 8. Saturated fat is the most dangerous kind 9. Saturated fat is harmful to our hearts. 10. The Canadian Food guide recommends we "choose lower-fat foods more often". 11. The small fries contain another two hundred and ten calories. 12. There is ten more grams of fat in the small fries. 13. You shouldn't eat this meal more than once a week.
Conclusion		1	14. A two dollar meal contains a lot of fat. 15. Even though fast food is cheap and convenient it is alarming to see how much fat we are eating.
Total episodes		**7**	**Total Propositions: 15**
Intactness of Global story components	**Total components**	**4**	1. Fast food might be convenient but it's a bad idea to eat it to much or often 2. A Big Mac and small fries contains a lot of calories and fat 3. Fat is harmful to our hearts. 4. Fast food contains a lot of fat
Story aim	3 points correct, 2 points partial score, 1 point incorrect/ no response.	**3**	It's not healthy to eat fast food

INFORMATION DOMAIN: DONATE BLOOD			
Episodic Structure			**Propositions**
		points	
Argument		1	1. To persuade the listener to become a blood donor
Supporting information	One piece Two pieces Three pieces Four pieces Five or more	1 2 3 4 5	2. You can save twelve lives every year. 3. The speaker is a blood donor. 4. The speaker donates blood every three months. 5. Blood donors play an active role in saving peoples lives. 6. Blood donors are needed because blood can not be manufactured 7. Blood can not be substituted for animal blood. 8. Blood only has a shelf life of thirty five days. 9. Everyday hundreds of New Zealanders need blood transfusions to live. 10. Eighty percent of all New Zealanders will need a blood transfusion sometime in their lives. 11. In reality you, your family and your friends will need the support of volunteer blood donors. 12. Less than five percent of all possible donors give blood.
Conclusion		1	13. Blood is constantly needed. 14. Spend forty five minutes to save 3 lives. 15. Donate blood now!
Total episodes		**7**	**Total propositions: 15**
Intactness of Global story components	**Total components**	**5**	1. You should become a blood donor 2. Blood donors are needed to save peoples lives. 3. You, your friends and family could need blood from a donor 4. Not enough people give blood. 5. Blood is always needed.
Story moral	3 = correct, 2 = partial score, 1 = incorrect/ no response.	**3**	Become a blood donor

INFORMATION DOMAIN: THE FOX AND THE GOAT			
Episodic Structure			**Propositions**
		points	
Setting	Characters Time Place	1 1 1	1. A fox was walking along a path. 2. He was not looking where he was going 3. The fox fell into a deep well. 4. The fox couldn't find a way to escape. 5. A goat came to the same well to drink.
Action	Sequence of events Turning point in story	1 1	6. He asked the fox if the water was good. 7. The fox pretended he was fine and explained that the water was fantastic. 8. He encouraged the goat to come down. 9. The goat thought only of being thirsty. 10. The goat jumped straight down and started to drink. 11. The fox explained that they were now both stuck. 12. The fox suggested that they escape together. 13. The goat agreed.
Resolution		1	14. The fox persuaded the goat to let him jump on his back to get to the top of the well. 15. When the fox had done this he ran away. 16. The goat yelled at him for breaking his promise.
Story closure		1	17. The fox yelled back that the goat should never have gone down without finding a way back up and continued to run away.
Total Episodes		**7**	**Total propositions: 17**
Intactness of Global story components	**Total components**	**5**	1. A fox falls in a well. 2. A goat comes to drink. 3. The fox persuades the goat into the well. 4. The fox uses the goat to escape. 5. The fox leaves the goat in the well.
Story moral	3 = correct, 2 = partial score, 1 = incorrect/ NR	**3**	Think things through before you act.

INFORMATION DOMAIN: THE SNAKE AND THE EAGLE			
Episodic Structure			**Propositions**
		points	
Setting	Characters Time Place	1 1 1	1. The snake was attacking the eagle. 2. The eagle flew high into the sky trying to loosen the snake's hold on him. 3. The eagle could not get free from the snake. 4. The eagle and the snake fell back to earth.
Action	Sequence of events Turning point in story	1 1	5. A farmer saw the snake and eagle fighting. 6. The farmer freed the eagle from the snake. 7. The snake was angry at the farmer. 8. He was not able to bite the farmer so he spit his venom into the farmer's drink bottle instead. 9. The farmer began to walk home. 10. He became thirsty from his walk. 11. The farmer filled his drink bottle with water at a stream. 12. He was about to drink from the poisoned drink bottle.
Resolution		1	13. The eagle flew back to the farmer. 14. The eagle grabbed the drink bottle from the farmer.
Story closure		1	15. The eagle flew away with the poisoned drink bottle to hide it where it could never be found.
Total Episodes		**7**	**Total propositions: 17**
Intactness of Global story components	**Total components**	**5**	1. A snake and eagle are fighting. 2. A farmer frees the eagle from the snake. 3. The snake poisons the farmer's drink bottle. 4. The farmer is about to drink from the bottle. 5. The eagle takes the drink bottle away from the farmer
Story moral	3 = correct, 2 = partial score, 1 = incorrect/ no response.	**3**	An act of kindness is well repaid/one good turn deserves another.

APPENDIX G

CDA-Modified Version Scoring Template

Modified from Damico, J. (1992). Clinical Discourse Analysis: A Functional Approach to Language Assessment. In C.S. Simon (Ed) *Communication skills and classroom success: Assessment and therapy methodologies for language and Learning disabled students.* Eau Claire, WI: Thinking Publications, pp.125-150

QUANTITY
Information redundancy : The Continued and inappropriate fixation on a proposition. Speaker will continue to stress a point or relate a fact even when the listener has acknowledged its reception. e.g. repeating propositions when retelling passages.
Insufficient information: The speaker does not provide the amount or type of information needed by the listener. Check that responses given are specific and able to sufficiently inform the listener. E.g. ambiguous information.
QUALITY
Message inaccuracy: While communication is attempted the information provided is not accurate information. E.g. if participant relays a proposition but it is not correct (wrong name or figures given).
RELATION
Inappropriate response: The response may be unpredictable, irrelevant or difficult to interpret what the desired meaning is.
Poor topic maintenance: The individual does not stay on the designated topic. May switch topics without providing sufficient cues to the listener. Poor topic maintenance should be interpreted as error or avoidance behaviours.
Situational inappropriateness: Lack of relevance to topic and occurs in inappropriate situation
MANNER
Failure to structure discourse: Damico (1991) describes this as a global problem and occurs when the discourse of the speaker lacks planning to organise responses. The response, even if it contains relevant propositions, may be confusing. Informational responses will allow more successful listener comprehension when presented in a logical and temporally sequential form. E.g. if argument is missing or not stated first when retelling persuasive passage.
Delay before responding: Long pauses **after** a communication partner has asked a question. Can disrupt interaction process.

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