CHAPTER 2

REVIEW OF LITERATURE

Contents

2.1 Traumatic Brain Injury (TBI)

2.1.1 Classification of Traumatic Brain Injury.

2.1.2 Neuropathophysiology of TBI.

2.1.3 Pathological hallmark and deficits in TBI.

2.2 Cognitive-linguistic deficits after TBI

2.2.1 Discourse level.

2.2.1.1 Studies on T-unit based analysis.

2.2.1.1.1 Sentence level analyses.

2.2.1.2 Across sentence analyses- Thematic level.

2.2.1.2 Qualitative discourse analysis.

2.2.1.2.1 Conversation task.

2.2.1.2.2 Narration task.

2.2.1.2.3 Picture description task.

2.3 Bilingualism

2.4 Indian studies on TBI
Traumatic brain injury (TBI) is the leading cause of death and disability in individuals less than 45 years of age in industrialized countries (Bruns & Hauser, 2003). Each year an estimated 1.4 million Americans experience a TBI and 80,000 to 90,000 suffer long-term substantial loss of function (Rutland-Brown, Langlois, Thomas, & Xi, 2006). Clinical studies have shown that 10–15% of individuals with mild TBI have persistent cognitive and behavioural complaints. Outcomes from moderate TBI are much less favourable with some estimates suggesting that 50% of these individuals endure long term injury-related disabilities (Kraus & McArthur, 2005). This places an enormous economic burden on the U.S. healthcare system with an estimated cost of $9–10 billion in acute care and rehabilitation annually. This cost is in addition to lost earnings, social services, and the cost to family members who must care for TBI survivors. TBI also represents a global healthcare crisis with an estimated 2% of the world’s population suffering from chronic symptoms of brain trauma, equating to more than 120 million individuals (National Institute of Health-NIH, 1998; Ragnarsson, 2002).

Data for the years 2008 – 2010 collected under the Bangalore road safety and injury prevention program conclusively point that as per National Crime Records Bureau (NCRB) data for India, Road Traffic Injuries (RTI) accounted for 27%. Even though injuries occur in all age groups and both sexes, young people in the age group of 15 to 44 years are affected most. It is most unfortunate that the productive and resourceful sections of Indian society are succumbing to injuries, as this age is characterized by hope, drive and ambition. This particular section of the society is not only the most crucial age for individuals and families, but also for building the nation. The gender distribution of injuries varies as per cause, but the male predominance is glaring and visible. Nearly 3–4 men are killed and injured for every female death in road crashes. Globally, RTIs alone result in economic losses to the tune of $ 518 billion every year & a $ 65 billion in low and middle income countries (WHO, 2004b). Much of this impact is seen in low and/or middle-income countries (LMIC) like India with a economic loss of 20-30 thousand at the time of accident. (Gururaj, 2011). For these reasons it has been a long sought goal of TBI researchers to understand the cognitive-linguistic deficits after TBI to help develop treatment strategies that may assist these patients with cognitive recovery.
2.1 Traumatic Brain Injury (TBI)

Traumatic brain injury is one of the most common neurological insults that affect individuals discourse ability. TBI has been defined as “an insult to the brain, not of the degenerative or congenital nature, but caused by an external force, that may produce a diminished or altered state of consciousness” (National Head Injury Foundation, 1985). According to this definition, TBI is the result of an external mechanical force applied to the cranium and the intracranial contents, leading to temporary or permanent impairments, functional disability, or psychosocial maladjustment. TBI can manifest clinically from concussion to coma and death. Road traffic accidents, falls, sports, industrial accidents and assaults are the most frequent causes of TBI.

2.1.1 Classification of traumatic brain injury.

Brain injury arising from head trauma is generally classified on the external observation and the clinical performance as non penetrating (closed) injuries and penetrating (open) brain injuries. Closed head injuries tend to be associated with diffuse brain pathology and in contrast, penetrating head trauma tends to lead to more focal brain pathology, although diffuse effects also can be observed. The closed head injury patients show more evident speech and language communication disorders and are usually referred to speech language pathologists. There is diverse and complex typical cognitive communication long-term impairments reported to follow closed head injury (CHI) yet there are no proper assessment tools. Recently research has been shifting towards nonstandardized assessment of higher cognitive functioning including discourse, pragmatics, and measures of executive function (Ylvisaker & Szekeres, 1994).

The most common classification system for TBI severity is based on the Glasgow Coma Scale (GCS) score determined at the time of injury (Appendix- A). The GCS is a 3 to 15 point scale used to assess a patient's level of consciousness and level of neurologic functioning. It consists of 3 sections, each of which is scored as best motor response, best verbal response, and eye opening. The total of the motor, verbal, and eye-opening scores range from 3-15 and indicates the severity of a TBI. A total score of 3-8 for the 3 sections indicates severe TBI, a score of 9-12 indicates
moderate TBI, and a score of 13-15 indicates mild TBI and a score of <3 indicates very severe as modified from Jennet and Teasdale (1981) (Table-1). The duration of coma or loss of consciousness (LOC) is another measure of the severity of a TBI (Greenwald, Burnett & Miller, 2003). The mild to moderate stage is more sensitive for the discourse measurement.

Table 1.

Classification of TBI.

<table>
<thead>
<tr>
<th>Severity</th>
<th>GCS Score</th>
<th>Duration of coma</th>
<th>Features</th>
<th>Discourse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>13-15</td>
<td>&lt; 30 min</td>
<td>Unconsciousness and clouding of consciousness with subsequent complete recovery.</td>
<td>Usually intact &amp; can attend to single sentence questions.</td>
</tr>
<tr>
<td>Moderate</td>
<td>9-12</td>
<td>30min to 6 hrs</td>
<td>Unconsciousness and clouding for up to 24 hours</td>
<td>Require prompting to begin conversation. Poor planning and organization.</td>
</tr>
<tr>
<td>Severe</td>
<td>3-8</td>
<td>&gt;6 hrs</td>
<td>&gt;24 hours without signs of brainstem dysfunction</td>
<td>May respond to verbal utterance restricted to close ended questions only.</td>
</tr>
<tr>
<td>Very severe</td>
<td>&lt;3</td>
<td>Upto 1 week</td>
<td>Signs of brainstem dysfunction</td>
<td>Complete nil in their verbal utterance.</td>
</tr>
</tbody>
</table>

A study by Choi (1992) focused on the recovery of cognitive function in patients with head injuries and used the Mini Mental State Examination (MMSE) score and its correlation with demographic (GCS score) and social data. Data on 77 patients with minor head injuries were analyzed. The MMSE scores one month after injury and at discharge were significantly lower in patients with head injuries that included skull fractures than in patients without skull fractures, suggesting lower cognitive function in patients with skull fractures. The MMSE score one month after the injury (at discharge) was highly correlated with the duration of unconsciousness (low GCS score). Thus, MMSE score one month after injury and at discharge were highly correlated with the GCS scores at admission, three days after admission, and one week after admission. Since both GCS and MMSE belongs to neuropsychological
assessment. In the present study, both GCS score and MMSE score are considered as main selection criteria to choose the participants for the study.

Another injury classification based on clinical and neuroradiological evaluation has been proposed. In this classification, TBI would be described as focal or diffuse. Focal injuries include scalp injury, skull fracture, and surface contusions and are generally caused by contact. Diffuse injuries include diffuse axonal injury (DAI), hypoxic-ischemic damage, meningitis, and vascular injury. These are usually caused by acceleration-deceleration forces. These 2 forms of injury are commonly found together. Diffuse axonal injury (DAI) is one of the most common and important pathologic features of TBI. It constitutes mostly microscopic damage, and it is often not visible on imaging studies. The main mechanical force that causes DAI is rotational acceleration of the brain, resulting in unrestricted head movement. Rotational acceleration produces shearing and tensile forces, and axons can be pulled apart at the microscopic level. Microscopic evaluation of the brain tissue often shows numerous swollen and disconnected axons. Rapid stretching of axons is thought to damage the axonal cytoskeleton and, therefore, disrupt normal neuron function. Contusions are distinct areas of swollen brain tissue. They are typically found on the poles of the frontal lobes, the inferior aspects of the frontal lobes, the cortex above and below the operculum of the sylvian fissures, and the lateral and inferior aspects of the temporal lobes. These changes due to head trauma can be observed in brain using many imaging studies. By studying the neuro-pathophysiological changes of brain, TBI can be diagnosed.

2.1.2 Neuropathophysiology of TBI.

Brain injury arising from head trauma is of two broad types: non penetrating (closed) injuries and penetrating (open) brain injuries. The pathologies associated with closed head injury are categorized into two types: Primary injury and Secondary injury. The two main mechanisms that cause primary injury are contact (example- an object striking the head or the brain striking the inside of the skull) and acceleration-deceleration. Primary injury due to contact may result in injury to the scalp, fracture to the skull, and surface contusions. Primary injury due to acceleration-deceleration results from unrestricted movement of the head and leads to shear, tensile, and
Review of Literature

Compressive strains. These forces can cause intracranial hematoma which is the most common cause of death and clinical deterioration after TBI. Hematomas are categorized as epidural hematomas, these are usually caused by fracture of the temporal bone and rupture of the middle meningeal artery. With epidural hematomas, clotted blood collects between the bone and the dura. Because the source of bleeding is arterial, this type of hematoma can grow quickly and create pressure against the brain tissue. Subdural hematomas, such hematomas are usually caused by rupture of the bridging veins in the subdural space. They can grow large enough to act as mass lesions, and they are associated with high morbidity and mortality rates. Subarachnoid hematomas result from damage to blood vessels in the posterior fossa stalk. Primary injury also includes injury to cranial nerves and the pituitary stalk. Other major types of primary brain injury are contusions, lacerations, basal ganglia haematoma and diffuse axonal injury. To explain each in detail a contusion consists of multifocal capillary haemorrhages, vascular engorgement and edema in an area of brain tissue. The injury can be at the site of the blow or impact of brain tissues to the skull (coup contusions) or at the opposite point to the trauma (contra-coup). When a brain contusion is sufficiently severe, it causes a visible breach in the continuity of the brain causing lacerations. Lacerations are more associated with penetrating head injuries than with closed head injuries. Basal ganglia haematoma occurs in approximately 3% of severe closed head injuries. Although it can occur in isolation or in association with other intracerebral haematomas and contusions, it is mostly found in subjects who have severe diffuse white matter injury (Coloquboun & Rawlinson, 1999). Diffuse axonal injury is usually caused by rotational acceleration in which there is rotation of head around its own center of gravity, which results in permanent stretching or rupturing of neuronal fibers causing diffuse axonal injury (Pang, 1985; Bigler, 1990). It leads to damage of the axons in the white matter of brain produced at the moment of impact and is widely considered to be the primary cause for closed head injury. The degree of diffuse axonal injury is directly related to duration and severity of coma and the clinical outcome.

Secondary injuries may occur immediately after trauma and produces effects that may continue for a long time. Injury may result from impairment or local declines in cerebral blood flow (CBF) after a TBI. Decreases in CBF are the result of cerebral
edema, intra cranial hemorrhage, ischemic brain damage, increased intra cranial pressure, cerebral atrophy and ventricular enlargement. As a result of inadequate perfusion, cellular ion pumps may fail, causing a cascade involving intracellular calcium and sodium. Resultant calcium and sodium overload may contribute to cellular destruction. Excessive release of excitatory amino acids, such as glutamate and aspartate, exacerbates failure of the ion pumps. As the cascade continues, cells die, causing free radical formation, proteolysis, and lipid per oxidation. These factors can ultimately cause neuronal death. This neurological defect leads to communication disorders. These are due to complex biomechanical forces associated with head injury. The biomechanical forces involved in closed head injury include, compression, acceleration, deceleration and rotational acceleration which result in brain tissue being compressed, torn apart by the effects of tension and sheared by rotational forces (Murdoch, 1990).

2.1.3 Pathological hallmark and deficits in TBI.

In TBI, frontal and temporal lobe injuries are most commonly reported, as these are the areas which are more vulnerable for the impacts. While temporal lobe pathology following TBI is associated with disorders of memory and new learning, frontal lobe damage and diffuse axonal injuries have been associated with loss of regulatory control over cognitive processes and affective and social behaviours. Alternately other individuals with TBI may demonstrate impoverished communication because of their inability to formulate and initiate goal-directed behaviour and reduced desire to express emotion or engage in social interaction (Auberach, 1986). Owing to the presence of these difficulties, individuals with TBI display impaired social perception, self image and self analysis. The common discourse impairments include verbosity, disorganization, tangentiality, concreteness, and an inability to interpret or utilize conversational inference. However, overall, little exploration of these deficits has occurred to date.

Other discourse difficulties which have been described following TBI include poor topic maintenance, difficulty meeting the informational needs of the listener, difficulty making contributions which sustain and extend an interaction, poor cohesion, and reduced communicative efficiency (Hagen 1984; Mentis & Prutting
Because TBI is typically associated with diffuse axonal injury, together with focal injury to the frontal and temporal regions, Ponsford (1995) reports that these discourse changes are generally considered to reflect neurobehavioural impairment, rather than aphasia. That is, TBI is thought to be associated predominantly with a disturbance of language use, rather than language form.

A number of workers have also emphasized the relationship between discourse impairment and underlying cognitive dys-function (Hagen 1981; McDonald & van Sommers, 1993; Hartley 1995; McDonald & Pearce 1995; Coelho, Liles & Duffy, 1994; 1996). Deficits in areas such as attention/concentration, mental flexibility, planning/organization, and self-regulation, have been implicated as being substantially, if not entirely, responsible for difficulties using discourse appropriately in everyday settings. Observations of non-aphasic patients with focal central nervous system damage implicate frontal cortex in the higher-level processes contributing to narrative skills. For example, patients with executive dysfunction due to prefrontal damage following traumatic brain injury fail to construct cohesive, temporally sequenced speech samples (Ferstl, Guthke, & von Cramon, 1999; Ferstl & von Cramon, 2002). This dysfunction can appear after damage to left or right prefrontal cortex.

2.2 Cognitive-Linguistic Deficits After TBI

It is observed that there are neuroanatomical and neurophysiological changes in brain due to traumatic brain injury. These changes with traumatic brain injury can alter neurocognitive and neurolinguistic skills in any individuals. These skills include cognition and language. Coelho (1995) noted that, because discourse may break down at a number of different levels, samples should be analysed at multiple levels of performance, for example cohesion, productivity, and content. There is evidence that different discourse genres place different cognitive and/or linguistic demands on a speaker, regardless of the presence of brain damage (Coelho, Liles, & Duffy, 1991a; Hartley & Jensen, 1991; Shadden, Burnette, Eikenberry & DiBrezzo, 1991). Non-brain-damaged controls have been found to produce longer monologues (both temporally and in terms of the number of utterances) when producing narratives than
when producing procedural discourse. Also, speakers tend to use more complex sentences when producing narratives. Hartley and Jensen (1991) reported that control subjects displayed greater difficulties with clarity of reference when producing procedural discourse, than when producing narratives. Specific observations can be made with respect to discourse deficits in individuals with traumatic brain injury for conversation, narration and picture description task. The discourse can be profiled under different parameters in a specific manner as mention in the following sections.

2.2.1 Discourse level.

The linguistic skills at the level of discourse can be assessed by considering different discourse genre. In the present study conversation, narration and picture description tasks were considered. Sherratt (2007) studied the applicability and utility of using a multi-level discourse-processing model to examine the interaction between levels of discourse produced by individuals without brain damage. A total of 14 narrative and procedural discourse samples were elicited from 32 non-brain-damaged males of different ages and socioeconomic status groups, yielding a total of 394 samples. These samples were analysed in terms of seven broad features like relevance, discourse grammar, clarity disruptors, productivity and syntactic complexity, clausal structures, cohesion and fluency relating to the levels of the multi-level discourse model. Greater relevance was related to more appropriate discourse grammar as well as greater cohesion and syntactic complexity. Longer samples were correlated with an increased proportion of cohesive ties, cohesive errors, and syntactic complexity. An increase in non-specific elements was related to reduced syntactic complexity and cohesion. A higher occurrence of left-branching clauses was associated with increased dysfluency. These correlations are explained in terms of the multi-level discourse model. Thus, it is concluded that using a multi-level discourse processing model one can offer a more realistic perspective of discourse than the analysis of individual aspects. The differential diagnosis of relatively similar discourse impairments (example- following head injury, dementia, right brain damage) may ultimately rely on a comparison of the relative deficits at different levels. Certain discourse features that can be assessed more objectively (example- the number and type of conjunctions) can signal a breakdown at a more conceptual discourse level (example- the linking of propositions to each other at a semantic level). Finally these correlations can provide explanatory
information regarding more subjective concepts that are difficult to define and measure (example- the perception of “relevance” relates to more structured discourse at the macro and micro level). Although this approach to discourse is challenging, it can provide a starting point for more productive investigations of discourse. Thus in the present study, an effort is made to analyze discourse at multiple levels.

2.2.1.1 Studies on T-unit based analysis.

The discourse analyses procedure begins with the elicitation of a spoken discourse, ideally five sentences or more in length. A variety of elicitation tasks has been described in the previous section and is related to different discourse types. The elicited samples are typically audiotaped and transcribed verbatim. Once transcribed the discourse samples are distributed into more basic units for analysis such as T-units. A T-unit, as described by Hunt (1970), is more reliably identified than sentences and is defined as an independent clause plus any dependent clauses associated with it. Depending on the elicitation task and the focus of the analysis, the actual discourse analysis may take place at a variety of levels, including within sentences, across sentences, and in the case of narration across the entire narration. Each of these levels of analysis will be described in more detail below.

2.2.1.1.1 Sentence level analyses.

There are numerous measures that can be generated at the sentence level once the transcribed discourse has been distributed into a basic unit such as T-units. Total number of T-units per discourse might be used as a measure of a participant’s verbal output or productivity for a given task. The total number of subordinate clauses might be tallied for each discourse sample as a measure of the complexity of sentence-level grammar. Various measures may also be combined to generate additional measures like, number of clauses (NC) and number of words per clauses (NWPC). For example, the number of subordinate clauses in each discourse or number of words in each clause divided by the total number of clauses in each T-units gives the number of clause. Such a ratio could be obtained in order to establish sentence level grammatical competence and permit comparisons across discourse samples that vary in length. Liles et al. (1989) reported that their CHI and normal subjects produced longer narratives (more T-units) in story retelling than generation. However, in story
generation both groups used more complex sentences (more clauses per T-unit) than in story retelling. The authors interpreted these results to mean that the subjects intended to retell literally what had been viewed in the film-strip with an effort to reproduce the story in its entirety.

2.2.1.1.2 Across sentence analyses- Thematic level.

The measures included in this section are Number of T-unit (NTU) and number of words per T-unit (NWPTU). This mainly include intersentential cohesion, cohesion is defined as structural coherence among the parts of a text (Halliday & Hasan, 1976). Sentences are conjoined by various kinds of meaning relations described as cohesive ties. These cohesive ties can be objectively measured as one T-unit. These ties vary, depending on cognitive-linguistic ability of the speaker. Each of the different types of discourse (e.g. picture description, narration, conversational) is distinct and therefore, requires a different pattern of cohesive use to instantiate the underlying rules of structure appropriate to the creation of coherent discourse. Analysis of intersentential cohesion may involve the sequential occurrence of coherent discourse involving initiating event, describing in a sequence and final description in a word/gist of information. The creation of episodes is evidence of picture description and narrative grammar knowledge, and because this unit is cognitive in nature, it is reasonable to believe that it may be disrupted by brain damage in TBI participants. This level of analysis may, therefore, be sensitive to a level of cognitive disruption not typically investigated in TBI participants. The research by Wyckoff (1984), on the CHI subjects were noted to use significantly fewer cohesive ties per communication unit (roughly equivalent to a T-unit) than the normal controls in both the narrative and procedural discourse tasks. This finding was felt to provide evidence that their discourse lacked continuity. Mentis and Prutting (1987) also noted that their CHI subjects used fewer cohesive ties than the normal subjects in the narrative tasks. However, Liles et al. (1989) reported that the number of cohesive ties (per T-unit) produced by their CHI subjects was the same as the normal subjects for both story generation and story retelling. Thus, in the present study an attempt is made to investigate discourse deficits of bilingual individuals with TBI using the same T-unit analysis.


2.2.1.2 Qualitative discourse analysis.

2.2.1.2.1 Conversation task.

Conversational discourse samples can be studied and analysed in terms of two broad areas comprising nine different individual measures (Hema & Shyamala, 2008). Due to the complexity and more quantity of data obtained from the individual subjects, the results from all the discourse samples can be profiled under individual measures. These reflect the propositional and non-propositional aspects of conversation. Propositional aspects of conversation include the notion of relevancy, clarity of reference and coherence. It deals with how discourse is organized with respect to overall plan, theme or topic and how individual utterances are conceptually linked to maintain unity (Hartley, 1995). This includes the following sub parameters.

Discourse structure evaluates whether the discourse is confusing or not even if it is organized with respect to overall plan, theme or topic and how individual utterances are conceptually linked to maintain unity. Thus, one can comment about the discourse forethought ability and organizational planning of any discourse.

Communication intent evaluates whether an individual uses greeting others by themselves or in response to other’s greeting, introducing self, starting the conversation, asking for information, asking for assistance in understanding conversation, criticizing the conversation by agreeing or disagreeing to a part in the conversation, imagining events correctly and understanding advancers and blockers in the conversation only in required circumstances or in the entire context of conversation.

Coherence assesses for the presence or absence of good relationship between the meaning and context of verbalization with respect to the general topic of conversation or with that of the immediately preceding utterance produced either by interviewer or participants. The literature suggests that, compared to non-brain-injured (NBI) controls, TBI survivors evidence impairment in macrolinguistic abilities, producing discourse that contains less output (Coelho, 2002) and contains deficits in coherence and cohesion (Mentis & Prutting, 1987; Glosser & Deser, 1990; Cannizzaro & Coelho, 2002). Their discourse also contains fewer implied meanings and is more concrete (Tucker & Hanlon, 1998), with more pragmatic errors (Snow,
Douglas, & Ponsford, 1999) than NBI controls. In terms of microlinguistic abilities, their discourse also contains a greater number of syntactic and lexical errors (Glosser & Deser, 1990) than NBI controls. Overall, TBI survivors demonstrate both macrolinguistic and microlinguistic deficits in discourse production.

*Topic management* checks for the presence or absence of irrelevantly introducing topics, rapid topic shift, non coherent topic changes/inappropriate topic changes, perseveration in the topics, responses which expand topics, minimal responses, minimal elaboration and extra elaboration of topics. Sohlberg and Mateer (1989) have noted that pragmatic deficits might be the most pervasive communication problems in adults with TBI. Performance on pragmatic rating scales and analysis of response appropriateness and topic management revealed that TBI individuals experienced difficulty when called upon to function as a discourse partner, whether in conversation or referential communication (i.e. structural exchange on a specific topic requiring extensive listeners’ feedback).

*Other discourse parameter* includes information adequacy in terms of individual’s answer to all the questions during conversation at word level/single sentence level/multiple sentence level. *Information content* is the meaningful and adequate information to all the questions in terms of initiating and/or sustaining conversation or if the individuals know what the person is talking about, even if the information does not appear to be available. *Message accuracy* checks whether an attempted communication involves correct answers to the question without any confabulation or any inaccurate information within the same question frame.

Speech related parameters include use of nonspecific vocabulary in terms of overuse of generic terms such as "thing" and “stuff” when more specific information is required. *Linguistic non-fluency* is the presence or absence of repetition, unusual pauses and hesitations in any discourse. *Inappropriate speech style* is the presence or absence of dialectal structural forms, code switching and style-shifting. *Inappropriate intonation* is the presence of abnormal rising, falling and flat intonation with respect to a particular context of conversation. *Gaze efficiency* is the presence of consistent use of appropriate or severe restricted eye gaze with another person during any conversational context. *Delay before responding* is the time taken to respond to any questions during the conversation which is measured in terms of seconds.
The non-propositional aspects of conversation are one of the important categories of social communication behaviour. These behaviours reflect the reciprocal nature of conversation and the joint co-operation required of the participants. *Turn taking* behaviour checks for the presence or absence of turn initiation, taking time to start a turn, use of non-contingent turn in terms of not fulfilling the semantic or informational expectation of the previous turn, but shares the same topic. This also includes "don't know," "yes," and "no" responses when used to avoid maintaining a topic, and echolalia. Other behaviours includes unable to take prosodic cues, rapid shift from verbal and non verbal mode and persistent in listeners or speakers mode with reference to the entire context of conversation. It also includes use of *revision behavior* in terms of false start and self interruptions in the entire context of conversation. And use of *conversation repair* in terms of self repair through repetition, revisions through clarification and use of other initiate repair. A variety of cognitive deficits like attention, memory, visual-spatial perception, reasoning, executive controls like organization, affect etc, which are seen after TBI leads to this type of communication impairment. Attention impairment causes inability to focus on, filter relevant versus irrelevant stimuli, organize, retain and retrieve the stimuli in a conversation, thus resulting in impaired comprehension of discourse or social interaction (Hagen & Malkmus, 1979). Memory problems impair comprehension and retention, reflecting inability to retain what was said at the beginning of a conversation or remembering the topic or remembering who said what and in which order. Slow processing of information causes difficulty in shifting between speaking and listening roles.

### 2.2.1.2.2 Narration task.

Narrative discourse involves recounting the sequence of events representing previous experience (McCabe, 1995). Narrative plays an important role in education, pragmatic and theoretical reasons. One reason narrative is so central is that it plays a critical role in skills underlying successful academic achievement, including reading and writing (Feagans, 1982; Graesser, Golding & Long, 1991; Snow & Dickinson, 1990; Watson, 1989). Instructors traditionally use narrative as a tool of instruction for both practical and theoretical reasons. On the practical side, most of the individuals will have competence at understanding and producing narrative, whereas knowledge of other
genres of discourse often requires formal training. Furthermore, information conveyed via narrative is both comprehended and recalled more readily than information conveyed in other genres, like explanation or description (Graesser, Golding & Long, 1991). On the theoretical side, narrative is built upon a foundation of event knowledge, and cognitive development in any individuals is critically dependent upon event knowledge (French, 1986; Nelson, 1986). Furthermore, listening to or producing narratives fosters cognitive skills, as these require individuals to temporarily remove themselves from the here-and-now, that is, to decontextualize their thinking. Narration is a cornerstone of school instruction according to Graesser, Golding and Long (1991) study on children. It is like narration “a). Rely on mental representations instead of the immediate environment when they speak, b). De-center from the present time, c). Formulate hypothetical and optional possibilities for events, and d). Abstract general features of events”. It requires the ability to comprehend and produce larger units of text that are organized in terms of the perception of the listener, maintenance of the topic, and integration of meaning throughout discourse (Ewing-Cobbs, Brookshire, Scott, & Fletcher, 1998). Individual words, sentences, and their interrelationships at the local level constitute the microstructure of discourse. Macrostructure refers to a more abstract representation of discourse that captures the meaning of the propositions or idea units and their interconnections (Kintsch & van Dijk, 1978; van Dijk & Kintsch, 1983). Extracting the macrostructure of discourse depends on the ability to make inferences based on prior context, world knowledge, and the content of the sentences that the discourse contains (van Dijk & Kintsch, 1983).

Adults with RHD have difficulty comprehending the main theme of narratives. Even though they may be able to understand and convey the literal meaning of information presented in individual sentences, they miss the thrust of a narrative because of their inability to infer meaning across sentences (Hough, 1990; Joanette, Goulet, Ska, & Nespoulous, 1986; Wapner, Hamby, & Gardner, 1981). Problems experienced by adults with RHD in producing narrative structure include forming coherent texts (Delis, Wapner, Gardner, & Moses, 1983; Schneiderman, Murasugi, & Saddy, 1992), revising sentence meaning (Brownwell, Potter, Bihrle, & Gardner, 1986), identifying words as meaningful based on inferences (Beeman, 1993), and
generating a thematic organization for a story (Hough, 1990). Compared to controls, the narrative productions of adults with RHD also contain fewer story propositions, or omit the propositions that are essential to telling a story (Joanette, Goulet, Ska, & Nespoulous, 1986). In explaining illustrations (Myers & Brookshire, 1996) and pictorially presented stories, adults with RHD tend to miss the main theme with a corresponding increase in the amount of tangential details, confabulations, and embellishments (Wapner, Hamby, & Gardner, 1981).

Recent studies of microlinguistic impairments in the narrative discourse of adults with traumatic brain injury (TBI) have applied syntactic analyses, with some noting no deficits and others specific problems with sentence formulation. An alternative approach to examining the microlinguistic dysfunction in the discourse of individuals with TBI is through the use of propositional analysis. The advantage of propositional analysis is that it enables one to assess semantic complexity of utterances apart from sentence structure and grammaticality. The study by Coelho, Grela, Corso, Gamble and Feinn (2005) was conducted on applied propositional analysis to the story narratives of participants with TBI and participants with no brain injury (NBI). Specifically, the mean number of propositions within a sentence was tallied, in other words the participants’ ability to insert multiple ideas into single surface sentences. It was hypothesized that the participants with TBI would produce fewer propositions per sentence because of organizational problems than the participants with NBI, regardless of level of education. Two story narratives (retelling and generation) previously elicited from the two participant groups TBI and NBI were analysed. For each language sample, the number of propositions was tallied and divided by the number of T-units. The resulting number, the propositional complexity index (PCI), was the average number of predicates per sentence. Results indicated that the group with TBI produced significantly fewer propositions per T-unit compared to NBI. These findings are in harmony with the notion that the participants with TBI studied presented with impairments of both micro- and macrolinguistic processes involved with the organization of semantic information in discourse.

Peach and Schaude (1986) examined the clausal structure in the descriptive narratives of 20 individuals with TBI. Results indicated that, although the syntactic complexity was comparable for the groups with TBI and NBI, the group with TBI
produced more syntactic errors including word order transpositions, verb tense and agreement errors and complex alterations. McDonald (1993) tallied unspecified propositions in explanations of a board game by two individuals with TBI and found that one individual provided less detail than the non-brain-injured controls.

According to Peterson (1994) the narrative skills which seem important for efficient discourse are as follows: Responsive to narrative prompts is important for children to be responsive to teacher prompts for narrative production (Feagans, 1982). Of most difficulty to teachers is the reaction termed the “unteachable response” (Blank, Rose, & Berlin, 1978) in which a child produces such as minimal response to a teacher’s probe that the teacher is unsure even if the child understood. Nor should the child require constant prompting to provide each additional piece of information the teacher requests. Children with good narrative skills readily narrate in response to teacher requests to do so. In agreement with this, the present study consist various parameters to assess narrative discourse ability of any individuals. The parameters are communication intent where the individuals initiates narration, asks for assistance during narration and imagines events correctly in the required circumstances.

Informative- Narratives should be dense with information units (Fivush, 1991). Such information includes a description of people, locations, objects, activities and attributes that played a role in the events being narrated about. Good narratives paint a detailed linguistic picture of the events they are describing. In the present study along with this parameter the same information adequacy and message accuracy of conversation task is also considered for narrative discourse analysis.

Decontextualized- A discourse should be able to stand alone, without support from its here-and-now context (Cazden, 1985; Snow & Dickinson, 1990). Specifically, a narrative about personal experience should make sense to listeners not present at the described experience. One criterion of a decontextualized narrative is that it is embedded in an explicitly described spatial-temporal context (Graesser, Golding & Long, 1991). In agreement with this, the present study consist various parameters to assess narrative discourse ability of any individuals. The parameter considered is the topic management, which is similar and discussed in the conversational task.
Linguistically explicit temporal and causal relationships - Events in a narrative are related both temporally and causally, they are not randomly ordered. To provide a coherent narrative account of these relationships, an individual should explicitly relate the events linguistically (Fivush, 1991). Temporal terms include then, and then, first, next, before, and after. Causal terms include because, so, when, if, while, and until. The same parameter is assessed in the present study under the heading of other discourse parameter.

Chronologically organized - A narrative is fundamentally a description of a series of events. Such series should be chronologically and logically organized with events occurring earlier in time being described before events occurring later, and causative events preceding their consequences (Labov, 1972; Peterson & McCabe, 1983). Misorder chronology often makes narratives confusing to listeners. This particular feature is assessed under the heading of discourse structure.

Structurally well-patterned - Two major types of narrative patterning have dominated investigations of narrative structure. Labov (1972) describes well-organized narratives as incorporating chronological description of events leading up to an evaluative high point, a crisis, which is subsequently resolved. Thus, the narrative story as a whole is interesting and reportable. This assesses the narrative discourse structure and describes coherent patterning of a narrative at local and global level.

Other is the non-propositional aspects, these includes use of revision behaviours and repair strategy. In revision behaviour one should check for the presence or absence of continuous use of false starts and self-interruptions in the entire context of narration. And repair strategy checks whether the individual use self correction, repair through repetition/revision, other initiated correction, request for clarification in all the required circumstances or in the entire context of narration. The foregoing list is by no means exhaustive, it includes, however several key ingredients of competent narration by any individuals. The question directing the current research is how traumatic brain injury affects these narrative kills. Since such skills seem to be important predictor of cognitive-communication ability and personal experience narratives are the first type of narrative to develop and in fact begin to appear in
rudimentary form in children as young as two years of age (Eisenberg, 1985; Peterson, 1990). They are also easier for children to produce than fictional stories or other forms of narrative (Hudson & Shapiro, 1991). In agreement with this, an attempt is made to study and profile the discourse abilities in the similar manner in bilingual individuals with traumatic brain injury.

2.2.1.2.3 Picture description task.

Discourse samples of picture description task can be studied and analysed in terms of two broad areas comprising eight different individual measures (Hema & Shyamala, 2008). This particular task has the added benefit of predictable content that yields relatively brief language samples within short duration and later it requires little time to transcribe, assess and infer the abstract information and efficiency of coherence among concrete items in the stimuli. Thus, the results from all this samples can be profiled under individual measures. These reflect the propositional and non-propositional aspects of picture description.

Propositional aspects of picture description include the notion of relevancy, clarity of reference and coherence of information. It deals with how discourse is organized with respect to overall plan, theme or topic and how individual utterances are conceptually linked to main theme/topic. This includes the following sub parameters. Discourse structure evaluates whether the discourse is confusing or organized with respect to overall plan, theme or topic and how individual utterances are conceptually linked to maintain unity. Thus, one can comment about the discourse forethought ability and organizational planning of any discourse. Communication intent evaluates whether an individual initiates picture description, asks assistance in understanding picture, criticizes the picture by agreeing or disagreeing to a part in the picture only in required circumstances or in the entire context of picture description and imagines events correctly. Coherence assesses for the presence or absence of good relationship between the meaning and context of verbalization with respect to general topic of picture description is the global coherence. And when the same relationship is with that of immediately preceding utterance produced by the participants is the local coherence. Topic management checks for the presence or absence of irrelevantly introducing topics, rapid topic shift, non coherent topic
changes/inappropriate topic changes, perseveration in the topics, minimal elaboration, and minimal/extra elaboration of topic. Other discourse parameter includes information adequacy in terms of adequate picture description at word level/single sentence level/multiple sentence level in presence of few or several prompts. Information content is the meaningful and adequate information of the picture description in terms of initiating and/or sustaining the task or if you know what the person is talking about, even if the information does not appear to be available or more than half of the picture described. Message accuracy checks whether an attempted picture description involves correct descriptions of picture without any confabulation or any inaccurate information within the same context of picture description.

Speech related parameters include use of nonspecific vocabulary in terms of overuse of generic terms such as "thing" and “stuff” when more specific information is required. Linguistic non-fluency is the presence or absence of repetition, unusual pauses and hesitations in any discourse. Inappropriate speech style is the presence or absence of dialectal structural forms, code switching and style-shifting. Inappropriate intonation is the presence of abnormal rising, falling and flat intonation with respect to a particular context of picture description. Delay before responding is the time taken to start the picture description and is measured in terms of seconds. Gist of information is the presence of correct depiction of the theme (picnic spot) with good local and global coherence.

The non-propositional aspects of picture description are one of the important categories of social communication behaviour. These behaviours reflect the reciprocal nature of conversation and the joint co-operation required of the participants. In picture description it is only from participant’s point of view. The following are the subcategories considered for analysis. Revision behaviour is the presence/absence of false start and self interruptions in the entire context of picture description. The other is the use of repair strategies in terms of self correction, here the participants find a word or sentence after giving a small pause and continue the topic of picture description. Other strategies are repeating themselves and correcting the discourse without the investigators help. This is termed as use of repair through repetition/revision. If the participant is not able to find the right word and when the
The investigator fills it with the correct word to continue the topic of picture description is termed as use of other initiated correction. The last is the use of request for clarification. Here the participant requests the investigator to modify the discourse and use the corrected version of discourse to continue the topic of picture description. Since the literature specific to picture description task is not available, the same parameters from the conversation task are employed and specific required modifications are made according to picture description task. Thus, the present study attempts to profile the discourse abilities of bilingual individuals with traumatic brain injury in conversation, narration and picture description tasks.

Evaluation of discourse is recognised as an important component in the diagnosis and management of adult acquired communication disorders. Picture description is a common and practical data elicitation procedure that has provided insights into the discourse of many adult groups. Such data may be analysed from several linguistic and pragmatic perspectives and, as is commonly the case with discourse measures, the usefulness of such data is limited by a paucity of relevant normative information. Mackenzie, Brady, Norrie and Poedjianto (2007) determined the influences of age, education, and gender on the concepts and topic coherence of the picture description of 225 non-brain-damaged adults. These adults described the “cookie theft” picture (Goodglass, Kaplan, & Barresi, 2001). Responses were analysed for presence and completeness of concepts (Nicholas & Brookshire, 1995) and topic coherence (Mentis & Prutting, 1991). The concept and topic coherence, confirmed education level as a highly important variable affecting the performance of non-brain-damaged adults. The number of concepts used accurately and completely, and the amount of topic subdivision, increased with amount of education (both with and without adjustment for age and gender). Clear influences of age or gender were not demonstrated, although some trends in favour of women and younger age were noted. Recognition of the impact of education is essential in the assessment and diagnosis of communication difficulty. Thus, in the present study education is considered as an important variable for TBI and NTA groups.
2.3 Bilingualism.

As the education systems have improved, there are more and more educated people in the social spectrum. This has resulted in creating awareness regarding certain issues. For example traumatic brain injury resulting due to road traffic accident and their recovery in communication abilities depends on their educational background or the world knowledge. Pragmatic-linguistic deficits are the most pervasive communication problems in TBI and more so among bilinguals. Thus, there is a need for cognitive-linguistic analysis at the level of discourse in bilinguals.

An attempt can be made to study specifically and analyze various discourse samples by Kannada-English bilingual adults. Comparing Kannada and English, as a matter of fact, offers an interesting research for cross-linguistic analysis, because they are such distinctly different languages. To begin with, Kannada is one of the major Dravidian languages of India and is spoken predominantly in the state of Karnataka. Numbering roughly 38 million population makes it the 27th most spoken language in the world. Kannada having its own script is a highly inflected language with three genders (masculine, feminine, neutral or common) and two numbers (singular, plural). It is inflected for gender, number and tense, among other things (Prakash & Joshi, 1995). In case of Indian English, it comprises several dialects and is evolved during and after the colonial rule of Britain in India. English is one of the official languages of India with about ninety million speakers according to the 1991 Census of India.Clauses in English language have a subject and a verb. There are three main types of dependent clauses like noun clauses, adjective clauses, and adverb clauses, so-called for their syntactic and semantic resemblance to nouns, adjectives, and adverbs, respectively. Here, a noun is the head of the phrase. These differences make comparison of English and Kannada of great potential interest for those who research cross-linguistic ability.

People not only use single language but also may have an addition of one or two languages to their mother tongue. This is the result of globalization and increased stimulation through various modes such as television, newspaper etc. Thus, bilingualism or multilingualism exposes several issues for practical consideration. Humans possess a capacity to learn aspects of more than one language (Branson,
A desire to communicate is what drives people to learn more languages and make it useful. Bilingualism is a widely prevalent phenomena and is related to a variety of factors like proficiency, social interaction etc. Thus, it is really difficult to give a precise definition of bilingualism covering all these aspects. Bilingualism can be defined as the ability to use two or more languages in proficient conversation with native speakers of each language. Not only are bilingual speakers able to use linguistic structures of their two languages, they also master pragmatic and sociolinguistic norms of the culture surrounding each languages (Bialystok, 2001). India has been a multilingual country right from earliest times. And English is one language which has become an integral part within bilingualism. Hence it is necessary to study the first language along with the proficient second language in the clinical population too. Literature in the Indian context regarding aspects of discourse processing that are preserved in individuals with TBI and those that are impaired is limited.

Language organization in these neuro-typical bilingual adults is studied based on neuroimaging studies. Studies in this regard by Chee, Soon, Lee and Pallier (2004), Perani et al and Wartenburger, Heekeren, Abutalebi, Cappa, Villringer, & Perani in 2003, have focused on the level of language proficiency in each of a bilingual's two languages as windows into bilingual brain organization and processing. Language proficiency, in both early and late bilinguals, has also been found to impact bilingual language organization in the brain. For instance, using semantic and phonological language processing tasks, Chee et al (2004) has shown neural differences in bilingual brains depending on whether they had high or low language proficiency in each language, independent of the age of acquisition. To reconcile the question of whether it is the age of exposure or proficiency that has more impact, Wartenburger et al. (2003) conducted a study which revealed that both age and proficiency influence neural organization of two languages in one brain. Also, a structural imaging study of gray matter density in high- and low-proficiency bilinguals versus monolinguals revealed a fascinating finding that bilinguals have an increase in gray matter volume in the left inferior parietal lobe as compared to monolinguals (Mechelli et al., 2004). The greatest increase in gray matter volume was in early high-proficiency bilinguals, and the lowest was in late low-proficiency
bilinguals. Most of these investigations are indirect comparisons of neural activation in bilingual versus monolingual brains during language switching/differentiation tasks (Rodriguez-Fornells, Rotte, Heinze, Noesselt, & Muente, 2002; Rodriguez-Fornells, van der Lugt, Rotte, Britti, Heinze, & Munte, 2005; Quaresima, Ferrari, van der Sluijs, Menssen, & Colier, 2002; Hernandez, Martinez and Kohnert, 2000; Price, Green and Studnitz, 1999). These imaging studies have yielded an important finding that specific brain areas are involved in bilingual switching they are dorsolateral prefrontal cortex, inferior frontal cortex, anterior cingulate and supramarginal gyrus. In agreement with this, on comparison with neuro-typical adult bilinguals there is a need for cognitive-linguistic analysis at the level of discourse in bilingual individuals with traumatic brain injury.

### 2.4 Indian Studies on TBI

Arvind and Karkanth (2000) have found the degree of spontaneous recovery of speech and language deficits in ten subjects with traumatic brain injury using the Western Aphasia Battery (WAB) (Kertesz & Poole, 1974). They concluded that the overall spontaneous recovery among their open head injured subjects were poorer than the closed head injured subjects. Age had a significant effect on the spontaneous recovery depending upon the Glasgow Coma Scale (GCS) scores. The younger TBI subjects showed greater recovery than the older subjects. The patients with low GCS scores showed less recovery than the patients with high GCS scores, irrespective of age.

An Indian study by Tanuja and Manjula (2004) has found that TBI individuals have impairment in discourse when compared to normal participants because of cerebral insults. Also variations in the discourse pattern were evident for subgroups of TBI. TBI with RHD participants showed a verbose pattern with extra elaboration and inability to maintain topics of conversation whereas TBI group with LHD showed less conversational output with minimal response and reduced informativeness. Even though a difference in the conversation traits were seen in various subgroups, the data was not sufficient to generalize the obtained findings.
Hema and Shyamala (2008) examined quantitatively conversational discourse in moderately Traumatic Brain Injured (TBI) with left hemisphere damage, right hemisphere damage and normal adults in Kannada using qualitative measures. All the participants underwent standardized neuropsychological tests with conversation task and narrative task for picture description. The authors used a scale to quantify the discourse called- “Discourse Analysis Scale”. From this, samples were analyzed under different discourse components. The results indicated that TBI participants had impairment in discourse when compared to normal speakers because of cerebral injury. Comparison across TBI participants with left hemisphere damage (LHD) and right hemisphere damage (RHD) group showed a significant difference only in communication intent like greeting others by himself/herself and introducing self which is a propositional aspect and turn taking in terms of initiating turns and conversational repair by using too much of other initiated repairs which is a non-propositional aspect of conversational task. On picture description task difference was seen again in communication intent in terms of fabricating/imagining events and delayed response under the propositional aspects. It was concluded that LH D group performed better compared to RHD group in all the aspects of discourse. Both the groups had better performance on propositional aspects of discourse compared to non-propositional aspects of discourse.

Narrative skills on bilinguals were studied by Hema and Shyamala (2011). According to the linguistic relativity hypothesis bilinguals may actually have different thought patterns when speaking different languages, this study, which examines the narration told by individuals in two different languages, sheds further light on the validity of the hypothesis. This study particularly explored how, when telling narratives, bilingual individuals express verbal notions through the use of the tense, aspect, and voice forms available in each of their two languages. Particularly the past tense was often used in oral narratives, specifying the typical series of events taking place in a particular sequence such as going on a trip or journey to a place. This was the target task considered for the present study. Here 20 normal bilingual adults were the participants and had to narrate in Kannada and English languages separately. These discourse samples were video recorded using digital handycam DCR-DVD 908. The objective was to compare and see the differences in Kannada and English
language narrative discourse. The narrative discourse of these participants were subjected for T-unit analysis; the parameters included were number of clauses, number of T-units, number of words per clauses and number of words per T-unit. Thus the participant’s Kannada and English narrative discourse were quantified separately. The statistical results showed significant differences for the parameter number of clauses, number of T-units and number of words per T-unit of Kannada narrative discourse when compared to English narrative discourse.